

A NEW SPECIES OF THE GENUS *AGRIOTES* (ESCHSCHOLTZ, 1829) (COLEOPTERA: ELATERIDAE) FROM DIFFERENT CROPS AND WEEDS FROM SINDH PAKISTAN

Shabana Mangi¹, Waheed Ali Pahnwar^{1*} and Abdul Manan Shaikh¹

Abstract

The members of genus *Agriotes* are well known as Click beetles. The specimens belong to this genus were collected from agricultural lands during March to December (2018-2020). The collected specimens were brought in the Entomological and Systematics Lab at Department of Zoology Shah Abdul Latif University Khairpur Sindh Pakistan. The specimens were identified into two species i-e: *Agriotes pakistanicus* sp. nov and *Agriotes bulgaricus* (Platia and Gudenzi, 2007). Out of which: *Agriotes pakistanicus* sp. nov is reported as new species to science while *Agriotes bulgaricus* is first time reported from Sindh Pakistan. Besides this, morphological description along with digital images are provided. Definitely this study will prove to be a base line for future taxonomist dealing with this genus.

Keyword: Biogeography, Morphometry, New species, Systematic, Pest control.

Citation: Mangi , S.; W.A. Pahnwar and A. M. Shaikh. 2021. A New Species of the Genus *Agriotes* (Eschscholtz, 1829) (Coleoptera: Elateridae) From Different Crops and Weeds. *Pak. J. Weed Sci. Res.*, 27 (3):369-380

¹Department of Zoology Shah Abdul Latif University Khairpur Mirs Sindh Pakistan

*Corresponding author email: Waheed.pahnwar@salu.edu.pk

Introduction

The members of genus *Agriotes* (Eschscholtz, 1829) are commonly known as Click beetles, they belong to family Elateridae and subfamily Elaterinae (Fleutiaux 1941). It is the largest subfamily of family Elateridae and *Agriotes* genus is the largest genus of tribe Agriotini (Platia and Gudenzi *et al.*, 1997). They are serious agricultural pests and its larva are known as wireworm, it contains the 09 tribes, 800 genera and 800 species. Widely distributed in Turkey, Lebanon, Iraq, Syria, Greece, Palaearctic region as well as in Oriental region (Platia *et al.*, 2008- 2012). Therefore 110 species are recorded from Turkey, 42 species are reported from Lebanon and 145 species are distributed in Palaearctic region from different localities by different scientists (Mertlik and Platia 2008; Kabalak and Sert 2009-2011; Platia and Nemeth 2011, Platia *et al.*, 2009, 2011; Platia 2003-2010- 2011, 2012 and Cate 2007). The members of genus *Agriotes* (Eschscholtz 1829) are polyphagous pests, badly effects on agricultural crops (Tóth *et al.*, 2002- 2003). They are pest species on various crops, vegetables, tobacco, potato, maize, weeds, meadow, different seeds, roots of underground plants, they decrease the yield in Indo-sub continent (Subchev *et al.*, 2004-2006). *Agriotes rufipalpis* (Brullé, 1832), *Agriotes sordidus* (Illiger, 1807), *Agriotes sputator* (Linnaeus, 1758), *Agriotes ustulatus* (Schaller, 1783), *Agriotes brevis* (Candèze, 1863), *Agriotes lineatus*

(Linnaeus, 1767), *Agriotes litigiosus* (Rossi, 1792), *Agriotes obscurus* (Linnaeus, 1758), *Agriotes proximus* (Schwarz, 1891), there are 09 species as pests of special agricultural and used as biological pest control in Europe (Karabatsas *et al.*, 2001). Present study reveals the finding of new species and new record of this genus for first time from Sindh Pakistan.

Materials and Method

Study site

The current surveys showed that the samples of Click beetles were captured from the Qambar Shahdatkot and Thatta districts of Sindh, Pakistan. During field survey total 78 specimens were collected from March to December (2018– 2020) out of which 35 male, 43 were female, collected from the potatoes, strawberries, maize, weeds, pulses, wheat, sugarcane, sunflower, mustard, agricultural land, grasses, herbs, shrubs and potatoes.

Sampling

These Click beetles were captured by formal hand picking method as well as light trap purposive random from different crops and weeds maize, weeds, pulses, wheat, sugarcane, sunflower, mustard, agricultural land, grasses, herbs, shrubs, potatoes, cereals, sugar beet, vegetables, fruit, tomatoes etc. The specimens were kept in plastic jars, capture the images of host plants and different localities and taken to laboratory for further experiments (Mangi *et al.*, 2020).

Table.1. Showing seasonal sampling from different Agricultural crops

Name of species of genus <i>Agriotes</i>	Summer April to September	Autum September to November	Winter November to February	Spring February to April
<i>Agriotes pakistanicus</i> sp. nov	Potatoes, Thorndike plants, grass and weeds	Herbs, Beans and Potatoes, Cabbage and Potatoes,	Onion, Lettuce leaf and Radish	Maiz, Sugarcane, and Tomatoes
<i>Agriotes bulgaricus</i> (Platia, 2007)	Maiz, Tomatoes, Potatoes and Corn	Spinach, Tomatoes and herbs	Turnip, Peas , grass and weeds	Tomatoes, Potatoes and Thorndike plants,
<i>Agriotes lineatus</i> (Linnaeus, 1767)	Sugarcane, Ladyfinger and Brinjal	Radish and Weeds	Herbs, Shrubs and Weeds	Potatoes, Tomatoes, Peas and Beans
<i>Agriotes duhokensis</i> (Platia 2013)	Weeds, Potatoes, Brinjal, Bitter gourd and Rocky areas	Sugarcane, Tomatoes, Tuber plants and Cotton	Broccoli, Tomatoes, Spinach, Herbs, Shrubs and Wheat	Grass and Weeds
<i>Agriotes sameki</i> (Platia 2003)	Weeds, Grass, Pumpkin, Cucumber and Potatoes	Grass, Tomatoes and Weeds	Fenugreek, Beet, Mustard and Tomatoes	Grass, Corn and Herbs

Methods of killing and preservation

The specimens were kept in jars paralyzed by ethyl acetate for (5 to 10 minutes), then specimens were carefully shift from ethyl acetate, pinning them into wooden insect boxes very descent manner, kept the naphthalene balls for protection from carnivore insects and labelled the specimens . The specimens were observed under stereoscopic dissecting binocular microscope (SDBM) Kyowa Tokyo No884443 and CCD Stero zoom Microscope of Meiji analysis image infinity software. Identify the specimens with the help of taxonomical keys.

Dissection of male genitalia

Male genitalia (aedeagus) was dissected, 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 and then preserved into micro vials with glycerin and re-attached with the particular specimens (Abdul, M.S, *etal.*, 2019).

Measurements and photography male genitalia

The measurement were taken with help of vernier caliper and Mean and standard deviation were taken by help of SPSS version (22.0). The photography of specimens were done through with the help of CCD Sterozoom Microscope of Meiji analysis image infinity software fitted into binocular dissecting microscope, measured the male genitalia as well as external body parts such as ful body length, elytra, head, lateral margins,

pronotum in millimeters (Platia, *et al.*, 2016).

Results and Discussion

Systematics

Class Insecta

Order Coleoptera

Family Elateridae (Leach, 1815)

Subfamily Elaterinae

Genus *Agriotes* (Eschscholtz 1829)

Agriotes pakistanicus sp. nov

Material Examined. Holotype; male, Pakistan: Qambar Shahdatkot Sindh 27.7244N, 68.8228E, 11. VII. 2020. Mangi and R.M, Mangi

Differential diagnosis.

Current new species *Agriotes pakistanicus* sp. nov recorded from Qambar Shahdatkot district of province Sindh Pakistan, closely resembled in external morphology to *A. lineatus*, *A. platiai*, body median in size, frons bigonal, antennae lengthened and legs having a dents, scutellum shield like, elytra longer pronotum, central section of aedeagus is wider, middle part distinctly lengthened, parameres smooth, apex tapered, arms convex. *A. heydeni* (Schwarz, (1891), frons flat, bulging eyes, antennae 1st three antennomeres serrated, goes upto pronotum, 2nd antennomeres cylindrical, base convex inverted having 2 lobe like, central paramere broad, rod shaped, apex circular, marginal paramere leaves like, tip pointed and base thick slightly convex. Elytra lengthened as compared to pronotum; *A. podlussanyi* (Platia and Nemeth 2011) is brownish. *A. gulnariensis* (Platia 2011) body densely brown and *A. mertliki* (Platia 2003) Pronotal margins downward. Present new species *Agriotes pakistanicus* sp. nov with aedeagus broader, narrower at anterior margins than posterior margins, base have two semicircular structure, lateral paramere slightly straight.

Description Holotype:

Body size and coloration:

Median in size, color of body is alcoholic dark brownish with deep black coarse punctures, eyes black, antennae 1st three segments are deeply brownish, last segments are golden brownish. Pronotum dark brown, scutellum golden brown. Abdomen anterior portion is brightest as compared to posterior portion, tip of abdomen bilateral yellowish brown in color. Elytra dark brown and dorsal surface deeply brownish. Ventral surface light brownish, femora golden brown, tibia ferruginous and tarsi dark brown.

Head:

Head longer than wider, concave, small hairs are present on anterior margins and median part depressed. Smooth vertex, eyes rounded, occiput hemispherical, tip circular. Frons lengthened having a hairs, frontal margins are bigonal and cylindrical.

Antennae:

Antennae lengthened consist of 12 segments mutilated, 1st segment is short just attached with head, 2nd segment is cylindrical longer than 3rd, 4th segments, 5th segment is trigonal, 6th slightly biconcave, 7th, 8th segments are circular, 9th segment is convex, 10th tapered, 11th slightly biconcave 12th segment is circular.

Pronotum and Abdomen:

Body tubular, pronotum narrow longer than wider, pronotal lateral margins rounded, lateral sides smooth, space absent between the pronotum and abdomen. More punctures on pronotum. Scutellum small trilobed shape, middle portion of scutellum depressed, abdomen tubular, oval in shape with circular punctuations, carina visible, pronotal lateral margins are smaller than elytra, large three spots on elytra, golden dents on the middle of carina on abdomen, striae separated from each other, 1st, 3rd stria circular, punctures same in size, deep, simple with spaces, different on average equal to same in diameters, tip of

abdomen bilateral in shape, ventral side of abdomen covered with huge thick punctures. For legs shorter than middle and hind legs, femur thick broadened, tibia flat lengthened, three trigonal dents like structure on tarsi, last hooked shaped dent, ovipositor bilateral tapered.

Genitalia:

Abdominal segment I transversally shorter in lateral in convex, anterolateral slightly concave, II segment parallel longitudinally wider, small space between the II segments. Anal area is bigonal in shape. Anterolateral margin of terminalia is wider than posterolateral margin and covered with regular pubescences. Male genitalia inner structures (aedeagus) is vary from other species, flower like in shape, base convex inverted having a two lobe like, median paramere thick rod shaped apex circular, lateral paramere leaves like, tapered at tip, base thick convex. Present species is totally different from all other species of this genus *Agriotes* because on male genitalial structures aedeagus longer broader than longer middle lateral margins are broader than anterolateral and posterior lateral margins. Lateral paramers long, broader and circular at apex. Anterior

side straight, apex tapered in shaped of central paramers. Small golden hairs are present on lateral margins.

Distribution. Pakistan: Sindh. Qambar Shahdatkot.

Etymology

The first name is *Agriotes* refers to genus name and last name refers to locality from where has been sampled.

Biogeography of *Agriotes* from Sindh

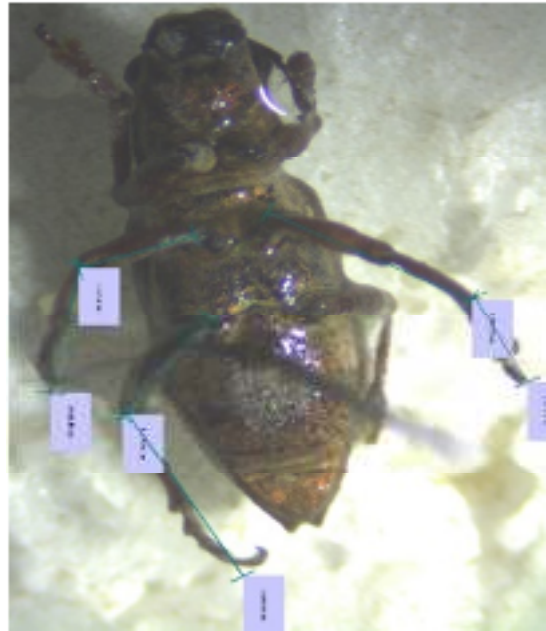
The more sampling of Click beetles were recorded from the Khairpur district then Qambar Shahdatkot because in summer and rainy season insects were seemed highest as compared to other seasons, Sindh province is located in subtropical summer season is hot highest temperature recorded 53c in Moenjo daro, winter is cold, Autumn and Spring is average hence the effects on terrestrial fauna, the sampling of Click beetles were more in summer season because more insects were appear on earth due to increase temperature of underground and from different agricultural crops and from different localities such as Potatoes, Tomatoes, weeds, grass and different vegetables from different district of Sindh.

Table.2. Showing the Biogeographical distribution of family Elateridae (+ species present and – species absent

Sp.no	Scientific Name of species	Districts	Sindh Province district wise distribution				
01	<i>Agriotes pakistanicus</i> sp. nov	Qambar Shahdatkot	-	+	+	+	+
02	<i>Agriotes lineatus</i> (Linnaeus, 1767)	Dadu	-	+	+	+	+
03	<i>Agriotes duhokensis</i> (Platia 2013)	Jamshoro	+	-	-	+	+
04	<i>Agriotes sameki</i> (Platia 2003)	Hyderabad	-	+	+	+	+
05	<i>Agriotes bulgaricus</i> (Platia 2007)	Thatta	-	+	+	+	+

Table 3. Morphometric study of *Agriotes pakistanicus* sp. nov

Parameters	Mean \pm SD (n=10)	Range
Length of head	0.24 \pm 0.05	0.29- 0.19
Width of head	36 \pm 6.3	32-41
Length of pronotum	38 \pm 6.3	34-43
Width of pronotum	49 \pm 7.07	44-54
Length of elytra	1005 \pm 6.3	96-105
Width of elytra	36 \pm 6.3	32-41
Total body length	158 \pm 6.3	154-163



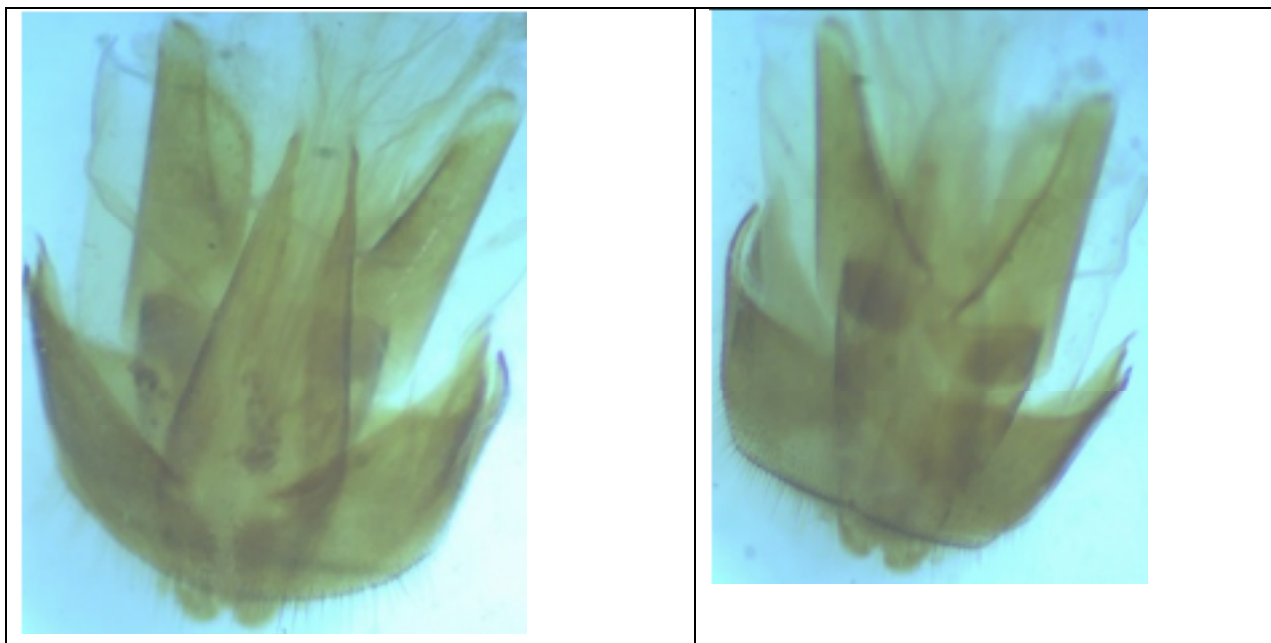


Figure. 1 A. Adult dorsal view, B. Adult ventral view, C. Aedeagus dorsal view, D. Aedeagus ventral view

***Agriotes bulgaricus* (Platia and Gudenzi, 2007)**

Material Examined. Pakistan: Thatta Sindh . 27.7244N, 68. 8228E , , 9. Viii. 2018 & 8. iv. 2020. Several specimens. (Mangi, S and S, Abdul Manan).

Description.

Body size and coloration:

Body lengthened, black shiny coloration, dark brown paraclypeus, clypeus, antennae black 1st, 2nd antennomeres , 5th ,6th dense brown antennomeres, last three antennomeres golden brown, dense brown pronotum, scutellum golden brown, apex of humeral angles brown , center lightish, lateral margins of abdominal golden brown, tarsi yellowish, meta tarsi dense brown , hairs on legs , dark brown color of ventral side.

Head:

Head separate from the pronotum, trigonal, frons (forehead) convex, frontal side smooth, outer side convex, paraclypeus longer than clypeus, concave. Anterior margin is concave than posterior margin. Eyes rounded.

Antennae:

Antennae small goes upto middle of abdomen serrated, antennae having a 12 antennomeres , 2nd thick Longer than other segments, cylindrical in shape, 2nd segment subcylindrical , 3rd 4th are trigonal , 5th, 6th slightly wider and shorter than other segments. 10th, 11th segments are bigonal in shape and 12th tapered.

Pronotum and Abdomen:

Pronotum broader than longer, convex, dorsal sides convex, with more punctuations but differed in size and shape, prantal angles tapered, pronotum and abdomen distinctly away from each other, covered with more punctuation on whole body. Prantal margins are smaller than elytra, dorsal surface of abdomen convex. Ventral surface was concave, tarsi tubular. Meta tarsi smooth dent like structure on meta tarsi, smooth prosternum with plane bright lines having a black spots on ventral sides.

Genitalia:

Male genitalia aedeagus broader than longer, paramere lengthened. Lateral paramere thin lengthened and circular at apex, median paramere small wider at apex. Base wider triangular in shape. Lateral margins of base are denticated having a anterior lateral margins are concave posterior margins are convex.

Comparative note:

Current species was resembled to *A. rahmei*, and *A. sameki*. *Agriotes*

bulgaricus apex rounded at the median lobe and the aedeagus resembled to *A. sameki* and *Agriotes longipronotum* on genitalial basis parameres apically pointed, convex and in present species lateral margins of base bigonal, base pointed, lateral paramere longer than median paramere, aedeagus ladder like. Current species was first time recorded from the Pakistan but already recorded from the Turkey.

Table.4. Showing measurement of various body parameters of *Agriotes bulgaricus*

Parameters	Mean \pm SD (n=10)	Range
Length of head	26 \pm 7.02	21- 31
Width of head	17 \pm 0.06	12-22
Length of pronotum	16 \pm 6.05	11-21
Width of pronotum	39 \pm 7.02	66-76
Length of elytra	17 \pm 7.05	12-21
Total body length	34 \pm 0.044	34-44

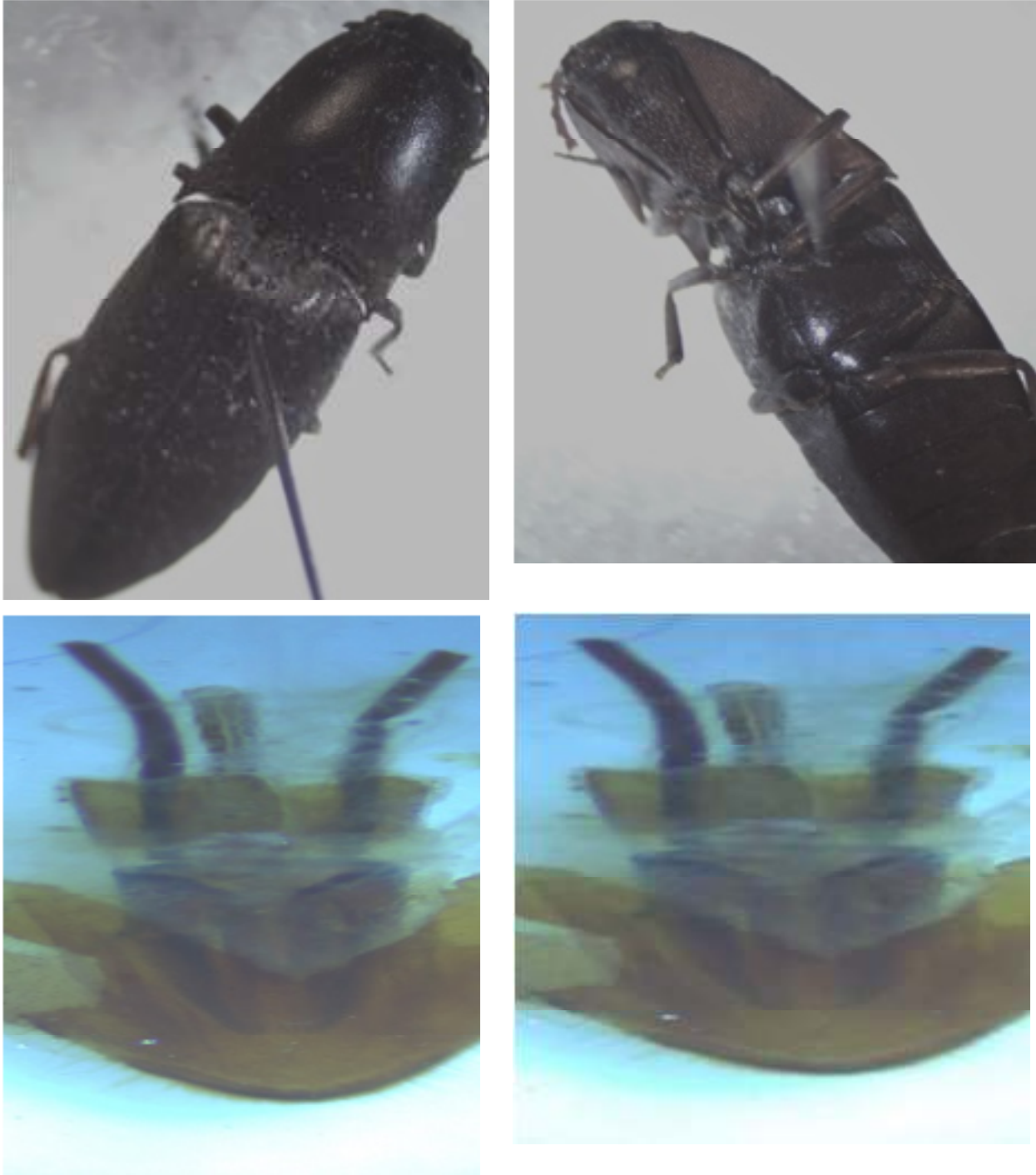


Figure .2 **A.** Adult dorsal view, **B.** Adult ventral view, **C.** Aedeagus dorsal view **D.** Aedeagus ventral view

Conclusion

The present study concludes the finding of new species to science and one new regional record from Sindh Pakistan.

Besides this, the host plants of species were different crops, vegetables and weeds maize, weeds, pulses, wheat, sugarcane, sunflower, mustard, agricultural land, grasses, herbs, shrubs, potatoes, tomatoes

and various crop field . If more surveys of Sindh will be carried out it may reveal finding of other fauna of this genus from Pakistan.

Author Contributions

Conceptualization, **Shabana Mangi**, Formal analysis, **Abdul Manan Shaikh**, **Waheed Ali Pahnwar**, 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**.

Conflicts of Interest: The authors declare no conflict of interest.

Acknowledgments

The authors thankful to Arslan Ahmad and Shakeel Ahmad Khaskheli for his generous support in scientific techniques and photography.

Reference

- Abdul, M.S, Waheed, A.P and Shabana, M .2019. A new record of *Andrallus* (Pentatomidae. Asopinae) from the Khairpur district Sindh. Pakistan, Int. Ju. Zoo. App. Bio. 4: (3):117-121.
- Cate P. 2007. Family Elateridae. In: Löbl I, Smetana A, Editors. Catalogue of Palaearctic Coleoptera, volume 4. Elateroidea - Derodontoidea - Bostrichoidea - Lymexyloidea - Cleroidea - Cucujoidea. Apollo Books. 89–209.
- Fleutiaux, E. (1914) Contributions a la fauna Indo-Chinoise. Cicindelidae et Elateridae. Annis Soc. ent. Fr., 9(6) : 137-146.
- Karabatsas K., V. Tsakiris, K, Zarpas, J. A. Tsitsipis, L. Furlan, M. Tóth .2001. Seasonal fluctuation of adult and larvae of *Agriotes* spp. (Coleoptera: Elateridae) in Central Greece. – Proceedings. XXI IWGO Conference, Lessgnaro Italia, 27 October – 3 November, 269-275.
- Kabalak M, Sert O. 2009. A New *Agriotes* (Coleoptera, Elateridae) Species from Turkey. Turkish Journal of Biology 33(4): 451–455.
- Kabalak M, Sert O. 2011. Faunistic composition, ecological properties and zoogeographical composition of the family Elateridae (Coleoptera) of the Central Anatolian Region of Turkey. Journal of Insect Science 11:57. Available online: <http://www.insectscience.org/11.157>
- Kabalak, M.; Sert, O.; Özgen, I.; Platia, G. A new species of the *Agriotesnuceus* species group from Turkey. J. Insect Sci. 2013, 13, 17. [CrossRef] [PubMed]
- Mertlik J, Platia G. 2008. Catalogue of the family Cebrionidae, Elateridae, Lissomidae, Melasidae and Throscidae (Coleoptera) from Turkey. Elateridarium 2: 1–40.
- Platia G. 2003. Descrizione diotto nuove di Agriotes del gruppo nuceus Fairmaire della Turchia con chiave di determinazione all specie note (Insecta, Coleoptera, Elateridae). II Naturalista Valtellinese - Atti del Museo civico di storia naturale di Morbegno 14: 13– 28.
- Platia G. 2008. New species and chorological data of click-beetles from western and southern Palearctic region (Coleoptera, Elateridae). Biocosme Mésogéen 25(4): 137– 150.
- Platia G. 2010. Descriptions of fourteen new species of click beetles from the Palearctic Region, with chorological notes (Insecta Coleoptera Elateridae). Quaderno di Studi e Notizie di Naturale della Romagna 30: 103-130.
- Platia G. 2011. Description of three new species of click beetles from the Palearctic region, with new distributional records (Coleoptera,

- Elateridae). Boletín de la Sociedad Entomológica Aragonesa 49: 19–22.
- Platia G. 2012. Description of ten new species of click beetles from the Palearctic region with new distributional records (Coleoptera, Elateridae). Boletín de la Sociedad Entomológica Aragonesa 50: 199–207.
- Platia G, Gudenzi I. 1997. Contributo alla conoscenza degli *Agriotes* del gruppo *nuceus* di Siria e Iraq (Coleoptera, Elateridae). Bollettino della Societa Entomologica Italiana 128(3): 201–211.
- Platia G, Gudenzi I. 2007. Click-beetles species and records new to the Palearctic region (Insecta Coleoptera Elateridae). Quaderno di Studi e Notizie di Naturale della Romagna 24: 79-96
- Platia G, Schimmel R, Tarnawski D. 2009. Description of two new species of *Agriotes* Eschscholtz of the *Agriotes nuceus*-group from Turkey with chorological notes (Insecta: Coleoptera: Elateridae). Genus 20(2): 243– 248.
- Platia G, Nemeth T. 2011. On some Palaeartic click beetles in the Hungarian Natural History Museum (Coleoptera: Elateridae). Annales Historico-Naturales Musei Nationalis Hungary 103: 1–41.
- Platia, G, Halgurd Rashed and Ismael Akrawi (2013) Contribution to the knowledge of the click-beetles (Coleoptera: Elateridae) from Kurdistan Region – Iraq, with description of three new species. Arquivos Entomoloxicos, (8): 209-218.
- Schwarz O 1906 Neue Elateriden aus Amerika. Deutsche Entomologische Zeitschrift 1906, 97-158.
- Shabana, M. 2020. New species of genus *Dipropus* Gemar1838 (Coleoptera: Elateridae: Elaterinae) from Sindh Pakistan, Pure Appl. Bio. 9(3)2088-2096.
- Subchev M., T. Toshova, M. Tóth, L. Furlan .2004. Click beetles (Coleoptera: Elateridae), and their seasonal swarming as established by pheromone traps in different plant habitats in Bulgaria: 1.Meadow. – Acta zoologica bulgarica, 56 (2): 187-198.
- Subchev M., T. Toshova, M. Tóth, L. Furlan .2006. Click beetles (Coleoptera: Elateridae) and their seasonal swarming as established by pheromone traps in different plant habitats in Bulgaria: 3. Potato. – Acta zoologica bulgarica, 58 (3): 361-370.
- Tóth, M. Furlan, L, Yatsynin, V.G, Ujvary, I, Szarukan, I, Imrei, Z, Subchev, M, Tolasch, T, Francke, W. 2002. Identification of sex pheromone composition of click beetle *Agriotesbrevis* Candèze. J.Chem. Ecol. 28, 1641–1652. [CrossRef].
- Tóth, M, Furlan, L, Yatsynin, V.G, Ujvary, I, Szarukan, I, Imrei, Z, Tolasch, T, Francke, W, Jossi, W. 2003. Identification of pheromones and optimization of bait composition for click beetle pests (Coleoptera: Elateridae) in Central and Western Europe. Pest Manag. Sci., 59, 417–425. [CrossRef] [PubMed].

