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Redescription of *Heterometrus latimanus* and confirmation of the genus *Heterometrus* (Scorpiones: Scorpionidae) in Pakistan

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ABSTRACT

Scorpions of the genus *Heterometrus* Ehrenberg, 1828, are distributed from India and Sri Lanka throughout the Southeast Asian mainland and archipelagos as far as Wallace's Line. Despite this widespread distribution, *Heterometrus* was not recorded from Pakistan until a single specimen from Azad Kashmir was reported from the collection of the Pakistan Museum of Natural History, Islamabad. Perhaps because the specimen was misidentified as *Heterometrus wroughtoni* (Pocock, 1899), a species that occurs much farther to the southeast in India, the presence of *Heterometrus* in Pakistan remained uncertain until fresh material of a distinctive species of *Heterometrus* was recently collected at several locations in Khyber Pakhtoon Khawa. After comparison of the material with the holotype and only known specimen of a little-known species, *Heterometrus latimanus* (Pocock, 1894), with an indefinite type locality in "India," the Pakistani material was determined to be conspecific. In the present contribution, *H. latimanus* is redescribed based on adult males and females from several localities, and the specimen from Azad Kashmir tentatively assigned to it, confirming the presence of *Heterometrus* in Pakistan. The new locality records extend the distribution of the genus considerably to the northwest, and west of the Indus River for the first time. The known records of *H. latimanus* appear to be isolated from other *Heterometrus* occurring on the Indian subcontinent by the Great Indian (Thar) Desert, an arid, sandy basin extending from eastern Pakistan to northwestern India.

KEYWORDS: Palearctic, biodiversity, systematics, taxonomy

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INTRODUCTION

Scorpions of the genus *Heterometrus* Ehrenberg, 1828, are distributed from India and Sri Lanka throughout the Southeast Asian mainland and archipelagos as far as Wallace's Line, where they inhabit tropical and subtropical rainforests, moist and dry tropical deciduous forests, and tropical thorn forests (Prendini et al., 2003). Along with its sister genus, *Pandinus* Thorell, 1876, *Heterometrus* includes some of the world's largest and most impressive extant scorpions, e.g., *Heterometrus swammerdami* Simon, 1872, which can reach 168 mm in length (Couzijn, 1981; Sissom, 1990).

Despite its widespread distribution in Asia, *Heterometrus* was not recorded from Pakistan (Couzijn, 1981; Tikader and Bastawade, 1983; Fet, 2000) until Khatoon (1999) reported a single juvenile specimen from Azad Kashmir in the collection of the Pakistan Museum of Natural History, Islamabad. Perhaps because the specimen was misidentified as *Heterometrus wroughtoni* (Pocock, 1899), a species that occurs much farther to the southeast in the Indian states of Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu (Pocock, 1900; Couzijn, 1981; Tikader and Bastawade, 1983; Fet, 2000; Kovařík, 2004), the presence of *Heterometrus* in Pakistan remained uncertain. For example, Kovařík (2004: 51; 2009: 35) cited the presence of *H. wroughtoni* in Pakistan with a question mark, but did not discuss the matter further. Kovařík (2009: 35, 38, 78) cited a single male *Heterometrus fulvipes* (C.L. Koch, 1837) from Nagarparkar, Sind, in the extreme southeast of Pakistan, on the border with India. This record may be possible, but it remains to be independently confirmed.

During a survey of the Pakistani scorpion fauna, funded by the Higher Education Commission of Pakistan, and in collaboration with the University of Sargodha, fresh material of a distinctive species of *Heterometrus* was collected at several locations in Khyber Pakhtoon Khawa, northern Pakistan. After comparison of the Pakistani material with the holotype and only known specimen of a little-known species, *Heterometrus latimanus* (Pocock, 1894), with an indefinite type locality in "India," the material was determined to be conspecific. In the present contribution, *H. latimanus* is redescribed based on adult males and females from several localities, and the specimen from Azad Kashmir tentatively assigned to it, confirming Khatoon's (1999) record of the presence of *Heterometrus* in Pakistan. The new locality records extend the distribution of the genus considerably to the northwest, and west of the Indus River for the first time (fig. 1). The known records of *H. latimanus* appear to be isolated from other *Heterometrus* occurring on the Indian subcontinent by the Great Indian (Thar) Desert, an arid, sandy basin extending from eastern Pakistan to northwestern India.

ON THE SYSTEMATICS OF *HETEROMETRUS*

Although the genus *Heterometrus* has been revised several times, there is little consensus about the limits of its species and subgenera. Couzijn (1981) published a monographic revision with keys, wherein 21 species and 31 subspecies (including nine nominotypical forms) were recognized, and classified into five subgenera. Tikader and Bastawade (1983) subsequently published redescriptions and keys for all the Indian species, and described two new ones.

Despite examining many of the same specimens, Tikader and Bastawade (1983) differed from Couzijn (1981) in their opinions on the rank or validity of various taxa such that 30 species and 27 subspecies (including eight nominotypical forms) were subsequently recognized (Fet, 2000). Kovařík (2004) followed with another revision of *Heterometrus* in which many of the same specimens were again reexamined. Couzijn's (1981) subgenera were synonymized, along with five species and six subspecies, seven new species described, and one species removed from synonymy, leaving the genus with 31 species and without subspecies. Four more species of *Heterometrus* have since been described (Lourenço et al., 2005; Zhu and Yang, 2007; Javed et al., 2010; Mirza et al., 2012).

The 31 species of *Heterometrus* recognized by Kovařík (2004), with subsequent additions, is unlikely to accurately reflect the diversity in the genus, and our understanding is predicted to improve with future, more detailed work. Many of the problems with previous studies on *Heterometrus* arise from the small samples of material examined (typically fewer than five, but often singletons, which are female or immature) and the propensity for sexual dimorphism among some species of this genus (Prendini et al., 2003). As in other scorpionid genera, adult males are important for species identification and delimitation in *Heterometrus*, and there are numerous species complexes comprising morphologically similar, range-restricted, or narrowly endemic species (Prendini, 2001a).

Couzijn's (1981) attempt to partition the morphological variation into widespread polymorphic species with many subspecies was unsuccessful. Subsequent attempts, describing new species and elevating subspecies on the basis of small samples comprising few or no adult male specimens from a limited number of populations (e.g., Tikader and Bastawade, 1983; Kovařík, 2004; Lourenço et al., 2005; Zhu and Yang, 2007; Javed et al., 2010; Mirza et al., 2012), have not clarified the situation. For example, it is evident that none of the type specimens in the most recent description (Mirza et al., 2012) are adult. Consequently, the diagnostic characters (coloration, granulation, meristic variation) presented to justify this putative new species are unreliable and the comparisons made with other species, described on the basis of adults, invalid. As Prendini et al. (2003) suggested, a thorough revision, involving the examination of many specimens to determine which morphological characters are consistent across the range of the various taxa, and probably augmented by DNA sequence data, is required to address the confusion in *Heterometrus*. When this is accomplished, many of the putative new species described, subspecies elevated, and synonyms resurrected by previous authors will likely prove synonymous with one another or with species described decades earlier. A quantitative cladistic analysis of relationships among the species of *Heterometrus* is also needed to reassess Couzijn's (1981) five subgenera, which were rather arbitrarily synonymized.

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-

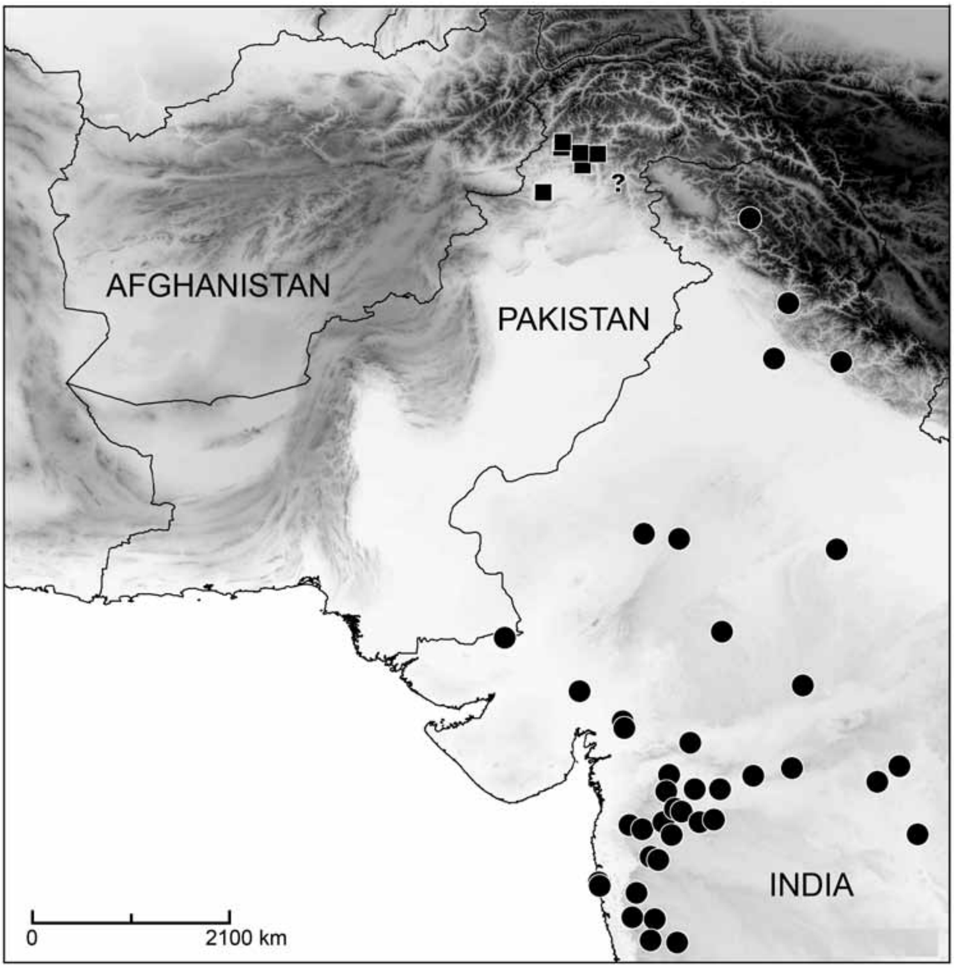

FIGURE 1. Map plotting the known distribution of *Heterometrus latimanus* (Pocock, 1894) in Pakistan (squares) on shaded relief. The question mark denotes a juvenile specimen, probably conspecific with *H. latimanus*, misidentified as *Heterometrus wroughtoni* (Pocock, 1899) by Khatoon (1999). Circles denote literature locality records of other *Heterometrus* Ehrenberg, 1828, species occurring in India, and one record from Pakistan, which remains to be confirmed.

LED flashlights. A portable Garmin™ GPS V Plus device was used for recording the geographical coordinates (WGS84 datum) of some collection localities in the field; others were retroactively georeferenced using Google Earth. Material examined is deposited in the American Museum of Natural History, New York (AMNH), the Natural History Museum, London (BMNH), and the Pakistan Museum of Natural History, Islamabad (PMNH). Tissue samples 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 description, were recorded using Mitutoyo® digital calipers (model NTD12–6″C). Morphological terminology follows previous papers on Scorpionidae Latreille, 1802, by the second author (e.g., Prendini 2000, 2001a; Prendini et al., 2003), 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 was created for mapping the distributional range of *H. latimanus* and geographically proximate *Heterometrus* records from India. Indian *Heterometrus* records from the literature (Pocock, 1900; Tikader, 1978; Couzijn, 1981; Tikader and Bastawade, 1983; Indra, 2001, 2006; Bastawade, 2002, 2005, 2006a, 2006b; Kovařík, 2004, 2009; Rao et al., 2005; Mirza and Sanap, 2010; Pande et al., 2012) were mapped with a single symbol because the accuracy of identifications cannot be verified without examining the material, which was beyond the scope of the study. 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).

SYSTEMATICS

Family Scorpionidae Latreille, 1802

Genus *Heterometrus* Ehrenberg, 1828

Heterometrus latimanus (Pocock, 1894)

Figures 1–8; tables 1, 2

Scorpio latimanus Pocock, 1894: 74, 75.
Heterometrus latimanus: Kraepelin, 1899: 113; Takashima, 1945: 92; Pérez Minnoci, 1974: 38; Kovařík, 2004: 21, 51, table 2 (misidentification); 2009: 39, 73, figs. 3, 4 (misidentification).
Palamnaeus latimanus: Pocock, 1900: 90, fig. 27.
Heterometrus (*Srilankametrus*) *indus* (DeGeer, 1778): Couzijn, 1981: 121 (misidentification, part).
Heterometrus (*Srilankametrus*) *latimanus*: Tikader and Bastawade, 1983: 545–550, fig. 1458–1468; Fet, 2000: 448.
Heterometrus wroughtoni (Pocock, 1899): Khatoon, 1999: 223, 224, fig. 12 (misidentification); Kovařík, 2004: 49, 51, table 2 (misidentification, part); 2009: 35, table 1 (misidentification, part).

Type Material: Holotype ♀ (BMNH 1879.7.3.1), "India" [examined].

New Records: **PAKISTAN: Azad Kashmir:** 15.vii.1994, 1 juv. ♂ (PMNH 52). **Khyber Pakhtoon Khawa:** *Boner District*: Daggar Tehsil: Daggar, 34°31′N 72°28′E, x.2012, M. Azhar, rocky area with stones, collected by turning stones, 2 ♂, 3 ♀, 1 subad. ♂ (AMNH), 1 ♀, 3 subad. ♂, 2 subad. ♀ (AMNH), 1 subad. ♀ (AMCC [LP 11601]), 27.ix.2012, M. Shahid, M. Ahsan, and A. Khan, rocky area with stones, 1 ♀ (AMNH), 1 subad. ♂ (AMCC [LP 11569]);

Daggar, 3 km W of Rega village, 33°51.14′N 72°48′E, 2257 ft, M. Ahsan, 13.ix.2012, rocky hilly area, collected with UV lamps (8–10 P.M.), 1 ♂, 1 ♀ (AMNH). *Peshawar District*: Peshawar Tehsil: Peshawar, 15 km W on road to Landi Kotal, 34°01′N 71°35′E, 1158 ft, 24.ix.2012, M. Shahid, M. Ahsan, and A. Khan, rocky area with little vegetation, collected by turning stones (4 P.M.), 3 ♀ (AMNH), 1 subad. ♀ (AMCC [LP 11568]). *Swat District*: Charbagh Tehsil: Charbagh village, 5 km W, 34°48′N 72°26.32′E, 3377 ft, 25.ix.2012, M. Shahid, M. Ahsan, and A. Khan, rocky area with little vegetation, collected by turning stones (3–6 P.M.), 2 ♂, 2 ♀ (AMNH). *Upper Dir District*: Barawal Tehsil: Barawal town, 7 km W, 35°06.51′N 72°01.59′E, 14.viii.2012, M. Ahsan, M. Irfan, M. Hussain, and M. Ayyub, hilly area with little vegetation, collected with UV lamp (10 P.M.), 3 ♂, 1 juv. ♀ (AMNH); Barawal town, 9 km W, 35°06.45′N 72°01.46′E, 14.viii.2012, M. Ahsan, M. Irfan, M. Hussain, and M. Ayyub, hilly area with little vegetation, collected with UV lamp (10 P.M.), 3 ♂ (AMNH).

REMARKS: The type locality of *H. latimanus* was indefinitely located in "India," which, at the time of its description, also included Pakistani territory. The holotype, originally dry and now conserved in ethanol, is in pieces, and the telson is missing. However, it is evidently conspecific with the new Pakistani material for the following reasons. The presence of three spiniform macrosetae on the laterodistal lobes of the telotarsi, observed in the Pakistani material, is unique to *H. latimanus* (Pocock, 1900: 90, fig. 27B). The count of spiniform macrosetae in the pro- and retroventral rows of the telotarsi of the holotype (I and II, 4, 5; III and IV, 4 or 5, 6) falls within the range of the Pakistani material (I and II, 4 or 5, 5–7; III and IV, 4–6, 5 or 6; tables 1, 2). The Pakistani material further resembles the holotype and descriptions of *H. latimanus* in size (holotype total length excluding telson, 76 mm); uniformly reddish-brown to black coloration with contrasting, yellow legs; female carapace interocular surface slightly granular; short, broad pedipalp chelae, with the dorsal surface of the manus convex and granular, becoming smooth posteriorly, and retromedian carina obsolete; and paired, costate ventrosubmedian and ventrolateral carinae on sternite VII (Pocock, 1900; Tikader and Bastawade, 1983).

The two female specimens identified as *H. latimanus* by Kovařík (2004: 21; 2009: 39, 73: figs. 3, 4), from "India," are not conspecific with the holotype of *H. latimanus* or with the new Pakistani material. The most obvious differences between these specimens and *H. latimanus* are their larger size (70–105 mm), darker coloration, apparently with dark legs (although this is difficult to tell given the poor condition of the specimen illustrated), more densely granular frontal lobes of the carapace interocular surface, and the uniformly coarsely and densely granular dorsal surface of the pedipalp chela manus.

DIAGNOSIS: *Heterometrus latimanus* differs from the Indian species, *H. wroughtoni*, with which it was confused by Khatoon (1999), in the following respects. It is slightly smaller (total length, 80–90 mm) than *H. wroughtoni* (95–130 mm; Kovařík, 2004). Its coloration is generally paler, the pedipalps reddish, the legs pale yellow and contrasting with the darker carapace, tergites, and metasoma, than that of *H. wroughtoni*, which is uniformly blackish, the legs olive to blackish brown (Pocock, 1900; Tikader and Bastawade, 1983; Kovařík, 2004). The pedipalp chelae are shorter and broader, with the dorsal surface convex and the retromedian carina obsolete, granular and indistinguishable from the granules of the adjacent intercarinal surfaces, unlike *H. wroughtoni*, in which the dorsal surface is relatively flat and the retromedian carina is complete,

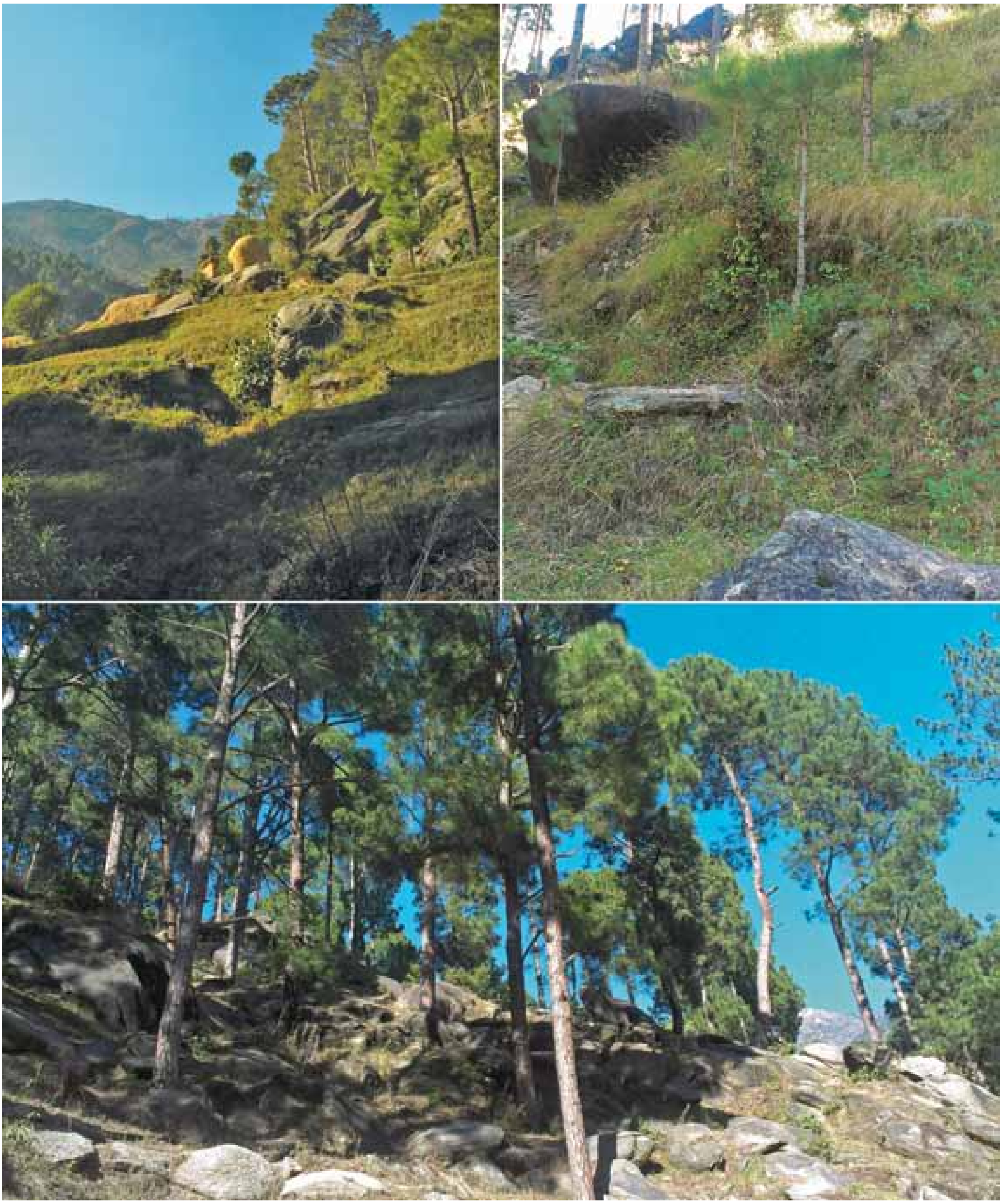

FIGURE 2. *Heterometrus latimanus* (Pocock, 1894) habitat in the Boner District of Khyber Pakhtoon Khawa, Pakistan.

TABLE 1. Meristic data for adult ♂ specimens of *Heterometrus latimanus* (Pocock, 1894) in the collections of the American Museum of Natural History, New York.

Measurements (mm) follow Prendini (2000): [1]sum of carapace, tergites I–VII, metasomal segments I–V, and telson; [2]distance from anterior carapace margin; [3]sum of metasomal segments I–V and telson; [4]distance from base of condyle to tip of fixed finger. Pectinal tooth and setal counts (left/right). Setal counts include areolar cups (sockets), if setae broken.

Total length[1]		80.9	80.7	89.9	89.6	91.8	79.6	70.6	81.8	75.2	78.0
Carapace	anterior width	9.2	8.6	9.3	10.1	9.7	8.2	7.8	8.7	9.7	8.0
	posterior width	12.4	13.8	14.1	13.8	15.2	13.8	13.0	14.7	12.1	13.9
	length	12.7	13.4	13.3	13.5	14.8	13.6	12.1	14.5	12.6	14.0
	median ocelli[2]	6.0	5.6	6.1	6.6	6.8	6.0	5.7	6.1	5.9	6.2
Tergite I	length	1.5	2.5	1.8	2.6	1.7	2.0	1.1	1.7	1.4	1.5
Tergite II	length	2.4	1.9	2.9	3.2	2.9	2.0	1.8	2.4	1.4	1.9
Tergite III	length	3.7	2.7	3.7	4.6	3.6	2.8	2.4	3.3	2.2	3.3
Tergite IV	length	4.3	3.5	4.2	4.0	4.4	3.6	2.7	3.1	2.8	3.4
Tergite V	length	4.3	3.1	4.4	4.0	4.7	3.3	2.8	2.8	3.2	3.1
Tergite VI	length	4.3	3.7	4.0	4.6	5.0	3.5	2.8	3.5	3.5	3.1
Tergite VII	length	4.3	4.2	5.3	4.6	5.3	4.4	3.8	4.8	4.1	4.2
Sternite VII	length	5.1	4.0	5.3	4.6	4.6	4.2	3.6	3.4	3.6	3.4
	width	9.4	9.6	10.7	10.0	12.1	10.3	10.1	10.3	10.8	10.4
Mesosoma	total length	24.6	21.6	26.3	27.6	27.7	21.6	17.4	21.6	18.5	20.4
Metasoma I	length	5.5	5.7	6.7	6.6	6.1	5.9	6.0	6.1	5.9	5.6
	width	5.4	6.0	6.1	6.2	6.9	6.4	5.6	5.9	5.4	5.5
Metasoma II	length	6.4	6.4	7.4	7.1	6.6	5.9	5.1	6.3	7.6	6.0
	width	5.2	5.6	5.8	5.9	6.2	5.6	5.4	4.4	4.9	5.1
Metasoma III	length	6.8	6.6	7.8	7.1	7.2	6.6	5.5	7.1	6.2	6.5
	width	5.2	5.5	5.4	5.5	5.7	5.3	5.0	5.6	4.8	5.3
Metasoma IV	length	7.3	7.2	7.8	7.6	7.8	7.4	5.9	5.2	5.9	6.9
	width	4.8	4.9	5.1	5.0	5.3	5.0	4.6	5.2	4.3	4.7
Metasoma V	length	9.3	10.2	10.9	11.2	11.0	9.7	8.9	11.5	9.9	9.9
	width	4.2	4.3	4.6	4.5	5.0	4.6	4.2	4.6	4.0	4.2
Telson	vesicle length	6.1	7.0	6.6	6.0	7.1	6.5	6.6	6.8	6.2	6.1
	vesicle width	4.7	5.1	5.0	4.8	5.7	5.4	5.0	5.4	4.8	5.1
	vesicle height	4.1	4.5	4.4	4.2	5.0	4.4	4.5	4.5	4.0	4.2
	aculeus length	2.3	2.7	3.0	3.1	3.6	2.5	3.1	2.9	2.4	2.7
	total length	8.4	9.7	9.6	9.0	10.7	9.0	9.6	9.6	8.6	8.8
Metasoma	total length[3]	43.6	45.7	50.3	48.6	49.4	44.4	41.1	45.7	44.1	43.6
Femur	length	8.2	8.6	8.5	7.9	10.2	9.5	8.3	8.8	7.4	7.3
	width	4.2	4.0	4.6	5.2	5.4	5.7	4.5	4.6	3.8	4.3
Patella	length	9.9	10.4	11.3	9.9	11.4	11.5	9.3	11.2	9.9	10.2
	width	5.2	5.5	5.7	5.4	5.9	5.7	5.4	6.1	4.8	5.3

Chela	length[4]	17.7	19.1	21.4	20.7	22.6	21.2	19.8	20.4	19.0	20.7
	height	10.5	11.8	12.1	11.6	13.3	12.2	10.9	11.7	10.1	11.4
	width	6.0	6.1	5.9	8.2	7.7	7.5	6.2	6.6	5.6	7.9
	length retroventral carina	7.9	8.4	9.7	8.2	9.6	9.4	8.6	9.1	7.7	9.7
	length mov. finger	11.9	12.8	14.1	13.5	15.4	13.8	13.1	14.2	11.8	15.2
Pectines	total length	7.4	8.6	8.2	8.4	9.0	7.1	7.9	8.4	7.5	8.1
	length dentate margin	7.1	7.2	7.5	7.2	7.7	7.1	5.9	7.1	6.2	6.7
	tooth count	21/18	21/18	19/19	20/19	18/18	17+/18	19/18	18/19	20/16	18/18
Telotarsi I	proventral row	4/4	4/4	4/4	4/2	4/4	4/4	-/-	5/3	4/4	4/-
	retroventral row	6/6	6/6	6/6	5/6	7/6	6/4	-/-	6/6	5/5	6/-
Telotarsi II	proventral row	4/-	4/4	4/4	4/4	4/4	4/4	4/-	5/4	4/4	4/4
	retroventral row	6/-	5/6	6/4	6/6	5/6	6/6	6/-	5/6	5/5	5/5
Telotarsi III	proventral row	5/5	5/5	5/5	5/5	5/6	5/5	5/5	5/6	5/4	4/5
	retroventral row	5/5	6/5	6/6	6/6	5/6	6/6	6/6	6/6	5/5	5/5
Telotarsi IV	proventral row	5/5	5/5	5/5	5/5	5/6	5/5	-/5	5/6	5/4	5/5
	retroventral row	5/6	6/6	5/6	5/6	6/6	6/6	-/6	6/6	5/5	5/5

costate, and distinct from the granules of the adjacent intercarinal surfaces (Pocock, 1900; Tikader and Bastawade, 1983). Three spiniform macrosetae are present on the laterodistal lobes of the telotarsi, unlike *H. wroughtoni*, in which only two spiniform macrosetae are present (Pocock, 1900; Couzijn, 1981; Tikader and Bastawade, 1983).

The obsolete retromedian carina and three spiniform macrosetae on the laterodistal lobes also separate *H. latimanus* from *Heterometrus fulvipes* (C.L. Koch, 1837) and *Heterometrus madraspatensis* (Pocock, 1900), two slightly larger Indian species with pale yellow legs contrasting with a dark blackish or reddish-brown carapace, tergites, and metasoma (Pocock, 1900; Tikader and Bastawade, 1983; Kovařík, 2004). Also unlike these species, in which the telson vesicle is reddish yellow and contrasts with the dark blackish metasoma, the vesicle and metasoma of *H. latimanus* are uniformly dark brown.

Heterometrus xanthopus (Pocock, 1897), from the Indian state of Maharashtra, most closely resembles *H. latimanus* in size (60–80 mm; Kovařík, 2004); coloration, notably the reddish-brown pedipalps and yellowish legs (Pocock, 1900; Tikader and Bastawade, 1983; Kovařík, 2004); short, broad pedipalp chelae, with the dorsal surface of the manus convex, and the retromedian carina obsolete, granular and indistinguishable from the granules of the adjacent intercarinal surfaces (Pocock, 1900; Tikader and Bastawade, 1983); and paired ventrosubmedian and ventrolateral carinae on sternite VII (Pocock, 1900; Tikader and Bastawade, 1983). However, *H. xanthopus* differs in the surface macrosculpture of the male carapace (Pocock, 1900; Tikader and Bastawade, 1983; Kovařík, 2004) and tergites (Couzijn, 1981), which are almost entirely granular, unlike the Pakistani material of *H. latimanus*, in which the male carapace is smooth except for the mediolateral and posterolateral surfaces, and along the median longitudinal sulcus, and the male tergites are only granular posterolaterally; and two spiniform

TABLE 2. Meristic data for adult ♀ specimens of *Heterometrus latimanus* (Pocock, 1894) in the collections of the American Museum of Natural History, New York, and the holotype ♀ in the Natural History Museum, London (BMNH 1879.7.3.1), listed in the first column.

Measurements (mm) follow Prendini (2000): [1]sum of carapace, tergites I–VII, metasomal segments I–V, and telson (except holotype, for which telson is missing); [2]distance from anterior carapace margin; [3]sum of metasomal segments I–V and telson (metasomal segments I–V only in holotype); [4]distance from base of condyle to tip of fixed finger. Pectinal tooth and setal counts (left/right). Setal counts include areolar cups (sockets), if setae broken.

Total length[1]		76.4	79.4	88.2	87.6	83.3	87.0	92.5	86.0	90.4	84.5	87.5
Carapace	anterior width	8.5	7.7	9.7	8.7	10.3	8.9	9.5	9.5	10.7	9.2	10.2
	posterior width	12.7	12.9	14.0	12.3	13.9	14.4	13.7	13.5	14.9	13.0	15.6
	length	12.9	12.2	13.9	12.7	14.1	12.9	14.2	14.2	14.1	13.3	14.1
	median ocelli[2]	6.4	5.8	6.2	5.6	6.3	6.1	6.8	6.1	6.8	6.5	6.4
Tergite I	length	2.0	1.8	2.4	2.6	1.7	2.3	1.9	2.0	3.0	2.0	2.6
Tergite II	length	2.7	2.1	2.4	2.8	2.3	2.9	3.2	2.8	3.0	2.3	2.2
Tergite III	length	3.4	3.1	3.1	4.1	3.8	3.8	4.3	3.6	3.6	3.2	3.6
Tergite IV	length	4.5	3.8	4.2	4.3	4.1	4.5	4.9	4.3	3.8	3.6	3.7
Tergite V	length	5.1	4.5	5.6	4.7	4.3	4.4	5.5	4.5	3.8	3.7	4.6
Tergite VI	length	5.3	5.0	5.7	5.2	4.5	5.4	5.9	5.0	3.8	4.4	4.6
Tergite VII	length	6.5	5.1	5.8	5.8	5.3	6.6	6.4	5.9	5.0	4.7	5.2
Sternite VII	length	6.6	3.7	5.2	6.0	4.9	5.6	5.5	4.6	5.1	5.6	5.0
	width	9.4	9.0	10.4	9.9	10.4	10.1	10.8	10.4	11.1	6.1	10.7
Mesosoma	total length	30.1	25.3	29.1	29.4	25.9	29.9	31.9	28.1	25.8	23.8	26.5
Metasoma I	length	5.5	5.6	6.9	6.8	5.9	6.7	6.8	5.9	6.6	6.1	6.6
	width	5.6	5.4	6.1	5.6	6.0	5.5	6.1	6.0	6.4	5.9	6.4
Metasoma II	length	5.7	6.0	5.7	7.2	6.2	6.7	6.8	6.0	7.2	7.0	6.6
	width	5.0	4.9	5.6	5.0	5.8	5.1	5.6	5.4	5.9	5.4	6.0
Metasoma III	length	6.3	6.6	6.3	7.0	7.3	6.7	6.8	6.7	7.2	9.0	6.7
	width	4.7	4.8	5.5	4.8	5.4	4.9	5.3	5.0	5.5	4.9	5.7
Metasoma IV	length	6.8	6.8	7.0	7.4	7.3	7.1	6.8	7.1	8.1	7.2	7.4
	width	4.4	4.3	4.9	4.3	4.9	4.4	4.9	4.6	4.9	4.6	5.0
Metasoma V	length	9.7	8.8	10.3	9.6	8.4	8.9	10.0	9.0	12.3	9.5	10.8
	width	3.7	3.9	4.3	3.8	4.3	3.9	4.2	4.6	4.1	4.0	4.3
Telson	vesicle length	-	5.5	6.7	5.3	5.9	5.3	6.3	6.3	6.6	5.9	5.7
	vesicle width	-	3.9	4.6	3.9	4.7	4.1	4.4	4.6	4.4	4.3	4.5
	vesicle height	-	3.4	4.2	3.4	3.6	3.6	4.1	3.8	3.9	3.9	4.0
	aculeus length	-	2.7	2.3	2.3	2.4	2.8	2.7	2.8	2.6	2.7	3.0
	total length	-	8.2	9.0	7.6	8.3	8.0	9.0	9.1	9.1	8.7	8.7
Metasoma	total length[3]	34.3	41.9	45.3	45.5	43.4	44.2	46.4	43.7	50.5	47.4	46.8
Femur	length	8.5	7.8	9.3	7.7	7.8	7.6	8.4	9.3	8.3	7.9	8.7

Femur	width	4.3	4.6	4.4	4.7	4.6	4.5	4.9	4.8	4.8	4.1	4.7
Patella	length	9.8	8.9	10.2	9.5	10.0	10.0	10.1	10.6	10.6	9.6	10.6
	width	4.5	5.2	5.4	5.1	5.9	5.2	5.7	5.7	5.8	5.5	5.9
Chela	length[4]	19.0	17.4	20.5	18.3	19.2	17.9	20.2	20.5	19.7	18.8	19.7
	width	10.2	10.8	12.6	11.1	12.4	11.4	11.9	13.1	12.2	11.7	12.7
	height	8.6	5.8	7.0	6.0	7.3	6.8	7.3	6.9	6.7	8.1	6.8
	retroventral carina	7.9	8.4	9.1	8.2	9.2	9.0	8.8	9.0	9.6	8.5	8.5
	mov. finger	11.9	12.1	13.1	12.5	13.1	12.6	13.5	12.8	12.4	13.5	12.9
Pectines	total length	5.9	6.7	6.8	6.3	7.0	5.7	7.0	6.7	7.6	6.4	7.4
	dentate margin	4.6	4.8	4.8	4.7	5.2	4.5	4.8	5.0	5.9	4.7	5.6
	tooth count	15/15	15/14	12/14	14/16	14/15	15/14	14/16	16/16	14/16	13/12	14/16
Telotarsi I	proventral row	-/4	-/4	4/4	4/3	3/4	4/4	4/4	4/4	4/4	4/4	4/4
	retroventral	-/5	-/7	6/6	6/5	6/6	6/6	6/5	6/7	6/6	6/6	6/6
Telotarsi II	proventral row	4/-	-/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
	retroventral	5/-	-/7	6/6	5/6	6/6	5/6	5/6	6/6	6/6	6/5	6/6
Telotarsi III	proventral row	4/5	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4/5	5/5	5/5
	retroventral	6/6	6/6	6/6	6/6	5/6	5/6	6/6	5/7	6/6	5/6	6/6
Telotarsi IV	proventral row	5/5	5/5	5/5	5/5	5/5	-/5	5/5	4/5	5/4	5/5	5/5
	retroventral	6/6	6/6	6/6	6/6	5/6	-/6	6/6	6/6	6/6	6/5	6/6

macrosetae are present on the laterodistal lobes of the telotarsi, rather than three as in *H. latimanus* (Pocock, 1900; Couzijn, 1981; Tikader and Bastawade, 1983).

Couzijn (1981) synonymized *H. latimanus* with the Sri Lankan species, *Heterometrus indus* (DeGeer, 1778), which was placed in subgenus *Srilankametrus* Couzijn, 1981. Tikader and Bastawade (1983) revalidated *H. latimanus* but retained it in *Srilankametrus*, where it was also listed by Fet (2000). Kovařík (2004) also upheld the validity of *H. latimanus* but abolished *Srilankametrus* along with Couzijn's (1981) other subgenera of *Heterometrus*. Based on examination of the holotype and the new Pakistani material, *H. latimanus* is a valid species, and does not appear to be closely related to *H. indus*, from which it differs in many respects, including coloration, e.g., reddish-brown pedipalps and yellowish legs; short, broad pedipalp chelae; paired ventrosubmedian and ventrolateral carinae on sternite VII; first proximal median lamella (scape) of pecten with mesial margin angular, approximately 90° (♂), or obtusely angular, greater than 90° but less than 180° (♀); teeth present along entire posterior margin of pecten; higher pectinal tooth count (♂, 16–21; ♀, 12–16); and three spiniform macrosetae on the laterodistal lobes of the telotarsi. *Heterometrus indus* is entirely black to greenish black in color; the pedipalp chelae are more elongated, with longer fingers; an obsolete pair of ventrolateral carinae is present on sternite VII; the mesial margin of the first proximal median lamella (scape) of the pecten is obtusely angular, greater than 90° but less than 180° (♂, ♀); the proximal third of the posterior margin of the pecten is devoid of teeth; the pectinal tooth count is lower (♂, 11–15; ♀, 10–12);

and two spiniform macrosetae are present on the laterodistal lobes of the telotarsi (Pocock, 1900; Couzijn, 1981; L. Prendini, personal obs.). Based, for example, on the absence of a notch or incision in the carapace lateral margin, adjacent to the posterior lateral ocelli, *H. latimanus* would be accommodated in subgenus *Chersonesometrus* Couzijn, 1981.

Description: The following description is based on the holotype and additional material examined. Measurements are recorded in tables 1 and 2.

Total length: Adult medium, length, measured from anterior margin of carapace to tip of aculeus, 82 mm (71–92 mm, n = 10) (♂), 87 mm (79–93 mm, n = 10) (♀) (tables 1, 2).

Color: Chelicerae, dorsal surfaces bicolored, prodorsal half of manus immaculate, paler than carapace and infuscate retrodorsal half of manus and fingers. Carapace and pedipalp trochanter, femur, and patella entirely infuscate, uniformly dark brown to blackish brown; pedipalp chela immaculate, manus reddish brown with fingers darker. Tergites entirely infuscate, uniformly dark olive to blackish brown, darker than carapace, pedipalps, and metasoma. Sternites partially infuscate, dark olive to blackish brown, becoming darker posteriorly. Coxosternal region immaculate, pale yellow, except maxillary lobes, slightly infuscate and darker. Legs immaculate, uniformly pale yellow, contrasting with carapace, pedipalps, tergites, and metasoma; dorsal and retrolateral surfaces becoming paler distally, usually with tibia, basitarsus, and telotarsus paler than femur and patella. Genital opercula and pectines uniformly pale cream. Metasomal segments and telson entirely infuscate; metasomal carinae blackish brown, as dark as tergites and sternites; intercarinal surfaces dark brown, paler than tergites and sternites.

Chelicerae: Movable finger, distal external (dorsal) and distal internal (ventral) teeth unequal, distal external tooth considerably smaller than distal internal tooth, aligned longitudinally and moderately opposable. Fingers and manus, proventral surfaces with long, dense vestiture of macrosetae. Coxae, prodorsal surfaces without stridulatory setae (scaphotrix); promedian surfaces without chemoreceptive lamelliform setae (trichocopae).

Carapace: Anterior width : posterior width, 66% (57%–80%, n = 10) (♂), 68% (59%–74%, n = 11) (♀); posterior width : length, 102% (96%–107%, n = 10) (♂), 105% (95%–112%, n = 11) (♀) (tables 1, 2). Three pairs of lateral ocelli, all similar in size, the two anterior pairs situated anteriorly, well separated from posterior pair, situated laterally. Median ocelli moderately larger than lateral ocelli, distance between ocelli equal to or greater than width of ocellus; median ocular tubercle situated anteromedially; ocular tubercle distance from anterior carapace margin : carapace length, 45% (42%–49%, n = 10) (♂), 46% (43%–50%, n = 11) (♀) (tables 1, 2). Carapace anterior margin with deep median notch (figs. 4A, B); without median projection or median depression; lateral margin without distinct notch adjacent to posterior lateral ocelli. Median longitudinal sulcus narrow, suturiform; continuous from median notch to interocular sulcus; anteriorly furcated; without antero-ocular depression. Anterior furcated sulci diverging broadly from anterior edge of median longitudinal sulcus. Median ocular tubercle raised, superciliary carinae higher than ocelli, extended anteriorly, and slightly posteriorly; anterior portions subparallel. Interocular sulcus present. Circumocular depressions completely encircling median ocular tubercle, converging anteriorly. Posteromedian and posteromarginal sulci deep. Paired mediolateral and posterolateral sulci shallow. Median longitudinal suture

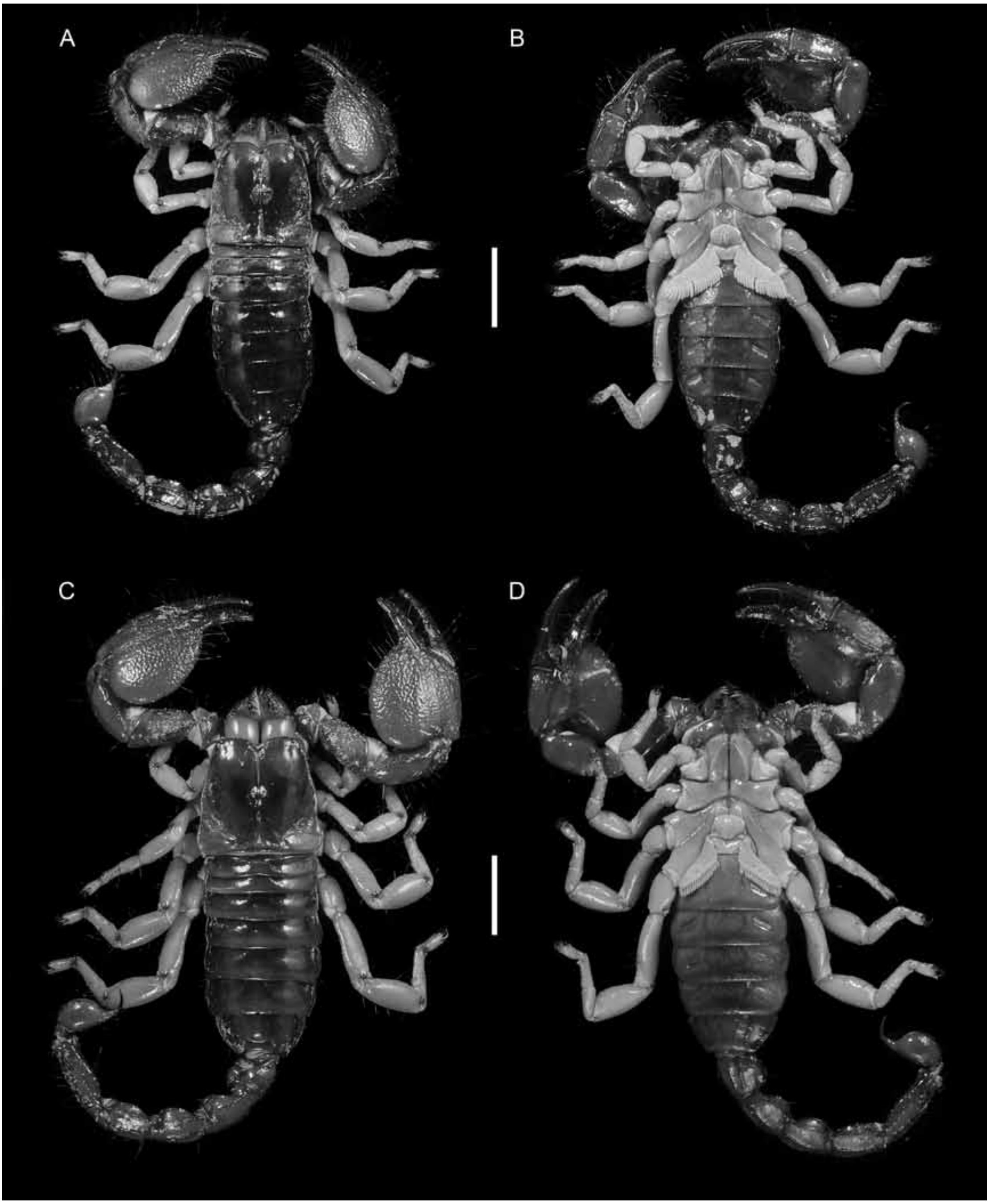

FIGURE 3. *Heterometrus latimanus* (Pocock, 1894) habitus, dorsal aspect (**A, C**) and ventral aspect (**B, D**). **A, B.** ♂ (AMNH), **C, D.** ♀ (AMNH), Daggar, Pakistan. Scale bars = 10 mm.

continuous from median notch to median ocular tubercle, equally strong along entire length; not extending to anterior margin of carapace, terminating at or posterior to median notch. Anterior furcated sutures fully developed. Antero-ocular furcated sutures absent. Interocular suture present, slender. Posterior sutures present but indistinct, converging on median ocular tubercle; connected anteriorly to posterior furcations of interocular suture. Interocular surface sparsely and finely granular along median longitudinal and anterior furcated sulci, elsewhere smooth (♂) or entirely smooth (♀) (figs. 4A, B). Anterolateral and posteromedian surfaces smooth or nearly so; mediolateral surfaces uniformly finely granular (♂) to almost smooth (♀); posterolateral surfaces finely granular; posteromedian surface smooth.

Pedipalps: Femur width : length, 54% (47%–55%, $n = 10$) (♂), 55% (47%–61%, $n = 11$) (♀) (tables 1, 2). Retrodorsal carina distinct, granular; more strongly developed than prodorsal carina. Dorsomedian carina vestigial, reduced to prominent granule demarcated by conspicuous macroseta. Dorsal secondary carina comprising scattered granules, becoming obsolete distally. Prodorsal carina distinct, granular. Promedian carina distinct, comprising row of spiniform or subspiniform granules (several demarcated by conspicuous macrosetae), oriented diagonally between prodorsal and proventral carinae. Proventral carina distinct, granular, more strongly developed than retroventral carina. Ventromedian and secondary accessory carinae absent. Retroventral carina vestigial, reduced to proximal quarter of segment. Retromedian carinae absent, indicated only by macrosetal rows. Intercarinal surfaces smooth. Patella width : length, 53% (49%–58%, $n = 10$) (♂), 55% (46%–59%, $n = 11$) (♀) (tables 1, 2). Dorsal surface convex, dorsomedian carina dorsal to retrodorsal carina, obsolete, costate (fig. 5A). Paired retromedian carinae obsolete (♂) or absent (♀). Retroventral carina obsolete, costate (fig. 5B). Promedian carina vestigial, reduced to subspiniform granule, demarcated by a conspicuous macroseta (♂) or absent (♀); anterior process absent (fig. 5C). Other carinae absent. Intercarinal surfaces smooth. Chela short, broad (figs. 6, 7); manus height : width, 59% (49%–71%, $n = 10$) (♂), 60% (53%–84%, $n = 11$) (♀); length along ventroexternal carina : width, 76% (71%–85%, $n = 10$) (♂), 74% (67%–79%, $n = 11$) (♀); length along ventroexternal carina : length of movable finger, 65% (61%–69%, $n = 10$) (♂), 69% (63%–78%, $n = 11$) (♀) (tables 1, 2). Dorsomedian carina distinct, comprising irregular row of unequal spiniform granules, becoming obsolete posteriorly. Dorsal secondary and subdigital carinae obsolete, costate to costate-granular, incomplete, respectively reduced to distal and proximal thirds of segment. Digital and retromedian carinae obsolete, granular, indistinguishable from granules of adjacent intercarinal surfaces. Retrolateral secondary and secondary accessory carinae vestigial, proximal to condyle of movable finger. Retroventral carina distinct, costate. Ventromedian and proventral carina obsolete, costate; promedian carina absent. Proventral and promedian carinae indicated by macrosetal rows. Prodorsal carina comprising irregular row of spiniform granules and associated macrosetae. Chela moderately (♂) to sparsely (♀) setose. Manus, dorsal intercarinal surfaces coarsely granular except for smooth depression at base of fixed finger; retrolateral intercarinal surfaces coarsely granular; ventral intercarinal surface smooth; prolateral intercarinal surfaces smooth, except for few scattered spiniform granules dorsally and distally. Fixed and movable fingers, intercarinal surfaces smooth; median denticle rows each with six enlarged retrolateral denticles (including terminal denticle), the proximal three situ-

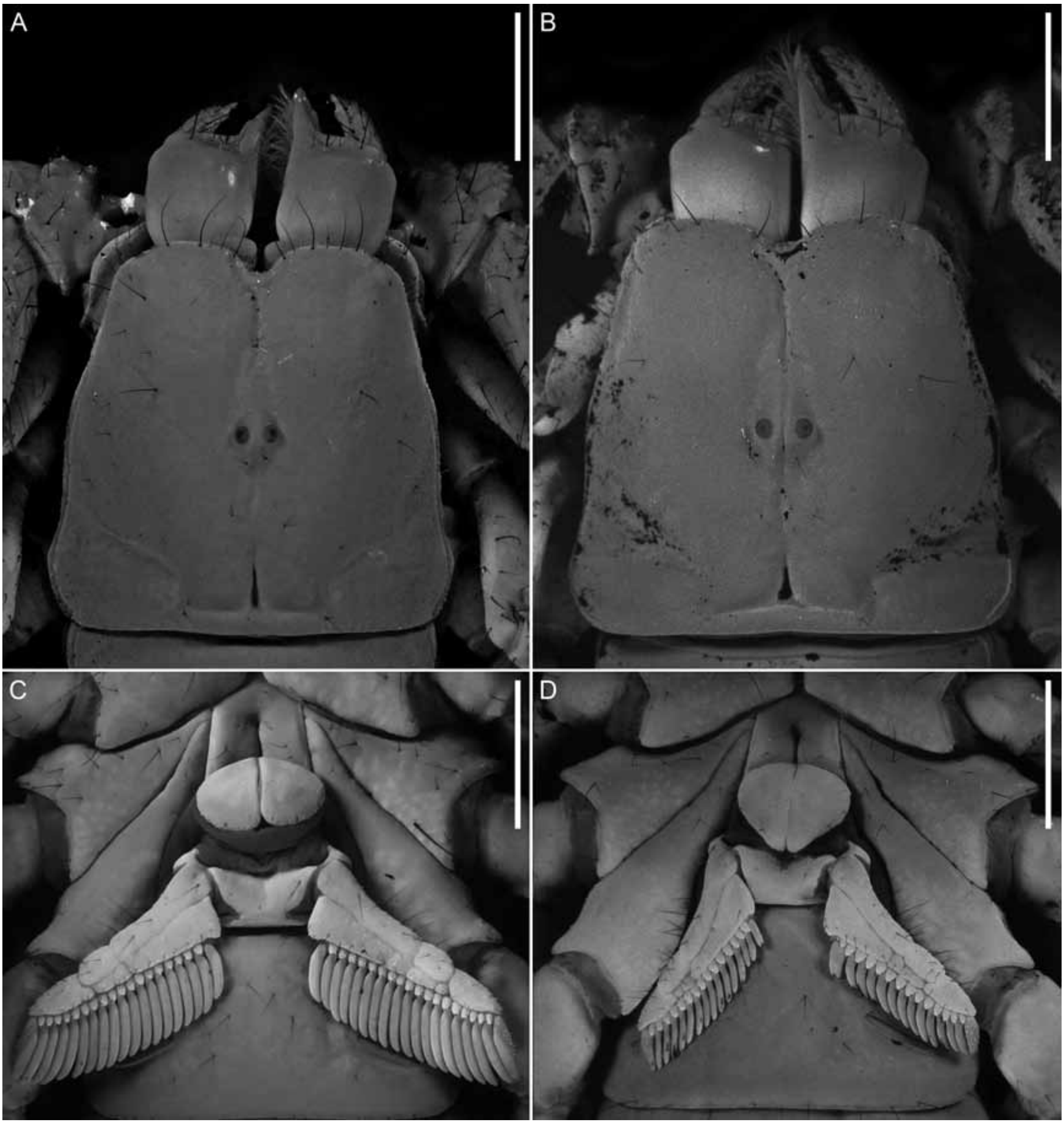

FIGURE 4. *Heterometrus latimanus* (Pocock, 1894), carapace, dorsal aspect (**A, B**), sternum, genital opercula and pectines, ventral aspect (**C, D**). **A, C.** ♂ (AMNH), Charbagh, Pakistan. **B, D.** ♀ (AMNH), Daggar, Pakistan. Scale bars = 5 mm.

ated on lobes; second lobe of movable finger larger than others, with correspondingly deeper notch in fixed finger; terminal denticles of fingers interlocking unevenly when closed, movable finger displaced to exterior; distinct notch near tip of fixed finger to accommodate terminal denticle of movable finger.

Trichobothria: Orthobothriotaxic, Type C, with the following segment totals (n = 42): femur, 3 (1 *d*, 1 *i*, 1 *e*); patella, 19 (2 *d*, 1 *i*, 3 *v*, 13 *e*, comprising 3 *et*, 2 *est*, 2 *em*, 2 *esb*, 5 *eb*);

chela, 26 (manus, 16, comprising 2 *D*, 10 *E*, 4 *V*; fixed finger, 10, comprising 4 *d*, 4 *e*, 2 *i*) (figs. 5–7). Total count of trichobothria per pedipalp: 48. Femur, *i* situated on dorsal surface. Patella, d_2 situated on internal surface, slightly closer to d_1 than to *i*; distance v_2–v_3 ca. half distance v_1–v_2. Chela, distance *et–est* ca. half distance *est–esb*; distance *est–esb* greater than half distance *esb–eb*; *est* aligned with *dst*; V_3 situated in proximal third of manus.

Legs: First pair of maxillary lobes (coxapophyses) tapering anteriorly, longer than, and encircling second pair. Stridulatory organs, comprising "rasp" (granular tubercles) and "scraper" (stridulatory setae or scaphotrix), present on opposing surfaces of coxae of first pair of legs and pedipalps, respectively. Legs acarinate. Femora, patellae, and tibiae, pro- and retrolateral surfaces each with scattered setiform macrosetae. Tibiae, prolateral surfaces, without spiniform macrosetae; I and II, retrolateral surfaces, each with two spiniform (*t*, *st*) macrosetae; III and IV, retrolateral surfaces, without spiniform macrosetae. Basitarsi I–IV, prolateral pedal spurs present (fig. 8); retrolateral pedal spurs absent; retrolateral margins similar, unmodified, rounded; I and II, slightly dorsoventrally compressed, III and IV terete. Basitarsi I and II, pro- and retrolateral surfaces, each with two (*t*, *sb*) spiniform macrosetae and scattered long and short setiform macrosetae; III and IV, pro- and retrolateral surfaces, each with one (*t*) spiniform macroseta and scattered long and short setiform macrosetae. Telotarsi I–IV short, stout and distally broadened in dorsal and lateral views. Laterodistal lobes rounded. Dorsomedian lobes approximately equal to laterodistal lobes; each terminating in a single setiform macroseta. Telotarsi, pro- and retrolateral surfaces, each with scattered setiform macrosetae; I and II, pro- and retrolateral surfaces, in addition with scattered microsetae. Telotarsi each with pro- and retroventral rows of spiniform macrosetae, three of which are inserted on laterodistal lobes; counts in pro- and retroventral rows equal on I and II, and on III and IV ($n = 42$): I, proventral: 4 (2–5), retroventral: 6 (4–7); II, 4 (4 or 5), 6 (4–7); III, 5 (4–6), 6 (5–7); IV, 5 (4–6), 6 (5 or 6) (tables 1, 2). Telotarsal ungues short, curved; equal to subequal on telotarsi I and II, equal on III and IV.

Sternum: Shape subpentagonal (fig. 4). Median longitudinal sulcus shallow anteriorly, deep and narrow posteriorly.

Genital operculum: Genital opercula suboval, completely divided longitudinally, partially overlapping, genital papillae present (♂, fig. 4C); subcordate, fused, genital papillae absent (♀, fig. 4D).

Hemispermatophore: Lamelliform, with complex, folded capsule and accessory distal lobe protruding between articular suture and distal lobe (hook). Distal lamina with distal crest truncate, unfolded.

Pectines: Distal edge reaching past distal edge of coxa IV but not reaching to distal edge of trochanter IV (♂, fig. 4C) or to distal edge of trochanter IV (♀, fig. 4D). First proximal median lamella (scape) of each pecten with mesial margin angular, approximately 90° (♂) or obtusely angular, greater than 90° but less than 180° (♀). Pectinal teeth straight and elongate (♂) or shorter and curved (♀), present along entire posterior margin; tooth count, 19/18 (17–21/16–19, $n = 20$) (♂), 14/15 (12–16/12–16, $n = 22$) (♀). Internal fulcral plates smooth proximally but densely setose (microsetae only) distally.

Mesosoma: Tergites each with shallow pair of submedian depressions, without obsolete median carina. Pretergites smooth and glabrous. Posttergites smooth and glabrous, sparsely and finely granular posterolaterally (♂); entirely smooth and glabrous (♀). Sternites IV–VI, each with paired longitudinal depressions prolateral to spiracles, absent on VII. Surface, sternites III–VII, smooth; VII with paired, costate ventrosubmedian and ventrolateral carinae, without posteromarginal carina. Sternite VII, length : width, 40% (32%–54%, n = 10) (♂), 55% (41%–92%, n = 11) (♀) (tables 1, 2).

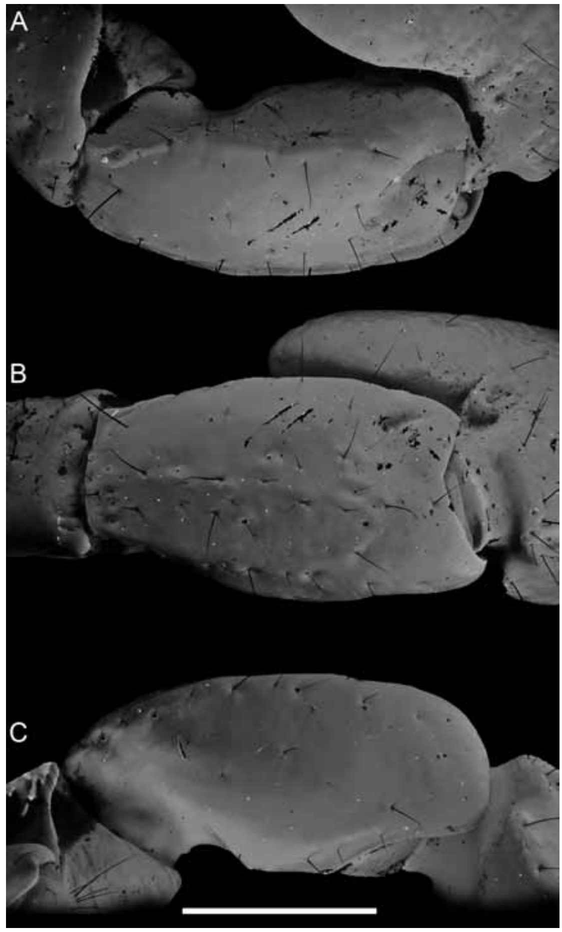

FIGURE 5. *Heterometrus latimanus* (Pocock, 1894), ♀ (AMNH), Daggar, Pakistan, dextral pedipalp patella, dorsal (**A**), retrolateral (**B**), and ventral (**C**) aspects. Scale bar = 5 mm.

Metasoma: Metasomal segments I–V progressively increasing in length, decreasing in width (fig. 3); segment V width : segment I width, 74% (71%–78%, n = 10) (♂), 70% (65%–77%, n = 11) (♀) (tables 1, 2). Metasoma fairly robust; width : length, segment I, 99% (91%–114%, n = 10) (♂), 94% (81%–103%, n = 11) (♀); II, 84% (64%–106%, n = 10) (♂), 84% (69%–99%, n = 11) (♀); III, 79% (69%–90%, n = 10) (♂), 74% (54%–86%, n = 11) (♀); IV, 72% (64%–100%, n = 10) (♂), 65% (59%–71%, n = 11) (♀); V, 43% (40%–47%, n = 10) (♂), 42% (34%–51%, n = 11) (♀). Dorsosubmedian carinae, segments I–IV, distinct, complete, costate, posterior spiniform granules obsolete; V, absent. Dorsolateral carinae, segments I–IV, distinct, complete, costate; V, obsolete, reduced to few spiniform granules. Median lateral carinae, segments I–IV, vestigial, each reduced to posterior granule, demarcated by conspicuous macroseta, at posterior margin; V, incomplete granular row, absent in posterior half of segment. Ventrolateral and ventrosubmedian carinae equally developed on all segments. Ventrolateral carinae, segments I–IV, distinct, complete, costate; V, distinct, complete, comprising spiniform granules, diverging posteriorly, terminal granule slightly larger than preceding granules. Ventrosubmedian carinae, segments I–IV, distinct, complete, costate; V, vestigial, each reduced to one or two isolated spiniform granules, demarcated by conspicuous macrosetae. Ventromedian carina, segment V, comprising single row of spiniform granules, unmodified posteriorly. Ventral surface, lateral aspect, segment IV, shallowly convex. Anal arch, segment V, dorsal carina, costate; ventral carina comprising subspiniform granules. Intercarinal surfaces, segments I–V, smooth.

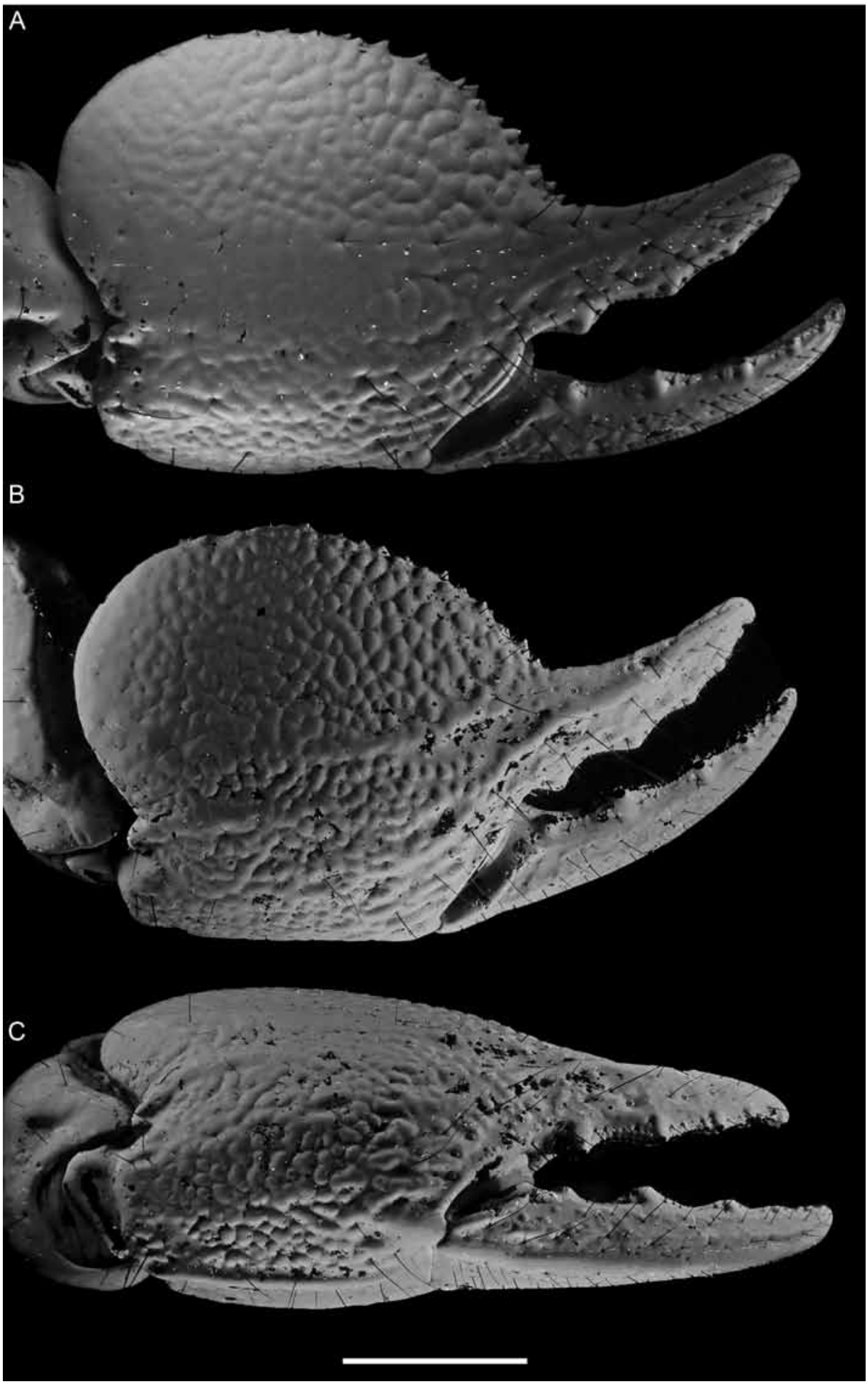

FIGURE 6. *Heterometrus latimanus* (Pocock, 1894), dextral pedipalp chela, retrodorsal (**A, B**) and retrolateral (**C**) aspects. **A.** ♂ (AMNH), **B, C.** ♀ (AMNH), Daggar, Pakistan. Scale bar = 5 mm.

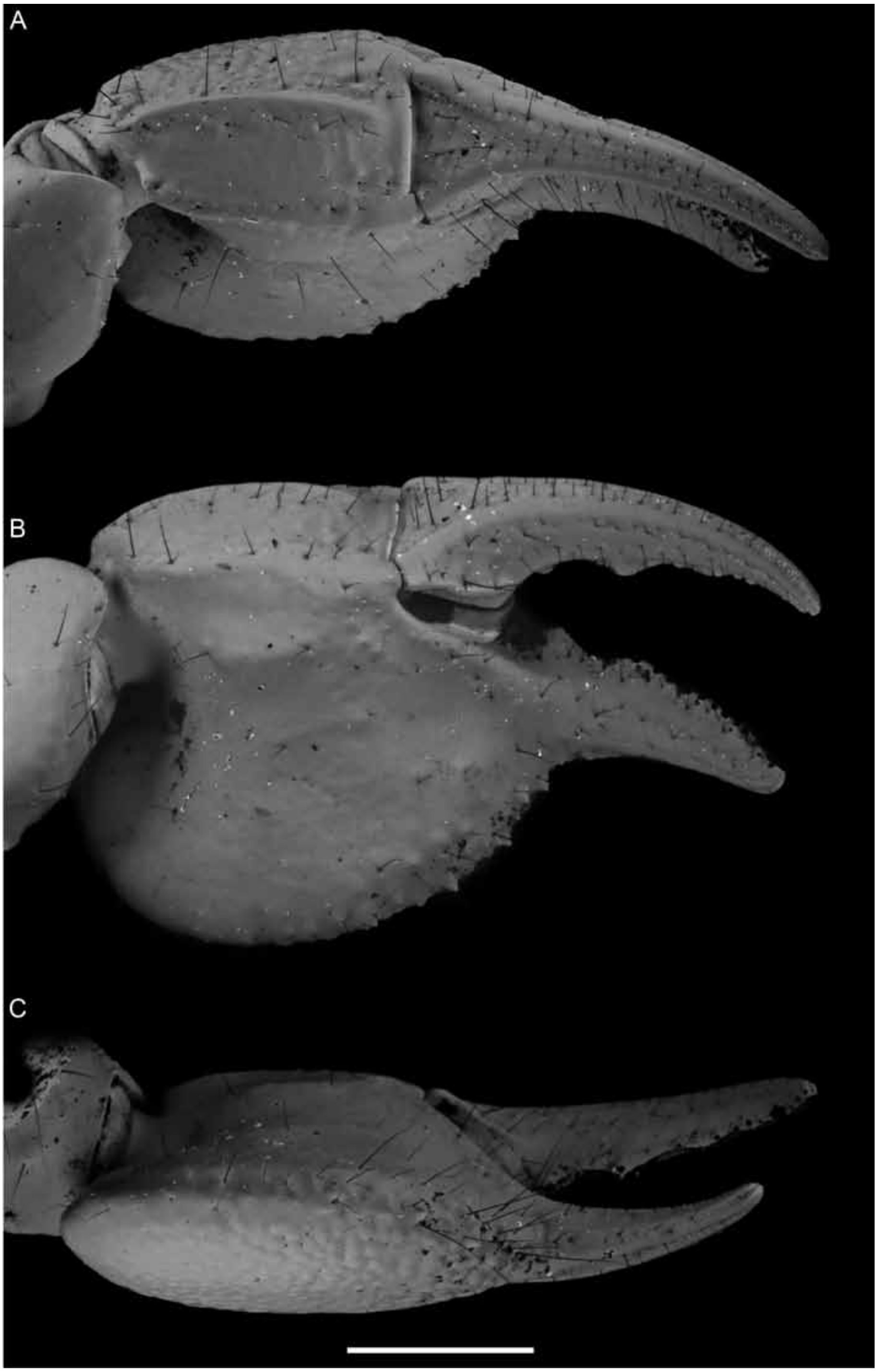

FIGURE 7. *Heterometrus latimanus* (Pocock, 1894), ♀ (AMNH), Daggar, Pakistan, dextral pedipalp chela, ventral (**A**), proventral (**B**), and prodorsal (**C**) aspects. Scale bar = 5 mm.

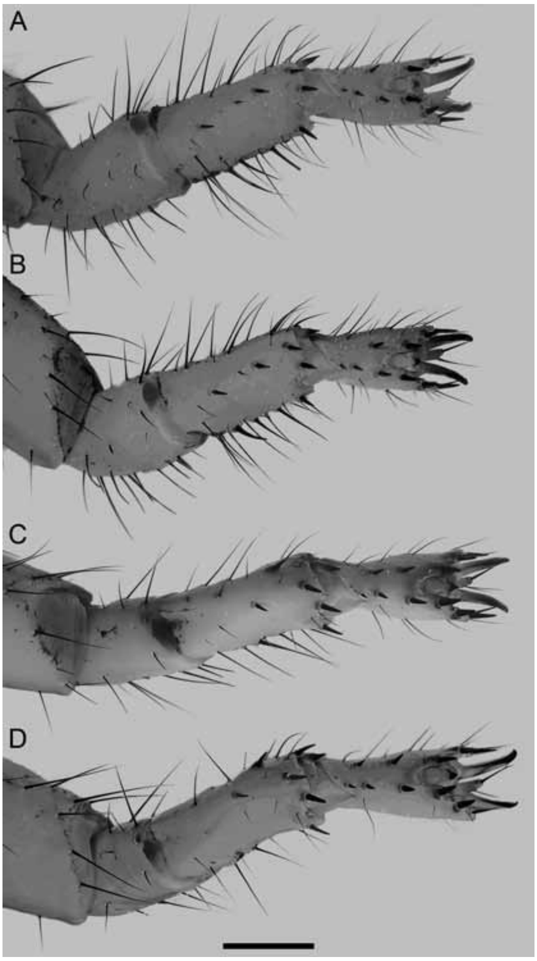

FIGURE 8. *Heterometrus latimanus* (Pocock, 1894), ♀ (AMNH), Daggar, Pakistan, legs I–IV (**A–C**), tibiae, basitarsi and telotarsi. Scale bar = 1 mm.

Telson: Vesicle width : metasomal segment V width, 116% (107%–109%, *n* = 10) (♂), 105% (99%–109%, *n* = 10) (♀); vesicle enlarged (♂), globose, vesicle height : length, 67% (64%–71%, *n* = 10) (♂), 63% (59%–69%, *n* = 10) (♀); dorsal surface flat; dorsal and lateral surfaces smooth; ventral surface evenly curved, with four longitudinal carinae, each comprising isolated spiniform granules. Aculeus relatively short, strongly curved; aculeus length : vesicle length, 43% (37%–51%, *n* = 10) (♂), 44% (34%–53%, *n* = 10) (♀). Length metasoma plus telson : total length, 56% (54%–59%, *n* = 10) (♂), 53% (50%–56%, *n* = 10) (♀).

Distribution: It is presently unknown whether the distribution of *H. latimanus* extends into India or whether it is endemic to Pakistan. The type locality of *H. latimanus* was indefinitely located in "India" (Pocock, 1894: 74), which, at the time of its description, also included Pakistani territory. Kovařík's (2004: 21; 2009: 39, 73) two female specimens of *H. latimanus* from "India" are misidentified. The new locality records reported in the present contribution are situated in Khyber Pakhtoon Khawa (Boner, Peshawar, Swat, and Upper Dir districts) and Azad Kashmir, Pakistan (fig. 1). Khatoon's (1999) poorly preserved juvenile specimen (PMNH 52) is tentatively assigned to *H. latimanus*. However, this identification requires confirmation by the collection of additional, adult specimens from Azad Kashmir. These records extend the distribution of *Heterometrus* considerably to the northwest, and west of the Indus River for the first time. The known records of *H. latimanus* appear to be isolated from other *Heterometrus* occurring on the Indian subcontinent by the Great Indian (Thar) Desert, an arid, sandy basin extending from eastern Pakistan to northwestern India. *Heterometrus* species are pelophilous (Prendini, 2001b) and associated with compacted, clayey soil, mostly in mesic habitats. No xeric and/or psammophilous species are known in the genus (Prendini et al., 2003) hence a sandy desert would probably represent a significant barrier to their dispersal.

Ecology: The new specimens of *H. latimanus* were collected under stones or on the surface at night, in rocky, forested, mountainous terrain (fig. 2) at 353–1029 m elevation. The thickened metasoma (fig. 3), short, robust legs (fig. 8) with stout, spiniform macrosetae distributed laterally and distally on the basitarsi, and curved telotarsal ungues of this species are consistent with the pelophilous ecomorphotype (Prendini, 2001b), and suggest that this species is fossorial, like many other *Heterometrus*, although the burrows were not personally observed. The ability to construct burrows has been confirmed in various Indian and Southeast Asian species (Prendini et al., 2003; Bastawade, 2004, 2005, 2006a, 2006b, 2008, 2009; Sureshan et al., 2007; Bastawade and Borkar, 2008; Javed et al., 2010; Mirza et al., 2012; Pande et al., 2012; L. Prendini, personal obs.). Burrows are constructed in loamy riverbanks and other sloping ground, in open ground, at the base of stones or among the roots of trees. Composite, multi-entranced burrows containing up to 15 related individuals of overlapping generations have been recorded in some species (Shivashankar, 1994).

Conservation: *Heterometrus latimanus* is harvested, dried, and consumed for medicinal purposes in Pakistan. The impact on wild populations is unknown, but several factors suggest that species of *Heterometrus* may in general be slow to repopulate and hence vulnerable to overharvesting (Prendini et al., 2003). Females have gestation periods up to 12 months and produce fairly small broods (30–35 young) compared with other scorpions. Young are relatively altricial, spending several months in the maternal burrow before dispersing, protracting the period before a female can give birth to her next brood. Age to sexual maturity is 4–7 years in these scorpions, during which period most juveniles experience natural predation (including cannibalism). The apparently restricted distributional ranges of species like *H. latimanus* provide further cause for concern, given that wild populations are threatened not only by harvesting but also by continued habitat destruction (e.g., agriculture, deforestation, mining, and urbanization). Many *Heterometrus* appear to be restricted to primary forest and may be regarded as equilibrium species.

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