

MANTODEA OF MIRPURKHAS SPECIES RICHNESS, HABITAT ASSOCIATION, AND POTENTIAL FOR BIOLOGICAL CONTROL

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Abstract

Mirpurkhas District, positioned at 25°31'39.3"N 69°00'50.6"E in Sindh, Pakistan, is renowned for its fertile agricultural land and variety of insects. Though praying mantids (Mantodea) play a crucial role as natural predators, no thorough research has yet evaluated their diversity in this area. To address this gap, a thorough field survey was carried out from May to November during 2022 and 2023 at ten locations showcasing diverse habitats such as grasslands, shrubs, tree bark, and agricultural areas. Standard entomological keys were used to classify the 424 mantid specimens that were collected. Around three families along with eight genus and species each were noted. The Mantidae family had the highest number, including five species and accounting for 51.4% of the individuals. Metrics of biodiversity revealed a moderate degree of diversity, with the most common species being *Aethalochroa affinis* and *Tenodera attenuata*. Certain species were restricted to particular habitats, while others were extensively spread, depending on the locality. These results offer the initial thorough baseline information on praying mantid diversity in southern Pakistan and emphasize the ecological significance of Mirpurkhas as a habitat hosting various mantid species.

INTRODUCTION

Mantodea, widely recognized as praying mantises, are land-dwelling insects that undergo incomplete metamorphosis and vary in size from small to large. They are found across the globe (Alejandro del Palacio and Javier Muzón, 2023). To date, around 2,600 species have been documented worldwide (Ehrmann, 2002; Otte *et al.*, 2020). As a small arthropod order, mantids are predominantly thermophilic, and their distribution is largely restricted to tropical and subtropical regions,

primarily between latitudes 45°N and 45°S (Klass *et al.*, 2003). Although rarely found beyond these limits, mantids can inhabit a wide variety of ecosystems (Ma *et al.*, 2023; Zohreh, 2024). Within the arthropod community, mantises function as top-level predators (Balakrishnan P., 2012), exhibiting specialized raptorial forelegs for prey capture while retaining their original locomotory function (Rossoni, S., and J. E. Niven, 2022). They are exclusively carnivorous and as predators of many harmful insect species, praying mantises are widely acknowledged as natural enemies that control plant pests (Richards & Davies, 1977; Rankin EEW *et al.*, 2023) through all

stages of their development, including both the nymph and adult phases.

Relatively little has been studied about praying mantises in Pakistan, especially in the Sindh region. The description of three new species (*Aethalochroa affinis*, *A. spinipes*, and *Texoderopsis Taurus*) are among the early contributions by (Wood-Mason J, 1878), followed by the later documentation of *Microthespis dimitrievi* from Karachi by (Uvarov, B.P, 1931). Since then, scattered studies have addressed various aspects of mantid biology in Pakistan (e.g., Soomro N.M *et al.*, 2012; Soomro N.M *et al.*, 2013), yet key ecological parameters such as species richness remain underexplored. In particular, the diversity and distribution of praying mantids in Sindh's Mirpurkhas District have not yet been thoroughly investigated.

This study aims to fill that gap by assessing species richness—a fundamental indicator of biodiversity—which is especially critical in the context of climate change and increasing anthropogenic pressure. Biodiversity reflects the variety and variability of

Research Zone

Mirpurkhas is a significant agricultural district situated in the Tharparkar Division of Sindh, Pakistan. It provides advantageous geographical and climate conditions for the development and existence of praying mantis species. The region is located in latitude 25°32'0"N and longitude 69°00'0"E. different selected locations within the District of Mirpurkhas were used for this study, specifically:

MK = Mataro Khaskheli

GM = Ghulam Qadir Mari

DL = Dolat Laghari

KS = Khadim Ali Shah

BM = Bair Morie

SA = ShujaAbad

KG = Kot Ghulam Mohammad

JT = Jhudoo Taaluka

ST = Sindhrie Taaluka

HT = Hussain Buxsh Mari Taaluka

life on Earth (CN Sureshbhai, 2018), and changes in species composition, through extinction, invasion, or climate-driven range shifts, reflect ecosystem instability. Land-use change and habitat fragmentation continue to displace many insect species (Ellis *et al.*, 2012), and recent global reviews warn of steep insect declines driven by such changes (Cardoso *et al.*, 2020). Urban configuration and landscape composition further influence the distribution of highly mobile and plant-associated insect species (Sattler *et al.*, 2011). The present study not only provides baseline data for the mantid fauna of Mirpurkhas but also contributes to understanding how regenerating habitats can sustain biodiversity. Furthermore, it explores the potential of mantids as environmentally friendly bio control agents in agricultural ecosystems, offering an ecologically sustainable alternative for pest management in Pakistan.

Materials and Method

These locations were chosen to showcase a variety of habitats throughout the district.

b. Sampling Techniques

Sampling took place from May to November in 2022 and 2023 to evaluate the species richness and biodiversity of praying mantids. To minimize seasonal bias, each location was visited two times. Field collection took place for one week each month, amounting to 84 sampling days and nights throughout the study duration.

Specimens were gathered through a mix of hand nets, manual collection, and light traps. Mantids are mainly active during the day, residing in tropical and subtropical areas, although a few species have been noted in temperate environments (Ehrmann, R. 2001). Males generally exhibit increased activity at dusk, usually flying to find mates (Yager, D. D. and May, M. L. (1990)),

whereas females usually stay still (EHRMANN). R.1985). In total, 424 specimens were gathered from all locations combined.

Sample Preservation and Identification

Gathered specimens were taken to the entomology lab and killed with chloroform for 30 minutes. Although still pliable, each specimen was secured through the thorax to avoid harm and aid in observation. Wings were cautiously opened to enable clear examination of morphological characteristics. Samples were kept in entomological containers, with each marked

Result

During the data collection period from 2022 to 2024, a total of 424 praying mantid specimens were recorded across District

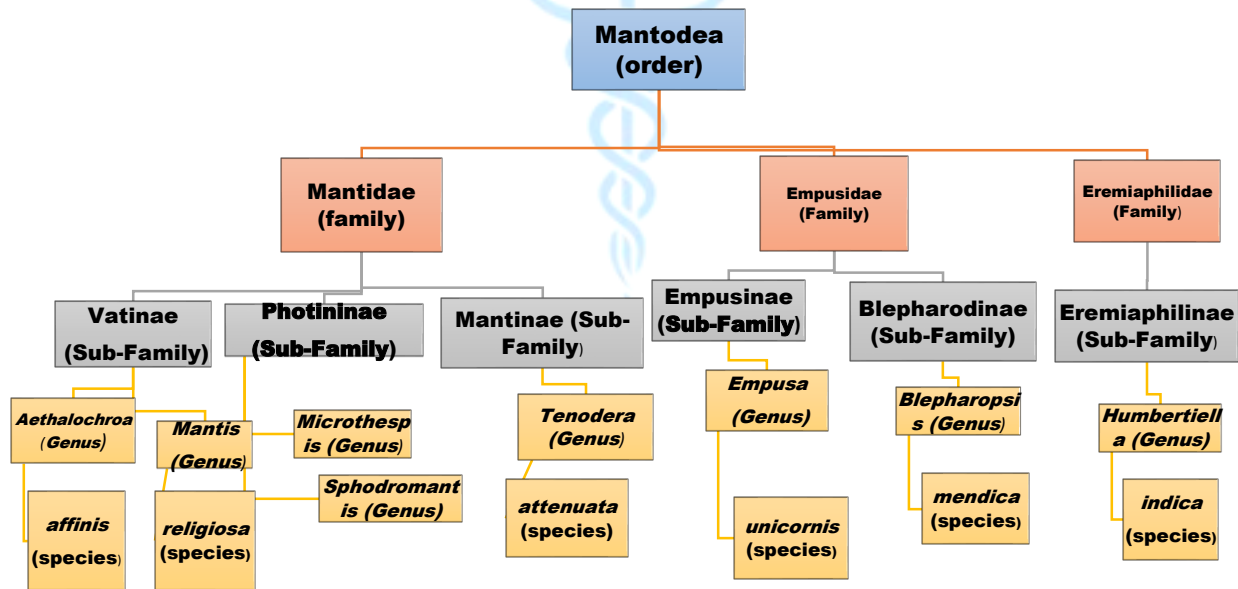
with the date, place, and name of the collector. Naphthalene balls were put in the containers to repel ants and other insects.

Species identification was carried out utilizing morphological keys and details from the Comprehensive Catalogue of the Mantids of the World (Ehrmann, R. 2002; Tahira J Ursani et al., 2017)

Assessment of Species Diversity and Richness

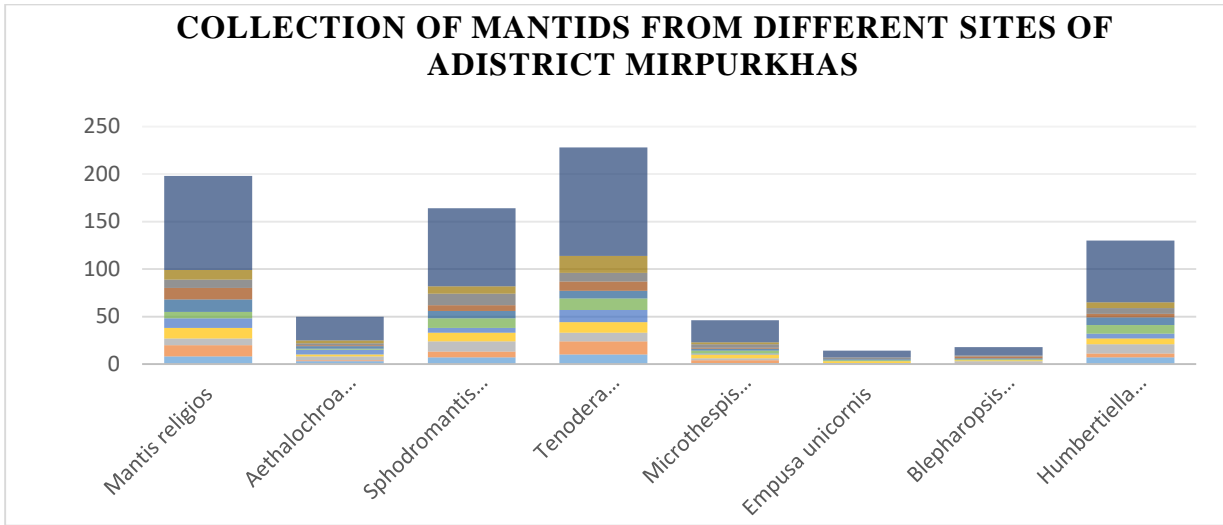
Data analysis was conducted to assess species richness and biodiversity indices employing the Lincoln-Petersen and Fisher & Ford formula.

Mirpurkhas. These specimens represented eight genera and eight species, encompassing three families and five subfamilies of Mantodea (Figure 1).



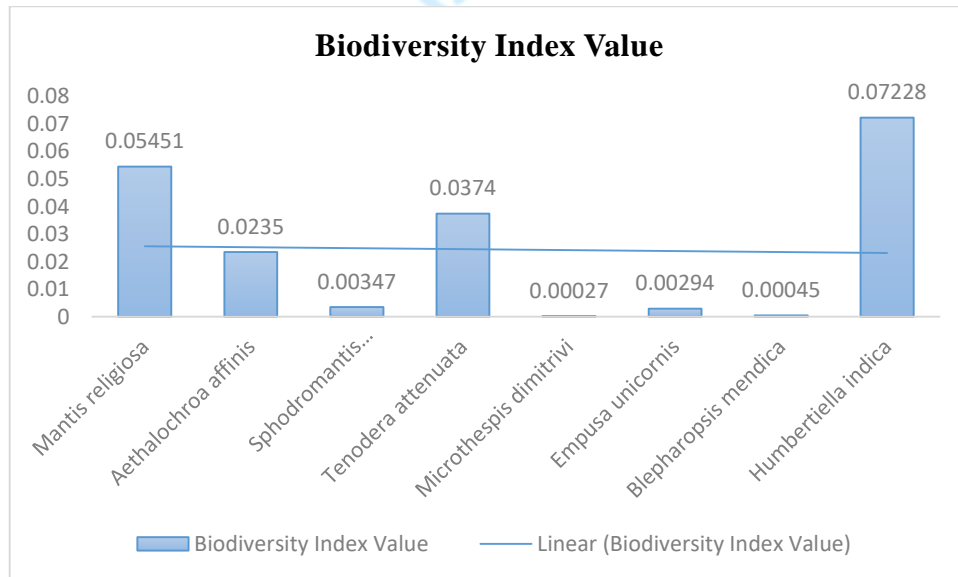
Specimens were collected from ten localities within the district. Species richness varied by site, ranging from 3 to 7 species per locality. The highest richness (7 species) was observed at multiple sites, suggesting localized biodiversity hotspots (figure 2). All surveyed

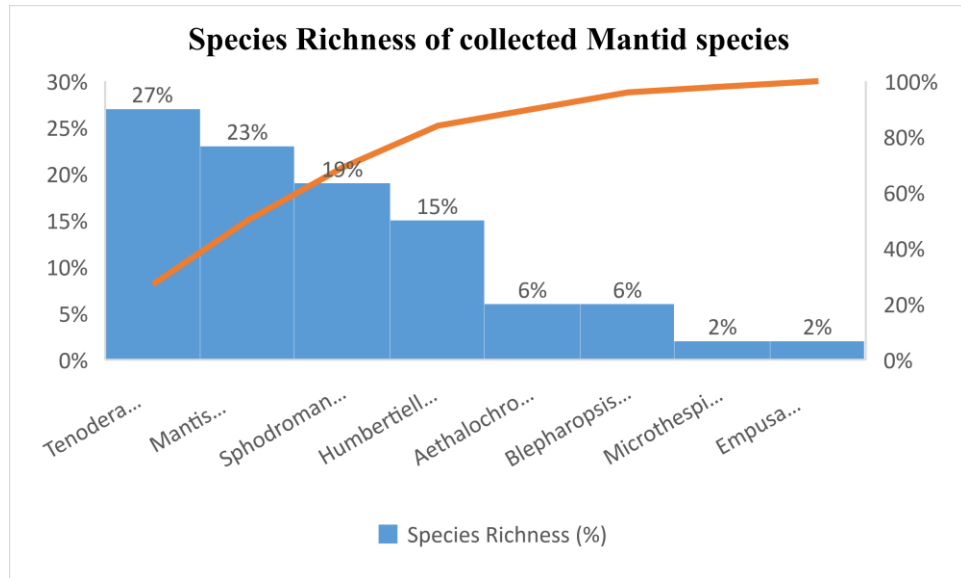
sites contributed to the overall species count, indicating a broad distribution of praying mantids throughout the study area.



Regarding abundance, *Tenodera attenuata* was the predominant species, with 105 individuals counted, followed by *Mantis religiosa* (94 individuals) and *Sphodromantis transcaucasica* (76 individuals). These three species demonstrated the greatest biodiversity index values (Figure 3) and species richness scores (Figure 4), with *T. attenuata* recording the highest biodiversity index

(0.07248) and species richness (5.3168). On the other hand, *Empusa unicornis* and *Blepharopsis mendica* were the least prevalent, exhibiting low abundance and diversity index scores. The findings suggest a moderate degree of species diversity and richness within the mantid populations in District Mirpurkhas.





Discussion

This study shows that mantid species and their numbers stay fairly steady in natural areas where the land is not disturbed. However, in farming areas where the soil is plowed, pesticides are used, and crops are grown regularly, their numbers drop. *Tenodera attenuata*, the most common mantid in Sindh, was showed strong hunting behavior by eating many types of harmful insects. Mantids were collected from different places like grasses, bushes, and tree bark using standard insect-collecting methods. Their egg cases and body structures were studied, and important features were found that help identify different species. Although mantids are important for both the environment and farming, they have not been studied much in the Mirpurkhas region. This research adds new information about where these mantids

live and offers useful data for future studies. Because pests are a big problem in farming areas, using native mantids as natural predators could be a good alternative to using chemical pesticides.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this research paper.

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Author Contribution Statement

All authors contributed significantly to the conception, design, execution, and interpretation of the study.

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