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TAXONOMIC ASSESSMENT AND DISTRIBUTION PATTERNS OF ACRIDIDAE AND PYROGOMORPHIDAE GRASSHOPPERS IN QUETTA, BALOCHISTAN

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Abstract

The goal of the current study was to ascertain the taxonomic studies and distribution of Acrididae and Pyrgomorphidae from July 2021 to June 2022. From various parts of Quetta, 300 locusts from two families were gathered. They were captured using hands, forceps, and a traditional aerial net. Slides and dry mounts were also made so that the various locust sections could be better understood. Ten species from the Acrididae and Pyrogomorphidae families were found during the study; these were subsequently divided into ten genera and six subfamilies. Oedipodinae, Gomphocerinae, Cyrtacanthacridinae, Catantopinae, Oxyinae, and Pyrgomorphinae are the six subfamilies of locusts that were identified. Acrididae was the most prevalent family with seven species (70%) and Pyrgomorphidae was the least prevalent with three species (30%). Anacridium aegyptium was the most common species in Quetta, while Oxya hyla was less common. The first recorded sighting of Chorthippus brunneus occurred in Quetta. The higher value of Shannon Index (1.87) in Acrididae showed that greater diversity of family in the area, as compared to Pyrogomorphidae, the value of Shannon Index (1.06) is low, which shows less diversity of family in that area.

Keywords: *Acrididae, Distribution, Locusts, Pyrogomorphidae, Quetta*

INTRODUCTION

Species that change their appearance and behaviour at high population concentrations are locusts. They include an important group of Orthopterous pests that economically harm both farmed and uncultivated crops, seriously damage agricultural crops, pastures, and forests (1).With 11,000 species worldwide, the Acridoidea superfamily is the largest and most diverse (2). Acrididae grasshoppers are of the highest economic value since they are a major plant pest that can significantly hinder the growth of crops, pastures, and forests as well as their nutritional content and pace of production (3). Their destructiveness is well known around the world (4). Flashy grasshoppers, or Pyrgomorphidae, are a family of Orthopteran grasshoppers that are a part of the Caelifera suborder. One family makes up the Pyrgomorphoidea superfamily.The family Acrididae is closely related to the family Pyrgomorphidae, which was formerly categorized by scholars as the subfamily Pyrgomorphinae. It was then promoted to the family level (Pyrgomorphidae) under the superfamily Acridoidea. It is now considered to be a member of the only family of Pyrgomorphoidea (5).

Grasshoppers play a dual role in ecosystems, serving as both herbivores that regulate plant communities and as prey for numerous predators including birds, reptiles, and small mammals. However, their outbreak populations frequently cause severe ecological imbalances and economic losses in agroecosystems (6). Acrididae species, in particular, demonstrate remarkable adaptability to arid and semi-arid environments, where they thrive under conditions of limited vegetation and irregular rainfall (7). The Pyrgomorphidae, though less economically damaging compared to Acrididae, are also ecologically significant due to their striking morphology, aposematic coloration, and often toxic or deterrent chemical compounds that protect them from predators (8).

In Pakistan, grasshoppers of both families have been reported from a variety of habitats ranging from plains to mountainous regions, with considerable diversity recorded in Balochistan (9). Quetta,

situated in a semi-arid zone, provides unique ecological conditions that may influence the distribution, abundance, and species richness of these groups. Despite their importance, detailed taxonomic surveys and distributional studies of Acrididae and Pyrgomorphidae in Quetta and its surrounding areas remain limited. Accurate taxonomic identification is essential not only for biodiversity documentation but also for the development of management strategies against potential pest outbreaks (10).

Furthermore, global climate change, habitat modification, and unsustainable agricultural practices are likely altering the distribution patterns and population dynamics of grasshopper species (11). Understanding their taxonomic diversity and ecological preferences in specific regions such as Quetta is therefore critical for predicting future pest scenarios, conserving local biodiversity, and supporting sustainable agricultural production. This study is aimed at filling this knowledge gap by providing a taxonomic assessment and documenting the distribution patterns of Acrididae and Pyrgomorphidae grasshoppers in Quetta, Balochistan.

METHODOLOGY

STUDY AREA

The Quetta Division of Balochistan lies between latitudes 3° and 15' N and longitudes 68° and 30' E. It is roughly 64,310 km in total area. It is mostly mountainous. Although there are sporadic winter showers, the climate is primarily dry. Rarely does the maximum temperature climb over 20˚C during the winter, while the minimum temperature can fall as low as -13˚C, well below freezing. The summertime high and low temperatures often fall between 40°C and 12°C (6).

COLLECTION OF ADULT GRASSHOPPERS

In 2021–2022, collected locusts, a survey were carried out in several Quetta agricultural regions. A common aerial net, forceps, and the human hand were used to catch them. To gather insects individually or in clusters, the net was used to sweep grasses, bushes, and other vegetation. The collected specimens were killed in bottles containing cyanide.

PREPARING FOR THE MORPHOLOGICAL INVESTIGATION

Dry mounts were also created in order to make certain features like size, color, and texture clearly visible. To do this, the specimens were first stretched and relaxed before being properly pinned and labelled. For upcoming studies on morphological structure, permanent collections of pinned specimens were kept in boxes.

PREPARATIONS OF SLIDES

To commence a broad examination of the diverse structures, permanent slides were created and subjected to a microscope examination, covering various components such as the antennae, legs, fore wing, and hind wing. Details were filled in by conventional microscope examination and in internet (7).

DATA MANAGEMENT AND ANALYSIS

SPSS software was used for organization of data in form of graphs and tables.Microscopt Excel was used for the findings of Shannon index.The Shannon Diversity Index is a way to measure the diversity of species in a community.Denoted as H, this index is calculated as:

$$\text{Shannon Index } H = -\sum_{i=1} pi \, Inpi$$

The higher the value of H, the higher the diversity of species in a particular community. The lower the value of H, the lower the diversity. A value of H = 0 indicates a community that only has one species.

RESULTS

Three hundred specimens were captured from Quetta, were determined by applying the method as described by Riffat and Wagan 2015 (8). Identification Keys methodology. There were 10 species found in all, representing 2 families and 10 genera. The recorded species are *Scintharista notabilis, Sphingonotus*

rubsences rubsences, Diabolocatantops innotabilis, Oxya hyla, Pyrgomorpha conica, Schistocerca gregaria, Chrotogonus trachypterus, Poekilocerus pictus, Anacridium aegyptium and *Chorthippus.brunneus*. Acrididae was found to be the most abundant family with seven species (70%) whereas Pyrgomorphidae was found to have only three species (30%). Fig. 1 illustrates the distribution of family Acrididae and pyrogomorphidae.The family Acrididae was found to be extreme in number as 70% as compared to pyrogomorphidae 30%.

Table I. Calculated the Shannon-Weiner Diversity Index of collected specimen in Acrididae family

Species	Number of individuals in Family Acididae	Pi	In Pi	Pi In Pi
Scintharista notabilis (Saussure, 1888)	25	0.11682	-2.1471	-0.2508
Sphingonotus rubsences rubsences (Walker.1870)	44	0.20561	-1.5818	-0.3252
Diabolocatantops innotabilis s (Walker, 1870)	21	0.09813	-2.3215	-0.2278
Oxya hyla (Serville, 1831)	18	0.08411	-2.4756	-0.2082
Schistocerca gregaria (Forsskal, 1775)	20	0.09346	-2.3702	-0.2215
Anacridium aegyptium (Linnaeus, 1764)	50	0.23364	-1.454	-0.3397
Chorthippus.brunneus (Thunberg, 1815)	36	0.16822	-1.7825	-0.2999
Sum	214	1		-1.8732
H				1.87317

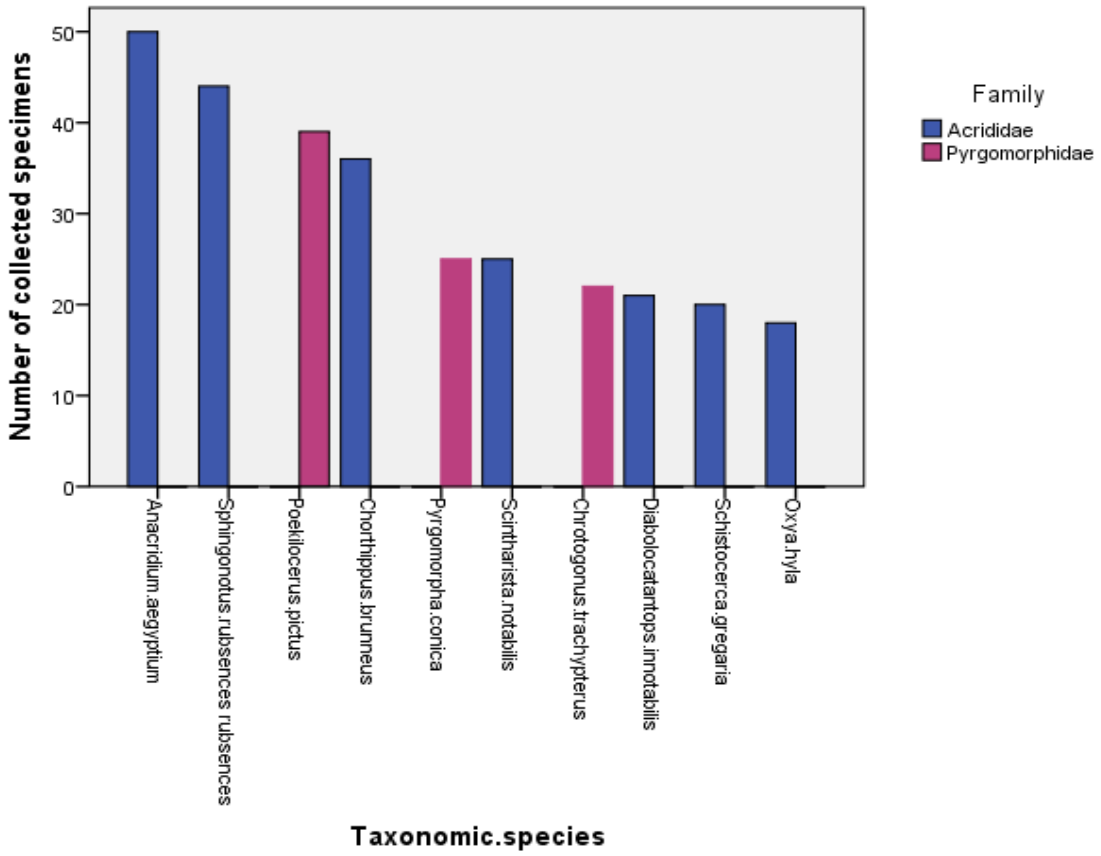

Fig. 1. Distribution of family Acrididae and Pyrogomorphidae reported from Quetta

Table I demonstrate the locust species in Quetta district were measured using the Shannon-Weiner Species Diversity Index. A total 214 number of individuals the sum ∑ of (Pi In Pi) =-1.8732 and the diversity index of relative value were H =1.87317 shows that Acrididae family is more diverse with locusts species.

Table II. Calculated the Shannon-Weiner Diversity Index of collected specimen in Pyrgomorphidae family

Species	Number of individuals in Ffamily Pyrgomorphidae	Pi	In Pi	Pi In Pi
Chrotogonus trachypterus (Blanchard,1836)	22	0.255814	-1.3633	-0.34875
Poekilocerus pictus (Fabricius, 1775)	39	0.453488	-0.79079	-0.35861
Pyrgomorpha.conica (Olivier, 1791)	25	0.290698	-1.23547	-0.35915
Sum	86			-1.06651
H				1.0665

Table II demonstrate the locust species in Quetta district were measured using the Shannon-Weiner Species Diversity Index. A total 86 number of individuals the sum ∑ of (Pi In Pi) = -1.06651 and the diversity index of relative value were H =1.0665 shows that Pyrgomorphidae family is less diverse with locusts species.

DISCUSSION

In the recent studies,300 locusts representing 2 families,six subfamilies and 10 species were collected from Quetta, as in (9) recorded from various locations in Rajasthan (India) 37 species of locusts 25 genera and 11 subfamilies of the Acrididae family have been documented, as also the current work supported by the research (10), 1,230 specimens were collected from different areas of Punjab (India). 54 species of Acrididae, belonging to 27 genera and 9 subfamilies, were identified as a result.

The family Acridiae was determined to be the most abundant with 7 species (70%) whereas the family Pyrgomorphidae included just 3 species (30%). They observed that 13 species (55.4%) belonging to 13 genera made comprised the Acrididae family, which was determined to be the most dominating family (11). Majority of specimens belong to Acrididae followed by Pyrgomorphidae.Results were also related that family Acrididae was found utmost leading with 19 species while lowest population of Pyrgomorphidae with 4 species (12). There observation were also alike they observed Acrididae with 8 species and there are just two species in the Pyrgomorphidae family(13).They also noted similar results they observed that the Acrididae family was found to be the most common representing 21 species (14).

In recent studies Pyrogomorphidae family was found with three species *Chrotogonus trachypterus, Pyrgomorpha conica* and *Poekilocerus pictus.* The Pyrogomorphidae family was found with two species *Chrotogonus trachypterus* and *Pocccilocerus pictus* (11). The findings were also related they observed *Chrotogonus trachypterus* and *Poekilocerus pictus* (15).

The lower diversity of Pyrgomorphidae may be due to their specialized feeding habits and narrower ecological range compared to Acrididae. While Acrididae thrive across different landscapes, Pyrgomorphidae species are more restricted and often associated with specific host plants.

The ecological significance of these findings is considerable. Grasshoppers, especially Acrididae, play a dual role in ecosystems. On one hand, they act as primary herbivores, contributing to nutrient cycling and serving as prey for birds, reptiles, and small mammals. On the other hand, they can cause severe damage to agricultural crops, particularly when populations reach outbreak levels. For example, species such as *Chrotogonus trachypterus* and *Poekilocerus pictus* are well-documented crop pests, infesting cereals, pulses, and vegetables in South Asia. In the context of Quetta, where agriculture forms a major livelihood source, the dominance of Acrididae underscores the need for regular monitoring and integrated pest management strategies.

Climatic conditions in Quetta also influence grasshopper distribution. The region is characterized by hot summers, cold winters, and limited rainfall, creating conditions suitable for xerophilous species. Acrididae, being better adapted to arid conditions, thrive in such climates, while Pyrgomorphidae remains less diverse. Furthermore, ongoing climate change may shift the distribution patterns of these families. Rising temperatures and altered rainfall patterns can potentially increase the breeding cycles of Acrididae, leading to higher population densities and more frequent pest outbreaks. This highlights the importance of

documenting baseline species diversity, as done in the present study, for predicting and managing future ecological and agricultural challenges.

Comparisons with global studies further reinforce these trends. In Africa, Acrididae also dominates locust and grasshopper fauna, with species such as *Schistocerca gregaria* causing devastating locust plagues. Similarly, in Central Asia and the Middle East, Acrididae represents the majority of grasshopper species collected from dryland ecosystems. This global pattern reflects the evolutionary success of Acrididae, which have developed robust physiological adaptations such as efficient water retention, high fecundity, and tolerance to variable vegetation types.

Another important aspect is the role of these species in biodiversity conservation. Documenting the diversity and distribution of grasshoppers in Quetta contributes to understanding the ecological balance of the region. Grasshoppers act as bioindicators of habitat quality, as their abundance and diversity are closely linked to vegetation cover and land use. The reduction in grasshopper diversity may indicate habitat degradation, overgrazing, or excessive use of pesticides. Thus, the present study not only has agricultural implications but also contributes to broader conservation and ecological monitoring efforts in Balochistan.

It is also worth noting that while Acrididae dominates in terms of species richness, the presence of Pyrgomorphidae adds ecological value by maintaining functional diversity. For instance, *Poekilocerus pictus* is known for its bright coloration and chemical defenses, making it less palatable to predators and an interesting subject for ecological and evolutionary studies. Such species highlight the need for preserving grasshopper diversity beyond agricultural perspectives, recognizing their role in food webs and natural pest regulation.

Despite its strengths, the present study has certain limitations. The survey was confined to Quetta, and seasonal variations were not fully explored. Grasshopper populations often fluctuate with rainfall and vegetation growth, which means that long-term monitoring across multiple seasons, would provide a more comprehensive understanding. Additionally, molecular tools could be employed in future research to confirm species-level identification and explore phylogenetic relationships among Acrididae and Pyrgomorphidae species in the region.

According to the present findings, the locust study offers useful information on the variety and abundance of locusts in Quetta. Due to a shift in the weather pattern, there haven't been any swarms in the province of Balochistan this year. Ten species in all have been found in this studies, and they are categorized into two families. The most common family was discovered to be Acrididae, with seven species (70%) and Pyrgomorphidae, with just three species (30). The dominant species of locusts in Quetta was *Anacridium aegyptium*.

CONCLUSION

The present study reaffirms the dominance of Acrididae over Pyrgomorphidae in Quetta, consistent with findings from other parts of South Asia and beyond. The ecological adaptability of Acrididae explains its widespread distribution and abundance, while Pyrgomorphidae remains relatively restricted. These findings hold significant implications for agriculture, biodiversity conservation, and climate change resilience. Expanding such taxonomic and ecological studies across Balochistan would not only enrich our knowledge of Orthopteran diversity but also support sustainable management of grasshopper populations in agroecosystems.

RECOMMENDATIONS

Primary method of controlling Desert Locust swarms and hopper bands is with mainly organophosphate chemicals applied in small concentrated doses (referred to as ultra low volume (ULV) formulation) by vehicle-mounted and aerial sprayers and to a lesser extent by knapsack and hand-held sprayers.Ground spraying using a chemical pesticides is the most successful method of managing locusts. There are chemical and biological insecticides available to small scale farmers wanting to protect their property from locust damage.

Conflict of interest:

All authors do not have any conflict of interest regarding this article.

Author's contribution:

LH Conceptualization, data curation, writing & statistical analysis; NR Supervision, project administration; AK Formal analysis & editing; GM investigation & editing; AI Methodology.

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