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**Research Article****An annotated Checklist of grasshoppers (Acridoidea: Orthoptera) of Punjab, Pakistan****Naheed Baloch, Muhammad Saeed Wagan, Waheed Ali Panhwar***Department of Zoology, University of Sindh Jamshoro Pakistan.***ABSTRACT**

Grasshoppers (Acridoidea) found in Punjab, Pakistan, are documented in this article with an annotated checklist. Grasshoppers were collected from several districts of Punjab for the current study with the help of insect net (3.5 inch in diameter and 20 inch in length). The field locations encompassed agricultural, mountainous, semi-mountainous, and semi-desert regions characterized by a diverse range of vegetation, including crops, grasses, herbs, shrubs, and other plant species. A comprehensive identification of 74 grasshopper species was conducted, encompassing 11 subfamilies such as Oedipodinae, Gomphocerinae, Eyprepocnemidinae, Acridinae, Oxyinae, Cyrtacanthacridinae, Hemiacridinae, Calliptaminae, Tropicopolinae, and Catantopinae and Dericorythinae (now known as Dericorythidae). Hopefully, this study will form a base line for future Orthopterists in Pakistan.

Keywords: Acridoidea; agriculture; documentation; diversity; check list; Pakistan.**INTRODUCTION**

Insects belonging to the order Orthoptera include katydids, locusts, crickets, and grasshoppers. The superfamily Acridoidea comprises locusts and grasshoppers. A few of the most profitable pests are found in this superfamily, especially the locust species, which can wreak havoc on crops by creating swarms and devouring massive quantities of vegetation (Panhwar, 2018; Ali et al., 2021). Acridoidea is one of the diversified superfamilies with 14 valid families with 11,000 described species worldwide (Kristln et al., 2020). The distinctive feature of the members belonging to the superfamily Acridoidea is their robust hind legs, specifically adapted for jumping. Additionally, their diet primarily comprises grasses, supplemented with other vegetation, making them herbivorous in nature. Large compound eyes, well-developed wings, and elongated bodies are typical characteristics (Saeed et al., 2000; Sarwar et al., 2021). Although grasshoppers and locusts are key ecological players in many ecosystems, both as prey and predators, their capacity to proliferate quickly and form swarms under specific circumstances can cause agricultural crises that impact livelihoods and food security in the affected areas (Soomro & Wagan, 2005; Wagan & Riffat, 2013). Acridoids are important herbivores in grassland ecosystems around the world. They are crucial to food chains and help in plant growth and nutrient cycling. Nonetheless, outbreaks of grasshoppers and locusts are seen as an international issue (Memon & Panhwar, 2021). They have the power to completely destroy crops and grasslands and severely harm rangelands and crops economically (Raza et al., 2019; Hussain et al., 2017). Due to their sensitivity to variations in climate and land use, a few species of grasshoppers have been suggested as ecological indicators of the health of ecosystems. Geographical features and climate change are important determinants of grasshopper population increase (Lund et al., 2023; Sarki et al., 2023). The database shows that Acridoidea

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Article History

Received: August 30, 2023

Accepted: November 20, 2023

Published: December 28, 2023

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(Grasshoppers) is the largest superfamily amongst Orthopterans comprising 28 families, 140 subfamilies, 265 tribes, 2459 genera, 57 subgenera and 10531 species and 1951 subspecies worldwide except Antarctica (Cigliano et al. 2022). A number of studies regarding species exploration, distribution and taxonomy on grasshoppers have been published from the various part of the country. These are includes: Wagan & Kevan (1992); Anjum et al. (1994); Suhail et al. (1999); Saeed et al. (2000); Wagan et al. (2001); Mahmood et al. (2004); Soomro & Wagan (2005); Shah et al. (2008); Wagan & Riffat (2013) ; Sultana et al. (2014); Panhwar et al. (2014); Nazir et al. (2014); Panhwar et al.(2016); Ali & Panhwar, (2017); Hussain et al. (2017); Usman et al.(2017); Panhwar (2018); Raza et al.(2019); Sarwar et al. (2021); Memon et al. (2021); Memon & Panhwar (2021); Panhwar et al. (2022); Panhwar et al. (2023); Ullah et al. (2023). Beside the significant contributions on grasshoppers of Pakistan. None of the study was conducted on the checklist of grasshoppers of Punjab. Herein, we have planned to compile the grasshopper's species from Punjab province of Pakistan.

MATERIALS AND METHODS

The grasshoppers were gathered from different regions of the Punjab (Figure 1). The current study was conducted at various locations in Punjab, Pakistan. Material was gathered from agricultural land, partially abandoned, hilly, and partially mountainous regions. The grasshoppers were collected using a 3.5-inch diameter and 20-inch long insect net, and then they were chloroformed. The specimens were promptly pinned within a few hours due to their pliability and minimal risk of losing any components during the required handling. Additionally, the portions could be easily elongated as needed. The insect pins were placed on the pronotum, namely behind the transverse sulcus and somewhat to the right of the median dorsal carina. Next, the specimens were carefully extended on the stretching board, with special focus given to the antennae, wings, and legs to highlight significant taxonomic features. The dry camel hairbrush was used to eliminate dust and other foreign particles. Completely desiccated specimens were taken off the stretching boards and put in insect boxes together with field labels indicating the location, date, and the name of the collectors. Boxes were filled with naphthalene balls to protect specimens from infestation by vermin commonly seen in museums. The specimens were identified using a stereoscopic binocular microscope and reference materials. In order to create the checklist of species, the specimens were cross-referenced with the Orthoptera species file Online (Cigliano et al., 2022) to verify their current species status (Table 1).

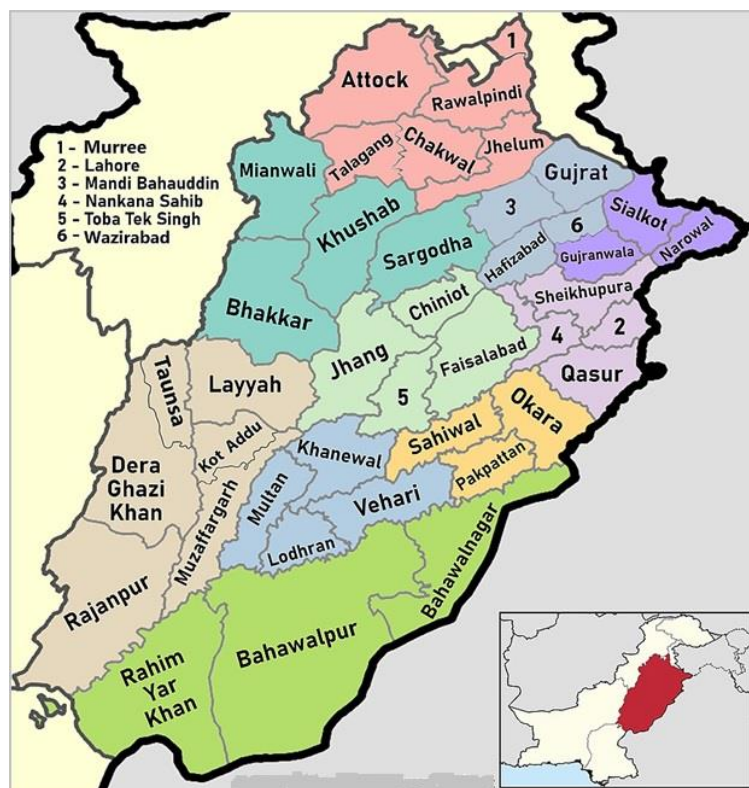


Figure 1. Showing collection sites.

Table 1. Checklist of Acridoidea MacLeay, 1821(Orthoptera) of Punjab, Pakistan.

Family/Subfamily	Species examined	Current status
Dericorythidae	<i>Dericorys tibialis</i> (Pallas, 1773)	<i>Dericorys tibialis</i> (Pallas, 1773)
Acrididae	<i>Oxya hyla hyla</i> Audinet-Serville, 1831	<i>Oxya hyla</i> Serville, 1831
Oxyinae	<i>O. fuscovittata</i> (Marschall, 1836)	<i>Oxya fuscovittata</i> (Marschall, 1836)
	<i>O. bidentata</i> Willemse, 1925	<i>Oxyina bidentata</i> (Willemse, 1925)
	<i>O. velox</i> (Fabricius, 1787)	<i>Oxya velox</i> (Fabricius, 1787)
Hemiacridinae	<i>Hieroglyphus perpolita</i> (Uvarov, 1933)	<i>Hieroglyphus perpolita</i> (Uvarov, 1933)
	<i>H. nigrorepletus</i> I. Bolivar, 1912	<i>Hieroglyphus nigrorepletus</i> Bolívar, 1912
	<i>H. banian</i> (Fabricius, 1798)	<i>Hieroglyphus banian</i> (Fabricius, 1798)
Spathosterninae	<i>Spathosternum prasiniferum prasiniferum</i> (Walker, 1871)	<i>Spathosternum prasiniferum prasiniferum</i> (Walker, 1871)
Tropidopolinae	<i>Tropidopola longicornis longicornis</i> (Fieber, 1853)	<i>Tropidopola longicornis longicornis</i> (Fieber, 1853)
Catantopinae	<i>Diabolocatantops innotabilis</i> (Walker, 1870)	<i>Diabolocatantops innotabilis</i> (Walker, 1870)
Cyrtacanthacridinae	<i>Anacridium rubrispinum</i> Bey-Bienko, 1948	<i>Anacridium rubrispinum</i> Bey-Bienko, 1948
	<i>Cyrtacanthacris tatarica</i> (Linnaeus, 1758)	<i>Cyrtacanthacris tatarica</i> (Linnaeus, 1758)
	<i>Chondracris orientalis</i>	No data found
	<i>Schistocerca gregaria</i> (Forskål, 1775)	<i>Schistocerca gregaria</i> (Forskål, 1775)
Calliptaminae	<i>Acorypha glaucopsis</i> (Walker, 1870)	<i>Acorypha glaucopsis</i> (Walker, 1870)
	<i>Sphodromerus undulatus undulatus</i> (Kirby, 1914)	<i>Sphodromerus undulatus undulatus</i> (Kirby, 1914)
	<i>Sphodromerus undulatus salinus</i> Uvarov, 1943	<i>Sphodromerus undulatus salinus</i> Uvarov, 1943
	<i>Sphodromerus undulatus pedestris</i> Uvarov, 1943	<i>Sphodromerus undulatus pedestris</i> Uvarov, 1943
Eyrepocnemidinae	<i>Eyrepocnemis alacris alacris</i> (Serville, 1838)	<i>Eyrepocnemis alacris alacris</i> (Serville, 1838)
	<i>Choroedocus illustris</i> (Walker, 1870)	<i>Choroedocus illustris</i> (Walker, 1870)
	<i>Cataloipus cognatus</i> (Walker, 1870)	<i>Cataloipus cognatus</i> (Walker, 1870)
	<i>Heteracris littoralis</i> (Rambur, 1838)	<i>Heteracris littoralis</i> (Rambur, 1838)
	<i>Heteracris adspersa</i> (Redtenbacher, 1889)	<i>Heteracris adspersa</i> (Redtenbacher, 1889)
	<i>Heteracris notabilis</i> (Uvarov, 1942)	<i>Heteracris notabilis</i> (Uvarov, 1942)
	<i>Tyloptropidius varicornis</i> (Walker, 1870)	<i>Tyloptropidius varicornis</i> (Walker, 1870)
Oedipodinae	<i>Acrotylus humberianus</i> Saussure, 1884	<i>Acrotylus humberianus</i> Saussure, 1884
	<i>Acrotylus longipes subfasciatus</i> Bey-Bienko, 1948	<i>Acrotylus longipes subfasciatus</i> Bey-Bienko, 1948
	<i>Aiolopus thalassinus thalassinus</i> (Fabricius, 1781)	<i>Aiolopus thalassinus thalassinus</i> (Fabricius, 1781)
	<i>Aiolopus thalassinus tamulus</i> (Fabricius, 1798)	<i>Aiolopus thalassinus tamulus</i> (Fabricius, 1798)
	<i>Aiolopus simulatrix simulatrix</i> (Walker, 1870)	<i>Aiolopus simulatrix simulatrix</i> (Walker, 1870)
	<i>Gastrimargus africanus sulphureus</i> Bey-Bienko, 1951	<i>Gastrimargus africanus sulphureus</i> Bey-Bienko, 1951
	<i>Hilethera aeolopoides</i> (Uvarov, 1922)	<i>Hilethera aeolopoides</i> (Uvarov, 1922)
	<i>Chloeobora grossa</i> Saussure, 1884	<i>Chloeobora grossa</i> Saussure, 1884
	<i>Locusta migratoria</i> (Linnaeus, 1758)	<i>Locusta migratoria</i> (Linnaeus, 1758)
	<i>Mioscirtus wagneri rogenhoferi</i> (Saussure, 1888)	<i>Mioscirtus wagneri rogenhoferi</i> (Saussure, 1888)
	<i>Oedaleus abruptus</i> (Thunberg, 1815)	<i>Oedaleus abruptus</i> (Thunberg, 1815)
	<i>Oedaleus roscens</i> Uvarov, 1942	<i>Oedaleus roscens</i> Uvarov, 1942
	<i>Oedaleus senegalensis</i> (Krauss, 1877)	<i>Oedaleus senegalensis</i> (Krauss, 1877)

	<i>Scintharista notabilis pallipes</i> Uvarov, 1941	<i>Scintharista notabilis pallipes</i> Uvarov, 1941
	<i>Sphingonotus savignyi</i> Saussure 1884	<i>Sphingonotus (Sphingonotus) savignyi</i> Saussure, 1884
	<i>Sphingonotus rubescens rubescens</i> (Walker, 1870)	<i>Sphingonotus (Sphingonotus) rubescens rubescens</i> (Walker, 1870)
	<i>Sphingonotus predtetschenskyi</i> Mistshenko, 1936	No data found
	<i>Sphingonotus akbari</i> Baloch & Wagan, 2000	No data found
	<i>Sphingonotus hussaini</i> Baloch & Wagan, 2000	No data found
	<i>Trilophidia annulata</i> (Thunberg, 1815)	<i>Trilophidia annulata</i> (Thunberg, 1815)
	<i>Oedipoda miniata</i> (Pallas, 1771)	<i>Oedipoda miniata</i> (Pallas, 1771)
	<i>Oedipoda fedtschenki fedtschenki</i> Saussure, 1884	<i>Oedipoda fedtschenki fedtschenki</i> Saussure, 1884
	<i>Heteropternis partita</i> Walker, 1870	<i>Heteropternis thoracica</i> (Walker, 1870)
Acridinae	<i>Acrida exaltata</i> (Walker, 1859)	<i>Acrida exaltata</i> (Walker, 1859)
	<i>Duroniella laticornis</i> (Krauss, 1909)	<i>Duroniella laticornis</i> (Krauss, 1909)
	<i>Duroniella laeviceps</i> Uvarov, 1938	<i>Duroniella laeviceps</i> Uvarov, 1938
	<i>Gelastorhinus semipictus</i> (Walker, 1870)	<i>Gelastorhinus semipictus</i> (Walker, 1870)
	<i>Gonista rotundata</i> Uvarov, 1933	<i>Gonista rotundata</i> Uvarov, 1933
	<i>Phlaeoba tenebrosa</i> (Walker, 1871)	<i>Phlaeoba tenebrosa</i> (Walker, 1871)
	<i>Phlaeoba panteli</i> Bolívar, 1902	<i>Phlaeoba panteli</i> Bolívar, 1902
	<i>Truxalis eximia eximia</i> Eichwald, 1830	<i>Truxalis eximia eximia</i> Eichwald, 1830
	<i>Truxalis fitzgeraldi</i> Dirsh, 1950	<i>Truxalis fitzgeraldi</i> Dirsh, 1950
Gomphocerinae	<i>Aulacobothrus punjabensis</i> Baloch & Wagan, 2000	<i>Aulacobothrus punjabensis</i> Baloch & Wagan, 2000
	<i>Aulacobothrus luteipes</i> (Walker, 1871)	<i>Aulacobothrus luteipes</i> (Walker, 1871)
	<i>Brachycrotaphus longiceps</i> (Bolívar, 1902)	<i>Brachycrotaphus longiceps</i> (Bolívar, 1902)
	<i>Chorthippus indus</i> Uvarov, 1942	<i>Chorthippus (Chorthippus) indus</i> Uvarov, 1942
	<i>Cruciotacris decisa</i> (Walker, 1871)	<i>Cruciotacris decisa</i> [temporary name] (Walker, 1871)
	<i>Leva indica</i> (Bolívar, 1902)	<i>Leva indica</i> (Bolívar, 1902)
	<i>Leionotacris bolivari</i> (Uvarov, 1921)	<i>Leionotacris bolivari</i> (Uvarov, 1921)
	<i>Mesopsis cylindricus</i> (Kirby, 1914)	<i>Mesopsis cylindricus</i> (Kirby, 1914)
	<i>Ochrilidia geniculata</i> (Bolívar, 1913)	<i>Ochrilidia geniculata</i> (Bolívar, 1913)
	<i>Ochrilidia gracilis gracilis</i> (Krauss, 1902)	<i>Ochrilidia gracilis gracilis</i> (Krauss, 1902)
	<i>Ochrilidia ahmadi</i> Wagan & Baloch, 2001	<i>Ochrilidia ahmadi</i> Wagan & Baloch, 2001
	<i>Ochrilidia</i> sp.	No data found
	<i>Oxypterna afghana</i> Ramme, 1952	<i>Oxypterna afghana</i> Ramme, 1952
	<i>Stenohippus mundus</i> (Walker, 1871)	<i>Stenohippus mundus</i> (Walker, 1871)
	<i>Stenohippus trapezoidalis</i> (Bolívar, 1914)	<i>Stenohippus trapezoidalis</i> (Bolívar, 1914)
	<i>Stenohippus xanthus</i> (Karny, 1907)	<i>Stenohippus xanthus</i> (Karny, 1907)

RESULTS AND DISCUSSION

The Acridoidea grasshoppers, belonging to the subfamily, play a crucial role in the agricultural and rangeland economy. To effectively diagnose an economic issue, it is imperative to have a comprehensive understanding of the extent to which they are detrimental. Grasshoppers were gathered from several regions of the Punjab. The field sites encompassed diverse landscapes, including agricultural, mountainous, semi-mountainous, and semi-deserted environments. These locations were characterised by a range of vegetation, such as crops, grasses, herbs, and shrubs. Panhwar et al. (2023) gathered extensive data on Orthoptera in British India. According to their statement, the fauna

in Pakistan consists of 28 species belonging to 12 subfamilies. In a similar manner, Panhwar et al. (2016) provided a comprehensive list of annotated Tettigoniodea (Orthoptera) species found in several regions of Pakistan. They documented a total of 47 species of Tettigoniodea. In this study, a total of 74 grasshopper species were examined from a collection of grasshoppers obtained from various regions of Punjab. The species were classified into various subfamilies, namely Oedipodinae, Gomphocerinae, Eyprepocnemidinae, Acridinae, Oxyinae, Cyrtacanthacridinae, Hemicacridinae, Calliptaminae, Tropidopolinae, Catantopinae, and Dericorythinae (now known as Dericorythidae) (refer to Table 1). Ali and Panhwar conducted a study in 2017. In the year 2016-2017, a survey was conducted in the Hazara region to gather information about the Acrididae fauna. A total of 1402 specimens of locusts and grasshoppers were collected and 73 species, 38 genera, and 11 subfamilies were identified. These subfamilies include Acridinae, Oedipodinae, Gomphocerinae, Oxyinae, Tropidopolinae, and Cyrtacanthacridinae. According to Wagan & Riffat (2013), multiple species of grasshoppers belonging to the families Eumastacidae, Dericorythidae, Acrididae, Pyrgomorphidae, Tetrigidae, and Pamphagidae were found in diverse ecological zones of Pakistan.

CONCLUSION

Present study concludes the finding of 74 grasshopper species belonging to Superfamily Acridoidea, Family Acrididae and 11 subfamilies: Oedipodinae, Gomphocerinae, Eyprepocnemidinae, Acridinae, Oxyinae, Cyrtacanthacridinae, Hemicacridinae, Calliptaminae, Tropidopolinae, and Catantopinae and Dericorythinae (now known as Dericorythidae). Additionally, the checklist provided is update with the names and current status of species in the world data base of Orthoptera (<https://orthoptera.speciesfile.org/>). Further, more surveys should be carried out in future that may lead to the discovery of new records or new species. The present study will be beneficial for the future taxonomist to study the biodiversity of grasshoppers (Acridoidea) fauna of this region.

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