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Research Article

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IDENTIFICATION OF *HETERORRHINA SAEEDI SP.NOV.* (SCARABAEIDAE: COLEOPTERA) FROM SINDH REGION, PAKISTAN

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ABSTRACT

Genus *Heterorrhina* belongs to subfamily Cetoniinae. They diurnal by nature and are called fruit beetles and flower chafers. They are frequent visitiors of flowers for nectar from pollen for their nutritional requirements. Meanwhile, few of their species feed on fruits. They are bright or glassy green in appearance and somehow reddish at angles, measuring 2 - 3 cm long. During the present study, a total of 19 specimens were collected during April 2021 to March 2022. The sampling were collected from four ecological zones of Sindh province i-e: Southern irrigated plain, Dry western plateau, Indus Delta and Sandy Desert. The specimens were sorted out into genus *Heterorrhina* (Westwood, 1842) with single species i.e., *Heterorrhina saeedi nov.spp* . Beside this, morphological descriptions, photographs, ecological account and GIS mapping of the species are given.

Keywords: Taxa, Genus, New Species , Identification , ecological zones, Pakistan.

INTRODUCTION

The largest order in the Kingdom Animalia is the order Coleoptera in the Phylum Arthropoda (Wang *et al.* 2023; Nieto & Alexander, 2010). More than 3 million species have been discovered of Coleoptera. The Scarabaeoidea is distinct and monophyletic, and it contains several distinctive characteristics. The two families that make up the superfamily Scarabaeoidea are like the Geotrupidae and Scarabaeidae families. Family Scarabaeidae is having significant beetles population and a crucial insect group from a functional and taxonomical perspective (Erler and Ates, 2015; Jagdale *et al.*, 2023). The family Scarabaeidae also known as dung beetles of the superfamily Scarabaeoidea is the biggest family of the order Coleoptera, with about 600 genera, 12 tribes, 13 subfamilies, and over 30,000 species reported throughout the world (Kumar *et al*. 2017a, 2017b). The genus *Heterorrhina* belongs to the family Scarabaeidae, which is a diverse family of beetles commonly known as scarab beetles or dung beetles. *Heterorrhina* beetles are known for their striking colors and unique horn-like structures on the heads of males. These beetles are primarily found in tropical regions of Africa and Asia. The genus *Heterorrhina* comprises a diverse group of beetles with several recognized species. These beetles are predominantly distributed across Africa and Asia, including countries such as Madagascar, Tanzania, Kenya, Malaysia, and Indonesia. They inhabit various habitats, ranging from rainforests to savannas (Seidel and Konstantinov, 2016; Ahuatzin *et al.*, 2023). *Heterorrhina* beetles are known for their impressive morphological features. Male beetles often possess large, horn-like structures on their heads, which can vary in size and shape among species. These horns are used rivalry attributes between males to establish dominance and gain access to mates. Female beetles on the other hand, generally lack these elaborate horns (Emlen, 2008; Wani *et al.*, 2023). *Heterorrhina* beetles play a crucial role in their ecosystems as decomposers. They are known to feed on decaying plant matter and dung, assisting in the breakdown of organic material and nutrient cycling. Additionally, their activities contribute to soil aeration and the dispersal of seeds through the burial of dung balls (Nicholas *et al.*, 2008). Assessing the conservation status of *Heterorrhina* beetles is important for their long-term survival. While, comprehensive studies focusing specifically on the conservation status of individual *Heterorrhina* species are limited, it is crucial to recognize the potential threats faced by these beetles, including habitat loss, deforestation, and climate change (Koh *et al.*, 2004).

OBJECTIVES: The objectives of this study were as follows: (1) to collect the individual *Heterorrhina and* (2) to identify *Heterorrhina* species. (3) To give distribution of *Heterorrhina* species in ecological zones of Sindh.

MATERIALS AND METHODS

Collection and killing of samples: Specimens were collected throughout the Sindh region in the different areas (latitude 25.8943°N and longitude 68.5247°E). The specimens were obtained by traps as well as by hand picking methods from habitats like agriculture lands, grassy areas, and river banks. The normal temperature of Sindh is warm and humid in the summer. Then, between 2021 and 2022, specimens were carefully transported to the Entomology lab, the Department of Zoology, Shah Abdul Latif University, Khairpur and stored using standard entomological methods in an insect collection box after being killed by potassium cyanide (KCN) in killing bottles for advance study (Larsen & Forsyth, 2005;Panhwar *et al.*, 2023*).*

Identification and morphometry of samples: The identification of the specimens was accomplished by examining the specimens using a binocular microscope, and excellent quality digital images of the samples were captured using a camera. For the purpose of *Heterorrhina* beetles identification, dichotomous keys and published research were utilized (Jessop 1985;1986; Noureen *et al.*2015; Arrow 1931). The specimens were labeled, and then transferred to the Entomology laboratory in the division of Zoology at Shah Abdul Latif University in Khairpur. The morphological characters were observed, and measurements of specimens were taken with scale divider in mm.

RESULTS

A total of 19 specimens were collected during April 2021 to March 2022. The sampling were collected from four cological zones of Sindh province (Table. 1). The studied specimens were belong to genus *Heterorrhina* (Westwood, 1842). This comprehensive data reported one new species, *Heterorrhina saeedi nov.spp* of the genus *Heterorrhina* reported first time in Pakistan.

Genus *Heterorrhina* (Westwood, 1842)

Type species. *Cetonia nigritarsis*, Hope, 1831

Distribution. Africa and Asia

Diagnosis: From varied, but often elongate, tapering, and depressed, with rather slender legs; highly shiny and free of hair both on top and underneath. Clypeus is neither big nor dilated, with the front edge being reflexed and (save in the male *Heterorrhina mutabilis*) gently serrated or notched, and the forehead in the female or both sexes bearing a slight protrusion that is free in front. The prothorax is roughly in the shape of a triangle, with the posterior angles being well-marked but not formed, and the base being excised before the scutellum. Scutellum has a point that is rather acute at its apex. With the exception of *Heterorrhina mutabilis* and *Heterorrhina dispar*, the sternal process is long and slender. Pygidium is broad and flat, and it does not have any hairs. In females, the front tibia are bidentate, but in males, they are often thin and unarmed. Bidentate front tibia are found only in females. When teeth are present in both sexes, the upper tooth in a male typically has less strength than the upper tooth in a female.

Ecology. Beetles belonging to the genus *Heterorrhina* are crucial to the reproduction of a wide variety of species of plants in the places in which they inhabit. As a result of their diet, which consists of ripe or overripe fruit, they also contribute to the breakdown of dead plant materials. In general, beetles belonging to the *Heterorrhina* genus are intriguing insects that have a distinct and lovely appearance. Both entomologists and people who are passionate about insects will find them to be an intriguing subject of study because of the role that they play in the habitats in which they are found and the value that they play for collectors.

Material Examined of *Heterorrhina saeedi sp.nov*.

Southern Irrigated Plan. Dadu, 13.iv.2021, 1♂ (Mehtab A.M & Waheed A.P). Jacobabad, 11.v.2021, 1♂ (Mehtab A.M & Waheed A.P). Badin, 12.iv.2022, 1♂ (Mehtab A.M & Altaf A.M). Khairpur, 9.v.2022, 1♀ (Mehtab A.M & Waheed A.P). Shaheed Benazirabad, 7.iii.2022, 1♂ (Mehtab A.M & Waheed A.P). Hyderabad, 10.iii.2023, 1♀ (Mehtab A.M & Iltaf A.S)

Indus Delta. Badin. 2.v.2021 1♀1♂, (Mehtab AM & Waheed AP). Hyderabad. 4.iv.2021 1♀ (Mehtab AM & Shaikh AM) same but 6.iv.2022 1♂ (Mehtab AM & Altaf AM)

Dry western plateau. Karachi 26.v.2021 1♂ 1♀ (Mehtab AM & Waheed AP) Dadu 30.iii.2023, 1♂ 1♀ (Mehtab AM & Waheed AP)

Sandy Desert. Khairpur, 18.v.2021, 1♀ (Mehtab A.M & Waheed A.P) same but 25.iv.2022, 1♀ (Mehtab A.M & Altaf A.M). Shaheed Benazirabad, 27.iv.2021, 1♂1♀ (Mehtab A.M & Altaf A.M). Sanghar 31.v.2022 1♂ (Mehtab AM & Waheed AP).

Diagnostics o *Heterorrhina saeedi sp.nov.*

Body coloration. Shiny and vibrant green metallic coloration on the dorsal side of its entire body. The colour of the rear region is typically a darker shade of green.

Head. The head is quite small as compared to the remaining parts of the body, and it has a spherical form. antennae in the shape of a club with three segments. Eyes are present and they have a large, spherical form.

Thorax. It has broad lateral borders and robust spurs on both legs, and the thorax appears to be substantial in size.

Abdomen. There are five distinct segments that may be seen along the lengthened and somewhat tapering abdomen. There is a scutellum present, and it has the

shape of a huge triangle. The head of men has a projection that resembles a horn, whereas the heads of females do not have this feature. This allows males to be identified from females (Fig. 1).

Derivato nominis. In recognition of the significant contributions that Prof. Dr. Muhammad Saeed Wagan has made to the area of insects classification, this species was given his name.

Measurements of Holotype (mm). Head: 2.6; Thorax: 9.4; Abdomen: 21.7; Total body length: 31 (For Allotype and Paratype see Table.2)

Distribution of *Heterorrhina saeedi* sp.nov. For Distributional data and Ecological account of *Heterorrhina saeedi sp.nov* (Table. 3). GIS Map of *Heterorrhina saeedi sp.nov* (Fig. 2). Feeding habitat of *Heterorrhina saeedi* sp.nov feed on Sunflower (Fig. 3)

Comparative note. The prothorax is rough in the shape of a triangle, with the posterior angles being well-marked but not formed, and the base being excised before the scutellum in *Heterorrhina mutabilis*..While in *Heterorrhina saeedi sp.nov* have broad lateral borders and robust spurs on both legs, and the thorax appears to be substantial in size. There is a scutellum present, and it has the triangular shape without posterior angles.

Table 1: Ecological Zones of Sindh Province

S. no.	Ecological Zones	Districts
1	Indus Delta	Thatta, parts of Badin and Hyderabad districts.
2	Southern Irrigated Plain	Dadu, Larkana, Jaccobabad, Sukkur, Badin, Shikarpur, Khairpur, Tharparkar, Sanghar, Shaheed Benazirabad & parts of Hyderabad.
3	Sandy Desert	Tharparkar (partially), Khairpur, Shaheed Benazirabad and Sanghar districts.
4	Dry western Plateau	Dadu and Karachi are in this zone.

Table 2: Morphometry of (Allotypes/ Paratypes) *Heterorrhina saeedi sp.nov*

Body Parameters	**Length (mm)**				**Length (mm)**			
	Male (n=5)		**Female (n=5)**		**Male (n=5)**		**Female (n=5)**	
	Mean ± SD	Min-Max	Mean± SD	Min-Max	Mean± SD	Min-Max	Mean ± SD	Min-Max
Head	2.5 ± 0.5	2 – 3	3.66± 0.76	3 – 4.5	2.5 ± 0.5	2 – 3	3.5 ± 0.5	3 – 4
Thorax	9.5 ± 0.5	9 – 10	10 ± 1	9 – 11	6.16± 0.76	5.5 – 7	6.5 ± 0.5	6 – 7
Abdomen	21.5 ± 0.5	21 – 22	24 ± 1	23 – 25	17 ± 1	16 – 18	20 ± 1	19 – 21
Total length	31 ± 1	30 – 32	34.83± 0.76	34– 35.5	----------	---------	----------	---------

Table 3: Distributional data *Heterorrhina saeedi sp.nov* different Ecological zones of Sindh

S.No	Ecological Zones	Male	Female	No. of Specimen
1	Southern irrigated plain	4	2	6
2	Dry western plateau	2	2	4
3	Indus Delta	2	2	4
4	Sandy Desert	2	3	5
Total		10	9	19

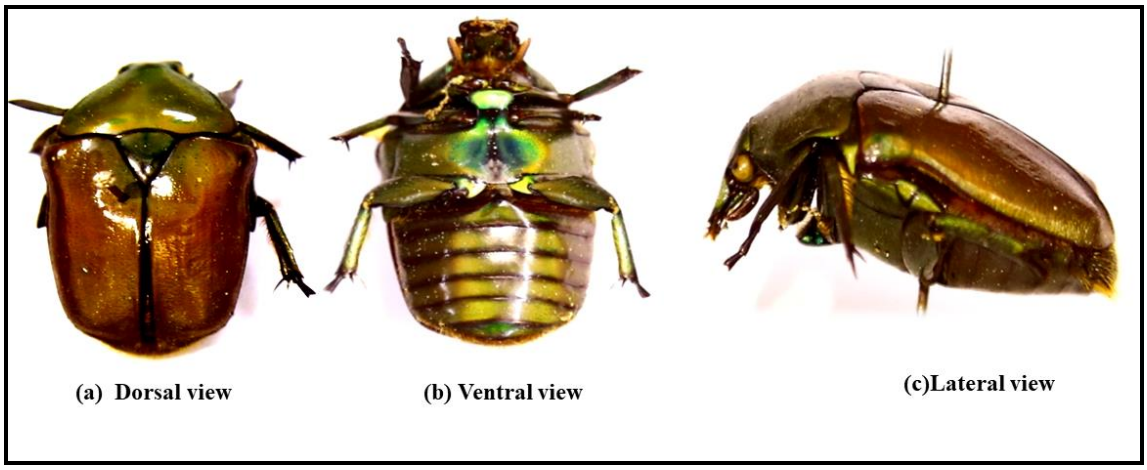

Fig. 1: Dorsal, Ventral and Lateral view of *Heterorrhina saeedi sp.nov*

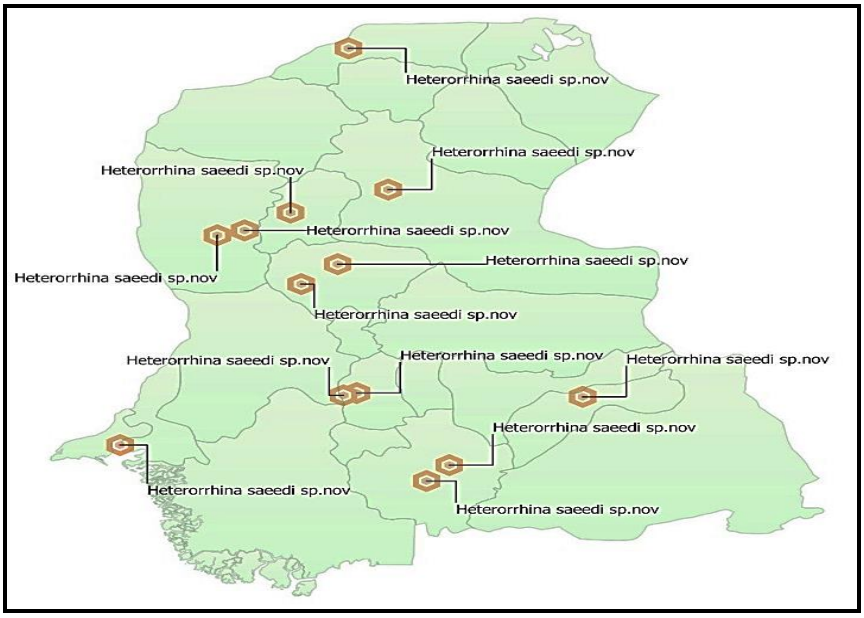

Fig. 2: GIS Map of *Heterorrhina saeedi sp.nov*

Fig. 3: Feeding habitat of *Heterorrhina saeedi sp.nov* feed on Sunflower

DISCUSSION

More than 30,000 different species of beetles have been described across the globe, making the Scarabaeidae family one of the most extensive and diverse families of beetles (Scholtz & Grebennikov 2005; Ayivi *et al.*2021). This family was split into two primary groupings, namely the saprophagous lineages and the phytophagous lineages, based on the individuals' preferred methods of food consumption. The majority of saprophagous scarabs are specialized dung eaters when they are adults. These scarabs are commonly referred to as dung beetles and are well recognized to the majority of people because of their relatively big body size, considerable ecological relevance, and the religious emblems of *Scarabaeus* in Egyptian history. On Earth, dung beetles are one of the principal users of the waste produced by mammalian animals. Because of their substantial amount of herbivorous behaviour many different species of phytophagous scarab beetles are considered to be economically destructive pests. One example of an invasive species is the Japanese beetle (*Popillia japonica*) which is responsible for millions of dollars' worth of harm around the globe (Hengeveld, 1989; Mori *et al.*2022). According to research conducted by Chandel *et al.*(2023) within the north-west Himalaya on two prominent univoltine species of white grubs called *Holotrichia longipennis* and, *Holotrichia sikkimensis* the most damaging seasons for the larvae are September throughout October as well as March throughout April. The adults are responsible for the severe defoliation of a variety of fruiting and forest plants. There are huge economic losses that occur as a result of the eating behaviour of third instar grubs, which takes place during a time when potatoes grown in summertime are putting on weight and maturing. *Holotrichia longipennis* grubs possess a larger capacity to cause damage to crops including ginger, potato, and other vegetable crops when they are exposed to field conditions. Based on occurrence data and bioclimatic characteristics, Wang *et al.* (2023) predicted the global distributions of the following species: *Heteronychus arator, Oryctes monoceros, Popillia japonica, Amphimallon majale*, and *Oryctes boas.* The research showed that there are environments that are suited for these species to reside on every continent. *Popillia japonica* and *Amphimallon majale* seemed more probable to be observed in the central and eastern sections of China, but *Heteronychus arator* and *Oryctes boas* were more probably to be located in the southwestern region of the country. There was a lack of information regarding the present geographic distribution of the *Oryctes monoceros.* During present study the *saeedi* sp.nov is reported as a new species to Science. This species has been captured from the different ecological zones of Sindh from the Sunflower plant. Besides, morphometric, species description and distribution have been given in detail.

CONCLUSION: Present study concludes the finding of one new species i-e: *Heterorrhina saeedi sp.nov* from Sindh Pakistan.

AUTHORS' CONTRIBUTION

M.A. Mahar, collected the samples, conducted the research and wrote manuscript. W.A. Panhwar analyzed the data, reviewed the manuscript and formatted the manuscript. A.M. Shaikh conceived the idea and constructed GIS map.

CONFLICT OF INTEREST:

Authors have no conflict of interest.

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