

## First reports of *Razianus* (Scorpiones: Buthidae) from Iraq and Pakistan, descriptions of two new species, and redescription of *Razianus zarudnyi*

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### ABSTRACT

The scorpion fauna of Pakistan, like that of the rest of the Indian subcontinent, is poorly known and many new species may await discovery. We describe two new species of the buthid genus *Razianus* Farzanpay, 1987, i.e., *Razianus birulai*, sp. nov., and *Razianus farzanpayi*, sp. nov., the first records of this genus from Pakistan, raising the number of species in the genus to four and extending its distribution southeast. In addition, we redescribe the type species, *Razianus zarudnyi* (Birula, 1903), report the first record from Iraq, extending the distribution of *Razianus* further west, plot the known locality records of the three species occurring in Iraq, Iran, and Pakistan, and provide a key to their identification.

KEYWORDS: Palearctic, biodiversity, systematics, taxonomy

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## INTRODUCTION

Little attention has been paid to the scorpion fauna of Pakistan since Pocock's (1900) monograph in the *Fauna of British India* series. Most works covering the systematics of Pakistani scorpions since 1900 did so in passing. For example, some of the species occurring within Pakistan were treated in Tikader and Bastawade's (1983) volume in the *Fauna of India* series. Others were covered in more general papers on scorpion taxa with species occurring in Pakistan (Lourenço and Vachon, 1997; Kovařík, 2000, 2003a, 2004, 2007; Lourenço, 2005; Kovařík and Fet, 2006). Only 16 papers explicitly address species occurring in the country (Kovařík, 1996, 2003b; Lourenço, 1997, 1998; Lourenço and Monod, 1998; Khatoon, 1999; Capes and Fet, 2001; Amir et al., 2004a, 2004b, 2005a, 2005b; Lourenço and Qi, 2006; Kovařík and Ahmed, 2007, 2009, 2011, 2013). The scorpion fauna of Pakistan currently comprises approximately 50 species (several of dubious validity) in 17 genera (depending on the authority) and five families. Up to five genera and 17 species, some of which have since been synonymized, were added to the fauna since 1900.

Given the poor state of knowledge of the Pakistani scorpion fauna, like that of the rest of the Indian subcontinent, many new species may await discovery. In the present contribution, we describe two new species of the poorly known buthid genus *Razianus* Farzanpay, 1987, the first records of this genus from Pakistan, collected during a survey of the Pakistani scorpion fauna, funded by the Higher Education Commission of Pakistan, and in collaboration with the University of Sargodha.

*Razianus zarudnyi* (Birula, 1903), the type species from Iran, was originally described in the genus *Hemibuthus* Pocock, 1900. As discussed by Fet and Lowe (2000), it became a homonym of *Buthus zarudnyi* Birula, 1900, currently *Sassanidotus zarudnyi* (Birula, 1900), when transferred to *Buthus* Leach, 1815, by Birula (1905a). Birula (1905b) therefore introduced a new replacement name, *Buthus zarudnianus* Birula, 1905. After Lourenço (1996) created *Neohemibuthus* Lourenço, 1996, Fet (1997) synonymized the type species with *Hemibuthus zarudnyi* Birula, 1903. Lourenço (1996) and Fet (1997) were unaware, however, that Farzanpay (1987, in Farsi but with a Latin index) had previously created the genus *Razianus*, to accommodate *R. zarudnyi*. A second species of the genus, *Razianus xinjianganus* Lourenço et al., 2010, was recently described from Xinjiang, China (Lourenço et al., 2010).

The description of two new species of *Razianus* from Pakistan raises the number of species in the genus to four and extends its distribution southeast (fig. 1). In addition, we redescribe the type species, *Razianus zarudnyi* (Birula, 1903), report the first record from Iraq, extending the distribution of *Razianus* further west, plot the known locality records of the three species occurring in Iraq, Iran, and Pakistan, and provide a key to their identification.

## METHODS

Scorpions were collected by turning stones during the day or searching at night using portable ultraviolet (UV) lamps, comprising a pair of mercury-vapor tubes attached to a chromium parabolic reflector and powered by a rechargeable 7 amp/hr, 12 V battery, or UV-LED

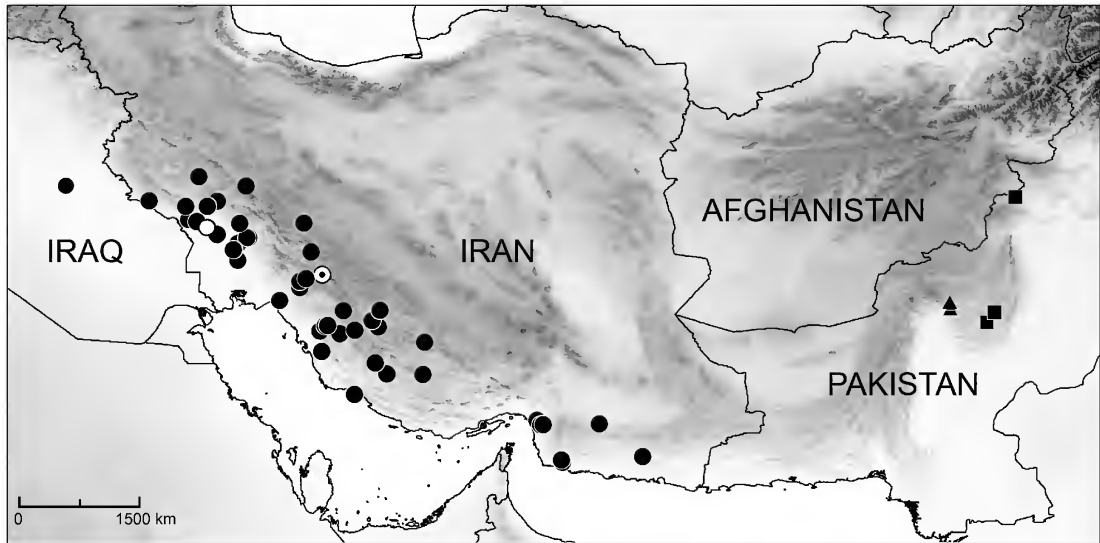


FIGURE 1. Map plotting the known records of *Razianus* Farzanpay, 1987 in Iran, Iraq and Pakistan, on shaded relief: *Razianus birulai*, sp. nov., indicated by triangles, *Razianus farzanpayi*, sp. nov., squares, and *Razianus zarudnyi* (Birula, 1903), circles. White circles denote type locality of *R. zarudnyi* (black dot) and its junior synonym, *Neohemibuthus kinzelbachi* Lourenço, 1996 (without dot). Records for *R. zarudnyi* based on the literature and museum material.

flashlights. A portable Garmin™ GPS V Plus device was used for recording the geographical coordinates (WGS84 datum) of some collection localities in the field. Material examined is deposited in the American Museum of Natural History, New York (AMNH), and the Museum National d’Histoire Naturelle, Paris (MNHN). Other material is deposited in the Natural History Museum, London (BMNH), Muséum d’Histoire Naturelle, Geneva (MNHG), and the Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZISP). Tissue samples for DNA isolation are stored in the Ambrose Monell Collection for Molecular and Microbial Research (AMCC) at the AMNH.

Photographs were taken in visible light as well as under long-wave UV light using a Microptics™ ML-1000 digital photomicrography system. Measurements (mm), given as average and range in the descriptions, were recorded using the ocular micrometer of a Nikon® SMZ-1500 stereomicroscope. Morphological terminology follows previous papers on Buthidae C.L. Koch, 1837, by the last author (e.g., Prendini, 2004a, 2004b, 2005; Vignoli and Prendini, 2008; Prendini et al., 2009; Prendini and Esposito, 2010), with the terms “external” and “internal” replaced by “retrolateral” and “prolateral” when referring to position on appendages (chelicerae, pedipalps, and legs).

A point locality geographical dataset of collection records of *R. zarudnyi* from the literature (Fet and Lowe, 2000; Navidpour et al., 2008a, 2008b, 2008c, 2008d, 2010, 2012, 2013; Pirali-Kheirabadi et al., 2009) and museum material was created for mapping the distribution of this species, together with the known records of the two new species described below. Records of sufficient accuracy for which georeferences were not provided were retroactively georeferenced

using the GEOnet Names Server (<http://earth-info.nga.mil/gns/html/namefiles.htm>), Fuzzy Gazetteer (<http://isodp.hof-university.de/fuzzyg/query/>), and Google Earth. A distribution map was produced using ArcMap Version 10.1 (Environmental Systems Research Institute, Redlands, California), by superimposing point locality records on the GTOPO30 global digital elevation model (<https://lta.cr.usgs.gov/GTOPO30>), obtained from the Oak Ridge National Laboratory Distributed Active Archive Center ([http://webmap.ornl.gov/wcsdown/wcsdown.jsp?dg\\_id=10003\\_1](http://webmap.ornl.gov/wcsdown/wcsdown.jsp?dg_id=10003_1)).

## SYSTEMATICS

Family Buthidae C.L. Koch, 1837

Genus *Razianus* Farzanpay, 1987

Key to Identification of the Species of *Razianus* Farzanpay, 1987,  
Occurring in Iraq, Iran and Pakistan

1. Habitus relatively robust, metasoma broader (width: length, segment I, 89%–100%; V, 41%); intercarinal surfaces more sparsely granular; carapace central median carinae obsolete, granular; pedipalp chela manus carinae obsolete, movable finger ( $\delta$ ) almost sublinear; leg basitarsi and telotarsi, pro- and retroventral macrosetae short and stout ..... *Razianus zarudnyi* (Birula, 1903)
- Habitus relatively gracile, metasoma more slender (width: length, segment I, 88%–89%; V, 34%–36%); intercarinal surfaces more densely granular; carapace central median carinae distinct, costate-granular; pedipalp chela manus carinae more pronounced, movable finger ( $\delta$ ) with shallow but distinct proximal lobe; leg basitarsi and telotarsi, pro- and retroventral macrosetae long and fine ..... 2
2. Total length, 26–29 mm; habitus more robust in  $\delta$  than  $\text{♀}$ ; coloration pale, immaculate; intercarinal surfaces more finely granular; cheliceral fixed finger with small proximal denticle, in addition to larger distal denticle; pedipalp chela manus ( $\delta$ ) more incrassate, with more pronounced proximal lobe on movable finger, and larger gap between fixed and movable fingers, when closed ..... *Razianus birulai*, sp. nov.
- Total length, 20–23 mm; habitus more gracile in  $\delta$  than  $\text{♀}$ ; coloration dark, infuscate; intercarinal surfaces more coarsely granular; cheliceral fixed finger without small proximal denticle, in addition to larger distal denticle; pedipalp chela manus ( $\delta$ ) less incrassate, with less pronounced proximal lobe on movable finger, and smaller gap between fixed and movable fingers, when closed ..... *Razianus farzanpayi*, sp. nov.

*Razianus birulai*, sp. nov.

Figures 1, 3A, B, 4C, D, 5, 6, 11A, B; table 1

TYPE MATERIAL: **PAKISTAN: Balochistan:** *Loralai District:* Duki Tehsil: Holotype  $\delta$  (AMNH), paratype  $\delta$  (AMCC [LP 11432]), Check post Loralai Scout camp, Mandi Tuk, 6 km N of Duki, 30°01'39.39"N 68°34'02.87"E, 3575 ft, 19.vi.2012, M. Irfan, M. Arif, S. Wahid, and



FIGURE 2. Habitat of *Razianus farzanpayi*, sp. nov.: Barkhan, 15 km W on road to Kohlu (29°54'N 69°31'E), in the Barkhan District of Balochistan state, Pakistan.

M. Zafar, rocky mountain with large stones, night collecting with UV lamps (8–10 P.M.). Loralai Tehsil: Paratype ♀ (AMNH), Pthan Kot, 4 km S of Loralai, 30°19'34.59"N 68°33'05.55"E, 4783 ft, 16.vi.2012, M. Irfan, M. Arif, S. Wahid, and M. Zafar, rocky with small stones and grass, UV light collecting at night.

**ETYMOLOGY:** The specific epithet is a patronym in honor of A.A. Byalynitskii-Birulya (A.A. Birula), who described the type species of the genus, *R. zarudnyi*, and many other Palearctic scorpion taxa.

**DIAGNOSIS:** *Razianus birulai*, sp. nov., most closely resembles the other Pakistani member of the genus, *R. farzanpayi*, sp. nov. The two species differ from the type species of the genus, from Iran, in the following respects. The habitus of the Pakistani species is more gracile, with a more slender metasoma (width:length, segment I, 88%–89%; V, 34%–36%), than that of *R. zarudnyi*, which is more robust, with a broader metasoma (width:length, segment I, 89%–100%; V, 41%), and the color patterns are distinctly different. The carapace central median carinae are distinct and costate-granular in the Pakistani species, but obsolete and granular in *R. zarudnyi*. The movable finger of the male pedipalp chela exhibits a shallow but distinct proximal lobe in the Pakistani species, compared with *R. zarudnyi*, in which the movable finger

TABLE 1. Meristic data for types of *Razianus birulai*, sp. nov., and *Razianus farzanpayi*, sp. nov., and non-type material of *Razianus zarudnyi* (Birula, 1903) in the collections of the American Museum of Natural History, New York.

Measurements (mm) follow Prendini (2004a, 2004b), Vignoli and Prendini (2008), Prendini et al. (2009) and Prendini and Esposito (2010). <sup>1</sup>Sum of carapace, tergites I–VII, metasomal segments I–V, and telson; <sup>2</sup>metasoma absent; <sup>3</sup>distance from anterior carapace margin; <sup>4</sup>sum of metasomal segments I–V and telson; <sup>5</sup>distance from base of condyle to tip of fixed finger. Pectinal tooth counts (left/right).

Specimen	sex type	<i>Razianus birulai</i>			<i>Razianus farzanpayi</i>					<i>Razianus zarudnyi</i>				
		♂ Holo.	♂ Para.	♀ Para.	♂ Holo.	♀ Para.	♀ Para.	♀ Para.	♀ Para.	♂ <sup>2</sup>	♂	♂	♂	♂
Total length <sup>1</sup>		26.5	26.0	28.9	20.6	20.3	21.7	23.2	21.2	- <sup>2</sup>	19.6	20.6	25.5	20.6
Carapace	median ocelli <sup>3</sup>	1.1	1.1	1.2	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.0	0.9
	length	2.7	2.7	3.0	2.2	2.3	2.5	2.7	2.4	2.2	2.2	2.2	2.6	2.1
	anterior width	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.1	1.0
	posterior width	2.6	2.8	3.3	2.3	2.4	2.5	2.7	2.5	2.2	2.2	2.2	2.2	2.2
Tergite I	length	0.6	0.5	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5
Tergite II	length	0.7	0.7	0.8	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.6
Tergite III	length	0.9	0.8	1.0	0.6	0.6	0.7	0.7	0.7	0.5	0.5	0.7	0.8	0.7
Tergite IV	length	1.1	1.1	1.2	0.8	0.8	0.9	0.9	0.9	0.7	0.6	0.9	1.1	0.8
Tergite V	length	1.2	1.2	1.5	0.9	0.9	1.0	1.0	1.0	0.8	0.7	1.0	1.1	0.9
Tergite VI	length	1.3	1.3	1.6	1.0	1.0	1.2	1.1	1.1	0.9	0.8	1.0	1.3	0.9
Tergite VII	length	2.1	2.1	2.2	1.4	1.4	1.9	1.7	1.4	1.5	1.4	1.5	1.9	1.5
Sternite VII	length	1.6	1.7	1.9	1.3	1.3	1.9	1.5	1.5	1.3	1.1	1.1	1.7	1.2
	width	2.6	2.7	3.1	2.2	2.2	2.5	2.7	2.4	2.1	2.0	2.0	2.6	2.1
Mesosoma	total length	7.9	7.7	9.0	5.5	5.4	6.5	6.2	5.9	5.1	4.8	6.0	7.3	5.9
Metasoma I	length	1.9	1.9	1.9	1.6	1.5	1.6	1.7	1.6	-	1.4	1.4	1.9	1.5
	width	1.7	1.7	1.8	1.4	1.4	1.4	1.5	1.4	-	1.4	1.3	1.7	1.4
	height	1.5	1.6	1.5	1.1	1.2	1.2	1.2	1.2	-	1.1	1.1	1.4	1.1
Metasoma II	length	2.2	2.1	2.3	1.8	1.8	1.9	2.1	1.9	-	1.8	1.7	2.2	1.7
	width	1.5	1.6	1.5	1.2	1.3	1.3	1.3	1.3	-	1.3	1.3	1.5	1.2
	height	1.5	1.5	1.5	1.1	1.2	1.2	1.2	1.2	-	1.1	1.1	1.4	1.1
Metasoma III	length	2.3	2.2	2.5	2.0	1.9	2.0	2.2	2.0	-	1.9	1.8	2.4	1.9
	width	1.5	1.5	1.4	1.2	1.2	1.3	1.3	1.2	-	1.2	1.2	1.5	1.2
	height	1.5	1.5	1.5	1.1	1.2	1.2	1.3	1.2	-	1.1	1.1	1.4	1.1
Metasoma IV	length	2.6	2.7	2.8	2.2	2.1	2.1	2.4	2.1	-	2.2	2.2	2.6	2.2
	width	1.4	1.4	1.4	1.1	1.2	1.2	1.2	1.1	-	1.1	1.1	1.5	1.1
	height	1.4	1.4	1.4	1.2	1.1	1.2	1.3	1.2	-	1.1	1.1	1.4	1.1
Metasoma V	length	3.7	3.8	3.8	2.8	2.8	2.7	3.1	2.8	-	2.7	2.7	3.4	2.7
	width	1.3	1.3	1.3	1.0	1.0	1.1	1.1	1.0	-	1.1	1.1	1.4	1.1
	height	1.3	1.3	1.3	1.1	1.0	1.1	1.1	1.1	-	1.0	1.0	1.3	1.0
Metasoma	total length <sup>4</sup>	15.9	15.6	16.9	12.9	12.6	12.7	14.3	12.9	-	12.6	12.4	15.6	12.6
Telson	total length	3.2	2.9	3.6	2.5	2.5	2.4	2.8	2.5	-	2.6	2.6	3.1	2.6

Specimen	sex type	<i>Razianus birulai</i>			<i>Razianus farzanpayi</i>					<i>Razianus zarudnyi</i>				
		♂ Holo.	♂ Para.	♀ Para.	♂ Holo.	♀ Para.	♀ Para.	♀ Para.	♀ Para.	♂	♂	♂	♂	♂
Vesicle	length	1.7	1.5	1.9	1.4	1.4	1.4	1.7	1.4	-	1.3	1.2	1.6	1.4
	width	1.0	1.0	1.2	0.8	0.9	1.0	0.9	0.8	-	0.8	0.8	1.1	0.9
	height	1.0	1.1	1.1	0.8	0.8	1.0	1.0	0.8	-	0.8	0.8	1.1	0.8
Aculeus	length	1.5	1.4	1.7	1.1	1.1	1.0	1.1	1.1	-	1.3	1.4	1.5	1.2
Femur	length	2.4	2.4	2.5	1.8	1.8	1.9	2.0	1.9	1.7	1.6	1.7	1.9	1.7
	width	0.7	0.7	0.8	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.5
	height	0.6	0.6	0.6	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.6	0.5
Patella	length	2.7	2.6	2.9	2.1	2.1	2.2	2.5	2.2	1.9	1.9	1.9	2.3	2.0
	width	1.2	1.2	1.3	0.9	0.9	1.0	1.2	0.9	0.9	0.9	0.9	1.1	0.9
	height	0.9	0.9	0.9	0.7	0.8	0.8	0.8	0.8	0.7	0.7	0.8	0.9	0.7
Chela	length <sup>5</sup>	5.0	5.0	5.4	3.8	4.0	3.8	4.4	3.9	3.6	3.6	3.8	4.2	3.5
	width	1.6	1.6	1.5	1.2	1.2	1.3	1.3	1.1	1.3	1.2	1.2	1.6	1.2
	height	1.4	1.4	1.4	1.0	1.1	1.0	1.3	1.0	1.3	1.3	1.2	1.4	1.2
	retroventral carina	1.9	1.9	1.9	1.6	1.6	1.7	1.9	1.7	1.4	1.4	1.5	1.7	1.5
	mov. finger	3.0	3.0	3.4	2.3	2.3	2.4	2.5	2.4	2.3	2.1	2.1	2.7	2.2
Pectines	total length	2.5	2.4	2.2	2.0	1.5	1.6	1.8	1.6	1.9	1.8	1.9	2.0	1.8
	dentate margin	2.4	2.4	2.0	2.1	1.4	1.5	1.5	1.4	1.8	1.7	1.9	2.1	1.8
	tooth count	16/16	17/17	13/13	15/15	12/11	11/12	10/10	11/11	16/16	14/15	14/-	14/12	14/14

is almost sublinear. The pro- and retroventral macrosetae on the leg basitarsi and telotarsi are slightly longer and finer in the Pakistani species, than in *R. zarudnyi*. The intercarinal surfaces of the Pakistani species are more densely granular, and the carinae of the pedipalp chela manus more pronounced, than in *R. zarudnyi*. *Razianus birulai*, sp. nov., is readily separated from *R. farzanpayi*, sp. nov., by its pale, immaculate coloration, finer surface granulation, larger size (26–29 mm) and sexual dimorphism: the male is more robust than the female, whereas the opposite is true of *R. farzanpayi*, sp. nov. Additionally, the cheliceral fixed finger of *R. birulai*, sp. nov., possesses a small proximal denticle in addition to the larger distal denticle that is present in *R. farzanpayi*, sp. nov., and the male pedipalp chela manus of *R. birulai*, sp. nov., is more incrassate, with a more pronounced proximal lobe on the movable finger, and a larger gap between the fingers, when closed.

**DESCRIPTION:** The following description is based on the type material.

**Total length:** Adult: small, maximum length, measured from anterior margin of carapace to tip of aculeus, 26 mm (26–27 mm,  $n = 2$ ) (♂), 29 mm (♀) (table 1).

**Color:** Uniformly pale, yellow, except for reddish-brown metasoma V and telson, contrasting with preceding segments and darker yellow to reddish-brown fingers of chelicerae and pedipalp chelae. Uniformly immaculate, except for carapace, which is lightly infuscate primarily on frontal lobes and along carinae. Legs and pectines slightly paler than carapace, pedipalps, tergites, sternites, and metasoma.



FIGURE 3. Carapace, dorsal aspect of *Razianus birulai*, sp. nov. (A, B), and *Razianus farzanpayi*, sp. nov. (C, D). A. Holotype ♂ (AMNH), B. Paratype ♀ (AMNH), Mandi Tuk, Pakistan. C. Holotype ♂ (AMNH), D. Paratype ♀ (AMNH), Miranshah, Pakistan. Scale bars = 1 mm.



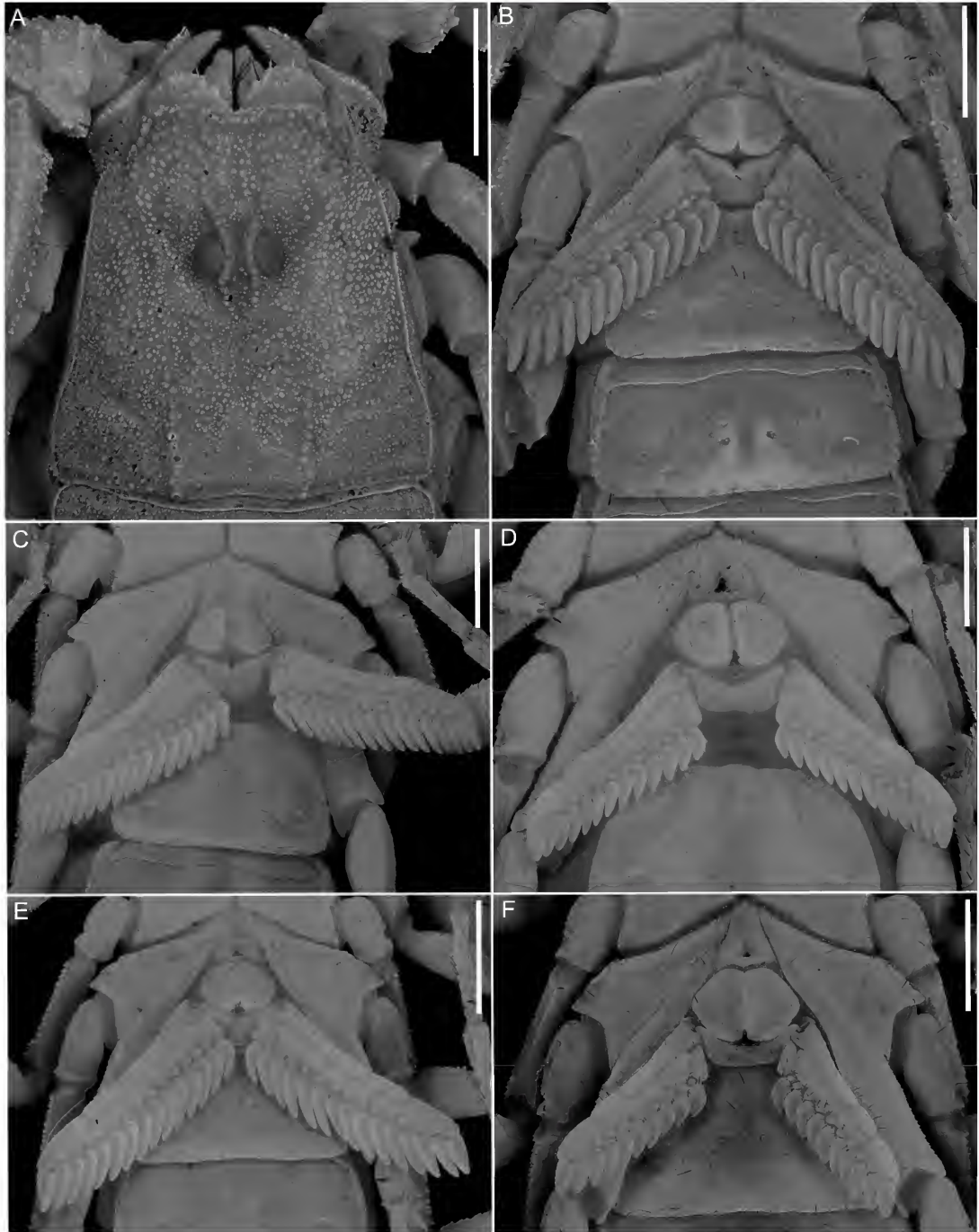


FIGURE 4. Carapace, dorsal aspect (A), sternum, genital opercula and pectines, ventral aspect (B–F) of *Razianus zarudnyi* (Birula, 1903) (A, B), *Razianus birulai*, sp. nov. (C, D), and *Razianus farzanpayi*, sp. nov. (E, F). A, B. ♂ (AMNH), Ilam Province, Iran. C. Holotype ♂ (AMNH), Mandi Tuk, Pakistan D. Paratype ♀ (AMNH), Pthan Kot, Pakistan. E. Holotype ♂ (AMNH), F. Paratype ♀ (AMNH), Miranshah, Pakistan. Scale bars = 1 mm.

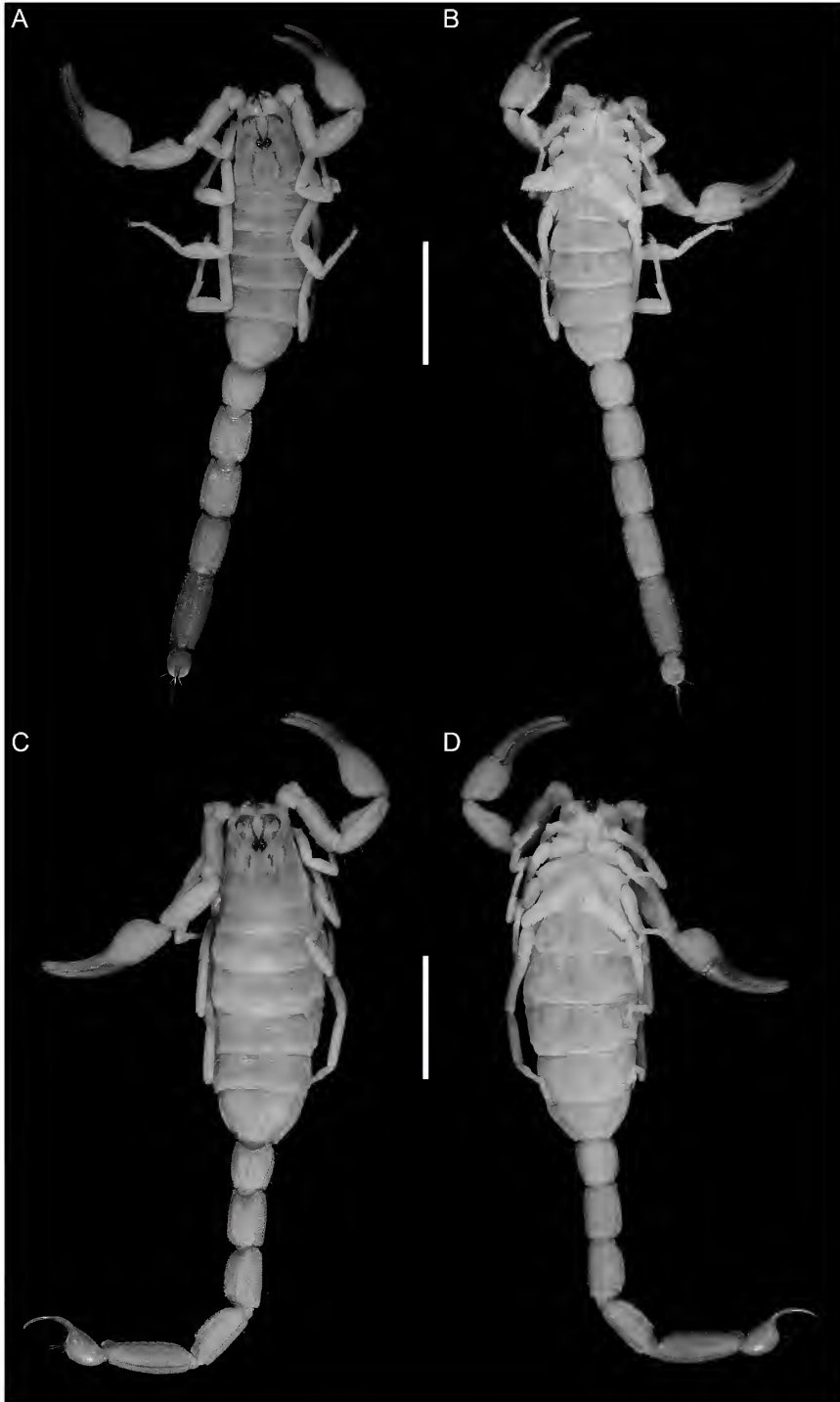


FIGURE 5. Habitus, dorsal aspect (A, C) and ventral aspect (B, D) of *Razianus birulai*, sp. nov. A, B. Holotype ♂ (AMNH), Mandi Tuk, Pakistan. C, D. Paratype ♀ (AMNH), Pthan Kot, Pakistan. Scale bars = 5 mm.

*Chelicerae*: Movable finger, ventral surface with two subdistal teeth; distal external (dorsal) and distal internal (ventral) teeth equal, opposable. Fixed finger, ventral surface with large denticle distally and considerably smaller denticle proximally. Fingers and manus, proventral surfaces, with long, dense vestiture of macrosetae.

*Carapace*: Anterior width:posterior width ratio, 45% (43%–46%,  $n = 2$ ) ( $\sigma$ ), 36% ( $\varphi$ ); posterior width:length ratio, 100% (96%–104%,  $n = 2$ ) ( $\sigma$ ), 110% ( $\varphi$ ) (table 1). Anterior and posterior carapace margins procurved (fig. 3A, B); anterior margin with very shallow median notch, without median projection (epistome). Five pairs of lateral ocelli (holotype with four on sinistral side); each lateral ocular tubercle with three major ocelli, similar in size, anterolaterally, and two minor ocelli posterodorsal to posterior major ocellus. Median ocelli considerably larger than lateral ocelli, distance between ocelli equal to or less than width of ocellus. Median ocular tubercle situated anteromedially, ocular tubercle distance from anterior carapace margin:carapace length, 41% ( $n = 2$ ) ( $\sigma$ ), 40% ( $\varphi$ ) (table 1). Superciliary carinae distinct, costate-granular, protruding slightly above median ocelli, and connected anteriorly to costate-granular anteromedian carinae. Paired central median and posteromedian carinae distinct costate-granular, weakly connected or disconnected. Other carinae obsolete or absent. Anteromedian sulcus moderately deep, ovate; posteromedian sulcus narrow, shallow anteriorly, deep posteriorly; posterolateral sulci shallow, wide, curved; posteromarginal sulcus deep, narrow. Intercarinal surfaces finely granular, except in sulci, more coarsely granular on frontal lobes.

*Pedipalps*: Femur width:length, 29% ( $n = 2$ ) ( $\sigma$ ), 32% ( $\varphi$ ) (table 1). Prodorsal, proventral, retrodorsal, and retromedian carinae distinct, costate-granular, complete (fig. 6A). Promedian carina distinct, discontinuous row of spiniform or subspiniform granules. Retroventral carina granular, vestigial, reduced to proximal quarter of segment. Other carinae absent. Dorsal and lateral intercarinal surfaces granular; ventral intercarinal surfaces smooth. Patella width:length, 45% (44%–46%,  $n = 2$ ) ( $\sigma$ ), 45% ( $\varphi$ ) (table 1). Dorsomedian, prodorsal, retrodorsal, retromedian, retroventral, and ventromedian carinae distinct, costate-granular, complete (fig. 6B–D). Promedian and proventral carinae distinct, granular, complete, each with pronounced spiniform granule, demarcated with prominent macrosetae, proximally. Other carinae absent. Dorsal and internodorsal surfaces granular; other intercarinal surfaces smooth. Chela manus incrassate ( $\sigma$ , fig. 6E–G) or slender ( $\varphi$ , fig. 6H); width:height, 114% ( $n = 2$ ) ( $\sigma$ ), 107% ( $\varphi$ ); width:length along ventroexternal carina, 84% ( $n = 2$ ) ( $\sigma$ ), 79% ( $\varphi$ ); length along ventroexternal carina:length movable finger, 63% ( $n = 2$ ) ( $\sigma$ ), 56% ( $\varphi$ ) (table 1). Manus sparsely setose; surfaces smooth (fig. 6E–H). Dorsomedian carina obsolete, smooth ( $\sigma$ ) or distinct, granular ( $\varphi$ ), complete. Dorsal secondary carina obsolete, smooth ( $\sigma$ ) or distinct, costate-granular ( $\varphi$ ), complete. Subdigital and digital carinae obsolete, smooth, partial, restricted to proximal half of segment. Retromedian carina obsolete, smooth, vestigial, reduced to proximal quarter of segment. Retroventral carina costate, complete. Proventral and promedian carinae vestigial, each demarcated by spiniform granule with prominent macroseta proximally. Other carinae absent. Movable finger with distinct proximal lobe and fixed finger with corresponding notch, such that considerable gap present between them proximally, when closed ( $\sigma$ , fig. 6F) or fingers sublinear with little to no gap present between them proximally, when closed ( $\varphi$ , fig. 6H).

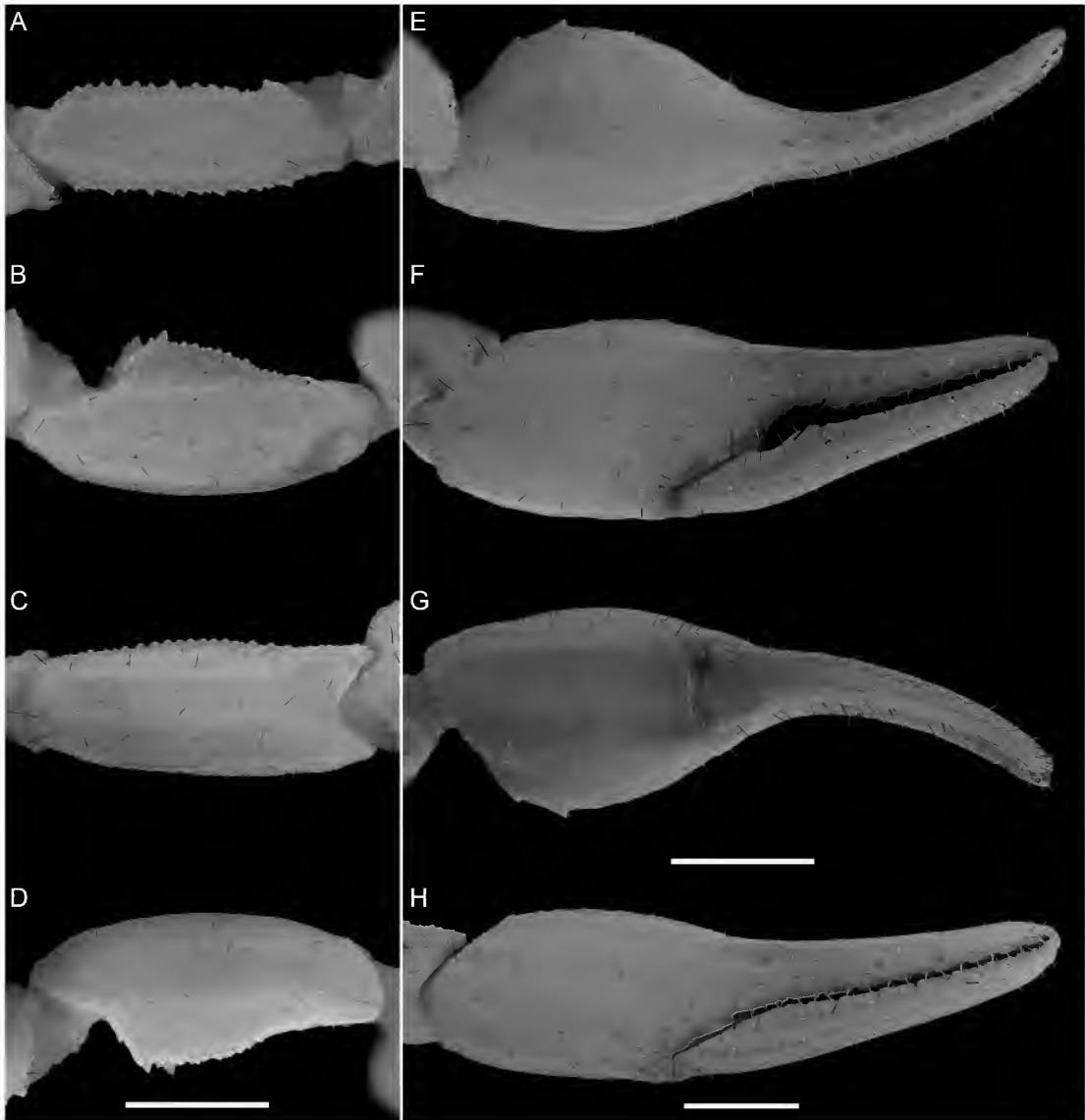


FIGURE 6. Dextral pedipalp segments of *Razianus birulai*, sp. nov., holotype ♂ (AMNH), Mandi Tuk, Pakistan (A–G) and paratype ♀ (AMNH), Pthan Kot, Pakistan (H). A. Femur, dorsal aspect. B–D. Patella, dorsal (B), retrolateral (C) and ventral (D) aspects. E–H. Chela, dorsal (E), retrolateral (F, H) and ventral (G) aspects. Scale bars = 1 mm.

Fixed and movable fingers, intercarinal surfaces smooth; median denticle rows respectively comprising eight (fixed finger) and eight or nine (movable finger) oblique denticle subrows, each terminating in large median denticle proximally, and flanked proximally by a large retrolateral denticle, and medially by a large prolateral denticle, prolateral denticles separated from median subrows by approximately one denticle width; movable finger in addition with short subterminal subrow comprising two denticles; fingers each with enlarged terminal denticle.

*Trichobothria*: Orthobothriotaxic, Type A,  $\beta$  configuration (fig. 6) with the following segment totals: 11 femur: 5 dorsal ( $d_1$ – $d_5$ ), 4 internal ( $i_1$ – $i_4$ ), 2 external ( $e_1$ ,  $e_2$ ); 13 patella: 5 dorsal  $d_1$ – $d_5$ , 1 internal ( $i$ ), 7 external ( $et$ ,  $est$ ,  $em$ ,  $esb_1$ ,  $esb_2$ ,  $eb_1$ ,  $eb_2$ ); 8 chela manus: 2 ventral ( $V_1$ ,  $V_2$ ), 6 external ( $Eb_1$ – $Eb_3$ ,  $Esb$ ,  $Est$ ,  $Et$ ); 7 chela fixed finger:  $dt$ ,  $db$ ,  $it$ ,  $et$ ,  $est$ ,  $esb$ ,  $eb$ . The following trichobothria are noticeably smaller (“petite”): femur:  $d_2$ ,  $d_3$ ,  $d_4$ ,  $i_4$ ,  $e_2$ ; patella:  $d_2$ ,  $eb_2$ ; chela manus:  $V_1$ ,  $Et$ ,  $Eb_3$ ,  $Esb$ ; chela fixed finger:  $esb$ .

*Legs*: Femur with four carinae; patella with five carinae. Tibiae I–IV, retrolateral margins with scattered macrosetae; III and IV with spurs. Basitarsi I–IV, each with pro- and retroventral rows of fine, acuminate macrosetae; macrosetal combs absent; pro- and retrolateral pedal spurs present. Telotarsi I–IV, each with pro- and retroventral rows of fine, acuminate macrosetae; laterodistal lobes truncated; median dorsal lobes extending to ungues; ungues short, distinctly curved, equal in length.

*Sternum*: Subtriangular (fig. 4C, D). Median longitudinal sulcus shallow anteriorly, deep, narrow posteriorly.

*Genital operculum*: Genital opercula suboval, completely divided longitudinally; genital papillae present ( $\delta$ , fig. 4C), absent ( $\text{♀}$ , fig. 4D).

*Hemispermatothore*: Flagelliform.

*Pectines*: Distal edge reaching past distal edge of coxa IV but not reaching to distal edge of trochanter IV ( $\delta$ , fig. 4C) or to distal edge of trochanter IV ( $\text{♀}$ , fig. 4D). Three marginal lamellae and six to seven ( $\delta$ ) or six ( $\text{♀}$ ) median lamellae; first proximal median lamella (scape) of each pecten unmodified, mesial margin angular, approximately 90°, teeth present along entire posterior margin. Fulcra present. Pectinal teeth curved, all similar in size, but larger in  $\delta$ ; tooth count, 17/17 (16–17/16–17,  $n = 4$ ) ( $\delta$ ), 13/13 ( $\text{♀}$ ).

*Mesosoma*: Tergites I–VI tricarinate, each bearing distinct costate-granular median and submedian carinae in posterior third of segment, and terminating in prominent spiniform processes that extend beyond posterior margin of tergite. Tergite VII pentacarinate, with distinct costate-granular median carina, restricted to anterior half of segment, costate-granular submedian carinae in posterior three-quarters, and costate-granular lateral carinae in posterior two-thirds. Pretergites smooth. Posttergites, intercarinal surfaces uniformly finely granular, becoming more so posteriorly. Sternites IV–VI, each with paired longitudinal depressions pro-lateral to spiracles, absent on VII, and obsolete ventrosubmedian and ventrolateral carinae, becoming more developed posteriorly; VII, with distinct costate-granular ventrosubmedian and ventrolateral carinae; III–VI, intercarinal surfaces, finely granular ( $\delta$ ) or smooth ( $\text{♀}$ ), VII, finely granular. Sternite VII, length:width, 62% (62%–63%,  $n = 2$ ) ( $\delta$ ), 61% ( $\text{♀}$ ) (table 1).

*Metasoma*: Metasomal segments I–V progressively increasing in length, decreasing in width (figs. 5, 11A, B); segment V width:segment I width, 76% ( $n = 2$ ) ( $\delta$ ), 72% ( $\text{♀}$ ) (table 1). Metasoma slender; width:length, segment I, 89% ( $n = 2$ ) ( $\delta$ ), 95% ( $\text{♀}$ ); II, 72% (68%–76%,  $n = 2$ ) ( $\delta$ ), 65% ( $\text{♀}$ ); III, 67% (65%–68%,  $n = 2$ ) ( $\delta$ ), 56% ( $\text{♀}$ ); IV, 53% (52%–54%,  $n = 2$ ) ( $\delta$ ), 50% ( $\text{♀}$ ); V, 35% (34%–35%,  $n = 2$ ) ( $\delta$ ), 34% ( $\text{♀}$ ). Metasomal segments sparsely setose. Dorsosubmedian carinae, segments I–IV, distinct, costate-granular, complete, posterior spiniform granules more pronounced than preceding granules; V, obsolete, granular,

restricted to anterior two-thirds of segment, posterior spiniform granules not larger than preceding granules. Dorsolateral carinae, segments I–IV, distinct, costate-granular, complete (fig. 11A, B); V, distinct, granular, complete, less developed posteriorly. Median lateral carinae, segments I–III, distinct, costate-granular, complete on I, partial, restricted to posterior three-quarters, on II and III; absent on IV; absent ( $\sigma$ ) or obsolete granular field in medial two-thirds ( $\varphi$ ) of V. Ventrolateral carinae, segments I–V, and ventrosubmedian carinae, segments I–IV, distinct, costate-granular, complete. Ventrosubmedian carinae, segment V, obsolete, discontinuous granular rows in anterior half of segment. Ventromedian carina, segment V, distinct, costate-granular, complete, but not reaching posterior margin, unmodified posteriorly. Dorsal and lateral intercarinal surfaces, segments I–V, sparsely and finely granular, more sparsely laterally than dorsally; I–IV, ventral intercarinal surfaces smooth; V, ventral intercarinal surfaces granular ( $\sigma$ ) or smooth ( $\varphi$ ).

*Telson*: Telson vesicle width: metasomal segment V width, 77% ( $n = 2$ ) ( $\sigma$ ), 92% ( $\varphi$ ); globose, height: length, 66% (59%–73%,  $n = 2$ ) ( $\sigma$ ), 58% ( $\varphi$ ); dorsal surface flat, ventral surface evenly curved; acarinate, dorsal, lateral and ventral surfaces smooth or nearly so; subaculear tubercle absent. Aculeus relatively long, gently curved; aculeus length: vesicle length, 91% (88%–93%,  $n = 2$ ) ( $\sigma$ ), 90% ( $\varphi$ ). Length metasoma plus telson: total length, 60% ( $n = 2$ ) ( $\sigma$ ), 59% ( $\varphi$ ).

**DISTRIBUTION**: Endemic to Pakistan (fig. 1). Known only from two nearby localities in the Loralai District of Balochistan.

**ECOLOGY**: The habitus of *R. birulai*, sp. nov., is consistent with the lapidicolous ecomorphotype (Prendini, 2001). The type material was collected at night with UV light in rocky mountainous desert at 1090–1458 m elevation. *Hottentotta khoozestanus* Navidpour et al., 2008 (first record for Pakistan) and *Orthochirus fuscipes* (Pocock, 1900) were collected in sympatry at Mandi Tuk, and *Vachonus atrostriatus* (Pocock, 1897) in sympatry at Pthan Kot (material deposited at the AMNH).

*Razianus farzanpayi*, sp. nov.

Figures 1, 2, 3C, D, 4E, F, 7, 8, 11C, D; table 1

**TYPE MATERIAL**: **PAKISTAN: Khyber Pakhtoon Khawa: Miranshah District**: Miranshah Tehsil: Holotype  $\sigma$ , 2  $\varphi$  paratypes (AMNH), paratype  $\varphi$  (AMCC [LP 11600]), Miranshah, 1 km N on road to Bannu, 33°02'N 70°07'E, 3056 ft, 9.xi.2012, K. Khan and M. Akhtar, rocky area, collected by turning stones (10 A.M.–12 P.M.). **Balochistan: Barkhan District**: Barkhan Tehsil: Paratype  $\sigma$  (AMNH), Dada Shah Mahmood, 29°58'N 69°42'E, 3623 ft, M. Shahnawaz, 30.viii.2013, from rocky area by turning stones (2 P.M.). Paratype  $\varphi$  (AMNH), Barkhan, 15 km W on road to Kohlu, 29°54'N 69°31'E, 3616 ft, 8.xi.2012, M. Shahnawaz and M. Imran, rocky area, collected by turning stones (1–2 P.M.).

**ETYMOLOGY**: The specific epithet is a patronym in honor of R. Farzanpay, who described the genus *Razianus*.

**DIAGNOSIS**: *Razianus farzanpayi*, sp. nov., most closely resembles the other Pakistani member of the genus, *R. birulai*, sp. nov., from which it may be separated by its dark, infuscate

coloration, coarser surface granulation, smaller size (20–23 mm) and sexual dimorphism: the male is more gracile than the female, whereas the opposite is true of *R. birulai*, sp. nov. Additionally, the cheliceral fixed finger of *R. farzanpayi*, sp. nov., does not possess a small proximal denticle, in addition to the larger distal denticle, that is present in *R. birulai*, sp. nov., and the male pedipalp chela manus of *R. farzanpayi*, sp. nov., is less incrassate, with a less-pronounced proximal lobe on the movable finger, and a smaller gap between the fingers, when closed. *Razianus farzanpayi*, sp. nov., may be separated from *R. zarudnyi*, the type species from Iran, by its more gracile habitus, with a more slender metasoma (width: length, segment I, 88%; V, 36%); dark, infuscate coloration; more densely and coarsely granular intercarinal surfaces; distinct, costate-granular central median carinae on the carapace; more pronounced carinae on the pedipalp chela manus; distinct proximal lobe of the movable finger of the male pedipalp chela; and longer, finer pro- and retroventral macrosetae on the leg basitarsi and telotarsi.

**DESCRIPTION:** The following account is based on the type material.

**Total length:** Adult small, maximum length, measured from anterior margin of carapace to tip of aculeus, 21 mm (♂), 22 mm (20–23 mm,  $n = 4$ ) (♀) (table 1).

**Color:** Uniformly brown to dark brown with darker, reddish-brown metasoma V and telson, contrasting with preceding segments. Carapace, tergites, and metasoma (except ventral surfaces of segments I and II) uniformly infuscate, carapace and tergites more so than metasoma. Pedipalp trochanter, femur, and patella immaculate; chela manus infuscate along carinae, prolaterally and distally at base of fingers; fingers infuscate. Legs I–IV, femora and patella infuscate dorsally and retrolaterally. Coxosternal region, genital operculum, pectines, sternites and ventral surfaces of metasomal segments III–V pale and immaculate.

**Chelicerae:** As for *R. birulai*, except fixed finger, ventral surface with single denticle distally.

**Carapace:** As for *R. birulai* (fig. 3C, D), except anterior width: posterior width, 48% (♂), 48% (44%–50%,  $n = 4$ ) (♀); posterior width: length, 105% (♂), 102% (100%–104%,  $n = 4$ ) (♀) (table 1); median ocular tubercle situated anteromedially, ocular tubercle distance from anterior carapace margin: carapace length, 41% ( $n = 2$ ) (♂), 37% (36%–39%,  $n = 4$ ) (♀); paired central median and posteromedian carinae distinct costate-granular, disconnected; other carinae obsolete or absent; intercarinal surfaces densely finely and coarsely granular, except in sulci, more coarsely granular on frontal lobes.

**Pedipalps:** As for *R. birulai*, except as follows. Femur width: length, 33% (♂), 33% (32%–35%,  $n = 4$ ) (♀) (table 1). Dorsal and lateral intercarinal surfaces granular (fig. 8A); ventral intercarinal surfaces granular. Patella width: length, 43% (♂), 44% (41%–48%,  $n = 4$ ) (♀) (table 1). Dorsal and internodorsal surfaces slightly granular; other intercarinal surfaces smooth or nearly so (fig. 8B–D). Chela manus incrassate (♂, fig. 8E–G) or slender (♀, fig. 8F); width: height, 120% (♂), 112% (100%–130%,  $n = 4$ ) (♀); width: length along ventroexternal carina, 75% (♂), 71% (65%–76%,  $n = 4$ ) (♀); length along ventroexternal carina: length movable finger, 70% (♂), 72% (70%–76%,  $n = 4$ ) (♀) (table 1). Manus sparsely setose; dorsal and retrolateral intercarinal surfaces smooth (♂) or granular (♀); ventral and prolateral surfaces smooth or nearly so (fig. 8E–H). Dorsomedian carina granular, complete. Dorsal secondary carinae costate-granular (♂) or granular (♀), complete. Subdigital carina granu-

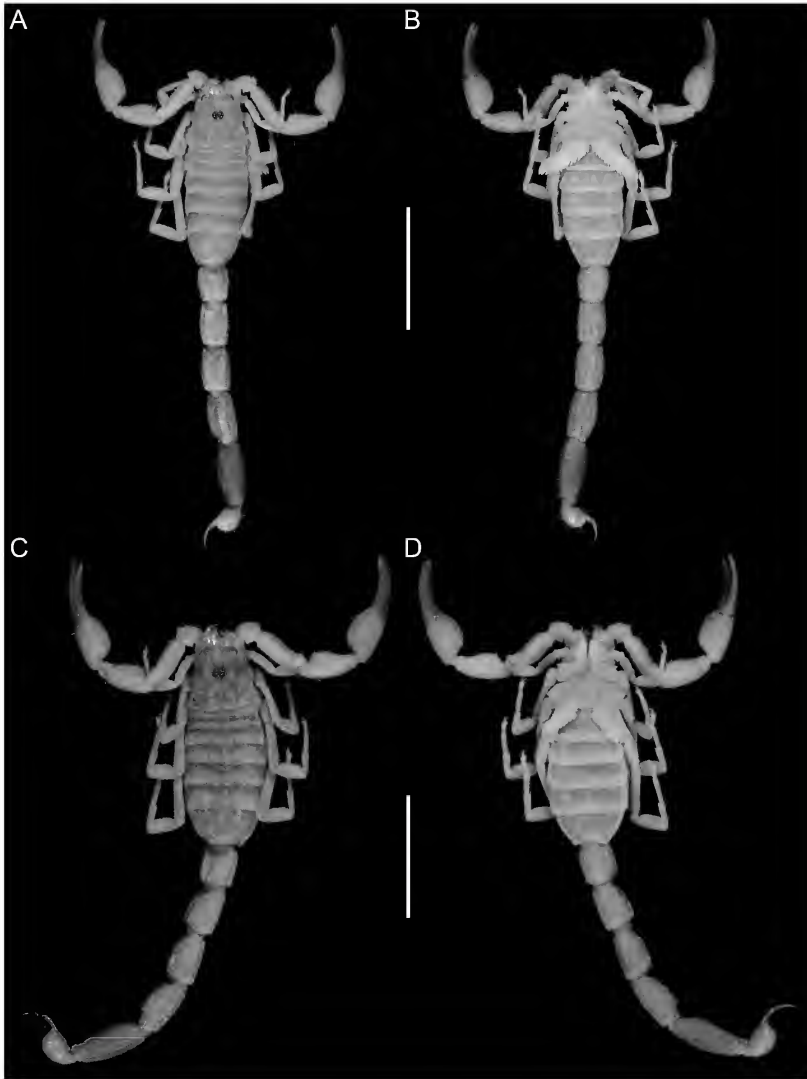


FIGURE 7. Habitus, dorsal aspect (A, C) and ventral aspect (B, D) of *Razianus farzanpayi*, sp. nov. A, B. Holotype ♂ (AMNH), C, D. Paratype ♀ (AMNH), Miranshah, Pakistan. Scale bars = 5 mm.

lar, partial, restricted to proximal half of segment; digital carina costate-granular (♂) or granular (♀), partial, restricted to proximal half of segment. Retromedian carina costate-granular (♂) or granular (♀), vestigial, reduced to proximal quarter of segment. Retroventral carina costate, complete. Proventral and promedian carinae vestigial, demarcated by one or more spiniform granules with prominent macrosetae. Other carinae absent. Movable finger with shallow proximal lobe and fixed finger with corresponding notch, such that small gap present between them proximally, when closed (♂, fig. 8F) or fingers sublinear with no gap present between them proximally, when closed (♀, fig. 8H). Fixed and movable fingers, median denticle rows respectively comprising eight (fixed finger) and eight or nine (movable finger) oblique denticle subrows; movable finger in addition with short subterminal subrow comprising two denticles.



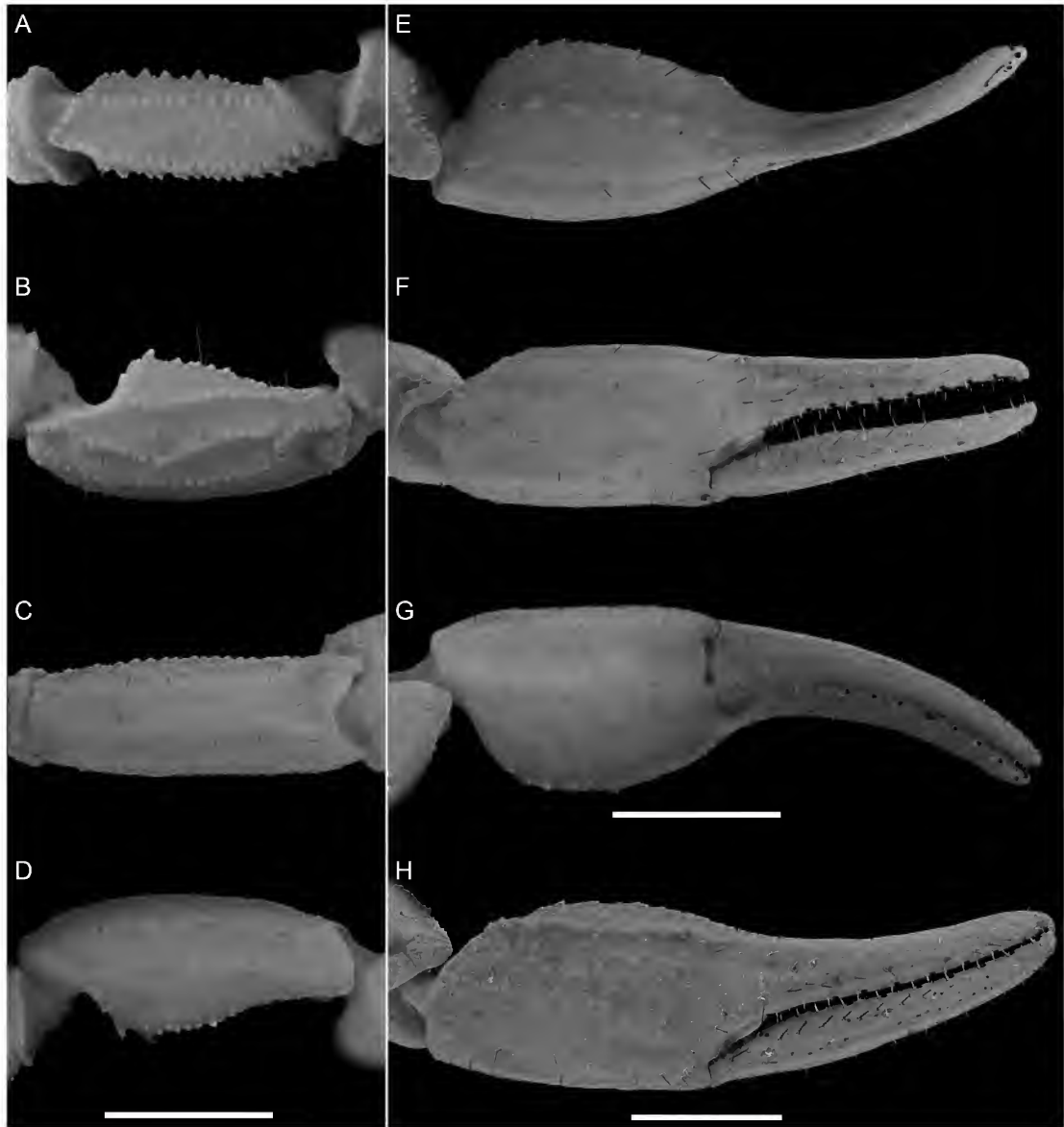


FIGURE 8. Dextral pedipalp segments of *Razianus farzanpayi*, sp. nov., holotype ♂ (AMNH) (A–G), paratype ♀ (AMNH) (H), Miranshah, Pakistan. A. Femur, dorsal aspect. B–D. Patella, dorsal (B), retrolateral (C), and ventral (D) aspects. E–H. Chela, dorsal (E), retrolateral (E, H) and ventral (G) aspects. Scale bars = 1 mm.

*Trichobothria*: As for *R. birulai* (fig. 8).

*Legs*: As for *R. birulai*.

*Sternum and genital operculum*: As for *R. birulai* (fig. 4E, F).

*Hemispermaphore*: As for *R. birulai*.

*Pectines*: As for *R. birulai*, except distal edge reaching to distal edge of trochanter IV (♂, fig. 4E) or to distal edge of trochanter IV (♀, fig. 4F); six (♂) or five (♀) median lamellae; pectinal tooth count, 15/15 (♂), 11/11 (10–12/10–12,  $n = 8$ ) (♀).

*Mesosoma*: As for *R. birulai*, except posttergites, intercarinal surfaces uniformly finely and coarsely granular, becoming more so posteriorly; sternite VII, length:width, 59% (♂), 63% (56%–76%,  $n = 4$ ) (♀) (table 1).

*Metasoma*: As for *R. birulai*, except as follows. Metasomal segments I–V progressively increasing in length, decreasing in width (figs. 7, 11C, D); segment V width:segment I width, 71% (♂), 74% (71%–79%,  $n = 4$ ) (♀) (table 1). Metasoma slender; width:length, segment I, 88% (♂), 89% (88%–93%,  $n = 4$ ) (♀); II, 67% (♂), 68% (62%–72%,  $n = 4$ ) (♀); III, 60% (♂), 62% (59%–65%,  $n = 4$ ) (♀); IV, 50% (♂), 54% (50%–57%,  $n = 4$ ) (♀); V, 36% (♂), 37% (35%–41%,  $n = 4$ ) (♀). Median lateral carinae, segments I–III, distinct, costate-granular, complete on I, partial, restricted to posterior three-quarters, on II and III; absent or obsolete, discontinuous granular row in medial two-thirds on IV; absent on V (figs. 11C, D). Dorsal and lateral intercarinal surfaces, segments I–V, densely and finely granular, more sparsely laterally than dorsally; I–IV, ventral intercarinal surfaces granular (♂) or smooth (♀); V, ventral intercarinal surfaces granular.

*Telson*: Telson vesicle width:metasomal segment V width, 80% (♂), 86% (80%–91%,  $n = 4$ ) (♀); globose, height:length, 57% (♂), 61% (57%–71%,  $n = 4$ ) (♀); dorsal surface flat, ventral surface evenly curved. Vesicle acarinate; dorsal, lateral surfaces smooth or nearly so, ventral surfaces weakly granular; subaculear tubercle absent. Aculeus long, gently curved; aculeus length:vesicle length, 79% (♂), 73% (65%–79%,  $n = 4$ ) (♀). Length metasoma plus telson:total length, 63% (♂), 61% (59%–62%,  $n = 4$ ) (♀).

**DISTRIBUTION**: Endemic to Pakistan (fig. 1). Known from only three localities, two in the Barkhan District of Balochistan, and the third in the Miranshah District of Khyber Pakhtoon Khawa.

**ECOLOGY**: The habitus of *R. farzanpayi*, sp. nov., is consistent with the lapidicolous ecomorphotype (Prendini, 2001). The type material was collected by turning stones in rocky desert (fig. 2A–D) at 931–1104 m elevation. *Hottentotta penjabensis* (Birula, 1897) was collected in sympatry at Dada Shah Mahmood and *Orthochirus fuscipes* was collected in sympatry at Barkhan and Miranshah (material deposited at the AMNH).

*Razianus zarudnyi* (Birula, 1903)

Figures 1, 4A, B, 9, 10, 11E; table 1

*Hemibuthus zarudnyi* Birula, 1903: 75–77; Vachon, 1966: 211.

*Buthus zarudnianus* Birula, 1905b: 144, synonymized by Fet, 1997: 66; Birula, 1905c: 450; Kraepelin, 1913: 127; Werner, 1936: 204; Vachon, 1966: 211; Habibi, 1971: 43.

*Buthus* (*Buthus*) *zarudnianus*: Birula, 1917: 214, 229, 240.

*Razianus zarudnyi*: Farzanpay, 1987: 159, 160; 1988: 41; Fet and Lowe, 2000: 216; Navidpour et al., 2008a: 20, figs. 42, 89–92; 2008b: 17, figs. 2, 5, 23, 57–60; 2008c: 14, figs. 2, 4, 10, 58–61; 2008d: 11, figs. 3, 9, 13, 47–50; Pirali-Kheirabadi et al., 2009: 10, figs. 2, 11, 40–43; Navidpour et al., 2010: 15; Karataş et al., 2012: 117; Navidpour et al., 2012: 17, figs. 2–4, 12; 2013: 16, figs. 6, 7.

*Neohemibuthus kinzelbachi* Lourenço, 1996: 94–98, figs. 2–8, synonymized by Fet, 1997: 66; Kovařík, 1997: 49.

*Neohemibuthus zarudnyi*: Fet, 1997: 65–68; Kovařík, 1998: 115.

**TYPE MATERIAL: IRAN: Sistan and Baluchistan Province:** *H. zarudnyi* syntypes: 1 ♀ (ZISP 1346), between Kala-Eybi and Mushkutuk in Kugak district, Kalagan Province, Baluchistan, Persia; 1 ♀ (ZISP 1345), Geh Province, between Kishi and Karahka, Mekran, Persia. *Khuzestan Province:* *N. kinzelbachi*: holotype ♂, paratype ♀ (MNHN RS 8555), 4 ♂, 15 ♀ paratypes (MNHN RS 8556) [examined], 9 ♂, 17 ♀ paratypes (MNHN RS 8557) [examined], 1 ♂, 2 ♀ paratypes (MNHG), Dezful [32°22'57"N 48°24'07"E]; 1 ♂, 1 ♀ paratypes (BMNH), Masdjede-Soleyman [31°56'11"N 49°18'14"E].

**OTHER MATERIAL EXAMINED: IRAN: Ilam Province:** 32°55'42"N 46°41'32"E, 375 m, x.2007, Masihipour, Hayader and Habibzade, IL-822.3, 2 ♂ (AMCC [LP 11072]). *Khuzestan Province:* Ahvaz-Masjedsoleyman road, Mayah village, 31°46'31"N 49°06'01"E, 48 m, i.2007, Masihipour and Hayader, HA106, 3 ♂ (AMCC [LP 9707]). **IRAQ: Baghdad Province:** Bazair [33°19'12"N 44°25'12"E], 15.iv.1934, E.W. Kaiser, 1 ♀, 1 subad. ♂ (AMNH).

**DIAGNOSIS:** *Razianus zarudnyi* differs from the Pakistani species of the genus as follows. The habitus of *R. zarudnyi* is more robust, with a broader metasoma (width:length, segment I, 89%–100%; V, 41%), than the Pakistani species, which are more gracile, with a more slender metasoma (width:length, segment I, 88%–89%; V, 34%–36%). The color and infuscation pattern of *R. zarudnyi* is distinctly different from both Pakistani species. The intercarinal surfaces of *R. zarudnyi* are more sparsely granular than in the Pakistani species. The central median carinae of the carapace are obsolete and granular in *R. zarudnyi*, whereas these carinae are distinct and costate-granular in the Pakistani species. The carinae of the pedipalp chela manus are obsolete, and the chela movable finger of the male almost sublinear in *R. zarudnyi*, compared with the Pakistani species, in which the carinae are more pronounced and the movable finger of the male exhibits a shallow but distinct proximal lobe. The pro- and retroventral macrosetae on the leg basitarsi and telotarsi are slightly shorter and stouter in *R. zarudnyi*, than in the Pakistani species.

**DESCRIPTION:** The following account is based on the type material of *N. kinzelbachi* and the other material examined.

**Total length:** Adult: small, maximum length, measured from anterior margin of carapace to tip of aculeus, 22 mm (20–26 mm,  $n = 4$ ) (♂) (table 1).

**Color:** Uniformly pale, yellow, and mostly immaculate except as follows. Carapace and mesosomal tergites I–VI lightly infuscate, especially on frontal lobes and interocular surface of carapace and along carinae of carapace and tergites. Legs II–IV femora and, to a lesser extent, patellae lightly infuscate dorsally and retrolaterally. Pedipalp femur lightly infuscate distally and along prodorsal, retrodorsal, and retromedian carinae; patella infuscate prodorsally. Metasoma V infuscate dorsally, laterally, and ventrally, becoming less so posteriorly; contrasting with immaculate telson and segments I–IV.

**Chelicerae:** As for *R. birulai*, except fixed finger, ventral surface with single denticle distally.

**Carapace:** As for *R. birulai* (fig. 4), except anterior width:posterior width, 46% (45%–50%,  $n = 5$ ) (♂); posterior width:length, 98% (85%–105%,  $n = 5$ ) (♂) (table 1); median ocular tubercle situated anteromedially, ocular tubercle distance from anterior carapace margin:carapace length, 41% (38%–43%,  $n = 5$ ) (♂); paired central median carinae obsolete, granular; posteromedian carinae distinct, granular, not connected to central median carinae; other cari-

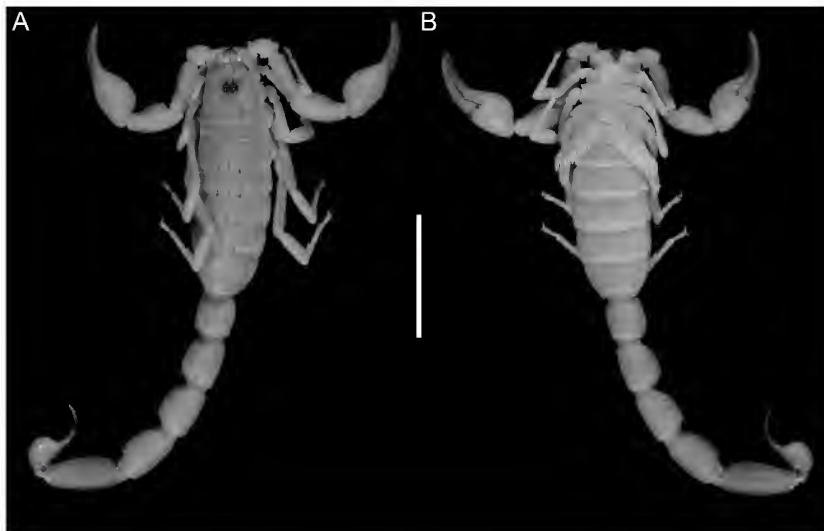


FIGURE 9. Habitus, dorsal aspect (A, C) and ventral aspect (B, D) of *Razianus zarudnyi* (Birula, 1903), ♂ (AMNH), Ilam Province, Iran. Scale bar = 5 mm.

nae absent; intercarinal surfaces sparsely and finely, except in sulci, more coarsely granular on frontal lobes.

*Pedipalps*: Femur width:length, 34% (29%–38%,  $n = 5$ ) (♂) (table 1). Dorsal and lateral intercarinal surfaces granular (fig. 10A); ventral intercarinal surfaces granular. Patella width:length, 47% (45%–48%,  $n = 5$ ) (♂) (table 1). Intercarinal surfaces smooth or nearly so (fig. 10B–D). Chela manus incrassate (♂, fig. 10E–H); width:height, 101% (92%–114%,  $n = 5$ ) (♂); width:length along ventroexternal carina, 87% (80%–94%,  $n = 5$ ) (♂); length along ventroexternal carina:length movable finger, 66% (61%–71%,  $n = 5$ ) (♂) (table 1). Manus sparsely setose; surfaces smooth. Dorsal secondary and retroventral carinae obsolete, smooth; proventral carina vestigial, demarcated by spiniform granule with prominent macroseta proximally. Other carinae absent. Movable finger sublinear and fixed finger almost so, small gap present between them proximally, when closed (♂, fig. 10F, G). Fixed and movable fingers, median denticle rows respectively comprising eight (fixed finger) and nine (movable finger) oblique denticle subrows; movable finger in addition with short subterminal subrow comprising two denticles.

*Trichobothria*: As for *R. birulai* (fig. 10).

*Legs*: As for *R. birulai*, except pro- and retroventral rows of macrosetae on basitarsi and telotarsi slightly shorter and more stout.

*Sternum and genital operculum*: As for *R. birulai* (fig. 4B).

*Hemispermaphore*: As for *R. birulai*.

*Pectines*: As for *R. birulai* (fig. 4B), except four or five median lamellae (♂); pectinal tooth count, 14/14 (14–16/12–16,  $n = 9$ ) (♂).

*Mesosoma*: As for *R. birulai*, except posttergites, intercarinal surfaces more sparsely granular; sternite VII, length:width, 59% (55%–65%,  $n = 5$ ) (♂) (table 1).

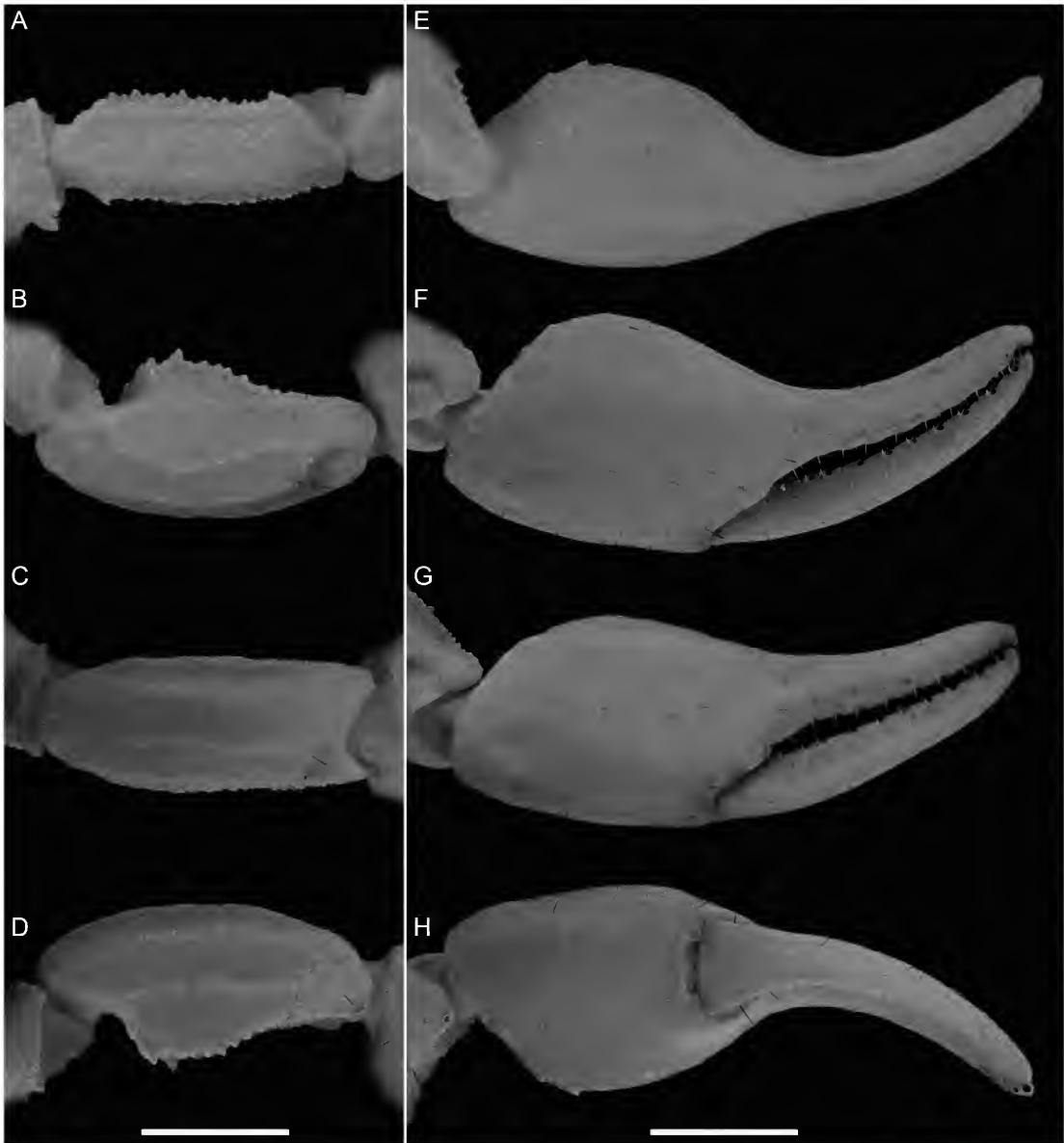


FIGURE 10. Dextral pedipalp segments of *Razianus zarudnyi* (Birula, 1903), ♂ (AMNH), Ilam Province, Iran. A. Femur, dorsal aspect. B–D. Patella, dorsal (B), retrolateral (C), and ventral (D) aspects. E–H. Chela, dorsal (E), retrodorsal (F), retrolateral (H), and ventral (G) aspects. Scale bars = 1 mm.

*Metasoma*: As for *R. birulai*, except as follows. Metasomal segments I–V progressively increasing in length, decreasing in width (figs. 9, 11E); segment V width:segment I width, 81% (79%–85%,  $n = 4$ ) (♂) (table 1). Metasoma slender; width:length, segment I, 94% (89%–100%,  $n = 4$ ) (♂); II, 72% (68%–76%,  $n = 4$ ) (♂); III, 64% (63%–67%,  $n = 4$ ) (♂); IV, 52% (50%–58%,  $n = 4$ ) (♂); V, 41% ( $n = 4$ ). Median lateral carinae, segments I–III, distinct, costate-granular, complete on I, partial, restricted to posterior three-quarters, on II and III (fig. 11E); absent on IV; absent

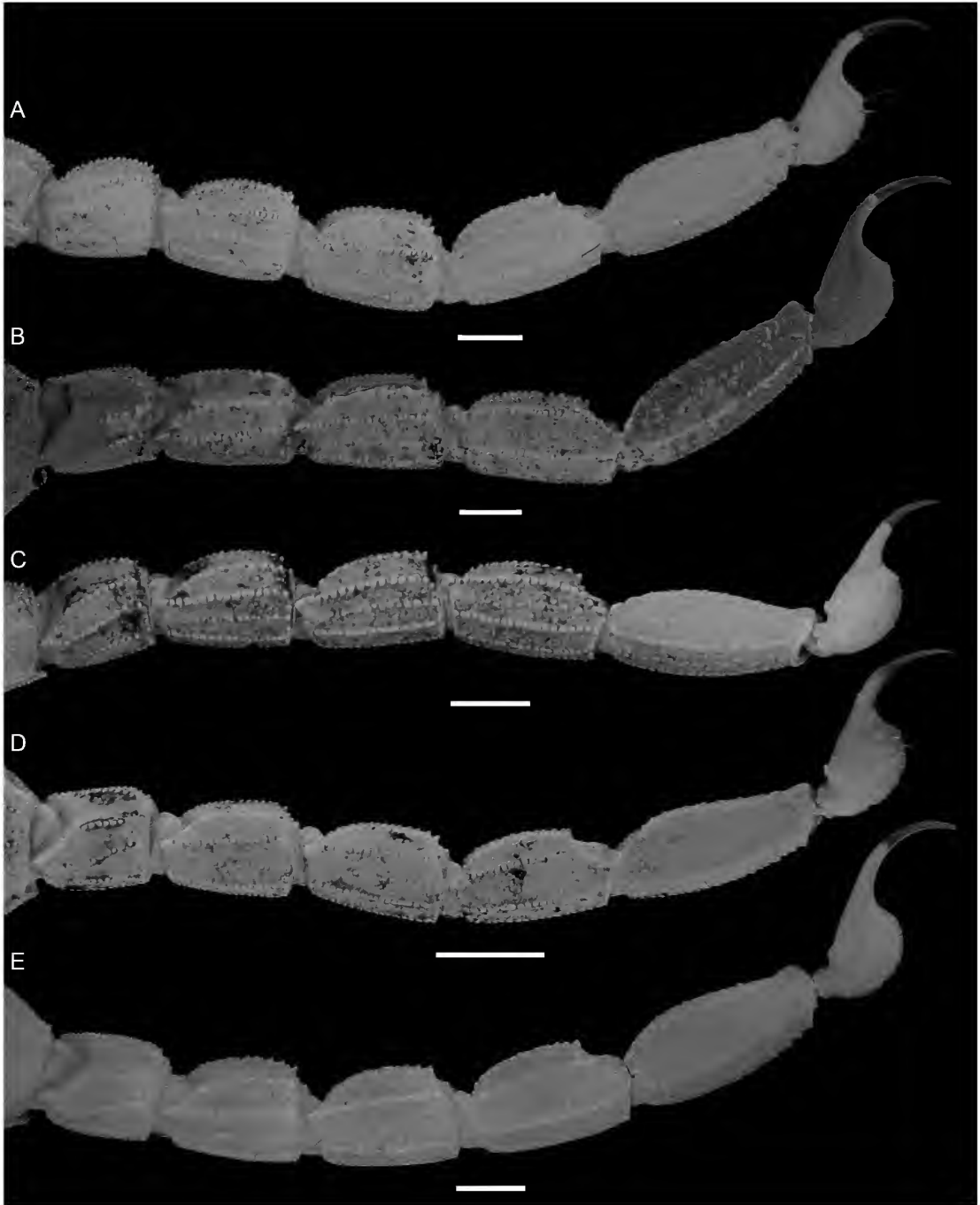


FIGURE 11. Metasoma and telson, lateral aspect of *Razianus birulai*, sp. nov. (A, B), *Razianus farzanpayi*, sp. nov. (C, D), and *Razianus zarudnyi* (Birula, 1903) (E). A. Holotype ♂ (AMNH), Mandi Tuk, Pakistan. B. Paratype ♀ (AMNH), Pthan Kot, Pakistan. C. Holotype ♂ (AMNH), D. Paratype ♀ (AMNH), Miranshah, Pakistan. E. ♂ (AMNH), Ilam Province, Iran. Scale bars = 1 mm.

(♂) or obsolete, discontinuous granular row in medial two-thirds (♀) of V. Dorsal and lateral intercarinal surfaces, segments I–V, densely and finely granular, more sparsely laterally than dorsally; I–V, ventral intercarinal surfaces granular.

*Telson*: Telson vesicle width: metasomal segment V width, 76% (73%–82%,  $n = 4$ ) (♂); globose, height: length, 64% (57%–69%,  $n = 4$ ) (♂); dorsal surface flat, ventral surface evenly curved. Vesicle acarinate, dorsal, lateral and ventral surfaces weakly granular to smooth; subaculear tubercle absent. Aculeus relatively long, gently curved; aculeus length: vesicle length, 99% (86%–117%,  $n = 4$ ) (♂). Length metasoma plus telson: total length, 62% (60%–64%,  $n = 4$ ) (♂).

**DISTRIBUTION**: Iran, recorded from the following nine provinces (Navidpour et al., 2013): Bushehr; Chaharmahal and Bakhtiari; Fars; Hormozgan; Ilam; Khuzestan; Kohgiluyeh and Boyer Ahmad; Lorestan; Sistan and Baluchistan. Newly recorded from Iraq (Baghdad Province).

**ECOLOGY**: The habitus of *R. zarudnyi*, sp. nov., is consistent with the lapidicolous ecomorphotype (Prendini, 2001). The known records are situated in areas of rocky mountainous desert.

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