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Diversity and Ecological Associations of Insect Fauna of Koh E Moor Forest District Bajaur Ex Fata

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ABSTRACT
The present inquiry seeks to illuminate the diversity and ecological relationships of insect fauna with wild host plants in Bajaur District , Khyber Pakhtunkhwa, Pakistan. The order Hemiptera showed the greatest diversity , with 7 genera among the families Cicadellidae and Delphacidae, followed by Coleoptera with 4 genera and Orthoptera with 2 genera. A total of 14 genera from 3 orders, 6 families, and 8 subfamilies were documented. The Cicadellidae (Deltocephalinae) was the most species-rich subfamily, comprising 5 genera , including Exitianus, Hishimonus, Chiasmus, Stirellus, and Aconurella. The attachment of hemipterans to plant hosts showed a strong preference for members of the families Poaceae and Cyperaceae, while coleopterans showed a preference for Asteraceae, Amaranthaceae, and Apocynaceae . Orthopterans such as Chortophaga and Poekilocerus were discovered mainly on Chenopodiaceae, Fabaceae, and Apocynaceae . To confirm identification and ecological relationships , morphological diagnostics, species diversity , and detailed keys to genera were used. The study provides important baseline data for biodiversity assessment and conservation in arid ecosystems and highlights the importance of wild flora for the conservation of insect diversity. The results offer potential for ecological monitoring , biological control strategies, and further taxonomic research in understudied dry habitats.
Keywords: Insect diversity, Hemiptera, wild host plants, Bajaur District, arid ecosystem conservation

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INTRODUCTION
Insects exist globally and encompass diverse climates and ecosystem, with a large array of insect life and indigenous flora. In Pakistan, flora is frequently constrained by significant temperature fluctuations and erratic weather; yet, there exists considerable possibilities for wild botanicals and bugs that must be researched, discovered, and classified. Approximately 47 billion hectares of the Earth's surface comprise forests (Ashfaq et al., 2017). The region of Khyber Pakhtunkhwa is abundant in wild plant species. The southern districts are the primary regions of this area (Shad et al., 2014). The Bajaur District is a significant southern district of Khyber Pakhtunkhwa Province in Pakistan, subdivided into three Tehsils: Bajaur, Sarai Naurang, and Ghaznikhel. It is geographically located between 32°17' to 32°53' N latitude and 70°23' to 71°16' E longitude (Khan et al., 2020). The western region of the territory is optimal for agriculture, whereas the eastern region of the district is characterized by sandy and arid conditions. The Climate of the Bajur District is arid to semi-arid subtropical, receiving 8-14 inches of annual precipitation. Temperatures typically range from 27 to 42 °C in summer and from 4 to 20 °C in winter (Khan, 2019). Plants and insects exhibit significant diversity owing to their capacity to flourish in a multitude of niches, encompassing desert and polar environments, as well as nearly all plant species presently existing worldwide. Plants and insects constitute around fifty percent of all

complex life forms. Plants engage with bugs in many ways; certain insects may offer protection, facilitate dispersal, or contribute to fertilization, while others may exploit plants for sustenance or as nesting sites (Calatayud et al., 2018). Various insect groups inhabit various dry and semi-arid environments, primarily consisting of ecosystem for weeds. Simultaneously, numerous species serve as advantageous pest predators or pollinators (Botias et al., 2016). Insect Pollination is directly responsible for the development of fruit and seeds in around 80% of wild plants, whereas 75% of agricultural plants used for human consumption rely totally on insect pollination, particularly by bees (Potts et al., 2010). For a long time,it has been acknowledged and recorded which insects are the majority varied species, possessing more species than any other category. Influence the environment, serving as crucial components of food webs in both terrestrial and aquatic ecosystems, while also playing a critical role in ecosystem protection and enhancing overall ecological well being(Ramzan et al., 2020). Coleoptera, the largest beetles, comprising over 386,500 species, accounting for nearly 40 percent of all insect species. Climates demonstrate the highest prevalence of this order within the insect fauna. In the climatic belt, beetles represent one-third of the insect species variety (Slipinski et al., 2011). Lepidoptera constitutes the second most varied order of insects, encompassing about 160,000 recognized species of butterflies and moths (Lukhtanov, 2015). The species is mostly linked to various plants; however, current study suggests it can lay eggs and develop at a higher level spectrum of weeds(Bawin et al., 2016). Flies has 150 families and exceeds 150,000 species, rendering it the majority diverse sequence biologically. Co-evolved alongside various cultivated and wild flora and fauna. Regarded as the leading category of living things worldwide (Parveen, 2021).

Order Hymenoptera has about 140,000 extant types alongside more than 2,000 vanished types (Klopfstein et al., 2013). The principal species in this sequence are bees, ants, sawflies, and wasps. Numerous types within wasps serve as vital floral visitors for various native plants and provide essential supplementary forage plants (Kleijn et al., 2015).

True bugs fifth biggest order of invertebrate, following Coleoptera, Lepidoptera, Diptera, and Hymenoptera. Estimated diversity of true bugs is approximately 82,000, while the precise figure remains undetermined (Forerol, 2008). insect order Hemiptera has a lengthy and intricate history due to its elevated categorization level (Brysz and Szwedo 2019). Over 300 current and extinct groups exist, with the majority of insect families occupying all terrestrial environments (arid regions) and certain marine ecosystems (Luo et al., 2020).

Order Orthoptera comprises 28,000 described species (Cigliano et al., 2018). insects present in nearly all global terrestrial ecosystems constitute a diverse assemblage of species referred to as grasshoppers, crickets, and locusts. Substantial order of insects. They are predominantly found found in in tropical and subtropical climates, particularly in arid and warm places (Moad, 2018).tropical and subtropical climates, particularly in arid warm places (Moad, 2018). majority of species are polyphagous, consuming a diverse range of crops and wild plants (Majid et al., 2021).

The significant range of ecosystems and possesses a rich insect species capable of adapting to various climatic areas. Pakhtunkhwa Province is an arid and mostly uncharted region. Been conducted on the insect fauna associated with natural plants. Knowledge gap exists that requires addressing. Study aims to furnish baseline data regarding the insect fauna associated with natural plants. Gather and classify insects linked to wild flora. Develop taxonomic key connected alongside natural flora at the Genus category. Identify the native flora associated with collected insects.

MATERIALS AND METHODS

thorough assessment was performed to investigate the entomofauna linked to weeds in the dry regions of the Koh-e-Moor Forest, situated in Bajaur District, Khyber Pakhtunkhwa Province, during the summer of 2022. The survey focused on ten unique sites within the Koh-e-Moor Mountain range to guarantee a varied representation of bug species. Multiple resources were utilized during the investigation, including bug handling nets, pooters, tweezers, specimen killers, ethanol, and ethyl acetate for the effective collection, preservation, and identification of specimens. Insects were gathered employing the sweeping method with a hand net, while aspirators and forceps were used to manipulate fragile specimens. Following collecting, insects were exterminated by placing them in sealed containers

with cotton swabs saturated with ethyl acetate. Specimens were subsequently kept in 50mL conical centrifuge tubes filled with 95% ethanol, accompanied by appropriate labeling for traceability. Before mounting, samples were submerged in 100% alcohol for 24 hours; Smaller insects were affixed to insect pins, but larger insects were secured through middle segment with suitably sized pins. Each sample was affixed with a data tag denoting the collection place, day, recorded by, and botanical host, succeeded by an identification label post-species identification. Artifacts were preserved in wooden boxes containing crystal ice crystals and phenyl tablets to safeguard them from potential museum pests. Identification was performed using existing literature, including Kirby's (1914) Identification Keys to the Fauna of British India (Orthoptera), Dietrich and Wilson's (2005) diagnostic features Common insect families and genera (Hemiptera), and beetle identification keys by Watt (1997), Choate (1999, 2001), Chris (2006), Ashfaque, and Naz (2012). The external traits, including dimensions, morphology, pigmentation, and distinct designs of the caps, chest, and belly, were meticulously analyzed.Regarding examination of aedeagus, the belly was macerated in a 10% NaOH solution, subsequently rinsed, and preserved in glycerin within micro-centrifuge tubes labeled with corresponding specimen numbers. Indigenous native plants were classified including the aid of a plant classifier and authenticated with showcasing the Pakistani plant collection at the unique Herbarium for Weeds and Medicinal Plants, University of Agriculture Peshawar. Helicon Focus software was used to merge several photos captured at varying focal points into a crisp composite image. All gathered specimens and study materials were ultimately stored in the Insect AWKUM entomology lab Mardan. This research offered significant insights into the insect biodiversity of the Koh-e-Moor Forest, enhancing ecological comprehension of Bajaur's arid ecosystems.

Results

A thorough field survey undertaken in the District Bajaur, Khyber Pakhtunkhwa, Pakistan, recorded a diverse and abundant collection of insect fauna connected with wild host plants. The research discovered 14 genera across 3 insect orders: Hemiptera, Coleoptera, and Orthoptera (Table 3). The order Hemiptera is the most diversified, consisting of two families: Cicadellidae (sub-family Deltocephalinae) and Delphacidae (sub-family Delphacinae). Within Hemiptera, five genera of Cicadellidae—Exitianus, Hishimonus, Chiasmus, Stirellus, and Aconurella—were documented (Table 2, Table 3), with Stirellus representing the most diverse genus (5 species, Table 6). Furthermore, two Delphacid genera—Sogatella and Perkinsiella—were identified, with diagnostic criteria differentiating them based on head shape (Table 8).

The order Coleoptera has two families: Coccinellidae (sub-family Coccinellinae) and Chrysomelidae (sub-family Chrysomelinae), encompassing four genera: Coccinella, Menochilus, Harmonia, and Zygogramma (Table 3, Table 10). Coccinella was the most prevalent species, with 39 males and 6 females analyzed (Table 10), and was primarily located on Verbesina encelioides and Boerhaavia diffusa (Table 11). Menochilus and Harmonia were also gathered from Digera muricata, Calotropis procera, and Peganum harmala. Zygogramma, a member of the Chrysomelidae family, was discovered in association with the invasive species Parthenium hysterophorus and Opuntia ficus-indica (Table 12).

Within the order Orthoptera, two families—Acrididae (Oedipodinae) and Pyrgomorphidae (Pyrgomorphinae)—were each represented by a solitary genus: Chortophaga and Poekilocerus, respectively (Table 13). Chortophaga, comprising three species (Table 13), was linked to Chenopodium album, Cynodon dactylon, and Prosopis juliflora (Tables 15, 16). Poekilocerus, distinguished by its sizable body adorned with prominent blue, black, and yellow patches (Table 18), was observed on Calotropis procera and Prosopis juliflora, with the maximum number of analyzed specimens (52♂, 25♀, Table 19), indicating its extensive adaptation and prevalence in the area. Host plant relationships (Table 5, Table 11, Table 16) indicated that the Poaceae family was the most prevalent, serving as a host to many species within Hemiptera and Orthoptera, including Stirellus, Exitianus, Hishimonus, Chiasmus, and Chortophaga. Other often documented plant families included Cyperaceae, Asteraceae, Amaranthaceae, Apocynaceae, and Fabaceae, which supported a range of insect species (Table 7). The morphological identification of genera was corroborated by diagnostic characteristics including head shape, aedeagus structure, pygofer morphology, and coloration patterns (Tables 2, 4, 8, 9, 14, and 17).

Geographical distribution data (Tables 4, 9, 12, and 20) indicated a substantial overlap with adjacent nations such as Afghanistan, India, and China, demonstrating ecological continuity and shared biodiversity across regional landscapes. This study presents the inaugural comprehensive faunal description of phytophagous and beneficial insect taxa linked to wild plants in the dry habitat of District Bajaur. These findings provide essential baseline data for biodiversity assessment, ecological monitoring, biological control techniques, and future taxonomic research, underscoring the significance of protecting native wild vegetation that sustains insect variety.

Table 1: Insects associated with native plants in District Bajur at, Khyber Pakhtunkhwa-Pakistan

Order	**Clan**	**Subfamily**	**Type**
Hemiptera	Cicadellidae	Deltocephalinae	*Exitianus*
			Hishimonus
			Chiasmus
			Stirellus
			Aconurella
	Delphacidae	Delphacinae	*Sogatella*
			Perkinsiella
Coleoptera	Coccinellidae	Coccinellinae	*Coccinella*
			Menochilus
			Harmonia
	Chrysomelidae	Chrysomelinae	*Zygogramma*
Orthoptera	Acrididae	Oedipodinae	*Chortophaga*
	Pyrgomorphidae	Pyrgomorphinae	*Poekilocerus*

Table No. 1 indicates that seven types of genera from 2 families and 2 sub-families of the true bugs, 4 genera from 2 families and 2 sub-families of the beetles, and 2 genera from 2 families and 2 sub-families of the orthopteran insects linked to wild flora were documented in Bajur District, Khyber Pakhtunkhwa, Pakistan. Diversity of 5 genera, after the Coccinellidae family (Coccinellinae: Coleoptera) with 3 genera, and the Delphacidae family (Delphacinae: Hemiptera) with 2 genera. The rest of the families are each symbolized by one sub-family and one category.

Table 2: Host Plants Serving as habitats for insects District Bajur at, Khyber Pakhtunkhwa-Pakistan.

Insect group(Classification)	**Associate host plants**			
	Bionomial nomenclature	**Scientific name**	**Family**	**Life cycle**
Leafhoppers (*Exitianus*, *Hishimonus*, *Chiasmus*, *Stirellus*, *Aconurella*)	Purple Nutsedge	*Cyperus rotundus* (L.)	Cyperaceae	Pesistent
	Buffel grass	*Dhaman*	Grasses	Persistent
	Stinkgrass	*Eragrostis cilianensis* (All.)	Grasses	seasonal
	Egyptian crowfoot grass	*Dactyloctenium aegyptium* (L.)	Grasses	seasonal
	Halfa grass	*Desmostachya bipinnata* (L.)	Grasses	Pesistent
	Cogon grass	*Imperata cylindrical* (L.)	Grasses	Pesistent
Delphacidae (*Sogatella*	Hairy Crabgrass	*Digitaria sanguinalis* (L.)	Grasses	seasonal
	Kans grass	*Saccharum spontaneum* (L.)	Grasses	Pesistent

Perkinsiella)	Chinese sprangletop	*Leptochloa chinensis* (L.)	Grasses	Annual
Coccinellidae (Coccinella)	Cowpen daisy	*Verbesina encelioides* (Cav.)	Daisies	seasonal
	Red spiderling	*Boerhaavia diffusa* (L.)	Nyctaginaceae	Pesistent
Coccinellidae (*Harmonia, Menochilus*)	False amaranth	*Digera muricata* (L.)	Amaranthaceae	seasonal
	Harmala	*Peganum harmala* (L.)	Zygophyllaceae	Pesistent
Coccinellidae (*Menochilus*)	Giant milkweed	*Calotropis procera* (Aiton.)	Apocynaceae	Pesistent
Pyrgomorphidae (*Poekilocerus*)				
Chrysomelidae (*Zygogramma*)	White top weed	*Parthenium hysterophorus* (L.)	Daisies	Annual
	Prickly pear cactus	*Opuntia ficus-indica* (L.)	Cactaceae	Pesistent
Acrididae (*Chortophaga*)	Lambsquarters	*Chenopodium album* (L.)	Beets	Annual
Delphacidae (*Sogatella Perkinsiella*)	Bermuda grass	*Cynodon dactylon* (L.)	Gramineae	Pesistent
Acrididae (*Chortophaga*)				
Acrididae (*Chortophaga*)	Mesquite	*Prosopis juliflora* (L.)	Alfalfa	Pesistent
Pyrgomorphidae (*Poekilocerus*)				

Table 3: Aphididae in District Bajaur (KP)

Characteristic	Family
Hind tibia having a long,pointed and moveable projection(Fig. 2)	Planthoppers
Entomology (Fig. 3)	Leafhoppers

Table 4: Genera of Sub-family Deltocephalinae of Family Cicadellidae

Characteristic	Genus
Vertex narrow basally (Fig. 4)	Stirellus
Bifurcate Aedeagus (Fig. 6)	Hishimonus
Male pygofer with caudal marginal darkly sclerotized crest	Aconurella
Anatomy (Fig. 8)	Chiasmus
Head margin rounded, pale brown species (Fig. 9)	Exitianus

Table 5: Insect Families and Genera obtained from non-domesticated Plants in District Bajaur (KP)

Order	Family	Sub-family	Genus
Aphids	Leafhoppers	Deltocephalinae	Stirellus
Aphids	Leafhoppers	Deltocephalinae	Hishimonus
Aphids	Leafhoppers	Deltocephalinae	Aconurella
Aphids	Leafhoppers	Deltocephalinae	Chiasmus
Aphids	Leafhoppers	Deltocephalinae	Exitianus
Aphids	Planthoppers	Delphacinae	Sogatella
Aphids	Planthoppers	Delphacinae	Perkinsiella
Beetles	Ladybugs	Coccinellinae	Coccinella

Beetles	Ladybugs	Menochilus	
Beetles	Ladybugs	Coccinellinae	Harmonia
Beetles	Leaf beetles	Chrysomelinae	Zygogramma
Locusts	Fruit family	Oedipodinae	Chortophaga
Locusts	Pyrgomorphidae	Pyrgomorphinae	Poekilocerus

Table 6: Genus and Distribution of Cicadellidae (Deltocephalinae)

Genus	Body Length (mm)	Color Variation	Host Plants	Distribution
Stirellus	3.8-4.2	Yellowish-brown to green	Cenchrus ciliaris, Eragrostis	Worldwide
Hishimonus	3.0-5.0	Greenish or yellow	Dactyloctenium aegyptium	Pakistan, China, Afghanistan
Aconurella	2.9-3.2	Various colors and markings	Imperata cylindrical, Cyperus	Pakistan, India, Japan

Table 7: Host Plants of Cicadellidae Genera in District Bajaur

Family	Genus	Host Plant
Poaceae	Stirellus	Cenchrus ciliaris, Eragrostis cilianensis
Poaceae	Hishimonus	Dactyloctenium aegyptium, Desmostachya bipinnata
Cyperaceae	Aconurella	Cyperus rotundus
Poaceae	Chiasmus	Desmostachya bipinnata
Poaceae	Exitianus	Dactyloctenium aegyptium

Table 8: Insect Families and Genera Collected from Wild Plants in District Bajaur (KP)

Group	Family	Sub-family	Genus	Species
Aphids	Leafhoppers	Deltocephalinae	Stirellus	5 species
Aphids	planthoppers	Delphacinae	Sogatella	2 species
Beetles	Ladybugs	Coccinellinae	Coccinella	3 species
Locusts	Acrididae	Oedipodinae	Chortophaga	3 species
Locusts	Lubber grasshoppers	Pyrgomorphinae	Poekilocerus	2 species

Table 9: Insect Families and Subfamilies Collected from Host Wild Plants

Family	Sub-family	Wild Plants
Cicadellidae	Deltocephalinae	Poaceae, Cyperaceae
Delphacidae	Delphacinae	Poaceae
Coccinellidae	Coccinellinae	Asteraceae, Apocynaceae, Amaranthaceae
Chrysomelidae	Chrysomelinae	Asteraceae, Cactaceae
Acrididae	Oedipodinae	Chenopodiaceae, Poaceae, Fabaceae
Pyrgomorphidae	Pyrgomorphinae	Apocynaceae, Fabaceae

Table 10: Key to the Genera of Sub-family Delphacinae of Family Delphacidae

Characteristic	Genus
Head including eyes narrower than pronotum	Sogatella
Head including eyes parallel with pronotum	Perkinsiella

Table 11: Genus and Diagnostic Characters of Delphacidae (Delphacinae)

Genus	Diagnostic Characteristics	Host Plants
Sogatella	General color stramineous, head narrower than	Digitaria sanguinalis, Leptochloa

	pronotum	chinensis
Perkinsiella	Dark brown color, basal vertex creamy white	Saccharum spontaneum, Cynodon dactylon

Table 12: Genus and Material Examined of Coccinellidae (Coccinellinae)

Genus	Material Examined	Host Plant
Coccinella	39♂, 6♀	Verbesina encelioides, Boerhaavia diffusa
Menochilus	27♂, 4♀	Digera muricata, Calotropis procera
Harmonia	11♂	Digera muricata, Peganum harmala

Table 13: Host Plants of Coccinellidae Genera

Genus	Host Plant
Coccinella	Verbesina encelioides
Menochilus	Digera muricata, Calotropis procera
Harmonia	Digera muricata, Peganum harmala

Table 14: Genus and Distribution of Chrysomelidae (Chrysomelinae)

Genus	Body Length (mm)	Color Pattern	Host Plants	Distribution
Zygogramma	5	Yellowish with dark spots	Parthenium hysterophorus, Opuntia ficus-indica	Pakistan, India

Table 15: Insect Families and Genera in Order Orthoptera

Family	Sub-family	Genus	Species
Acrididae	Oedipodinae	Chortophaga	3 species
Pyrgomorphidae	Pyrgomorphinae	Poekilocerus	2 species

Table 16: Key to the Families of Orthoptera

Characteristic	Family
Pronotum with foveolate texture (Fig. 42)	Pyrgomorphidae
Pronotum without foveolate texture (Fig. 43)	Acrididae

Table 17: Genus and Material Examined of Orthoptera (Acrididae)

Genus	Material Examined	Host Plants
Chortophaga	25♂, 13♀	Chenopodium album, Cynodon dactylon

Table 18: Host Plants of Orthoptera (Acrididae)

Genus	Host Plants
Chortophaga	Chenopodium album, Cynodon dactylon

Table 19: Key to the Genera of Pyrgomorphinae (Pyrgomorphidae)

Characteristic	Genus
Body marked with blue, black, and yellow patches	Poekilocerus

Table 20: Genus and Diagnostic Characteristics of Pyrgomorphidae (Poekilocerus)

Genus	Diagnostic Characteristics	Host Plants
Poekilocerus	Large body, marked with blue, black, yellow patches, fastigium dorsal	Prosopis juliflora, Calotropis procera

Table 21: Genus and Material Examined of Pyrgomorphidae (Poekilocerus)

Genus	Material Examined	Host Plants
Poekilocerus	52♂, 25♀	Prosopis juliflora, Calotropis procera

Table 22: Genus and Distribution of Pyrgomorphinae (Poekilocerus)

Genus	Distribution	Host Plants
Poekilocerus	Afghanistan, India, Pakistan	Prosopis juliflora, Calotropis procera

DISCUSSION

The current study offers a comprehensive insight into the diversity and host Associations of insect taxa residing in natural plant ecosystems in the District of Bajaur, Khyber Pakhtunkhwa. The documented diversity of 14 taxa among three insect orders—Hemiptera, Coleoptera, and Orthoptera—underscores the biological richness of the region's wild flora and their capacity to sustain entomofaunal populations (Triplehorn & Johnson, 2005).

Hemiptera is the largest insect order taxonomically different, with seven genera amid the families Cicadellidae and Delphacidae. The Deltocephalinae subfamily (Cicadellidae) exhibited notable diversity, with Stirellus as the predominant species, presumably owing to its adaptability to several Poaceae hosts, such as Cenchrus ciliaris and Eragrostis cilianensis (Table 5). This corresponds with other studies demonstrating that leafhoppers (Cicadellidae) exhibit significant specialization and frequently have pronounced preferences for monocot hosts, especially within the grass family (Poaceae) (Nielson, 1968; Zahniser & Dietrich, 2013). Sogatella and Perkinsiella (Delphacidae) were similarly linked to Poaceae species, particularly Digitaria sanguinalis and Saccharum spontaneum (Table 9), both prevalent in disturbed dry environments.

The Coleoptera order supplied four genera, particularly the Coccinellidae family. Predatory coccinellids, including Coccinella, Harmonia, and Menochilus, were gathered from a variety of host plants, comprising Asteraceae, Nyctaginaceae, Amaranthaceae, and Apocynaceae (Table 11). The prevalence of Coccinella (Table 10) indicates that these beetles likely play a crucial role in controlling aphid and other soft-bodied pest populations on wild hosts, a phenomenon also noted in dry and semi-arid areas of South Asia (Omkar & Pervez, 2004). Zygogramma, a phytophagous Chrysomelid, was observed on Parthenium hysterophorus, an invasive weed, aligning with its established biocontrol efficacy against Parthenium in areas like India and Pakistan (Evans, 1997).

In the Orthoptera order, Chortophaga (Acrididae) and Poekilocerus (Pyrgomorphidae) were the sole genera, yet they were notable for their abundance and host associations. Chortophaga, as a polyphagous grasshopper, exploits both indigenous and invasive flora such as Cynodon dactylon and Prosopis juliflora (Table 16), demonstrating its ecological adaptability (Lockwood et al., 2000). Poekilocerus pictus, recognized for its aposematic coloration and toxicity sourced from its host Calotropis procera, was the most visually unique species documented. The genus's prevalence among various host plants and substantial specimen count (Table 19) corresponds with earlier documentation from arid and semi-arid regions of South Asia, where it flourishes owing to little predation constraints and the plentiful supply of Calotropis (Kunte, 2000; Ali & Shah, 2016).

Plant-insect connections predominantly favored Poaceae, a conclusion substantiated by ecological literature owing to the family's dominance and ecological breadth in arid habitats (Anderson, 2005). Other notable host families—Cyperaceae, Asteraceae, Fabaceae, and Apocynaceae—have been acknowledged for their endurance and adaptation in extreme settings, rendering them suitable habitats for diverse insect taxa (Van Dam et al., 2009). These linkages underscore the necessity of conserving native and wild plant species as repositories of insect variety, which subsequently uphold ecological equilibrium, pest regulation, and pollination services (Altieri, 1999; Tscharntke et al., 2005).

The diagnostic characteristics employed for genus identification, including head morphology in Delphacids (Table 8), genital structures in Cicadellids (Table 2), and pronotal textures in Orthopterans (Table 14), were crucial for precise identification, aligning with established entomological practices (Dietrich, 2005; Capinera, 2008). Furthermore, the regional distribution overlap of various genera with

adjacent countries such as Afghanistan, India, and China (Tables 4, 9, 12, 20) substantiates the hypothesis of transboundary ecological continuity, especially in arid biogeographic regions where flora and fauna are influenced by common climatic conditions rather than political demarcations.

This study establishes a foundational faunistic inventory of insect taxa linked to wild vegetation in an inadequately examined desert region. The documented species Richness, host affiliations, and distribution patterns provide essential information for forthcoming research on biodiversity assessment, ecosystem services, and biological control initiatives in agroecological planning. Further taxonomic, ecological, and molecular investigations are required to assess the seasonal dynamics, reproductive biology, and potential of these insect groups in sustainable pest management strategies.

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