

Redescription of the genus *Plesiobuthus* Pocock, 1900 (Scorpiones: Buthidae) from Pakistan

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(With 12 figures)

Abstract

The genus *Plesiobuthus*, long enigmatic, is redescribed based on a neotype specimen from Baluchistan (Pakistan), the same general area from which the lost holotype originated. Based on its morphological features, it is apparent that *P. paradoxus* Pocock, 1900 is psammophilic: it bears distinct setal combs (bristlecombs) on the leg tarsi, flattened and widened leg basitarsi, and long, slender unguis. Illustrations of diagnostic features are provided along with a table of morphological comparisons between *Plesiobuthus* and other psammophilic scorpions of the general region, including *Polisius*, *Anomalobuthus*, *Liobuthus*, *Psammobuthus*, and *Pectinobuthus*.

Introduction

The monotypic genus *Plesiobuthus* was described by Pocock (1900) from Northern Baluchistan, then at the northwestern border of British India (now the Baluchistan Province of Pakistan). The sole species of this genus, *P. paradoxus*, has been since collected only once (Kraepelin, 1913), also from Baluchistan and also without an exact locality.

Opinions of several subsequent authors about the validity of these taxa were likely based on the brief original description rather than on the analysis of specimens. Both Kraepelin (1905) and Werner (1934) considered it to be a synonym of *Liobuthus* Birula, 1898 from Turkmenistan. However, this synonymy was not based on comparative analysis of specimens, since no specimens of *Liobuthus* were available to the European zoologists before Vachon (1958). Stahnke (1972) included *Plesiobuthus* into his generic key of buthid scorpions; he in fact gave an original illustration (Stahnke 1972, Fig. 5), which leads us to believe that Stahnke had seen an actual specimen (perhaps the type) of this species. Both Francke (1985) and Kovařík (1998) followed Werner (1934) and listed this genus as a synonym of *Liobuthus*, while Fet (1989) and Fet & Lowe (2000) considered *Plesiobuthus* a valid genus. The genus was not listed by Sissom (1990).

The type specimen of *P. paradoxus* could not be found in the Natural History Museum (London) (P. Hillyard, pers. comm., 1996; also checked by the second author, December 2000). It is therefore lost, and maybe even never reached London, since not all scorpion material of Pocock has been deposited in the Natural History Museum. The specimen used by H. Stahnke in preparation of his 1972 key also could not be located (it is not present in the California Academy of Sciences, where Stahnke's collection is deposited; C. Griswold, pers. comm., 1996). However, we were able to locate the male specimen of *P. paradoxus* listed by Kraepelin (1913) in the collection of the Hamburg Zoological Museum; it was labeled as *Liobuthus kessleri* Birula, most likely due to the synonymy assumed by Werner (1934). This specimen matches well the few details given in Pocock's original description, and there seems to be no doubt that it is referable to this species. It consequently represents the only specimen known to exist in zoological collections. This specimen, according to its label, originated from Baluchistan, and was received in October 1912 from the Calcutta Museum. We designate this specimen as the neotype of *P. paradoxus* Pocock, and provide its redescription below.

Genus *Plesiobuthus* Pocock, 1900
(Figs 1-12)

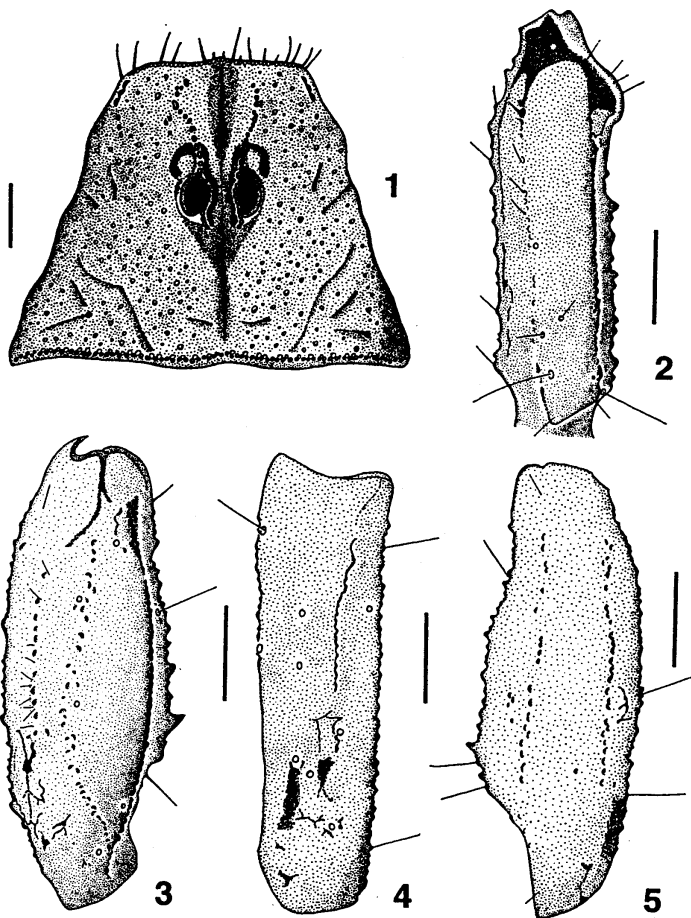
Plesiobuthus Pocock, 1900: 43-44, Figs. 11A-C; type species by original designation *Plesiobuthus paradoxus* Pocock, 1900.

Plesiobuthus: Kraepelin, 1913: 134; Birula, 1917: 164; Stahnke, 1972: 123, Fig. 5; Fet, 1989: 83; Fet & Lowe, 2000: 213.

DIAGNOSIS. The genus *Plesiobuthus* is compared to the other Asian psammophilic buthids in Table 1.

DESCRIPTION. Carapace acarinate. Tergites vestigially tricarinate. Pectines long, with high number of plates; pectinal tooth count 37-37 in male. Cheliceral dentition typical of family; movable finger of chelicera with two ventral denticles. Trichobothrial pattern of pedipalps orthobothriotaxic, Type A; femur with *beta* configuration (Vachon 1974, 1975). Pedipalp chela of average proportions, with fingers shorter (movable finger less than two times the length of the underhand). Dorsal marginal, dorsointernal, and ventroexternal carinae of pedipalp chela crenulate. Fixed and movable chela fingers with 12 slightly oblique rows of denticles, these flanked by both inner and outer accessory denticles (Fig. 7, 10); fixed finger lacking basalmost inner accessory granule; dentate margin of movable finger anomalous (Fig. 9). Movable finger anomalously shorter than fixed finger (Fig. 7). Dentate margins of chela fingers straight, lacking basal lobe on movable finger and corresponding notch on fixed finger. Tibiae and basitarsi of legs I-III with prolateral and retrolateral bristlecombs; basitarsus of leg IV with retrolateral row of finer setae, more or less arranged as bristlecomb; telotarsi with dense rows of long, curved setae on prolateral and retrolateral margins. All legs with two pedal spurs between tarsomeres I and II; prolateral pedal spur (especially on legs III and IV) much larger, single, bearing numerous long setae. Dactyl small and blunt; unguis slender, elongate, and weakly curved (Fig. 12).

Distribution. Known only from Baluchistan, Pakistan.



Figs 1-5: *Plesiobuthus paradoxus* Pocock, neotype ♂: 1 - carapace; 2 - left pedipalp femur, dorsal aspect; 3 - left pedipalp patella, dorsal aspect; 4 - left pedipalp patella, external aspect; 5 - left pedipalp patella, ventral aspect (all scale bars = 1 mm).

Plesiobuthus paradoxus Pocock, 1900
(Figs 1-12)

Plesiobuthus paradoxus Pocock, 1900: 43-44, Fig. 11A-C.

Plesiobuthus paradoxus: Kraepelin, 1913: 134; Birula, 1917: 241; Fet & Lowe, 2000: 213.

HOLOTYPE (sex uncertain) from Northern Baluchistan, now in Pakistan; depository unknown, presumed lost.

NEOTYPE (male; herein designated) from "Beludschistan" (Baluchistan, now in Pakistan), "X. 1912, Mus. Calcutta" (Zoologisches Museum Hamburg, Hamburg, Germany). The neotype is disarticulated, with the metasoma attached to the body using a straight pin; both pedipalps detached (the right one missing the femur, patella, and part of the movable finger); several legs with distal segments detached, these loose in the vial.

Distribution. Known only from Baluchistan, Pakistan.

DIAGNOSIS. Same as for the genus.

Description based on the neotype male, herein designated.

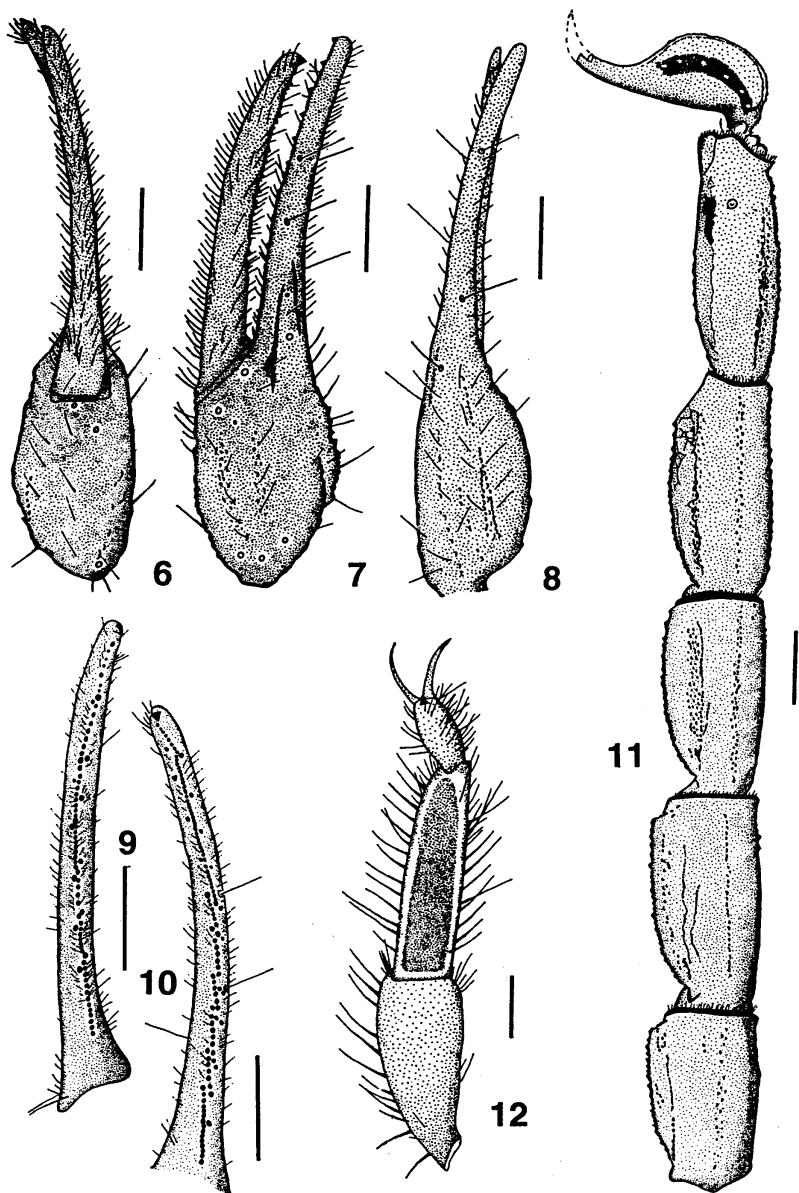
Coloration. Base coloration yellowish brown, with dorsum darker than venter. Metasomal carinae (especially on segment V) melanized; dorsal pedipalpal carinae, inner aspects of pedipalp femur and patella, anterior portion of carapace, telson, and dorsal aspects of legs with underlying dusky markings; dorsal intercarinal spaces of metasoma with dusky, reticulate pattern.

Prosoma. Carapace (Fig. 1) wider (at posterior margin) than long; without distinct carinae; moderately, densely granular. Anterior margin of carapace essentially straight but with small median projection; anteromedian furrow distinct but shallow. Ocular tubercle and median eyes relatively large. Three lateral eyes on each side. Mesosoma: tergites I-VI finely granular, tricarinate; median carina weakly developed only on posterior portions of segments I-VI; lateral carinae present on segments II-VI, each consisting of several small granules near the posterior margin; tergite VII pentacarinata, median carina smooth, lateral pairs crenulate. Pectines: long, reaching almost to trochanteral-femoral joint of leg IV; with high number of plates (37-37).

Metasoma (Fig. 11). Segments I-III wider than IV-V. Segments I-IV: dorsal median furrow shallow. Dorsal carinae feebly denticulate. Dorsolateral carinae moderate and irregularly serrate. Lateral supramedian carinae on I-III strong, granulose; on IV moderate, granulose. Lateral inframedian carinae on I vestigial, present on posterior 1/3, coarsely serrate; on II-III represented by a few posterior granules; on IV absent. Ventrolateral carinae moderately serrate. Ventral submedian carinae on I weak, smooth; on II-III moderate, smooth anteriorly with a few posterior serrations; on IV moderate, finely granular. Intercarinal surfaces with sparse granulation. Segment V: dorsolateral carinae moderate, granulose. Lateral median carinae obsolete. Ventrolateral carinae strong, serratocrenulate. Ventromedian carina strong, serrate. Ventral faces with sparse, coarse granulation; others essentially smooth. Anal lobe with 3 medium-sized denticles.

Telson (Fig. 12). Slender (narrower than segment V). Ventral aspect of vesicle moderately setose, with weak midventral keel; granulation sparse. Subaculear tubercle subtle. Aculeus broken near midpoint but apparently long and gently curved.

Chelicerae. Distal edge of manus granulose. Fixed finger with two ventral denticles, the distal much larger than the basal. Movable finger with distointernal and distoexternal teeth subequal and apposable.



Figs 6-12: *Plesiobuthus paradoxus* Pocock, neotype ♂: 6 - left pedipalp chela, ventral aspect; 7 - left pedipalp chela, external aspect; 8 - left pedipalp chela, dorsal aspect; 9 - movable finger of the pedipalp chela, 10 - fixed finger of the pedipalp chela, 11 - metasomal segments III-V and telson, left lateral aspect; 12 - left leg III, ventral aspect (all scale bars = 1 mm).

Table 1. Comparative morphology of six psammophilic genera of Buthidae from central and southern Asia (based on personal examination and Birula 1899, 1911, Vachon 1958, Fet 1987, Fet et al. 2001).

	<i>Plesiobuthus</i> Pocock, 1900 (NW Pakistan)	<i>Polisius</i> Fet et al., 2001 (E Iran)	<i>Anomalobuthus</i> Kraepelin, 1900 (Kazakhstan, Uzbekistan, Turkmenistan)	<i>Liobuthus</i> Birula, 1898 (Kazakhstan, Uzbekistan, Turkmenistan, NE Iran)	<i>Psammodbuthus</i> Birula, 1911 (Uzbekistan, Tajikistan)	<i>Pectinibuthus</i> Fet, 1984 (Turkmenistan)
Carapacial carinae	obsolete	anterior medians, superciliaries, central medians, posterior medians well developed, granular	anterior medians weak, granular; superciliaries moderate, smooth; others obsolete	obsolete	superciliaries granular; others obsolete	superciliaries granular; others obsolete or indistinct
Tergal carination	vestigially tricarinate	vestigially tricarinate	vestigially tricarinate (lateral carinae with 1-2 posterior granules)	vestigially tricarinate (lateral carinae feeble)	vestigially tricarinate (lateral carinae with 2-3 posterior granules)	vestigially monocarinate
Pectinal tooth counts	37 in male	24-25 in female	24-26 in male	12-14 in females	20 in females; 24-26 in males	39-46
Metasomal carinae	well developed, crenulated; intermediary carinae on I-III vestigial, absent on IV	well developed, crenulated; intermediary carinae vestigial on II, absent on III-IV	greatly reduced to obsolete on I-III; ventrolaterals and ventromedian crenulate on V	greatly reduced	I-III with well developed, serrated carinae; dorsal carinae reduced on IV-V	dorsolateral (on I-III), ventrolateral, and ventral submedian carinae distinct, finely crenulate
Dorsal furrow of metasoma	shallow	moderately deep	absent	moderately deep on I-III, shallow on IV-V	moderately deep	weak, complete on I-II; limited to extreme base on III-V
Metasomal morphometrics	carapace length greater than metasoma V length	carapace length less than metasoma IV length	carapace length less than or equal to metasoma III length	carapace length greater than metasoma V length	carapace length slightly less than metasoma V length	carapace length less than metasoma II length
No. of ventral denticles of chei- lateral fixed finger	two	two	one	one	one	one

Table 1 (contd.)

Trichobothrial pattern	orthobothriotaxy	orthobothriotaxy	orthobothriotaxy	additive neobothriotaxy: 6d & 4e on femur; 11e on patella	unknown	orthobothriotaxy*
Pedipalp chela morphometrics	chela of average proportions, with fingers shorter (movable finger < 2X underhand)	chela slender with long, slender fingers (movable finger > 2X length of underhand)	chela very slender, with long slender fingers (movable finger > 2X length of underhand)	chela of average proportions, with fingers shorter (movable finger < 2X underhand)	chela of average proportions, with fingers shorter (movable finger < 2X underhand)	chela very slender, with long fingers (movable finger > 2X length of underhand)
Pedipalp chela carination	dorsal marginal, dorsointernal, and ventroexternals crenulate	acarinate	acarinate	dorsal marginal, ventroexternal, dorsointernals weak, granular	acarinate	acarinate
No. of denticle rows on pedipalp chela fingers	12 slightly oblique rows	15 slightly oblique rows	10 rows, distal rows slightly oblique, basal rows essentially aligned	7 oblique rows	11 rows, essentially straight	10 rows (fixed finger), slightly oblique distally, but more or less straight basally
Inner and outer accessory denticles	both types present	both types present	inner accessories present; outer accessories absent	both types present	inner accessories present; outer accessories absent	inner accessories present; outer accessories absent
No. of accessory granules proximal to terminal denticle on movable finger	unknown	three	one or two	three	three	three
Pedal spurs	prolateral spur enlarged, single	prolateral spur enlarged, weakly bifurcate	prolateral spur enlarged, single	prolateral spur enlarged, feebly bifurcate	prolateral spur enlarged, weakly bifurcate	prolateral spur enlarged, weakly bifurcate
Tibial spurs	absent	present, but small, on III-IV	absent in females; occasionally present, but small, on IV in males	absent	present, but tibial spurs on III reduced in female	absent

* neobothriotaxy reported by Fet (1987) was erroneously based on undercounted petite trichobothria

P e d i p a l p (Figs 2-10). Orthobothriotaxic, type A; femur with β configuration. Femur: pentacarinat. Dorsointernal carina strong, serratocrenulate. Dorsoexternal carina strong, irregularly serratocrenulate. Ventroexternal carina weak proximally, moderate distally; small irregular serrations proximally, larger serrated granules distally; cluster of long setae flanking carina distally. Internal carina strong, with large, irregularly spaced subconical granules. Intercarinal spaces essentially smooth. Patella: heptacarinat. Dorsointernal carina strong, serratocrenulate. Dorsomedian carina weak, granular. Dorsoexternal carina strong, crenulate. Externomedian carina moderate, irregularly granular. Ventroexternal carina moderate, finely, irregularly serrate. Ventrointernal carina strong, coarsely serrate. Internal carina consisting of an irregular row of large, isolated, serrated granules. Intercarinal spaces smooth. Chela: manus slender, with moderately elongate fingers. Dorsal marginal and dorsal secondary carinae moderate, crenulate. Digital carina obsolete. External secondary carina weak, mostly smooth, but bearing a few raised granules. Ventroexternal carina moderate, crenulate. Ventro-median carina obsolete. Ventrointernal carina weak, with a few raised granules. Dentate margin of fixed finger (Fig. 10) composed of 12 oblique rows of granules; both inner and outer accessory granules present (except that basalmost inner accessory granule is lacking); trichobothrium *ef* just distal to fifth outer accessory denticle, *eb* at level of seventh outer accessory denticle, *dt* slightly distal to *ef* (Figs 7, 10). Dentate margin of movable finger anomalous (Fig. 9). Movable finger anomalously shorter than fixed finger (Fig. 7). Dentate margins of chela fingers straight (i.e., lacking basal lobe on movable finger and corresponding notch on fixed finger).

L e g s. Coxae finely granulated; femora distinctly carinated, patellae and tibiae weakly so. Tibial spurs lacking. Basitarsi I-III strongly compressed and widened (Fig. 12), convex above and concave below; basitarsus IV only moderately flattened and widened, without concave underside. Tibiae and basitarsi of legs I-III with prolateral and retrolateral rows of long, curved setae (bristlecombs); basitarsus of leg IV with retrolateral row of finer setae, more or less arranged as bristlecomb. Telotarsi with dense rows of long, curved setae on prolateral and retrolateral margins. All legs with two pedal spurs between tarsomeres I and II; prolateral pedal spur (especially on legs III and IV) much larger, single, bearing numerous long setae. Dactyl small and blunt; ungues slender, elongate, and weakly curved (Fig. 12).

M e a s u r e m e n t s (mm): Total body length 49.4. Carapace length 5.5. Pedipalp: femur length 5.0; patella length 5.3; palm length 3.7, width 2.0; fixed finger length 4.7; movable finger length 5.0. Mesosomal tergite lengths: 1.0; 1.0; 1.5; 1.8; 2.0; 2.2; 4.0, total mesosoma length 13.5. Metasomal segments: I, length 4.3, height 3.3, width 3.1; II, length 5.0, height 2.4, width 3.3; III, length 5.0, height 2.4, width 3.2; IV, length 5.8, height 2.0, width 2.5; V, length 5.3, height 2.0, width 2.5; telson, length 5.0, height 2.0, width 1.8; total metasoma length 30.4.

Discussion

The only species of this monotypic genus exhibits some very characteristic leg features of a psammophilic scorpion, namely flattened tarsal segments, "bristlecombs" of long setae, as well as long claws. These, however, are highly convergent features found in the psammophile scorpions which are known from many sand deserts of the world (Fet *et al.*, 1998). In features other than these adaptive morphology, *Plesiobuthus*

differs from all other genera known from the Asian sand deserts, including the genus *Liobuthus* to which it has been synonymized earlier (Table 1).

Both the neotype and the original Pocock's specimen lack any geographic data; we only know that the Pocock's specimen was collected in the Northern Baluchistan, in what is now the Baluchistan Province of Pakistan. Pocock mentioned collectors' names as "Maynard and MacMahon"; they also were collectors of other scorpions from the same area, namely *Androctonus amoreuxi baluchicus* (Pocock, 1900); *Mesobuthus macmahoni* (Pocock, 1900), *M. caucasicus persicus* (Pocock, 1899), *Hottentotta alticola nigrifrons* (Pocock, 1900), *Orthochirus fuscipes* (Pocock, 1900), and *Hemiscorpius lepturus* Peters, 1861. All these taxa represent a typical western Palaearctic desert scorpiofauna. The Baluchistan Plateau in western Pakistan lies east of the Sulaiman and Kirthar ranges, with an average elevation of about 600 m a.s.l., while mountains reach elevations of 2000-3000 m. Baluchistan receives scanty and irregular rainfall (ca. 100 mm); the temperature is very high in summer and very low in winter. Numerous deposits of alluvial sands are found in the Baluchistan Desert, and therefore local speciation of the endemic psammophilic forms is expected here as in the other sand deserts of central and southern Asia (Fet *et al.*, 1998, 2001).

Acknowledgements

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