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Pezodrymadusa saeedi a new species of the genus *Pezodrymadusa* (Tettigoniidae: Orthoptera) from Pakistan

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Abstract

The genus *Pezodrymadusa* is studied and a key to species and a checklist are provided. One new species *Pezodrymadusa saeedi* sp.nov. is described. In total 15 species of the genus have been described already and images are also provided. Based on the shape and structure of the male cerci, the stridulatory file, the subgenital plate, and particularly the texture of the tegmina, the new species differs from *Pezodrymadusa uvarovi*. The holotype (Male) was collected from Pakistan, Khyber-Pakhtunkhwa (Lower Dir).

Key words: Orthoptera, Tettigoniidae, Tettigoniinae, *Pezodrymadusa*, New species

Introduction

Pakistan is a diversified region with different ecological and biogeographical zones ranging from Alpine, sub-Alpine, tropical, sub-tropical and semi-desert. The Orthopteran fauna of Pakistan is rich and varied. Tettigonioidea encompasses a group of insects that exhibit phytophagous behavior. Within this group, certain species hold significant relevance as pests in agriculture, while numerous others establish biological associations with forest ecosystems, leading to detrimental effects on shrubs and trees. Furthermore, the inclusion of forest vegetation, fruit orchards, berry bushes, and grasses expands the scope of harmful plants beyond herbaceous

species (Panhwar, 2015; Panhwar *et al.* 2013). They are among the most prevalent taxa of Orthoptera (Jago, 1997). The Tettigoniidae subfamily is the third largest in the family (Eades *et al.* 2016). A few members of this subfamily are confined to the canopy, others in this subfamily are frequently connected with certain host plants (Rentz, 2010). Several studies have been carried out by (Panhwar *et al.* 2013-2014; Ingrisch & Gorochov, 2007; Ingrisch, *et al.* 2003; Ingrisch & Muralirangan, 2002; Ingrisch, 2002, 1998,1995, 1990; Ingrisch & Shishodia, 2000, 1998) did a lot of work on the Tettigoniidae family from the Oriental, Palearctic, and Ethiopian regions. Unal (2010, 2006, 2003, 1999) and Unal and Naskrecki (2002) documented a significant number of newly discovered species, one of which being the Drymadusuini tribe found in Turkey. Consequently, there is a lack of knowledge regarding their life history. The taxonomic classification of the genus Pezodrymadusa was established by Karabag in 1961. It belongs to the tribe Drymadusini and its type species is Drymadusa angorensis (Uvarov, 1931). This species is commonly observed in the regions of Turkey, Transcaucasia, and Iran. According to Heller *et al.* (2014), the taxonomic group comprising the plant-feeding Phaneropterinae, Pseudophyllinae (Mugelston *et al.* 2013), Mecopodinae, and Phyllophorinae is considered to be a single, very diverse group within the family Tettigoniinae. This classification has been implemented by the Orthoptera Species File (Eades *et al.* 2016). Detailed morphological and distributional data of *Glyphonotus sinensis* Uvarov, 1939 (Orthoptera:Tettigoniinae) was given from Pakistan (Panhwar *et al.* 2013). Ecological and taxonomic status of genus *Euconocephalus* Karny, 1907 (Orthoptera: Tettigonioidea: Conocephalinae) was revised from Pakistan (Panhwar *et al.* 2014). Nearly 47 species of Tettigonioidea were reported by Panhwar (2015) from Pakistan excluding the genus *Pezodrymadusa*. The aim of the present study was to explore the genus *Pezodrymadusa* from Pakistan and in results we describe one new species of genus *Pezodrymadusa.* Hopefully, this study will be beneficial to the future researchers concerned with biodiversity of *Pezodrymadusa* fauna of Pakistan.

Materials and Methods

The specimens analysed in this study were obtained from the field during survey expeditions. The specimens were collected during daylight hours from undisturbed regions in close proximity to the agricultural areas. The newly discovered species is documented based on specimens obtained from Lower Dir, located in the Khyber Pakhtunkhwa Province. The conventional sweep

nett was employed for the purpose of collecting specimens. The samples were killed using a normal insect jar that contained potassium cyanide, and afterwards prepared for mounting. Compound microscope (KYOWA MEDILUX 20) equipped with USB Digital Camera (3STEMI 200 K PIXEL) was used to take digital pictures of specimens and their bodily parts. In the process of creating line drawings, a camera Lucida was employed, which was specifically adapted to be mounted atop a microscope. To enhance the quality of certain line drawings, the software Adobe Illustrator CS6 and Adobe Photoshop were employed.

Measurements. The term "total body length" denotes the measurement of an insect's body from the anterior end to the posterior end, encompassing the entirety of the abdomen, which includes the male subgenital plate. The measurements were taken with scale divider in millimeter (mm).

Depositories. The materials utilized for this study are stored within the institutions, which are abbreviated as indicated in the text:

WPC: Waheed Ali Panhwar Personal Collection

IKC: Imran Khatri Personal Collection

IMSAU: Insect Museum Sindh Agriculture University, Tandojam Pakistan

BMNH: The Natural History Museum, London, United Kingdom

BM: Berlin Museum, Germany

ZIUA: Zoological Institute, University of Ankara, Turkey

VM: Vienna Museum, Austria

MM: Madrid Museum, Spain

Results

Check list of Genus *Pezodrymadusa* Karabag, 1961 species

S.No.	Species name	Figure No.
1	*Pezodrymadusa affinis* (Bolivar,1899)	Fig.1 a,b
2	*Pezodrymadusa angorensi* (Uvarov, 1930)	Fig. 1.c,d
3	*Pezodrymadusa diffusa* (Ramme, 1951)	Fig.1 e,f,g
4	*Pezodrymadusa grisea* (Brunner von Wattenwyl, 1882)	Fig. 1 h
5	*Pezodrymadusa indivisa* Karabag, 1961	Fig.1 i,j
6	*Pezodrymadusa karabagi* Ünal, 2013	--

7	*Pezodrymadusa konowi* (Bolívar, 1899)	Fig.1 k,l
8	*Pezodrymadusa kurmana* (Ramme, 1939)	Fig. 1 m,n,o
9	*Pezodrymadusa lata* Karabag, 1961	Fig.1 p,q,r
10	*Pezodrymadusa magnifica* (Werner, 1901)	--
11	*Pezodrymadusa sinuata* (Ramme, 1951)	Fig.2 a,b,c
12	*Pezodrymadusa striolata striolata* (Ramme, 1951)	Fig.2 d,e,f
13	*Pezodrymadusa striolata ziyaretensis* Koçak & Kemal, 2010	--
14	*Pezodrymadusa subinermis* Karabag, 1961	Fig.2 g,h,i
15	*Pezodrymadusa uvarovi* Karabag, 1961	Fig 2. J,k,l
16	*Pezodrymadusa saeedi* sp. nov.	Fig 2. m,n,o Fig. 3 a,b,c

Taxonomy

Simplified key to enable recognition of *Pezodrymadusa* species

1.	Elytra very small, extending to the end of first tergite……..	**2**
--.	Elytra shorter than pronotum, blackish brown, with some oval spots……...	**3**
2.	Metazona convex, metazona weakly flattened……	***P. affinis***
--.	Metazona short, weakly convex…….	***P. angorensis***
3.	Posterior edge of pronotum almost straight, greyish-brown marbled……	***P. diffusa***
--.	Posterior edge straight, without brown marbled……..	**4**
4.	Subgenital plate longer than wide, with a deep and acutangular excision….	***P. grisea***
--.	Subgenital plate short, with a rounded excision……	***P. indivisa***
5.	Subgenital plate with widely rounded excision……..	***P. konowi***
--.	Subgenital plate with widely triangular posterior incision.	**6**
6.	Cercus slender, strongly incurved almost in right angle in distal half, with a distinct apical tooth……..	***P. karabagi***
--.	Cercus cylindrical, very weakly incurved in last third without apical tooth…	***P.kurmana***
7.	Appendages of last tergite divergent without depression……	**8**
--.	Last tergite with a distinct depression on the middle of appendages……	***P.magnifica***
8.	Styli cylindrical and very short……..	***P. lata***
--.	Styli not cylindrical and short……	***P.sinua***
9.	Elytra dirty brown, with some light spots……	***P. striolata striolata***
--.	Elytra light brown with minute spots……..	***P.striolata***

		ziyaretensis
10.	Subgenital plate, with deep subacute excision ……..	**11**
--.	Subgenital plate longer than wide, with acute angular excision……	***P.uvarovi***
11.	Fastigium of vertex long, widened in the middle, narrowed to the vertex, as wide as first antennal segment……	***P. subinermis***
--.	Fastigium of vertex a little wider than first antennal segment; with very shallow median sulcus…….	***P.saeedi* sp. nov.**

TAXA

Family Tettigoniidae Krauss, 1902

Subfamily Tettigoniinae Krauss, 1902

Tribe Drymadusini Uvarov, 1924

Genus *Pezodrymadusa* Karabag, 1961

Type species: *Drymadusa angorensis* (Uvarov,1931)

Description. The facial features exhibit a clearly defined narrow strip of black or dark brown pigment located between the eyes. The pronotum is cylindrical in shape and often exhibits an X-shaped pattern. It is convex from the pro-meso notum, while the meta notum typically lacks flattening. A broad transverse depression is present behind the sulcus, and there is an absence of a median carina. The lateral carina is distinguishable from the shoulders, with the excision of the shoulders being very shallow. The first sulcus is clearly defined, while the typical sulcus is less distinct and exhibits a slight curvature slightly behind the midpoint. The length of the elytra is less than half of the length of the abdomen. The subgenital plate exhibits a greater length than width, characterised by a circular excision. The styli are of short length and possess a cylindrical shape. The cercus displays an expanded basal articulation.

Distribution: Pakistan, Transcaucasia, Iran and Turkey.

***Pezodrymadusa saeedi* sp. nov.**

Fig 2. m,n,o Fig. 3 a,b,c

Material examined. (1 ♂ Holotype) Holotype: Pakistan: Malakand, Lower dir (34.8500° N, 71.8500° E) 22.i.2014, Leg. Ahmed (Khyberpakhtunkhwa Province); 3 Paratypes, 25.vi.2010, Leg. Ahmed (Khyber Pakhtunkhwa (KPK) (WPC, IMSAU, IKC)

Description. The fastigium of the vertex is somewhat wider than its precursor antennal segment, and it has a deep central sulcus. The pronotum is cylindrical in shape, comparatively short, with a broadly rounded posterior edge. The lateral carina at the corner of the metazoan is very weak. The first sulcus is distinct, while the typical sulcus is roundly curved behind the middle of the pronotum. The elytra are longer than the pronotum and extend up to the end of the third tergite. The hind femur is short and stout. The appendages of the last tergite are short and spine-like, diverging from each other. The circus is stout, and the titilator is also stout. The subgenital plate is narrow and has an acute inclined excision. The styli are cylinder-shaped and small in size. The general coloration of the specimen is light brown. The face is also light brown, with the absence of a black band between the eyes. The outer sides of the first and second segments of the antenna exhibit a black coloration, while the area surrounding the eye is also black. The occiput lacks any distinct pattern and matches the ground colour. The pronotum is light brown, with the lateral edges of the pronotal lobes being slightly lighter. The posterior margin of the pronotum is reddish-brown in colour. The elytron is reddish-brown and displays an irregular yellowish texture or spots. The basal parts of the femoral spines are black, and there is a dark brown ring near the apices of the femora. On the basal upper edge, there is a large elongated black spot, as well as a longitudinal black spot that widens towards the apex. Additionally, there is a small elongate black spot near the upper edge on within of the hind femur. The apical edge of the V-VIII th tergites is bright brown.

Measurements (mm). Hind Femur 25-26; Fore Femur 23-24; Elytra 6-7; Pronotum 9.5-10; Length of total body 23.5-24.

Discussion. The order Orthoptera comprises a data base of Orthoptera species file (http://orthoptera.speciesfile.org/) that contain taxonomic detail about the Orthoptera group. About fifteen species of the genus *Pezodrymadusa* are reported and listed (Cigliano *et al.* 2020). First checklist of the Tettigoniidae of Pakistan was presented with 47 species under 07 subfamilies i.e: Decticinae, Conocephalinae Phaneropterinae, Mecopodinae, Tettigoniinae,

,Hexacentrinae and Pseudophyllinae of Tettigonioidea (Panhwar *et al.* 2016). One more species i-e *Conocephalus* (*Anisoptera*) *fuscus* (Fabricius, 1793) was described as new regional record (Sadiq et al., 2017). Two species i-e: *Mecopoda platyphoea* Walker, 1870 and *Afromecopoda monroviana* (Karsch, 1886) of subfamily Mecopodinae were reported from Pakistan (Panhwar et al.,2016). The katydid population in Pakistan consists of 20 tribes and 22 genera. Additionally, 29 new records have been identified in Pakistan, along with the discovery of 5 new species in the field of science (Panhwar *et al.* 2018). Present study was conducted to explore the biodiversity of genus *Pezodrymadusa* from Pakistan and it resulted in finding of one new species to this genus. Following taxonomic variation were observed in the new species with respect to already described species. The species under consideration exhibits distinct variations from *Pezodrymadusa uvarovi* Karabag, 1961 in terms of the morphology and composition of the male cerci, stridulatory file, subgenital plate, and notably the texture of the tegmina. In *P. uvarovi*, the appendages of the last tergite are elongated and take the form of divergent spine-like structures. The cercus is robust, while the titillator is also stout. The subgenital plate is longer than its width and exhibits an acutangular excision. The styli are cylindrical and small. In the case of the newly discovered species, the appendages of the last tergite are shorter and resemble spine-like structures that diverge. The cercus remains stout, and the titilator maintains its stoutness. However, the subgenital plate is shorter and displays an acute angular excision. The observed species exhibits distinct variations from *P.subinermis* in terms of its morphology. Specifically, the fastigium of the vertex is elongated, with a broader middle section that gradually narrows towards the vertex. This varies from *P.subinermis*, where the fastigium of the vertex is as wide as the first antennal segment. Additionally, the new species has a slightly wider fastigium of the vertex compared to its first antennal segment, and it possesses a very deep central sulcus.

Etymology. The nomenclature of this recently discovered species is attributed to Professor Dr. Muhammad Saeed Wagan, former Chairman of the Department of Zoology, in recognition of his significant efforts in advancing Orthoptera Research within the context of Pakistan.

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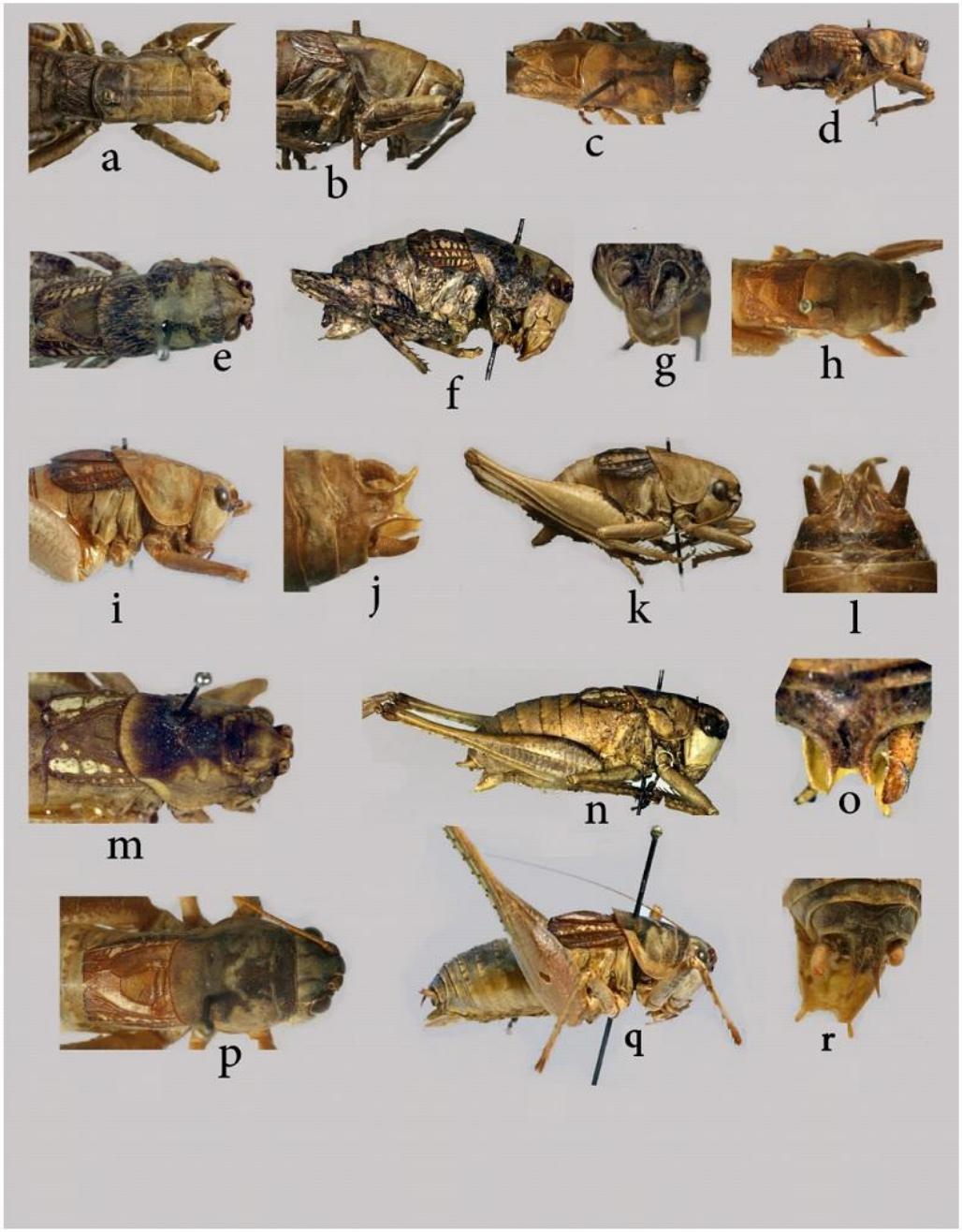

Fig.1 a,b, *Pezodrymadusa affinis* (Bolivar, 1899),c,d, *Pezodrymadusa angorensis* (Uvarov, 1930), e,f,g, *Pezodrymadusa diffusa* (Ramme, 1951),h *Pezodrymadusa grisea* i,j, *Pezodrymadusa indivisa* Karabağ, 1961, k,l, *Pezodrymadussa konowi* (Bolivar, 1899), m,n,o, *Pezodrymadusa kurmana* (Ramme, 1939), p, q, r, *Pezodrymadusa lata* Karabağ, 1961

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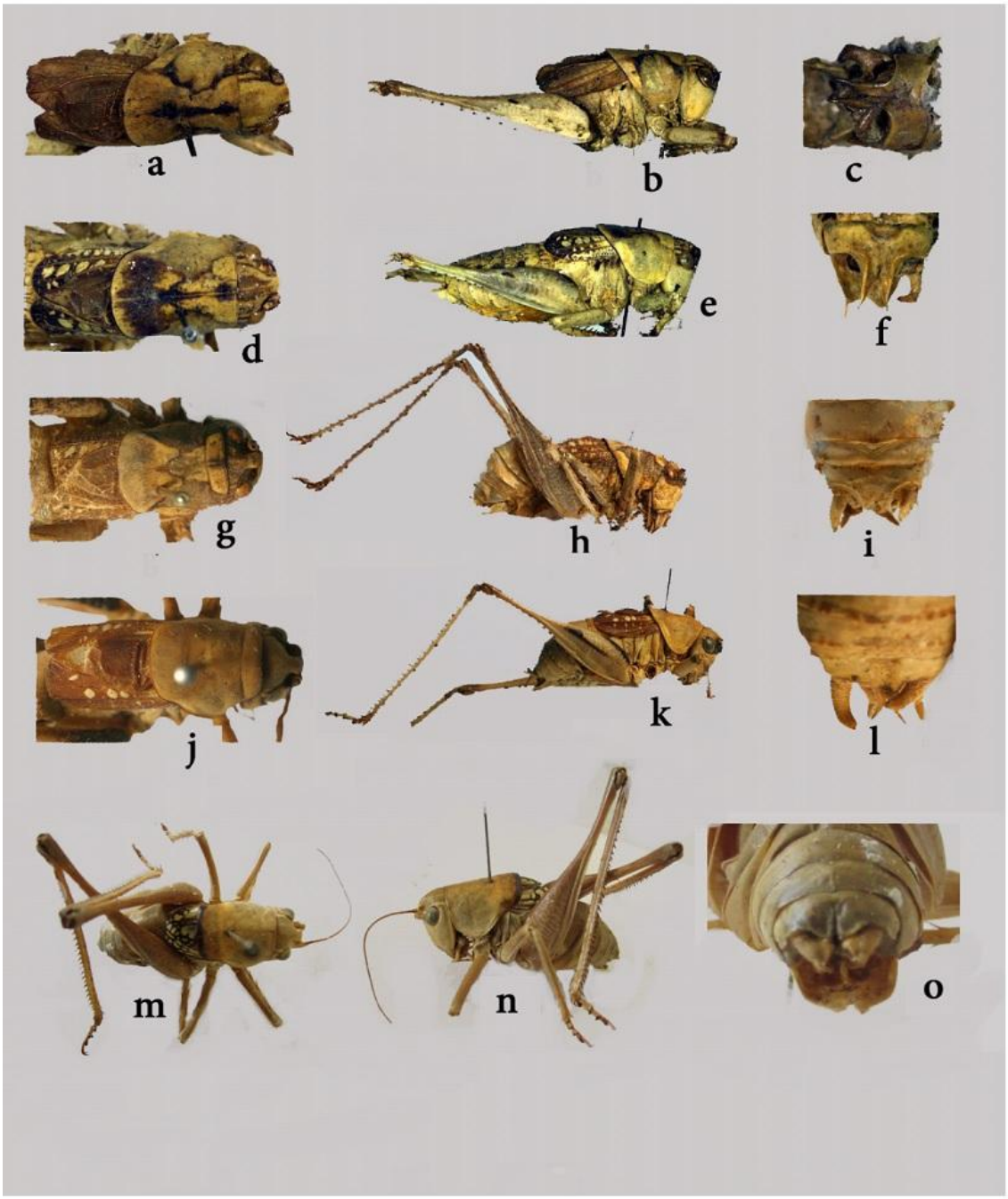

Fig.2. a,b, c, *Pezodrymadusa sinuata* (Ramme, 1951), d, e, f, *Pezodrymadusa striolata striolata* (Ramme, 1951), g,h,i, *Pezodrymadusa subinermis* Karabağ, 1961, j,k,l, *Pezodrymadusa uvarovi* Karabağ, 1961, m,n, o , *Pezodrymadusa saeedi* sp.nov.

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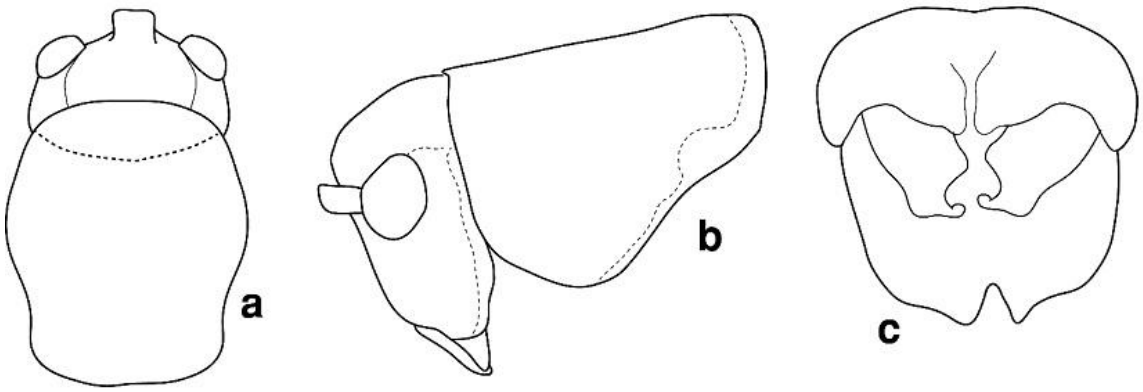

Fig.3 *Pezodrymadusa saeedi* sp.nov.