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Research article

Systematic Status and Ecological Account of *Poekilocerus* (Pyrgomorphidae: Orthoptera) of Pakistan

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Abstract

The survey, conducted from 2021 to 2023, resulted in the collection of 368 specimens of *Poekilocerus*. This genus was identified as a significant pest affecting various crops, including wheat, cowpea, corn, grasses, and bushes. The primary host plant for *Poekilocerus* was found to be *Calotropis procera* (Akk plant), a species widely used in traditional medicine for treating various ailments. The populations of *Poekilocerus* were observed to sometimes reach plague proportions. A notable increase in individuals was recorded in the Cholistan Desert during the summer of 2020-2021, with a higher concentration found on Akk *Caltrops procera*. Additionally, *Poekilocerus* has been reported to damage approximately 40 crop species, including citrus, tobacco, *Cassia* spp., and pear trees. The present study discusses both a systematic account and the ecological aspects of this pest. It was also noted that a considerable number of leaves, as well as the flowers and fruits of the Akk plant, can be damaged or even stripped.

Keywords: Survey, systematics, ecology, grasshopper, plants

1. Introduction

Genus *Poekilocerus* contains five species and two subspecies worldwide. It is a prevalent pest in Afghanistan, India and Pakistan, [1-5]. The body of *Poekilocerus* (Serville, 1831) is large and robust, subfusiform; pronotum with median carina unclear, lateral carinae is absent, three transverse sulci present at dorsal side; wings are advanced, superior abdomen, mesosternal interspace open and external apical spines of hind tibia present [6]. There is only one species of genus *Poekilocerus* found in Pakistan, which is *Poekilocerus pictus*. Its body contains bright and eye catching colors. In Pakistan and India, *Poekilocerus pictus* is referred to as Akk grasshopper. This is the pest of many crops like cotton, papaya, wheat, corn, alfalfa, okra, brinjal, castor, citrus and cow pea [7]. The species of *Poekilocerus* is a pest of (*Calotropis gigantea*) which causes significant damage to cultivated crops in Sindh, Pakistan [8]. This *Poekilocerus* species is a pest of varied crops [9,10] such as cowpea, okra, and forest trees, mulberry, brinjal, castor, citrus, papaya, trees of Jasmine, mango orchards and wheat. *Poekilocerus pictus* usually found on leaves of *Caltrops procera* in Pakistan [11]. In May and June of 1973, there was an epidemic in the Jhang area of Punjab beside the Chenab River that badly devastated cucurbit, chili, melon, and cotton plants. In the Jamshoro district, a study on the morphology and development of eggs from one species, *Poekilocerus pictus* of family Pyrgomorphidae was conducted in a laboratory [7, 12].

The hoppers and adults are highly gregarious. The young hoppers tend to occur in dense groups, and their daily behavior closely resembles that of locusts, with marching bands being observed. In the last two instars, the gregarious behavior becomes less pronounced, with smaller groups and more isolated individuals. Adults are less gregarious, though they have been observed flying in loose swarms. Adults often gather in large numbers on trees and shrubs, arranged in a manner that mimics foliage. Even fully alate individuals are not very mobile, so damage typically remains localized. As with other *Phymateus* species, *Poekilocerus* raises and rustles its wings when disturbed, simultaneously exuding a noxious, malodorous fluid from a gland located behind the first abdominal tergite.

There has been very limited systematic and ecological work on this genus in Pakistan, with the exception of numerous authors who worked on different characteristics and identified *Poekilocerus pictus* from diverse regions [7, 13-20]. Subsequently, the current study is aimed to systematic status and ecological account of *Poekilocerus*.

2. Materials and Methods

2.1 Sampling site, killing and preservation

The survey was carried out from different regions of Pakistan (30.3753° N ,69.3451° E) during 2022-2023. The specimen was captured by sweeping over the host plants, using an insect net. Collected Specimens were kept in polythene bags or in plastic bottles then transferred to laboratory.

2.2 Killing

Samples were brought to laboratory and kill them with help of chloroform for 5-10 minutes, based on the methods of [17, 21]. Specimens were stretched on the stretching board. After 24 hours, the specimens were removed from the stretching boards.

2.3 Preservation

The dried specimens were preserved using entomological boxes at the Museum, Department of Zoology, University of Sindh, Jamshoro. Naphthalene balls were placed in each box to repel insects and ants. With the help of bibliography of [22, 23] and Orthoptera Species File [24] collected samples were identified. Photographs were taken by using the camera "Canon EOS 80D". Morphometry abbreviations are as follows

L.A- Antennae Length
L.H- Head Length
D.B.T.E- Distance b/w two Eyes
L.P- Protonum Length
L.Ab- Abdomen Length
L.T- Tagmina Length
L.W- Wing Length
L.F- Femur Length
L.Ti- Tibia Length
T.B.L- Total body length

3. Results and dicsussion

1.1. Genus *Poekilocerus* (Serville, 1831)

Body is large and subfusiform. Antennae are filiform, rod like, shorter than head. Fastigium of vertex is horizontal and convex. Pronotum is subcylindrical while slightly constricted in prozona; median carina hardly traceable; lateral carinae are absent; three sulci crossing dorsum are present. Prosternal process subconical with obtuse apex. Tegminae and hind wings are fully developed. Hind wings are extensively colored bright orange or more rarely pink. Hind femur is slender. External apical spines of the hind tibiae are present. Only one species of genus *Poekilocerus* Serville, 1831 is reported from various regions of Pakistan i-e *Poekilocerus pictus*.

1.2. *Poekilocerus pictus* (Fabricius, 1775)

Gryllus pictus. Fabricius, 1775
Gryllus (*Locusta*) *pictus*. Goeze, 1778
Acrydium pictum. Olivier, G.A. 1791
Gryllus pictus. Borkhausen. 1802
Poecilocera picta. Burmeister, H. 1838
Acridium (*Poecilocera*) *pictum*. Haan. 1842
Poecilocerus pictus. Bolívar, I. 1884.
Poecilocerus pictus. Bolívar, I. 1902[1901].
Poecilocerus pictus. Bolívar, I. 1904
Poecilocerus pictus. Kirby, W.F. 1910
Poecilocerus pictus. Kirby, W.F. 1914
Poecilocerus pictus. Hingston. 1927
Poecilocerus pictus. Pruthi and Nigam. 1939
Poecilocerus pictus. Singh, M. 1940
Poecilocerus pictus. Pruthi. 1954
Poekilocerus pictus. Shumakov. 1963
Poekilocerus pictus. Wasti and Akbar. 1970.
Poekilocerus pictus. Akbar and Askari. 1972.
Poekilocerus pictus. Kevan, D.K.M. [Ed.]. 1977
Poecilocerus pictus. Delvi & Pandian. 1979
Poekilocerus pictus. Saini, R.S. 1987
Poekilocerus pictus. Moizuddin. 1987
Poecilocerus pictus. Livingstone and Pugalenthi. 1992
Poecilocerus pictus. Mahobe, 1994
Poekilocerus pictus. Shishodia, K. Chandra and Gupta, S.K.

2010.

Poekilocerus pictus. Kim, T.W. and Hong Thai Pham, 2014.

Poekilocerus pictus. Kumar, H., M.K. Usmani and Kumari. 2014

Poekilocerus pictus. Sultana, I. Soomro, M.S. Wagan and Panhwar. 2015

Poekilocerus pictus. Sultana, S. Kumar and I. Soomro. 2017

1.3. Morphological features

Body is large sub fusiform. Antennae contain 16 to 18 segments. Head is wide. Pronotum is flat. Base of wings are orange in color. Femur is slender in shape. Tibia contains 8 to 9 inner spines and also contains 6 to 8 inner spines.

1.4. Morphometry (n=5mm ♂♀)

♂, L.A: 16.64 ± 0.415, L.H: 10.74 ± 0.622, D.B.T.E: 2.548 ± 0.0.552, L.P: 5.74 ± 0.487, L.Ab: 34.62 ± 0.449, LT: 34.64 ± 0.461, L.W: 33.66 ± 0.421, L.F: 20.62 ± 0.426, L.Ti: 19.56 ± 0.439, T.B.L: 49.56 ± 0.456 ♀ L.A: 18.52 ± 0.46, L.H: 12.64 ± 0.415, D.B.T.E: 2.905 ± 0.074, L.P: 7.58 ± 0.46, L.Ab: 42.64 ± 0.49, LT: 37.58 ± 0.438, L.W: 34.52 ± 0.46, L.F: 24.56 ± 0.456, L.Ti: 20.7 ± 0.447, T.B.L: 62.58 ± 0.46.

1.5. Affected host plants

This species was most abundant on *Caltrops procera* (Akk plant) and other crops like, *Gossypium herbaceum* (cotton), *Triticum aestivum* (wheat), *Vigna unguiculata* (cow pea), *Zea mays* (corn) and grasses.

1.6. Global distribution

Asia, Estern Africa, N.Ethopia, Somalia,Horn of Africa, Rowell et al. [26], Mariño-Pérez, & Song, [27] and Sultana et al. [28],

1.7. Remarks

The genus *Pokilocerus* includes several species from Asia and a single species from continental Africa. The larval patterning and coloration are similar to those of adults, primarily sandy yellow with fine dark speckles [26]. Only one annual generation. Females became sexually mature 2 months after fledging, followed by mating. After copulation most males die but females move towards oviposition sites. This movement is slow, because females are now full of eggs. Adult life of a female lasts up to 7 months. Oviposition occurs from the end of May until August . Eggs are normally laid in uncultivated, stony, or compact sandy soils at a depth of 4-8 cm. Eggs in ovaries vary in total number from 183-238. One female oviposits 2-4 times. Its development lasts roughly 17-29 days. Hopper stages develop during the rainy season. Hopper development (7 instars in both sexes) occupies about 4 months. This species can be managed using several methods. A product based on the spores of the entomopathogenic fungus *Metarhizium acidum* (strain IMI 330189) has been successfully used against various locusts and grasshoppers in Africa and may offer an efficient and ecologically viable control method. The product is still available in several southern African countries and Madagascar, but not in the rest of Africa. In terms of chemical control, being gregarious, visible, and slow-moving, these locusts can be easily handpicked during the morning and evening to be disposed of as garden fertilizer. Digging up and destroying egg pods can also be an effective control method. Adult aggregations are easy to recognize, and oviposition sites can be identified for egg removal during the long incubation period. However, the impact on locust populations is usually minimal because finding a high proportion of egg pods can be difficult. *P. pictus* is challenging to kill with contact insecticides. Carbaryl is effective as either high- or low-volume sprays. More generally, the list of insecticides recommended by FAO for locusts and grasshoppers can serve as a good baseline [29]. Species of *Pokilocerus* have been recorded in Pakistan, India, and Afghanistan [1, 3, 4, 8]. In Pakistan, only one species of this genus, *Pokilocerus* pictus, has been examined (Figure 3). Akram et al. [25] reported P. pictus from Khushal Garh in the Kohat district of Khyber Pakhtunkhwa Province.

Table 1. *Poekilocerus pictus* collected from various crops of Pakistan.

Provinces	Sources					
	Akk Plant (*Caltrops procera*)	Wheat (*Triticum aestivum*)	Cow pea (*Vigna unguiculata*)	Corn (*Zea mays*)	Cotton (*Gossypium herbaceum)*	Grasses/ Bushes
Sindh	+++	++	+	+	++	+++
Punjab	+++	++		+	++	++
Balochistan	++	-	+	-	-	++
Khyber Pakhtunkhwa	+	+	-	-	+	+

Table 2. Numbers and Percentage of specimens collected from various areas of Pakistan.

Sr. no	Provinces	No. of Specimens	Percentage
1.	Sindh	123	33.423%
2.	Punjab	107	29.076%
3.	Balochistan	87	23.641%
4.	Khyber Pakhtunkhwa	51	13.858%
	Total	368	

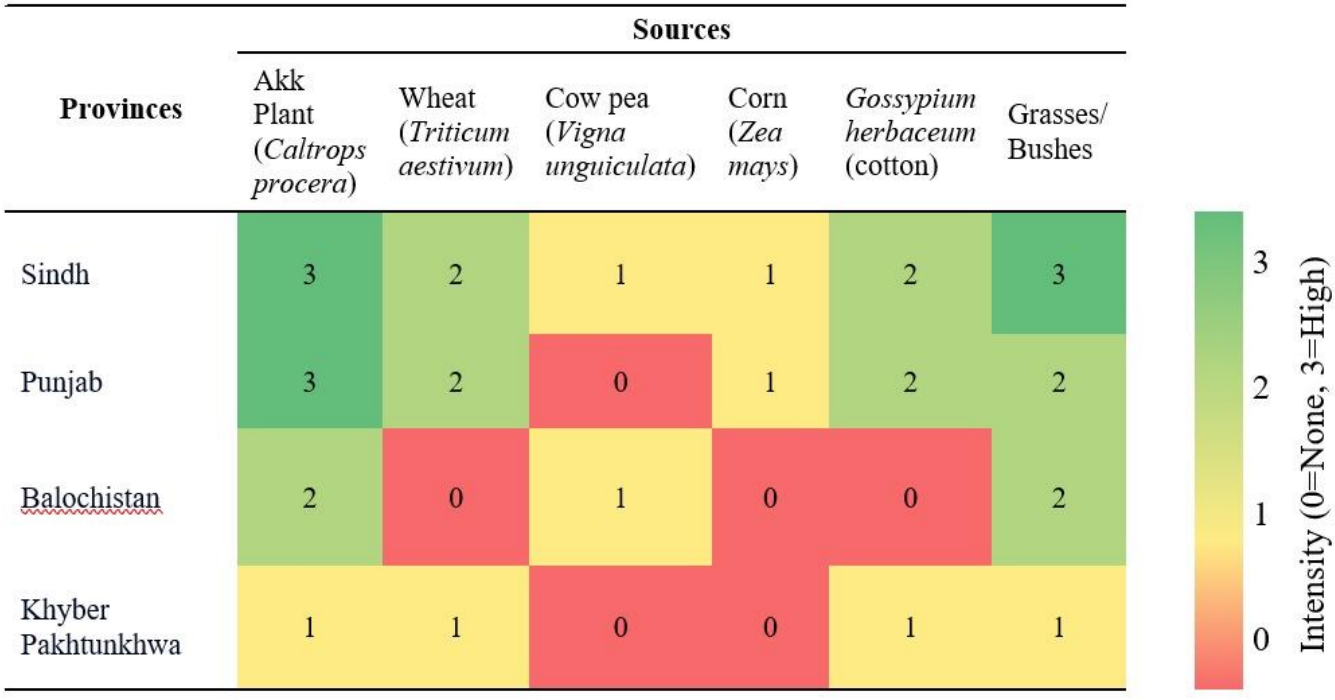

Figure 1. Intensity of *Poekilocerus pictus* in different provences.

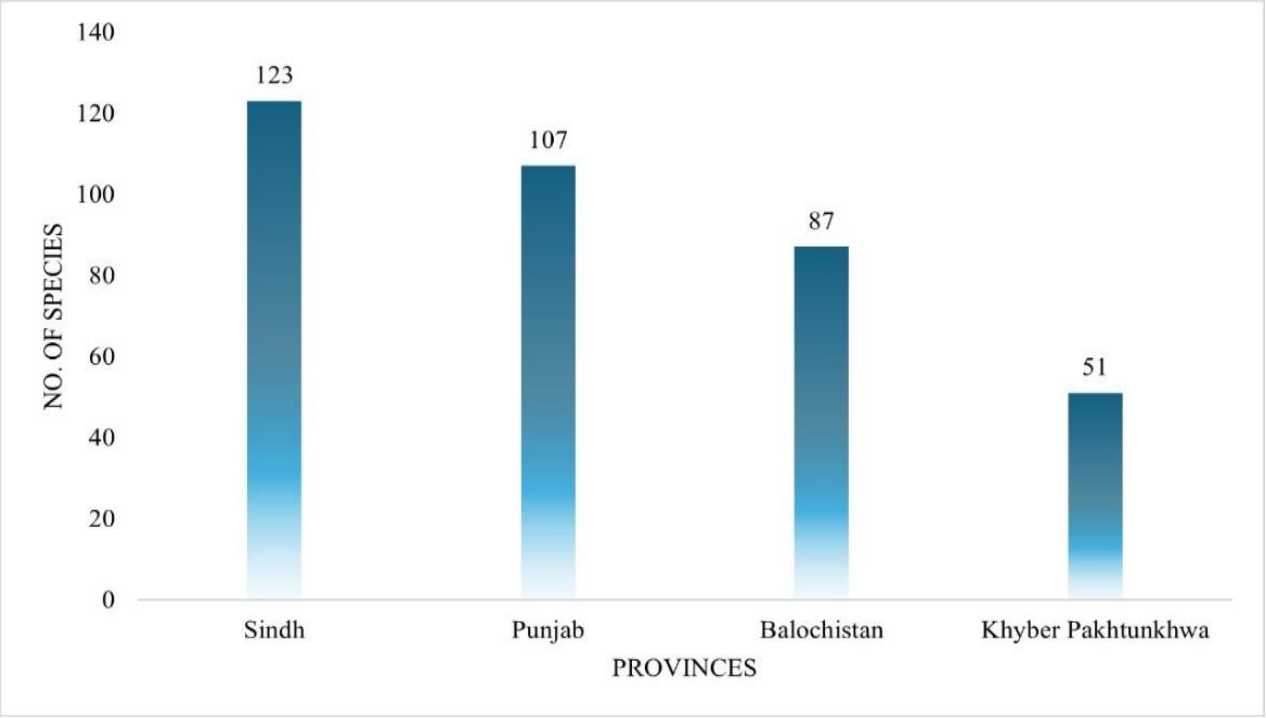

Figure 2. Specimens collected from different areas of Pakistan.

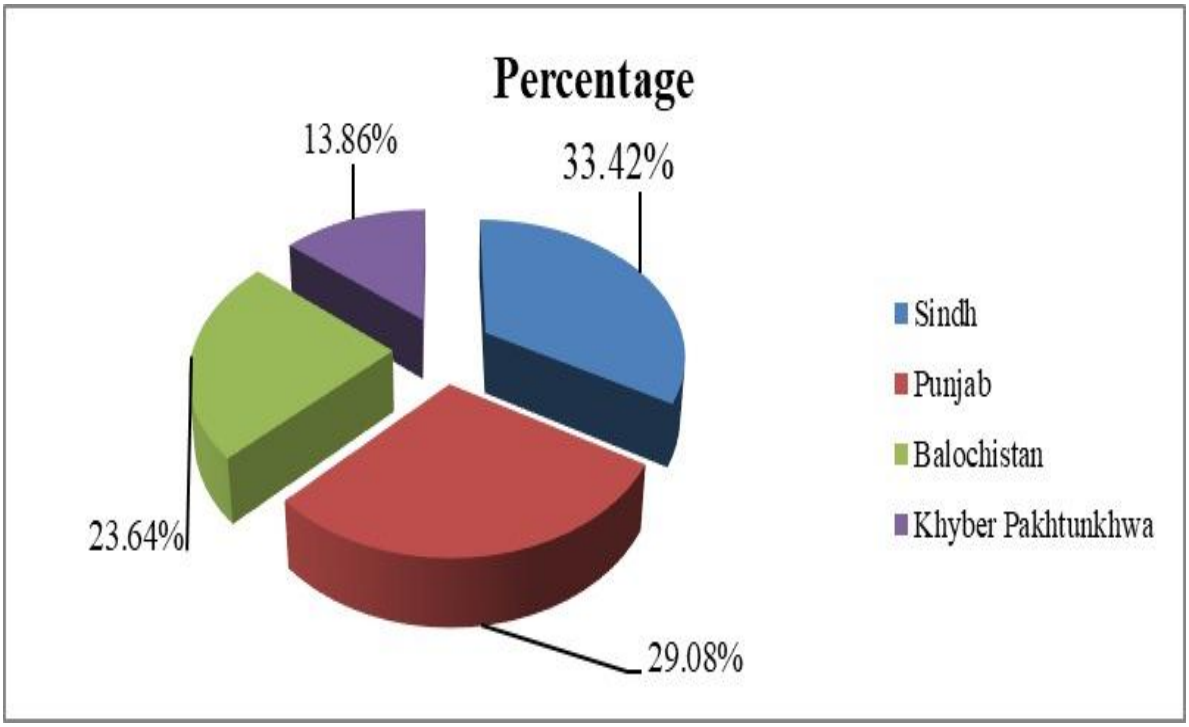

Figure 3. Percentage of collected *Poekilocerus pictus* in various provences of Pakistan.

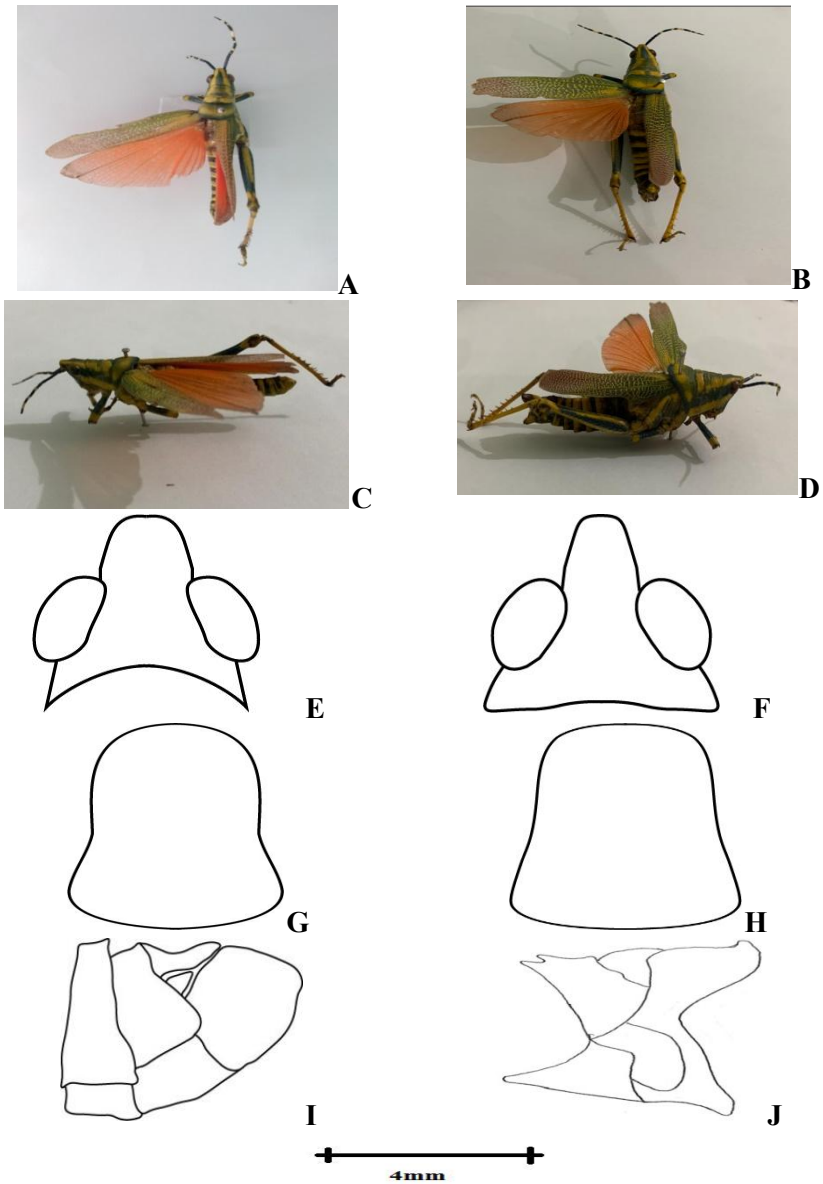

Figure 4. Showing *Poekilocerus pictus* ♂,♀ (A, B) DV (C, D) LV (E, F) line drawing of Head (G, H) line drawing of Pronotum (I) line drawing Cerci (J) line drawing Ovipositor (Bar line: 4mm).

Other studies recorded it in the Cholistan Desert of Punjab Province [16] and in several locations across Sindh Province, including Shikarpur [18], Khairpur Mirs [19], the Thar Desert [20], and Jamshoro District [12, 23]. *Pokilocerus* pictus is a significant pest of Calotropis procera (Akk plant) and other valuable crops, such as cowpea, cotton, wheat, and surrounding grasses.

During survey period 368 specimens were collected from various areas of Pakistan, i-e 123 specimens from Sindh; 107 specimens from Punjab; 87 specimens from Balochistan; 51 specimens from Khyber Pakhtunkhwa, Figure: 1. Highest percentage was noted from Sindh province like 33.423%, Figure 2. while lowest percentage was calculated from Khyber Pakhtunkhwa i-e 13.858%, Table 2.

4. Conclusion

This study aimed to investigate the systematic status and ecology of *Poekilocerus* (Pyrgomorphidae: Orthoptera) in Pakistan. The findings revealed that the genus Poekilocerus

Serville, 1831 (Pyrgomorphidae: Orthoptera), is distributed across Pakistan. Only one species, *Poekilocerus pictus* (Fabricius, 1775), was identified in the region. This grasshopper is a significant pest of the Akk plant (*Calotropis procera*) and other valuable crops. Beside this citrus, tobacco, *Cassia* spp. pear trees wheat, cowpea, and cotton were also affected.

Author Contributions

Memon S.P. collected the material, compiled the data, and wrote the manuscript. Sultana, R. designed the study. Bughio analyzed the data. Kumar S. analyzed the material and conducted the field survey

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Conflicts of Interest

The authors declare that they have no conflict of interest.

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Data Availability statement

The data that were analyzed in the present article are available upon justifiable request to the corresponding author.

REFERENCES

1. Shumakov, E.M., 1963. Saranchovya Afganistan Irana (Acriodoidea of Afghanistan and Iran). Trudy vses Ent Obshch. 49:3-248.
2. Uvarov, B.P., 1966. Grasshoppers and locusts: A hand book of general acridology, Cambridge University Pre. 1- 481.
3. Cejchan, A., 1969. Beitraze Zuo Kenntinisder fauna Afghanistan Acrididae Orthoptera. Cas Morav Mus Brane Science Net. 54:229-276.
4. Sheri, A.M., 1976. Reproduction of a common grasshopper Poekilocerus pictus (Fab). Pakistan Journal of Agriculture Science. 13:37-40.
5. Popov, L. and Kevan, D.K.M.E., 1979. A revision of the genus Poekilocerus Audient Serville 1831 (Orthoptera: Acrididea: Pyrgomorphidae). Anti Loc Bull. 51:1- 48.
6. Gupta, S.K. and Chandra, K., 2016. A new species of the Akk grasshopper genus Poekilocerus Serville, 1831 (Orthoptera: Pyrgomorphoidea) from India. International Journal of Global Science Research. Vol.3, Issue 6, October 2016, pp. 371-378 Available Online at www.ijgsr.com.
7. Sultana, R., Soomro, I., Wagan, M.S. and Panhwar, W.A., 2015. Studies on the Reproductive Activity of Poekilocerus pictus (Fabricus, 1775) (Pyrgomorphidae: Acridoidea: Orthoptera). Pakistan Journal of Zoology. 47(3):739-743.
8. Lohar, M.K., 1998. Introductory Entomol. (1st Edi) S.A.U. Tandojam. 82p.
9. Bindra, O.S., 1958. Food preference of of Poekilocerus pictus Fabr. A pest of some horticultural plant at Gwalior, Indian J. Hori. 15:80-86.
10. Rizvi, N., 1992. "Seasonal population of akk grasshoppers poekilocerus pictus," M.Sc. thesis Sindh Agricultural university Tandojam, pp. 1-83
11. Ghouri, A.S.K., 1975. Poekilocerus pictus in the Punjab. FAO Pl Prot Bullet. 23:52-53.
12. Sultana, R., Kumar, S. Soomro, I.A., 2017. Study on morphology and development of egg-pod and eggs of Poekilocerus pictus (Orthoptera: Pyrgomorphidae). J Entomol and Zool Studies., 5(3), 537-540
13. Majeed, A. Suhail, A. and Yousaf, M., 1996. Pyrgomorphidae (Acridoidea: Orthoptera) of Thal area (Punjab) [Pakistan]. In Second International Congress of Entomological Sciences, Islamabad (Pakistan), 19-21 PARC.
14. Mahmood, K. and Yousuf, M., 2000. Taxonomic study of some Pyrgomorphidae and Catantopinae (Acridoidea: Orthoptera) from Azad Jammu and Kashmir [Pakistan]. Pakistan Journal of Biological Sciences (Pakistan), 3(11), 1914-1916.
15. Kumar, S., Sultana, R. and Husemann, M., 2021. Extended List of Orthoptera Fauna of Cholistan Desert (Punjab, Pakistan). Pakistan J. Zool., pp 1-6. https://dx.doi.org/10.17582/journal.pjz/20200516150559

16. Prince, M.A., Sultana, R. and Kumar, S., 2022. Biodiversity of Caelifera (Orthoptera) in Cholistan desert, Punjab, Pakistan. Plant Cell Biotechnology and Molecular Biology 23 (1 and 2):38-44
17. Sultana, R., Wagan, Y. S. and Wagan, M.S., 2013. Orthopteran biodiversity of Thar desert, Sindh, Pakistan. Pakistan Journal of Zoology, 45(2), 299-304.
18. Sultana R, Lal, M, Samiullah S, Kumar S, Samejo, A.A. 2024. Biodiversity and Systematic Status of band-winged grasshoppers, Oedipodinae Walker, 1871 (Orthoptera: Acrididae) from Thar Desert, Pakistan (Accepted) Pakistan Journal of Zoology. 23(1):1-15
19. Soomro, S. and Sultana, R., 2020. Diversity with position of habitat of Pyrgomorphidae Brunner Von Wattenwyl, 1874 (Orthoptera: Caelifera) from Khairpur, Sindh. International Journal of Current Research Vol. 12, Issue, 07, pp. 12647-12650. https://doi.org/10.24941/ijcr.39171.07.2020
20. Lal, M. Sultana, R. and Wagan, M.S., 2016. A Checklist of Caeliferans (Orthoptera) Species from Thar Desert, Sindh, Pakistan. International Journal of Current Research Vol. 8, Issue, 10, pp.
21. Vickey, V.R. and Kevan, D.K. McE., 1983. A monograph of the Orthopteroid Insects of the Canada Adjacent Regions, Mem. Lyman. Ent. Mus. Res. Lab. Vol: 1 and 2.
22. Sultana, R. and Song, H., 2024. Annotated catalogue of Pakistani Acrididae (Orthoptera: Caelifera: Acridoidea). Zootaxa 5486 (1): 001–047. https://doi.org/10.11646/zootaxa.5486.1.1
23. Sultana, R. and Wagan, M.S., 2015. Grasshoppers and locusts of Pakistan. Higher Education Commission-Pakistan, Islamabad, 200 pp
24. Cigliano, A., Simile, M.M., Vidili, G., Pes, G.M., Dore, M.P., Urigo, F. and Calvisi, D.F., 2024. Fatty Acid Synthase Promotes Hepatocellular Carcinoma Growth via S-Phase Kinase-Associated Protein 2/p27KIP1 Regulation. Medicina, 60(7), 1160.
25. Akram, M., Khattak, A. and Zahoor, T., 2022. Exploration of Caeliferans' Diversity in the Eastern Regions of District Kohat, Khyber Pakhtunkhwa, Pakistan. Journal of women Medical and Dental College. 1, 25-31
26. Rowell, C.H.F., Hemp, C. and Harvey, A.W. (2015) In Jago's Grasshoppers of East and North East Africa. Volume 1. Pneumoridae, Pyrgomorphidae, Lentulidae, Pamphagidae and Dericorythidae. 238 pp.
27. Mariño-Pérez, R. and Song, H. (2019) On the origin of the New World Pyrgomorphidae (Insecta: Orthoptera). Molecular Phylogenetics and Evolution, 139.
28. Sultana, R.Yawar, S.W. and Wagan, M.S. (2013). Orthopterian biodiversity of Thar Desert, Sindh, Pakistan. Pakistan Journal of Zoology, 45(2), pp. 299-304.
29. Lecoq M and Zhang L , 2019. Encyclopedia of pest Orthoptera of the world, China Agricultral University press, Beijing.1-310 page

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