New species of genus *Conoderus* Eschscholtz, 1829 (Coleoptera: Elateridae) from Pakistan

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Abstract

A new species of genus *Conoderus i.e., Conoderus pakistanicus* sp. nov.is described and illustrated from Sindh Pakistan. Identification of new species has been done based on the taxonomical characteristics such as external morphology and male genitalial structures. The biogeographic distribution and taxonomical key to the species is also provided. In addition, this study revealed that the population of new species were considerably different on its geographical distribution of Click beetles (Elateridae) fauna of different districts. Present study was identified 35 species of the Elateridae from Sindh Pakistan.

Keywords: Systematics, New species, Coleoptera, Elateridae, Pakistan, distribution, significance.

I INTRODUCTION

The family Elateridae consists of 10,000 species, globally including Pakistan [1]. *Conoderus* is the largest genus of subfamily Agrypninae originally described by Eschscholtz 1829. The various species of genus *Conoderus* are described from the America, Qatar, China, Japan, Oman, Afghanistan, India, Saudi Arabia, and Taiwan include Pakistan [2] [3]. From Madre de Dios, Peru described the twenty species [4] [5], four species are documented from Maltese Islands, Spain, Italy [6] [7]. A collection of click beetles were collected in various localities of Pakistan, it contains 48 species, being 6 of them new records for the country, Wide efforts on fauna of click beetles from Pakistan was carried out on the subfamilies Agrypninae and Cardiophorinae [8]. While 67 species out of 6 new species studied from Kalam, Kalar Khar, Swat Valley, Chilam, Chauki, Nanga Parbat and Rama Northern areas of Pakistan such as *Conoderus aeolodermoides* and *Conoderus nigromaculosus* Vats & Chauhan, 1992, are recorded from Northern areas of Pakistan [9]. *Conoderus drasterioides*is, *Conoderus cylindricus*, *Conoderus vartiani*, *Conoderus mithiensis* and *Conoderus nigromaculosus* Vats & Chauhan1992, are noted from Tharparkar, Mithi, Chakri, Islamabad and Kashmir Bagh [10]. From Insect Systematic Postgraduate Laboratory, Department of Entomology, Sindh Agriculture University Tandojam Sindh Pakistan was described the 73 samples of Family Elateridae out of them 8 species were belongs to three subfamilies and three tribes include 5 species from subfamily Agrypninae, larva of genus *Conoderus* are polyphagous soil insects, smooth, slender and rounded in shape, commonly known as wireworms, it is major pest on different root crops, seeds, tubers, sweet potatoes, beets, vegetables, stored corns. It was found in houses, lighting areas, summer season having a different ecological variation [11] [12] [13].

Current new species *Conoderus pakistanicus* **sp. nov**.is economically important Click beetle, seen hidden under leaves, grasses and garbage during day light and damage different crops, vegetables, cucumber, malanga, potatoes, sweet potatoes, wheat, squash, sweet corn, roots, stem and cause big loss to the economy. The use of the proper cultural exercise hopefully reduces the damage by *Conoderus*. The discovery of this new species will help the entomologists as well as farmers for better management under field conditions in Pakistan. The goal of this research study is to find out about the Elateridae species in Sindh, Pakistan.

II MATERIALS AND METHODS

A. Study site:

The research study was conducted during March to December (2018- 2020). The sampling localities included Sukkur, Larkana and Khairpur, Ghotki, Hyderabad and Jamshoro districts of Sindh Pakistan. Sampling were carried out at the wetland areas, rocky areas, sand grains and dried areas feeding on upper most part of small spiny type grass, sugar cane, carrots, sweet potato, tuber plants, cereal crops, agricultural land areas etc. The temperature, humidity, vegetation, nurseries, latitude, altitude, waterfall of the habitats were also recorded. The type material has been deposited in Entomology laboratory at the department of Zoology, Shah Abdul Latif University Khairpur Mirs. (**Fig. 1)**

Figure 1. Map showing the localities

B. **Sampling:**

Trials were conducted through random sampling method around wetland areas, rocky areas, sand grains areas and dried areas. The insect was feeding on upper most part of small spiny type grass, sugar cane, carrots, sweet potato, cereal crops. The insects were picked through hand picking and light trap methods and then preserved in jars more in summer season than other [14]

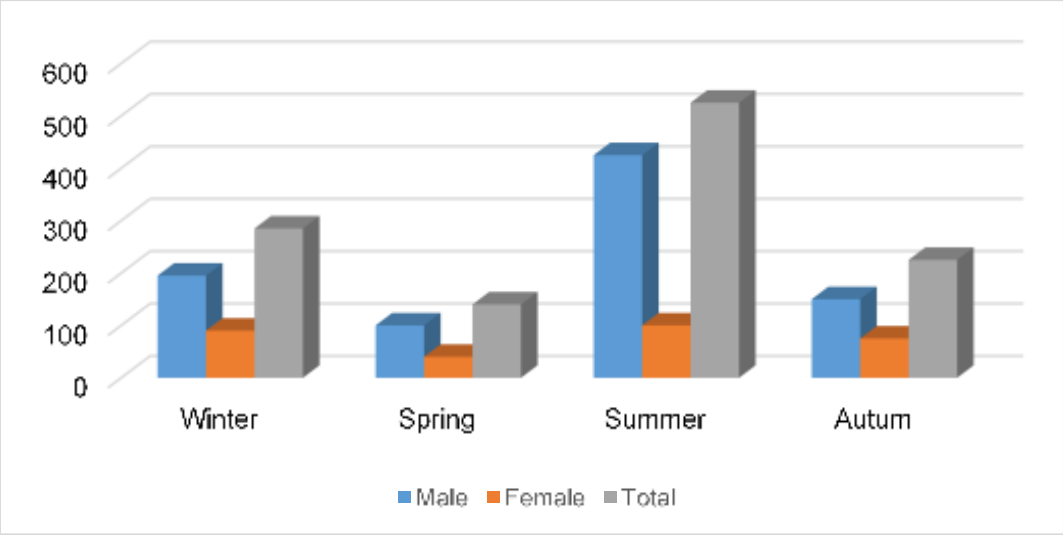


Figure 2 Showing the season through graph

C. Methods of killing and preservation:

The preserved samples were paralyzed by chloroform. The specimens were kept into jars for (5 to 10 minutes) and were taken out from chloroform, then transferred consciously and preserved appropriately in special timber boxes specially designed for the purpose. Naphthalene balls were used for protection against predators (ants) and fungus etc. These samples were identified based on their taxonomical characteristics and number of samples were counted. The identification process was undertaken based on external morphology through current publications, Keys, taxonomical classification were observed by dissecting microscope following the protocols of [15].

D. Dissection of male genitalia:

Male genitalia (aedeagus) was dissected and kept into (10 % KOH) and were boiled about (10-15) minutes depended upon the hardness of aedeagus until the inner is being visible. Then washed and examined through dissecting microscope. Subsequently examined aedeagus was preserved into micro vials with glycerin and re-attached with the specimens [16].

E. Measurements and photography of male genitalia:

The measurements of various external body sections (morphology) length and width of its head, pronotum, elytra were measured through micro millimeters under the binocular dissecting microscope.

Photography was done with the help of CCD Sterozoom Microscope of Meiji analysis image infinity software fitted with computer [17].

III RESULTS AND DISCUSSION:

Systematic Account:

Class: Insecta

Order: Coleoptera

Family: Elateridae (Leach, 1815)

Subfamily: Agrypninae

Tribe: Oophorini Gistel, 1848

Diagnosis: Pronotum wider, punctures elliptical, legs are light yellowish to darkish, black, elytra depressed at anterior than posterior margins, antennae hardly have a notch, frons concave, prosternal part arcuate, tarsi have various shapes attached the claws and seta, scutellum short theca like structures.

Genus *Conoderus* Eschscholtz, 1829

Diagnosis: Apical margins of frontal clypeal area thin depressed, antennae smooth, 2nd segment longer than others, metathoracic coxal plates medially 2.0- 4.0 times broader than laterally.

Key to the species of genus *Conoderus* (Eschscholtz, 1829) from Pakistan

1. Densely punctures on pronotum…….*Conoderus mithiensis (*Platia, 2016).
- Light punctures on pronotum……2.
2. Body small in size……. *Conoderus drasterioides* (Platia, 2016).
- Body median in size……..3.
3. Dark ferruginous with very dense yellowish pubescence that hides the colour of integument…….. *Conoderus cylindricus.* (Platia, 2016).
- Lightish ferruginous pubescence covered the integument……..4

4. Apical anterior lateral margins of antennae with beaded…… *Conoderus nigromaculosus* (Vats & Chauhan, 1992).
- Apical anterior lateral margin of antennae with light Pubescence……5.

5. Scutellum quadrangular……. *Conoderus aeolodermoides.* Vats & Chauhan, 1992).
- Scutellum sheild shaped pentagonal……6.

6. Antannae filiform 3rd antennomers longer.....……*Conoderus vartiani* (Platia, 2015).
- Antennae serrated 2nd antennomers longer than other…….……***Conoderus pakistanicus*, sp. nov.**

Differential diagnosis:

The male genitalia in general are very similar to those of *Conoderus mithiensis* and *Conoderus cylindricus* [10], stated from Mithi, Tharparkar, *Conoderus drasterioides* recorded from Chakri, Islamabad, *Conoderus cylindricus* 2nd and 3rd segments subcylinderical and sub equal in measurments, taken together as long as 4th, 4th, 5th sub conical, lengthen. Pronotum longer than broader, broadest late the middle and at the tips of the later angles, powerfully convex with a very small, slender and narrow mid-longitudinal notch on the basal angle; Scutellum circular, convex, slightly punctured. *Conoderus nigromaculosus* (Vats and Chauhan, 1992) is mentioned from Kashmir, Bagh, *Conoderus cylindricus* and *Conoderus mithiensis* both species are similar in body coloration having vertex denticated, antennae lengthened but the apical segment of each inferior appendage is slightly truncate in *Conoderus cylindricus*, although apical segment is tapered in *Conoderus mithiensis. Conoderus nigromaculosus* vii tergite is broader slightly concave, regular pubsecences and *Conoderus drasterioides* ii tergite narrow concave, irregular pubsecences. Whereas frons slightly concave in *Conoderus nigromaculosus* and frons convex in *Conoderus drasterioides.* Present new species *Conoderus pakistanicus* sp. nov. with aedeagus short, broader at anterior lateral margins than posterior lateral margins, base have two semicircular structure moon like, lateral paramere hooked shaped, median paramere parallel apex, circular covered with hairs, body lengthened, antennae 12 segments,2nd segment tubular, last segment pointed, posterior 3rd segment, yellowish in color.

Type material:

Male holotype: Pakistan: Sukkur**;** Sindh. 27.7244N, 68.8228E, ♂; 17. iii. 2019. Holotype was deposited in the Department of Zoology, Shah Abdul Latif University Khairpur, Sindh, Pakistan S. Mangi and R.M, Mangi.

Paratype: 2 ♂, 1.♀: Pakistan: Khairpur. Sindh. 20. Vi. 2017. Paratype were deposited in the Department of Zoology, Shah Abdul Latif University Khairpur, Sindh, Pakistan A.M, Mangi.

Description:

Male holotype:

Body size and coloration Male: Body lengthened, color in alcohol dark brown to black body coloration, head dark brown to redish brown, black eyes, densely brown antennae, elytra golden ferruginous, stira are densely brown, 1st, 2ndtergite nearly, ferrugineus, fastigium black having hairs densely brown to black, dark brown adult dorsal view, redish brownish of pronotum and scutellum, yellowish spots, dorsal view of legs dense brown, ventral view light brown. **(Fig. 3)**

Head: Head short, biconvex, circular covered with hairs, anterior section denticated and posterior regular.

Antennae: Antennae serrate lengthened12 segments, 1stsegment of antennae just attached with head, 2nd segment tubular lengthened as compared to other. 3rd, 4th broad triangular, 5th narrow posterior laterally irregular, 8th and 9th are uniform at posterior margins, 12th segment shorter, yellowish ventral side of antennae. Vertex upward, occiput smooth, anterior lateral side's concave. **(Fig 3**.A**)**.

Pronotum: Pronotum lengthened as compared to width, shorter than elytra, anterior lateral margins slightly concave, medilateraly slightly straight, posterior laterally convex, prontal angles pointed, and pronotum densely covered with punctures, space between the pronotum and abdomen and scutellum theca like structure **(Fig 3**. B**):**

Scutellar shield: visable, rugose, tetragonal and distally tapered with median groove. **(Fig 3**. A**).**

Abdomen: Abdomen lengthened having elliptical spots with straight lines on abdomen, anterior lateral margins of 10th 11th tergite has been broader than posterioriolateral margins, whole abdomen covered with spots and lines, femur broader cyclinderical, tarsi subcyclinderical, 5 teeth-like structures, apex of tarsi having a two needles-like structures are present, ovipositor broader half-moon like, 4th and 5th sternite were slightly closed with each other. **(Fig 3**. **A&B).**

Elytra: striate gaps minutely raised; exteriors crosswise rugose.

Legs: I tarsomere wider as combined lengths of remaining four on mesothoracic and metathoracic tarsi; tibiae as long as in cross section; metathoracic tarsomeres II–III teethed; metathoracic tarsomere IV simple; metathoracic tarsomere V small, with basally toothed claws. **Venter:** finely punctate to rugose, golden recumbent setae, metathoracic episternum parallel; metathoracic coxal plates medially 3.4–6.1 times broader than laterally.

Male genitalia: X sternite longitudinally long in lateral view slightly concave in anterolateral, XI arcuate lengthened, space between the XIII and XV sternite are wider than XII and XIV. Anterolateral margin of terminalia is broader than posteriolateral margin, triangular in shape and covered with uniform punctures, aedeagus of this species is totally different from all other species of this genus *Conderus*, aedeagus longer than broader middle anterior lateral margins are wider than posterior lateral margins having a long bright hair on lateral sides, anterior margins are wider than posterior margins view from the dorsal side. Base layers like anterior margins of base convex and median margins concave. Right lateral paramere has been smaller than left lateral paramere, base of right lateral paramere almost equal with apex view from ventral side. Base of left lateral paramere broader than apex, the apex of both lateral parameres are hooked shaped. Median paramere completely straight equal in measurments in base and apex, apex rounded. Small golden hairs are present on lateral margins. Alcohol dark shish in coloration. **(Fig 3. C&D).**

Variations:

Two male and one female paratypes were examined, including one male recorded from Khairpur, one male communicated from Sukkur and one female communicated from Dadu. The female Paratype is 13.5 mm long and 4.0 mm wide, much larger and wider than the holotype. Abdominal punctures are slightly indicated in all Paratype compared against the holotype. Major differences were observed in genitalial structures between these paratypes and the holotype. In holotype male geniatalia aedeagus broader in medilateraly margins, anterior margins covered with golden brown hairs and lateral paramers wider at base as compared to apex. Median paramere straight and apex circular. Base of aedeagus in holotype bilayer half-moon shaped in structures. But in paratypes specimens male geniatalia aedeagus longer than wider and lateral parameres almost equal in width and length. Median paramere apex slight diverted and base concave.

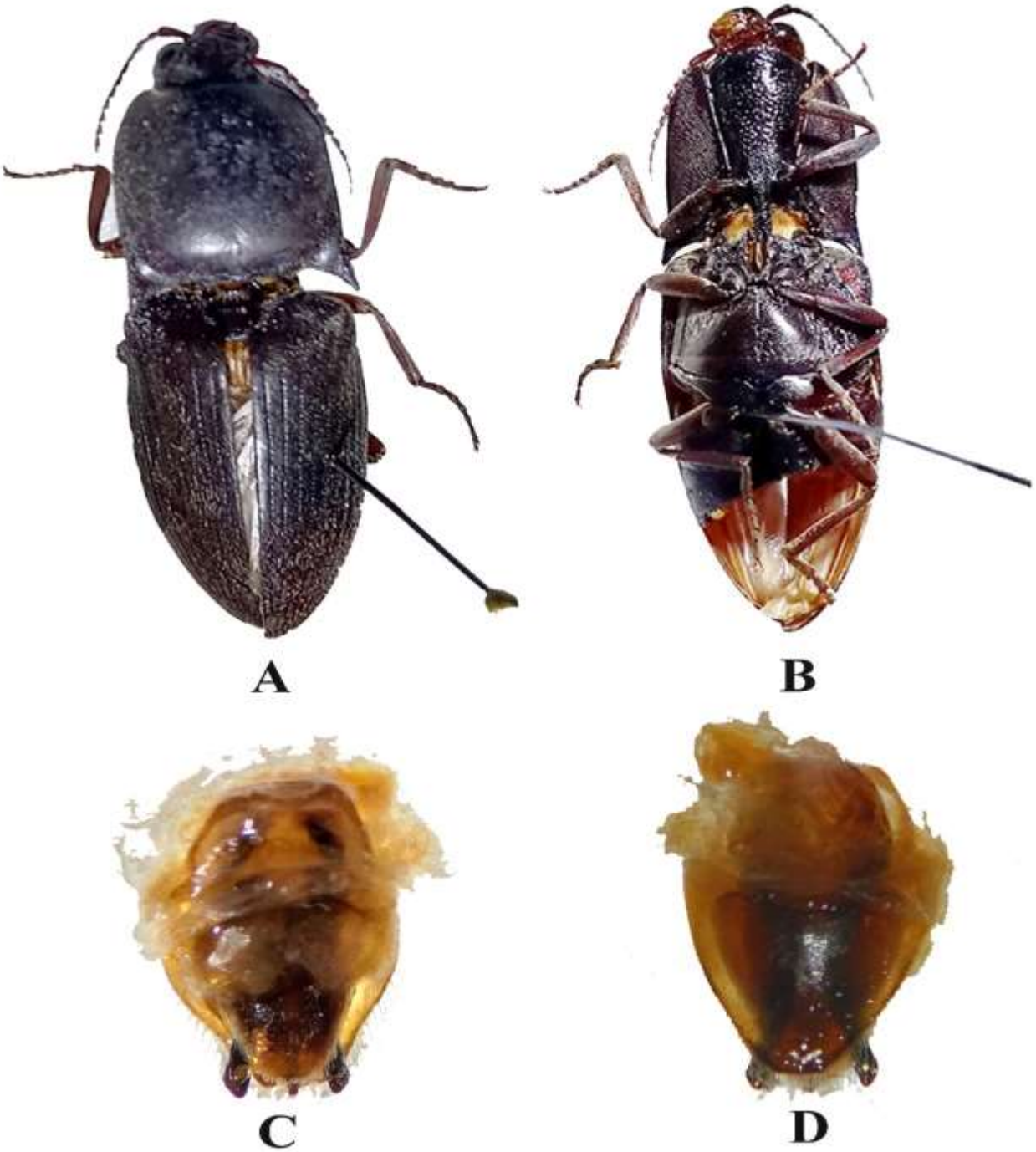
Distribution: *Conoderus pakistanicus* sp.nov is presently known from the Sukkur Sindh Pakistan:

Etymology:

The first name mentions to genus *Conoderus* and last name denotes to locality from where has been sampled.

Figure 1. Measurement of various body parameters of *Conoderus pakistanicus* sp. nov.

Parameters	**Mean ±SD (n=10)**	**Range**
Length of head	8±2.9	3-13
Length of femur	9±7.1	4-14
Length of tarsi	92±7.3	87-97
Total body length	90 ±70.11	85-95



Figures 3. *Conoderus pakistanicus* sp. nov A) Adult dorsal view. B) Adult ventral view .C) Aedeagus, dorsal view. D) Aedeagus, ventral view.

Discussion:

Conoderus pakistanicus **sp.nov**. belongs to genus *Conoderus* Eschscholtz,(1829)well known as Click beetles, it was captured from sukkur district of Sindh Pakistan., They are agricultural pest mostly on sugarcane, carrots, potatoes, grass, vegetables, sweet potatoes, nuts, tuber plants, rocky areas sand grains dried areas feeding on apical part of small spiny type grass, various crop field its larva badly effected to crops. About 120 specimens of genus *Conoderus* were captured including many different already described species from Pakistan. After detailed analysis of the specimens it revealed one new species and three were new records from that area, whereas highest population were captured from grass, potatoes, sugarcane and succulent plants beside lake. The Genus *Conoderus* Eschscholtz 1829 was described by many researchers, scientist from different regions in Pakistan as well as worldwide. The current new species *Conoderus pakistanicus* **sp. nov**., has been collected from agricultural crops surrounded by vegetables and single specimen was collected from light trap from Sukkur, same genus study was conducted by [5]. from different localities from Madre de Dios, Peru and highest population were collected from northern areas and lowest work had been from one district of Sindh Pakistan such as *Conoderus drasterioides* was reported from Chakri, Islamabad, *Conoderus mithiensis* is recorded from Tharparkar, Mithi, *Conoderus cylindricus* from Tharparkar, Mithi, *Conoderus nigromaculosus* from Kashmir, Bagh, *Conoderus vartiani* from Chakri, Islamabad, *Conoderus aeolodermoides* is collected from the Islamabad [9],[10]. Highest number of samples were observed in summer season as compared to autumn, spring season but lowest sampling was observed in winter season.

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Author Contributions:

Conceptualization, **Shabana Mangi**, Formal analysis, **Abdul Manan Shaikh, Waheed Ali Panhwar,** Investigation, Shabana Mangi, **Waheed Ali Pahnwar**, Methodology, Shabana Mangi and **Abdul**

Manan Shaikh; Supervision, **Abdul Manan Shaikh, Visualization**, Shabana Mangi, writing – original draft, **Shabana Mangi** Writing – review and editing **Shabana Mangi.**

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