

- Telson: ventral surface of vesicle smooth and agranular. Pedipalp chela, Fig. 532, with τV_2 submedial. Pedipalp tibia, with τd_2 closer to i than d_1 . Caudal segments: cauda III and IV with ventral and ventro-lateral keels absent to obsolete. Legs: tarsi III and IV with a ventral anterior row of 2–3 spine-like setae *penrithorum* sp. n.

SYSTEMATICS

Family Buthidae E. Simon, 1879

Subfamily Buthinae Kraepelin, 1899

Genus *Buthotus* Vachon, 1949b

Type species: *Buthus judaicus* E. Simon, 1872, by original designation.

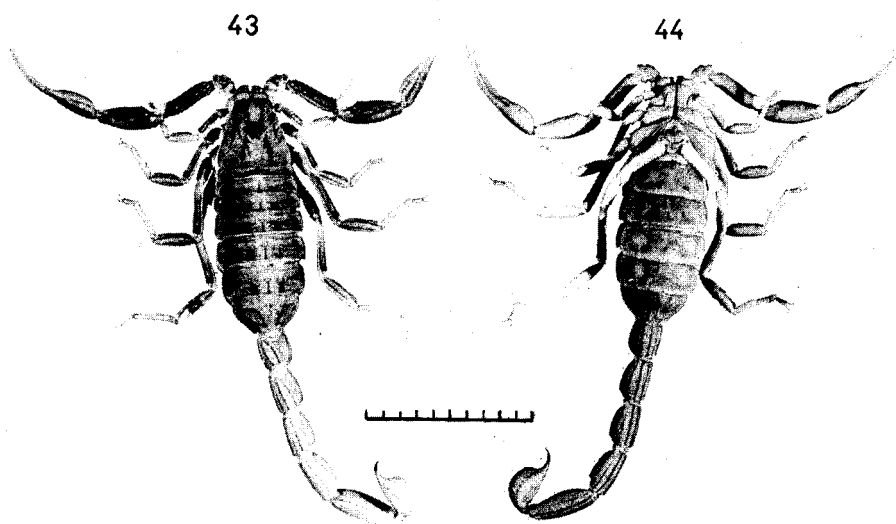
Diagnosis: Vachon (1949b: 143–145; 1952b: 229–231) and Vachon & Stockmann (1968: 89) diagnose this genus in detail.

Distribution: Angola, Namibia, northern Cape and northern Transvaal of South Africa. East Africa northwards to Ethiopia and Sudan. West Africa, North Africa, Arabia, Iran, Pakistan and India.

Buthotus arenaceus (Purcell, 1901). Figs 43–53, 56–61

Buthus arenaceus Purcell, 1901: 137–139

Diagnosis: A small species (greatest body length of adult ♂ 3.2 cm of ♀ 4.3 cm) which is most closely related to *B. conspersus* but can be distinguished from this species by having a clear halo around each trichobothrium on infuscated surfaces.



Figs 43–44. *Buthotus arenaceus*. largest ♀ from Schwarzkuppen farm (NM 10372). Scale in mm.

Description: The following account supplements Purcell's original description based on a single female.

Colour: Overall fairly uniform moderate yellow No. 87 to dark orange yellow No. 72. Tergites as in Figs 60–61, with blackening of keels in specimens from localities further north, tergites with three keels distinctly blackened and a median transverse black marking on each side stretching from lateral keel to two-thirds of distance to outer margin (Fig. 61); postero-lateral margins of tergites and their submarginal granules also blackened. In specimens from northern areas, body and appendages slightly infuscated except for well-defined clear haloes around each τ .

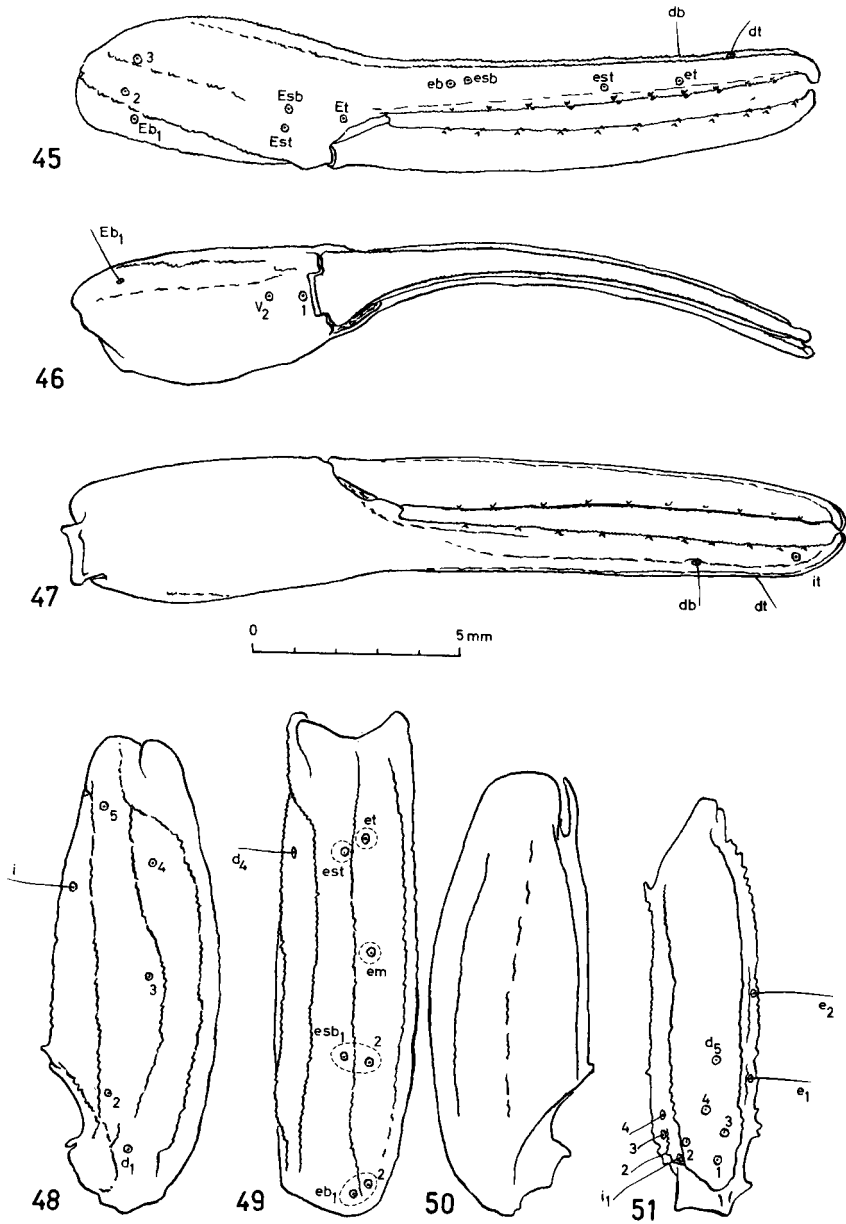
Granulation: Overall granulation of body and appendages very fine, giving a matt appearance; chelicerae agranular, smooth and shiny (Figs 58, 59). Sternites III to VII ranging from densely and finely granular over the whole surface to sparsely granular and almost smooth to shiny in some specimens; the latter conditions being more predominant in males. Femur to basitarsus of legs I–IV with well-defined keels.

Pedipalps: Keels weakly developed and distributed as in Figs 45–51.

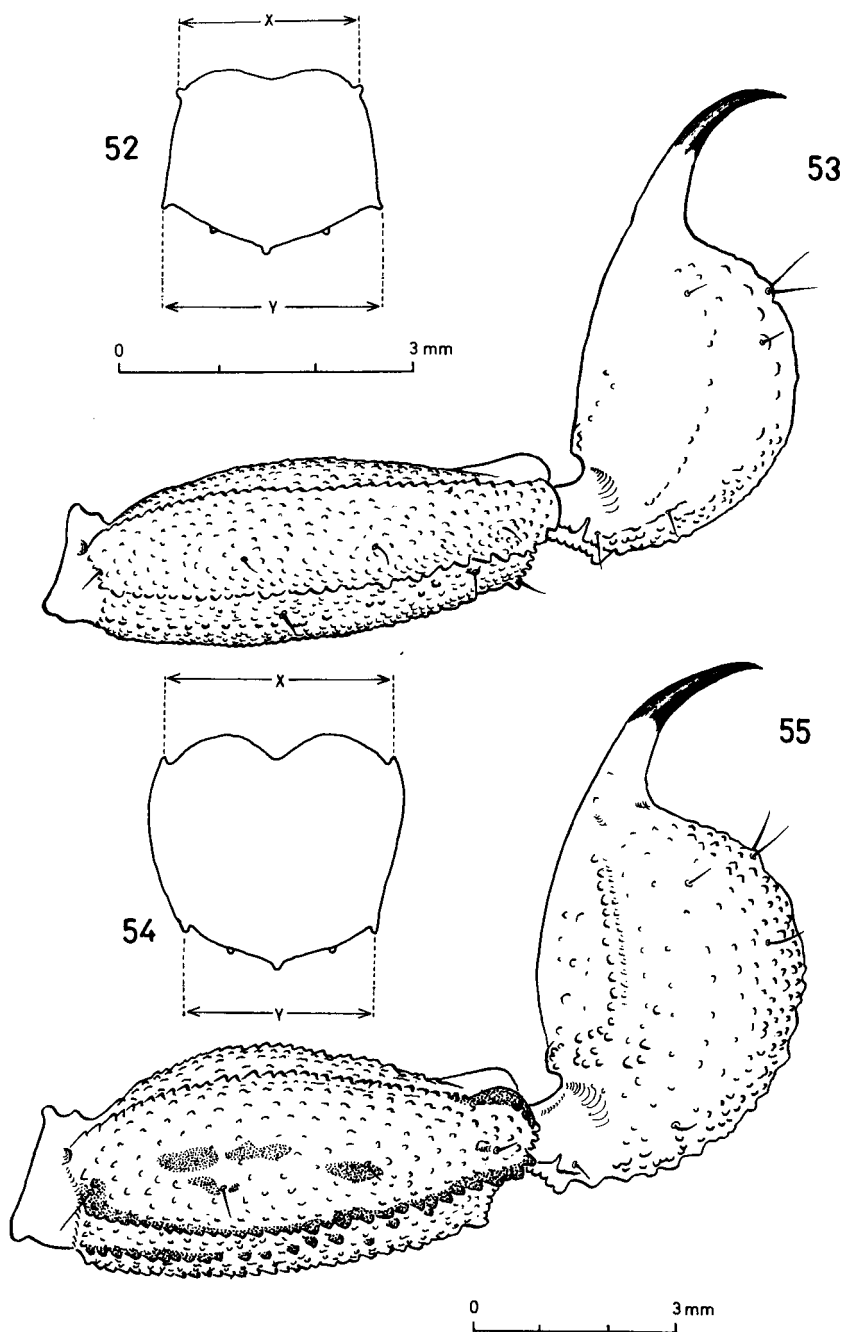
Cauda: Caudal keels moderately developed, slightly blackened in specimens from type locality, more strongly in populations further north. Cauda V and telson as in Figs 52, 53. Ventral and lateral sides of telson vesicle with fewer granules than in *conspersus*. Telson vesicle proportionately smaller than *conspersus*. Cauda V with dorso- and ventro-lateral keels sub-parallel and median cross-section sub-trapezoidal with long base on ventral side, i.e. mean ratio of transverse median distances of dorso-lateral over ventro-lateral keels (x/y in Fig. 52) equal to 0,85 (0,80–0,90). These two form very good diagnostic characters. Cauda I with width/length ratio 1,01 (0,95–1,05, SD = 0,014) for ♂, 1,08 (1,03–1,14, SD = 0,02) for ♀ (Fig. 56). Ten specimens of comparable size from Louws-hoop and Schwarzkuppen farms compared with topotypical material, for mean cauda I width/length ratio do not differ significantly at either the 0,1 or 0,5 levels (using Student's *t* tests) and the slight differences in ratio are consistent with normal intraspecific variations. The absence of a regression in the values plotted indicates that width/length ratios are not subject to allometric growth and that they represent a good diagnostic character. Fig. 56 shows that there is a slight degree of sexual dimorphism. Lawrence (1927: 71) states that in *B. arenaceus* caudal segment V is not quite twice as long as I. Vachon & Stockmann (1968: 136) used this information in their key to distinguish *arenaceus* and *conspersus* from *aeratus*. In 30 specimens of *arenaceus* the ratio length cauda V/length cauda I is 2,18 (2,05–2,33); in 30 specimens collected near the Kunene River (the type locality of *aeratus*) this ratio is 2,25 (2,17–2,40) while in 10 specimens from mid-western Namibia (where the type of *conspersus* is presumed to have been collected) it is 2,26 (2,17–2,37). The above overlaps indicate that this ratio cannot be diagnostic for either of the Namibian *Buthotus*.

Pectines: ♂ 21–24, ♀ 16–19 teeth per pecten

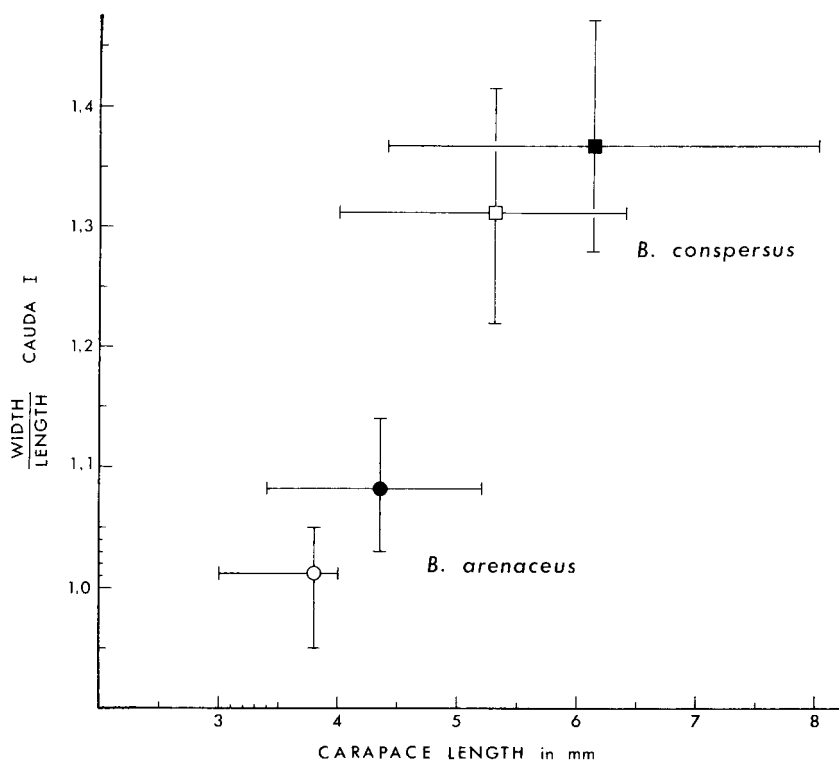
Trichobothria: As in Figs 45–51. My observations on the distribution of τ in the two species occurring in Namibia confirm those of Vachon & Stockmann (1968: 83–84) for other species of the genus, namely that the number of τ is fixed and



Figs 45-51. *Buthotus arenaceus*, ♀ (NM 10377). 45-47, right hand; 45, outer aspect; 46, ventral aspect; 47, inner aspect; 48-50, right pedipalp tibia; 48, dorsal aspect; 49, outer aspect; 50, ventral aspect; 51, right pedipalp femur, dorsal aspect.



Figs 52-55. *Buthotus* species. 52-53, *B. arenaceus*, ♀ (NM 10377); 52, outline of median cross-section of cauda V; 53, left lateral aspect of telson and cauda V; 54-55, *B. conspersus*, ♀ (NM 10021); 54, outline of median cross-section of cauda V; 55, left lateral aspect of telson and cauda V.



smooth sternites. Populations in the northern regions of the species range are darker than those in the South.

Measurements: Taken from larger topotypes (in mm). ♂: carapace length 4,0, posterior width 4,2; length of handback: 2,5, of movable finger 4,9; handback width 1,4; length of caudal segments, I 2,0, II 2,5, III 2,7, IV 3,0, V 4,3, of telson 4,6; widths of these segments 2,2, 1,9, 1,8, 1,8, 1,8, 1,8; total body length 34,6. ♀: carapace length 5,2, posterior width 5,5; length of handback 2,9; of movable finger 5,9; handback width 1,7; lengths of caudal segments, I 2,4, II 2,8, III 3,2, IV 3,6, V 5,2, of telson 5,5; width of these segments 2,7, 2,4, 2,2, 2,2, 2,2, 2,2; total body length 42,0.

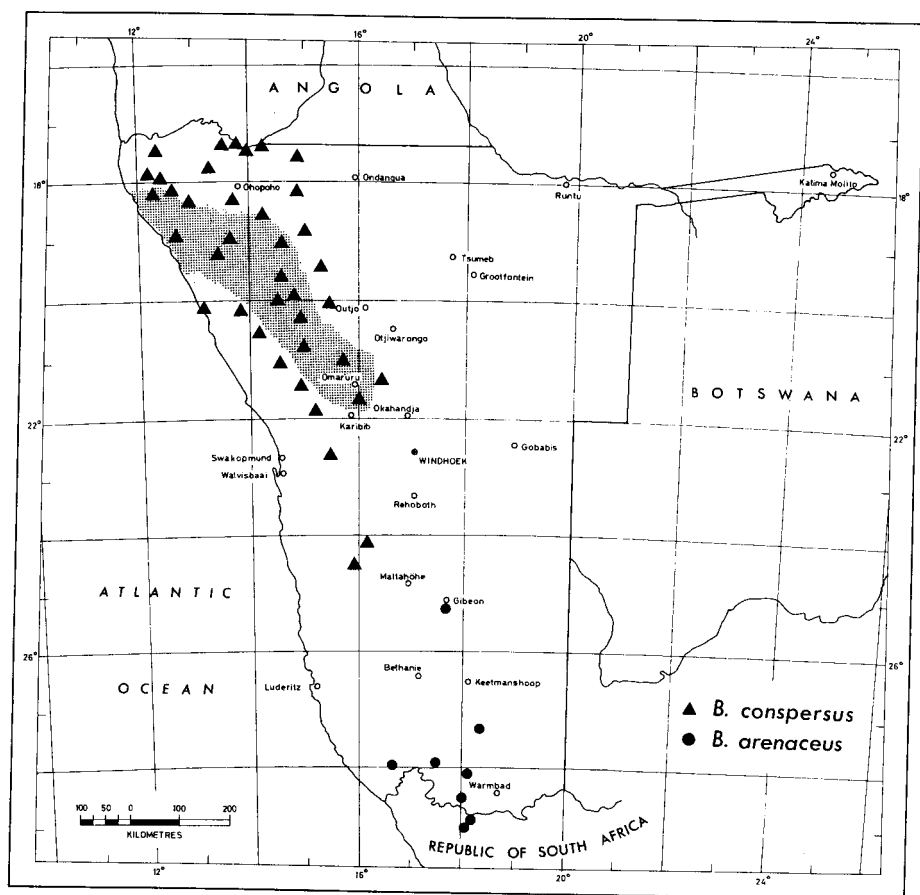


Fig. 57. Distribution of *Buthotus conspersus* and *B. arenaceus*. The stippled area of the map shows the central transition region of the species range of *B. conspersus* in which the number of pectinal teeth and other characters fluctuate most. Localities listed under (ii) and (iii) in the list of *B. conspersus* material examined fall within this stippled area.

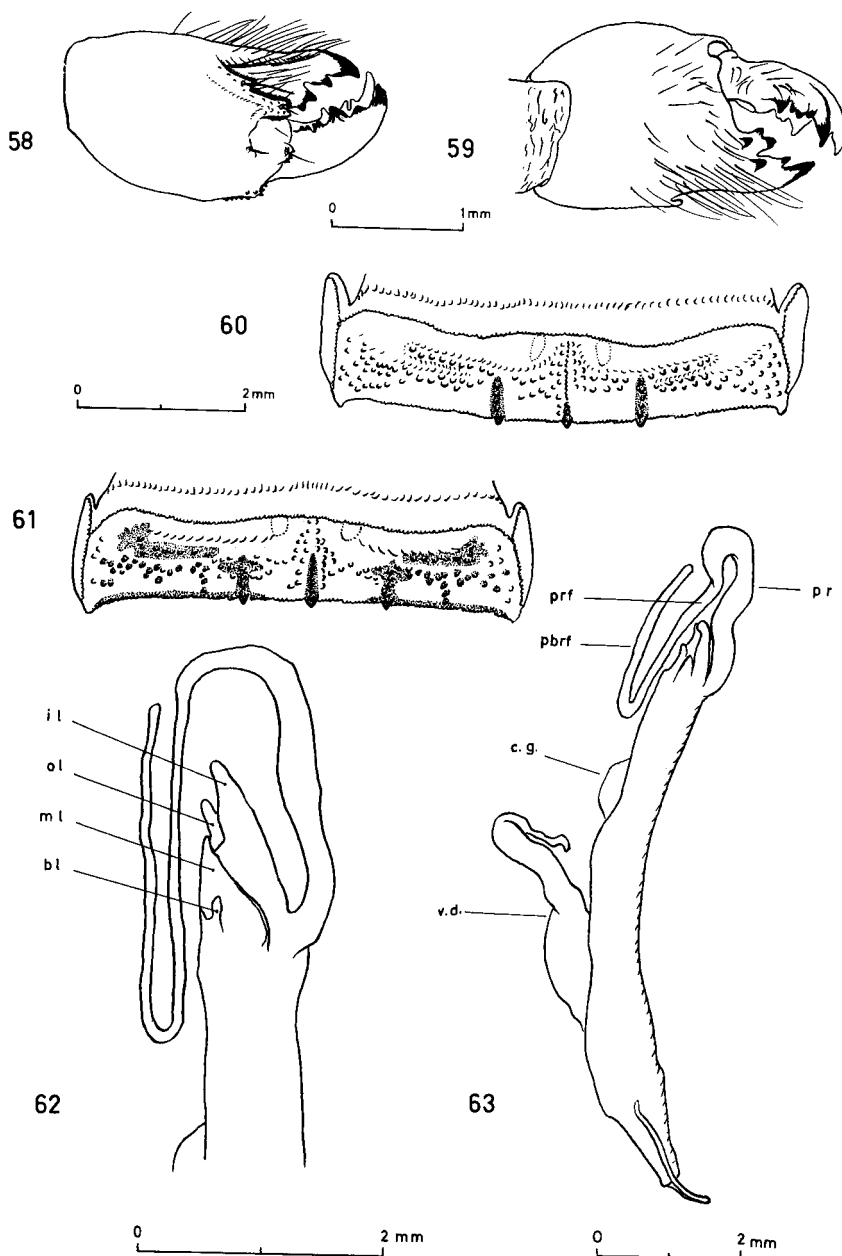
Type material: Purcell's ♀ holotype is in bad condition as it was allowed to dry and was badly damaged by mould which has destroyed all tissues, dismembered it and rendered the cuticle soft and translucent. As a result of this the type looks very much like a discarded exuvium. I was able to collect a small but good series of specimens from the type locality (29° 04' S, 18° 06' E, 21 km S.W. of Goodhouse, N. Cape, S. Africa) and pairs of these topotypes have been deposited in the South African Museum, Transvaal Museum and Museum national d'Histoire naturelle, Paris. The balance of the topotypes are in the Natal Museum collection (NM 10377).

Material examined: SOUTH AFRICA: ♀ holotype, 29° 04' S, 18° 06' E between Henkries and Wolftoon, Koa Valley northern Cape, Feb 1901, M. Schlechter (SAM, No. 2206). 8 ♂ 12 ♀ 1 juv ♀ topotypes, 29–31 Jan 1973, B. Lamoral (NM 10377 5 ♂ 10 ♀) (SAM 1 ♂ 1 ♀) (TM 1 ♂ 1 ♀) (MNHP 1 ♂ 1 ♀); 1 ♀, 29° 00' S, 18° 13' E, ± 13 km south of Goodhouse, N.W. Cape, B. Lamoral (NM 10378). NAMIBIA: 1 ♀, Ai-Ais, N. Hoon (SMN 102); 3 ♂ 2 ♀, 3 km west of Rosh Pinah, 17 Feb 1973, B. Lamoral (NM 10369); 6 ♂ 14 ♀, Louwshoop farm, 3 Feb 1973, B. Lamoral (NM 10373); 7 ♂ 7 ♀, Schwarzkuppen farm, 8 Feb 1973, B. Lamoral (NM 10372); 1 ♀ 1 ♂, Belda farm, 28 Jan 1973, B. Lamoral (NM 10371 & 10370).

Distribution: As in Fig. 57.

Bionomics: Nocturnal. Most specimens were collected at night resting on raised sand surfaces at the base of small succulent shrubs such as *Euphorbia* and *Ruschia* spp., or slightly larger shrubs such as *Catophractes* and *Rhigozum* spp. in areas of vegetation types 3A and 9 (Fig. 4). Being such small scorpions it is virtually impossible to spot them at night with ordinary field light and all specimens were caught by using ultra-violet light. No specimens were ever found under rocks on sandy surfaces. Specimens caught, marked and replaced where they had been found at night were dug out the following day from shallow burrows (6–10 cm deep) around the base of the shrubs referred to above). The entrances to these burrows were in all cases impossible to detect as they were closed up with sand. Further tracking of marked specimens indicated that females are fairly sedentary, having been recaptured under the same shrubs on three consecutive nights, whereas males move about more since no specimens were recaptured under the same shrub.

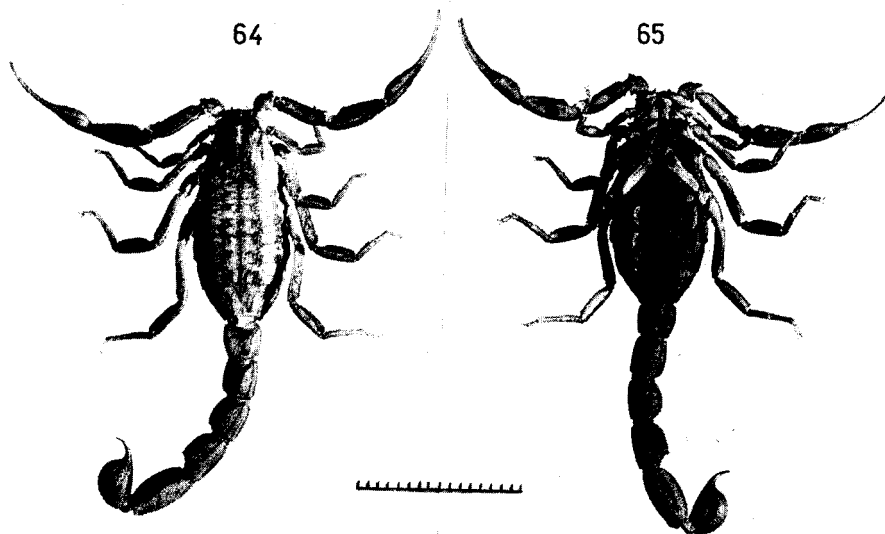
Remarks: In their revision of the genus *Buthotus*, Vachon & Stockmann (1968: 97–99) described, figured (Fig. 15) and accepted Lawrence's determination of a female specimen from the Natal Museum collection (NM 9045) as *Buthotus arenaceus* collected from the Brandberg Mountains in Namibia. Re-examination of the specimen revealed that it is a typical example of *B. conspersus* and in the ensuing treatment of this species I have selected it as a homotype of Thorell's species.



Figs 58–63. 58–61, *Buthotus arenceus*, ♀. 58–60, specimen from type locality, N. Cape, South Africa (NM 10377); 58–59, right chelicera; 58, dorsal aspect; 59, ventral aspect; 60, tergite IV; 61, tergite IV, specimen from southern Namibia (NM 10372); 62–63, *Buthotus conspersus* ♂ (NM 10409); 62, distal outer aspect of left hemispermatophore; 63, outer aspect of left paraxial organ.

Buthotus conspersus (Thorell, 1877). Figs 54–57, 62–71*Buthus conspersus* Thorell, 1877: 41–44.*Buthus angolensis* Monard, 1930: 38; Vachon & Stockmann, 1968: 94.*Buthus conspersus aeratus* Lawrence, 1927: 69; *Buthus aeratus*, Lawrence, 1955: 207; *Buthotus aeratus*, Vachon & Stockmann, 1968: 94. *Syn. n.*

Diagnosis: An average to large species (body length of adult ♂ 4,0–5,5 cm of ♀ 4,7–6,2 cm) which is most closely related to *B. arenaceus* but can be separated from it by having the base of each trichobothrium partly or completely encircled with a black spot.



Figs 64–65. *Buthotus conspersus*, ♀ from Kaoko Otavi (SMN 203) with 18 teeth on pectine.
Scale in mm.

Description: The following account supplements Thorell's original description based on a single female.

Colour: Based on homotype but with variation in specimens from northern regions of range added in brackets. Overall coloration, fairly uniform dark orange yellow No. 72 (moderate yellowish-brown No. 77 with cauda III–V turning gradually to moderate-brown No. 58 and telson strong-brown No. 55). All keels on body and appendages only faintly blackened, excepting carapace, median and lateral keels of tergites (these more pronounced in northern specimens). Tergites I to VI with five distinct longitudinal black markings confined to the posterior half of each tergite (spread into distinct bands almost extending from the anterior to the posterior margins of each tergite), legs I to IV lightly to moderately infuscated and motley. Base of each τ on pedipalps always partly or completely encircled with a black spot.

Granulation: Overall as in *arenaceus*. Keels of pedipalp hand, tibia and femur well-developed, composed of granules as large as those of the caudal keels.

Femur, tibia and basitarsus of legs I–IV with well-defined keels. In most females from the northern region of the species range, sternites III–V tend to be smooth and shiny to only partially granular.

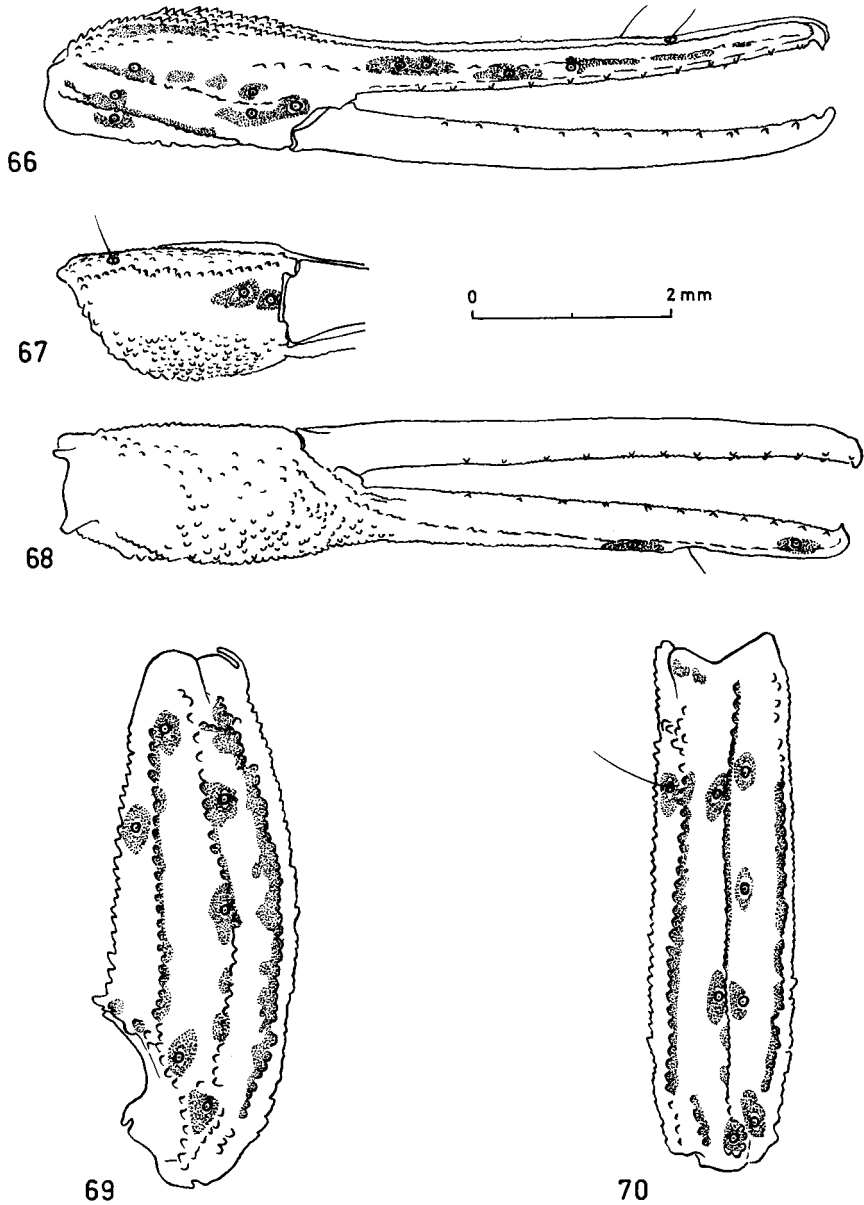
Cauda: Caudal keels well-developed. Dorsal and dorso-lateral keels of cauda I–IV with an enlarged terminal tooth posteriorly. Ventral and ventro-lateral keels of cauda II–V sparsely blackened in southern and central regions, becoming continuously and boldly blackened in northern regions of the range. Keels of cauda I unblackened except for two dark small spots on ventrals. Cauda V and telson as in Figs 54–55, Cauda V with dorso- and ventro-lateral keels clearly diverging away from each other medially (Fig. 55); median cross-section of cauda V sub-trapezoidal in outline with the long base on the dorsal side, i.e. mean ratio of transverse median distances of dorso-lateral over ventro-lateral keels (x/y in Fig. 54) 1,15 (1,10–1,20). Cauda I with width/length ratio 1,31 (1,22–1,42, SD = 0,02) for ♂, 1,37 (1,28–1,47, SD = 0,014) for ♀ (Fig. 56). Eight specimens of comparable size from the Brandberg Mts region (the locality of the homotype and presumably not far from the type locality of *conspersus*) compared with eight specimens from Kaoko Otavi area (not far from the type locality of Lawrence's *aeratus*) for cauda I width/length ratio, do not differ significantly at either the 0,1 or 0,5 levels (using Student's *t* test). The slight differences in ratios (1,327 at Brandberg and 1,343 at Kaoko Otavi) are consistent with normal intrapopulation variations and do not support a specific or subspecific separation of northern specimens (*B. aeratus*) from the southern (*B. conspersus*), but merely represent two extremes of a cline. The absence of a regression in the values plotted indicates that width/length ratios are not subject to allometric growth and that they represent a good diagnostic character. Fig. 56 shows that there is a slight sexual dimorphism. Lawrence (1927: 71) stated that cauda V in *B. aeratus* 'is more than twice the length of I, while in the other two forms it is not quite twice as long'. I have shown in the section dealing with the cauda of *B. arenaceus* that length of cauda V/cauda I is not diagnostic for any of the species of *Buthotus* from Namibia.

Trichobothria: As in Figs 66–70.

Hemispermaphore: As in Figs 62–63.

Pectines: Males 19–28 teeth and females 13–20 teeth per pecten. In the southern regions of the species range, the number of teeth per pecten is usually 19–21 for males and 13–15 for females while in the northern regions it is 24–28 for males and 18–20 for females. In all the areas between these two regions the number of pectinal teeth fluctuates gradually with no evidence of discontinuities that might suggest that we are dealing with different subspecies. To retain *aeratus* as a subspecies of *conspersus* on the basis of a difference in the number of pectinal teeth is thus not warranted. In the list of 'material examined' given below localities listed under (i) are from the southern regions, (ii) and (iii) from intermediary regions and (iv) from the northern and north-eastern regions of the species range in Namibia. In specimens listed under (ii) and (iii) the number of teeth per pecten fluctuates from 21–24 in males and 15–19 in females.

Haemolymph electrophoresis: Four samples of haemolymph were drawn from



Figs 66–70. *Buthotus conspersus*, ♀ (NM 9045). 66–68, right hand; 66, outer aspect; 67, ventral aspect; 68, inner aspect; 69–70, right pedipalp tibia; 69, dorsal aspect; 70, outer aspect.

specimens (2 ♂ & 2 ♀) collected at each of four different localities selected so as to represent a transect through the north-south distribution of *B. conspersus*. The four localities were: (1) farm Narib 4, Maltahöhe district (one of the more southern localities recorded); (2) farm Vrede 719, Damaraland (just south of the central transition region of the species range); (3) Sesfontein, northern Damaraland (in the middle of the central transition region of the species range); (4) Opuwa, central Kaokoland (north of the central transition region of the species range). Fig. 71 represents one of the phoregrams for a female from farm Vrede. The 16 phoregrams obtained demonstrated no significant differences. This result further indicates that *B. aeratus* is conspecific with *conspersus* and that *aeratus* should not be retained as a separate taxon. The significance of phoregrams as a diagnostic character in the genus *Buthotus* is discussed at length by Goyffon *et al.* (1973) who show that phoregrams from north African species and subspecies of *Buthotus* exhibit marked differences in the R_M values of the bands of different taxa. In his work involving the use of phoregrams from taxa of the family Buthidae, Goyffon (pers. comm.) found that the phoregrams of all the species studied consistently contain a band with an R_M smaller than 0,45 which is absent in species of all other families. Goyffon has termed this band the 'buthid band'. Band 7 in Fig. 71 is the buthid band and its R_M value is always 0,39 in *B. conspersus*.

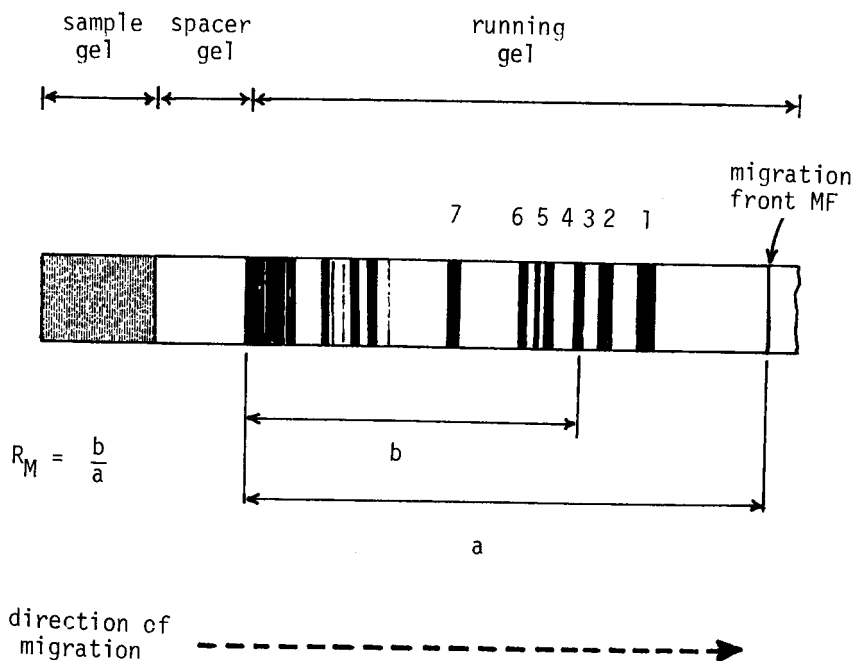


Fig. 71. Diagrammatic representation of a phoregram of *Buthotus conspersus*.

Variation: Sexual dimorphism: Males differing very little from females except in: total body length 15% shorter in adults; only slightly more slender than ♀, mean ratio sternite V width/carapace length 1,21 for ♂ and 1,25 for ♀; ♂ 19–28 and ♀ 13–20 teeth per pecten.

Intraspecific variation: Tergites I to VI with five distinct longitudinal black markings confined to posterior half of tergites in specimens from southern regions of range but spread into distinct bands almost extending from anterior to posterior margins of each tergite in specimens from northern regions. Specimens from the latter larger, darker yellow to brown in overall coloration with cauda IV, V and telson darkening from brown to dark-brown, this tendency being accentuated even more in specimens from Angola. The number and distribution of the very fine granules on the sternites are subject to variation within single populations while there is a tendency among many of the females in the northern regions of the range to have almost smooth and shiny sternites.

Type material: Thorell's ♀ holotype is in the Naturhistoriska Riksmuseet in Copenhagen, but was mislabelled and lost for many years. On receiving my request for this type material, the Curator of the collection discovered a specimen labelled *Buthus polystictus* Pocock (not in Thorell's handwriting) together with a label identifying the collecting locality as 'Caffraria' and the collector as 'Wahlberg 1840–1845' and two other small labels bearing the numbers '148' and '16'. Thorell's type was collected by Wahlberg in 1840–5 in South West Africa (= 'Caffraria' of Wahlberg). The measurements of the specimen referred to above correspond very closely with those given for the type of *B. conspersus* by Thorell, and the morphological characters agree very well with his description. On these grounds there is little doubt that the specimen is in fact Thorell's type. It agrees very well also with material I have studied from the Brandberg Mountains, and accordingly I have selected a ♀ from this locality (NM 9045) in the Natal Museum Collection as homotype. It also seems reasonable on the basis of the above to assume that the type locality of *conspersus* is south of the Brandberg Mountains.

Material examined: ♀ holotype, Caffraria, 1840–5, J. Wahlberg (Naturhistoriska Riksmuseets Copenhagen, Entomologiska Afdeling no. 148/16).

(i)

1 ♀, Brandberg, Numas Vallei, 2 Aug 1970 C. Coetzee (SMN 99); 1 ♀ 2 juv ♂, Farm Sesriem, June 1973, G. Sander (NM 10379); 1 ♂, Brandberg, Numaskloof, 16 Aug 1969, P. Buys (NM 10411); 1 ♀, Torrabaai, Nov 1961, W. Steyn (SMN 169); 1 juv ♀, Northern valley, Brandberg Mts, 20 Feb 1969, B. Lamoral (NM 10016); 1 ♂, Klein Spitzkoppe farm, F. Gaerdes (NM 10408); 1 ♀ subad 1 juv ♀, Brandberg, Numaskloof, 16 Aug 1969, P. Buys (SMN 96); 1 ♀ homotype, Brandberg, June 1963, F. Gaerdes (NM 9045); 2 ♂ 7 ♀, from Narib 4, 9 Mar 1976, B. Lamoral (NM 10844).

(ii)

1 ♀, Onguati, 24 Feb 1962, E. von Koenen, (SMN 110); 1 ♂, Hoas 273, 11 May 1973, M-L. Penrith (SMN 444); 1 ♂ 3 ♀ 1 ♂ subad, Annabis farm, 24-25 Feb 1969, B. Lamoral (NM 10020); 2 ♂ 1 ♀ subad, Khorixas (formerly Welwitchia), Aug 1960, F. Gaerdes (NM 7322).

(iii)

1 ♀, Ugab River Bridge, 21 Feb 1969, B. Lamoral (NM 10021); 1 ♂, Otjitundua, 28 Nov 1970 (SMN 210); 1 ♀ subad, Marienfluss, 2-3 km S. Otjinungwa, 22 Nov 1970, E. Motgoabone (SMN 224); 1 ♂, Onverwag 412, 8 May 1973, M-L. Penrith (SMN 445); 1 ♀, Otjinungwa, N. Kaokoveld, 22 Nov 1970, P. Olivier (SMN 234); 6 ♂ 11 ♀, farm Vrede 719, 31 Mar 1976, B. Lamoral (NM 10843).

(iv)

1 ♀, farm Tsuwandes 107, Apr 1973, G. Sander (NM 10376); 7 ♂ 7 ♀ 1 juv ♀, Kaoko Otavi, Rocky Hill, 27 Nov 1970, J. Batista (SMN 203); 1 ♀ 4 ♂ subad 3 juv ♀, Ondarusu, 23-25 Aug 1973, J.B. (SMN 473); 2 ♂ 5 ♀, Ondarusu Falls, Kaokoveld, 18 Oct 1971, M. J. Penrith (SMN 447-8); 1 ♂, 8 km NE Omatjenguna, 24 Nov 1970, P. Olivier (SMN 228); 1 ♂ 1 ♀ subad, Orupembe, 17 Aug 1973, J. Batista (NM 10410); 1 ♀, 25 m SW of Orupembe Kaokoveld, 2 Oct 1965, P. Swart (SMN 119); 1 juv ♂, Orupembe = Anabib, 25 Nov 1970, P. Olivier (SMN 244); 1 ♀ 1 juv ♀, W of Hartmansberge, 18 Aug 1973 (SMN 462); 2 ♂ 2 subad ♀, Orupembe, 17 Aug 1973, J.B. (SMN 459); 1 ♂ juv, 45 miles W of Ondarusu Falls, Kaokoveld, 26 Oct 1971, M. Penrith (SMN 450); 1 ♀ subad, N of Orupembe, 18 Aug 1973, M-L. Penrith (SMN 460); 1 ♂ juv, Otjinungwa, 22 Nov 1970, P. Olivier (SMN 251); 1 ♂ 1 ♀, Ondarusu, near Kunene River, 23-26 Aug 1973, J. Batista (NM 10409); 1 ♀ 1 ♂ subad, Ondarusu, 23-26 Aug 1973, J.B. (SMN 472); 1 ♀ 1 ♀ subad, Ruacana, 26-27 Aug 1973, M-L. Penrith (SMN 474); 1 ♂, Swartboys Drift, Kunene River, Dec-Feb 1972, J. Menge (TM 10440); 1 ♀, N of Orupembe, 19 Aug 1973, E.M. (SMN 466); 1 ♂, W of Hartmansberge, 18 Aug 1973, M-L. Penrith (SMN 461); 1 juv ♀, Okonjombo (now Nowantes), Kaokoveld, 26 Nov 1970, P. Olivier (SMN 255); 1 ♂ Otjinungwa, 21 Nov 1970, P. Olivier (SMN 245); 3 ♀, Kunene River, Nov 1960, F. Gaerdes (NM 7327); 1 ♂ 1 ♀, Kaoko Otavi, Rocky Hill, 27 Nov 1970, J. Batista (NM 10412); 6 ♂ 11 ♀, 10 km W of Sesfontein, 4 Apr 1976, B. Lamoral (NM 10841); 32 ♀ 22 ♂, 3 km N of Sesfontein, 3 Apr 1976, B. Lamoral (NM 10842).

Distribution: Fig. 57 shows the distribution in Namibia. The northernmost limit of the species range is central Angola.

Bionomics: Nocturnal, but specimens were occasionally seen moving about during daytime in the shade of trees. Most specimens captured in the southern and central region of the species range in Namibia were found under large stones and boulders on sandy to sandy-loam soils in areas of vegetation types 1, 2 and 4 (Fig. 4). Further north, wherever these types of habitats are absent and the vegetation changes to type 5, specimens were usually found under the coarse bark of dead trees or under dead trees lying on the ground. Even further north,

on the fringe of the Moçamedes desert in Angola, where the vegetation is transitional between types 1 and 5, most specimens were found under rocks, even though other potential microhabitats are available. This suggests that rocks and boulders on the ground are the preferred habitat and that dead trees are used as an alternative.

Remarks: Vachon & Stockmann (1968: 96) state that the taxonomic history of *B. conspersus* is complex. This is largely due to the fact that Thorell's type had remained undetected through mislabelling and thus unavailable. The problems of synonymy have now been resolved and there is no doubt that *conspersus* is valid.

Genus *Karasbergia* Hewitt, 1913

Type species: *Karasbergia methueni* Hewitt, 1913, by monotypy.

Diagnosis: At present monotypic, *Karasbergia* can be separated from all other genera of the family Buthidae by the following combination of characters: sternum subpentagonal in outline (Fig. 81); antero-lateral margins of carapace on either side predominantly with two lateral eyes in adults but a third smaller eye occasionally present (Fig. 80); distal end of hemispermatophore of male with a *pars recta* to flagellum but no *pars reflecta* (Figs 85–86); τd_2 of femur and tibia missing (Figs 78–79); male genital aperture without genital papillae; granular rows of movable finger of pedipalp chela with an inner but no outer flanking series; size very small, adults not exceeding 2.3 cm in total body length. In addition there are no teeth on the ventral proximal margin of the fixed finger of chelicera, this character being found only in species of the genus *Uroplectes* in subfamily Buthinae. Dorsal and lateral surfaces of leg I–IV, pedipalp tibia and hand without keels.

Distribution: To date recorded only from localities between 25° and 29° S in Namibia and North-western Cape Province of South Africa. The easternmost record is approximately 21° E. *Karasbergia* is therefore predominantly endemic to the south-central regions of Namibia.

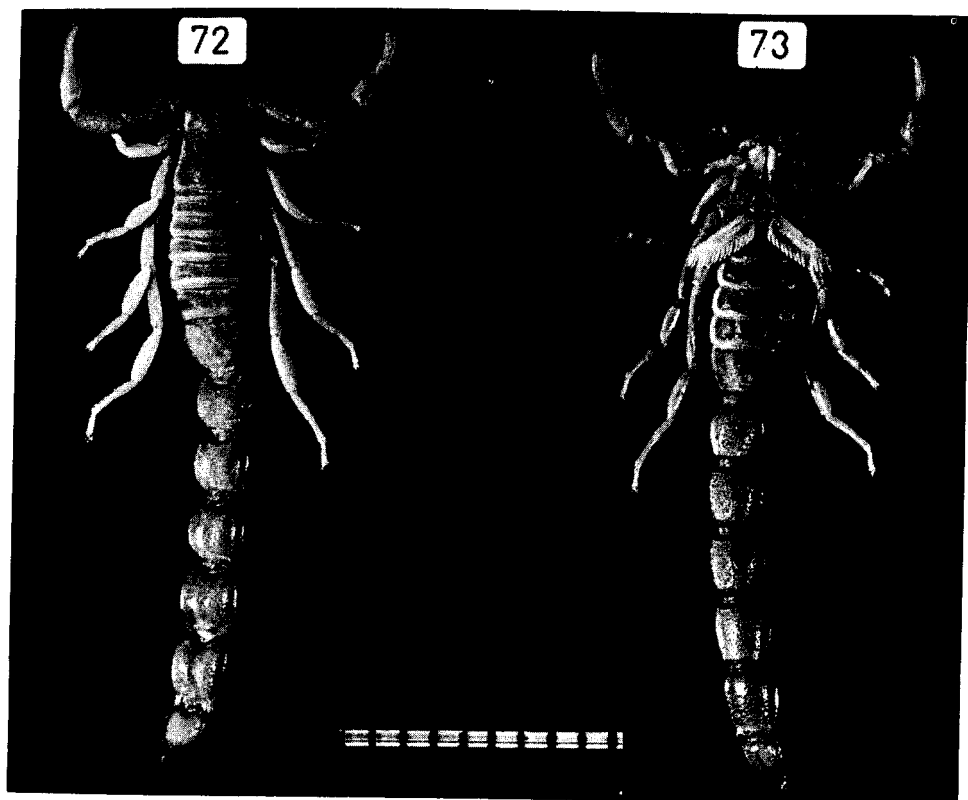
Karasbergia methueni Hewitt, 1913. Figs 72–86

Karasbergia methueni Hewitt, 1913: 148–149.

Diagnosis: In addition to generic diagnosis: ventral surface of cauda I–III with scattered granules bounded laterally and posteriorly by a U-shaped row of larger crescent-like granules (Fig. 83); dorsal and dorso-lateral keels of cauda I very poorly developed; keels of all other caudal segments absent; no subaculear tubercle ventrally on telson; sternum with subcordate basal pit and no median furrow.

Description: The following account supplements Hewitt's original description based on three females. No males have previously been described.

Cauda: Dorsal surface of cauda I and II without a stridulatory area; lateral surfaces of cauda II–V, ventral surfaces of cauda IV–V and telson vesicle, punctate (Figs 72–73, 83) with a very short microseta, averaging about 50 μ in length, arising out of each punctation. Anal arch of cauda V as in Fig. 83.



Figs 72-73. *Karasbergia methueni*. ♂ from Tses (NM 10566). Scale in mm.

Legs: Telotarsus lateral claws long (about half of telotarsus length) with angle of curvature not exceeding 90° ; lateral lobes greatly reduced and truncated, median lobe very short (about one-tenth of telotarsus length) and squat. Legs III and IV long, as long as length of cauda I-V; legs I and II one-third and half of caudal length respectively.

Pectines: 3 marginal lamellae; 5 middle lamellae, proximal two rectangular, distal three ovoid to round in shape; fulcra present; pectinal teeth 14-16 per pecten in ♂, 11-13 in ♀.

Sternum: As in Fig. 81.

Setation: Whole of body and appendages almost apilose, except for sparse vestiture of fine setae on ventral surface of protarsi and tarsi of all legs and microsetae arising out of punctations of the cauda described above. Three specimens (1 ♀ 2 ♂, NM 10919) from Springbok Vlakte in the Richtersveld in the north-western Cape and 1 ♂ (NM 10920) from Ai Ais in the south-western part of Namibia have strikingly pilose cauda and telson. The numerous fine setae present on these segments are long (1 mm) and inserted in the shallow punctations described above, replacing the microsetae typical of all other specimens of *K. methueni*.

Trichobothria: As in Figs 74–79. (–) neobothriotaxic for group A with d_2 of femur and tibia missing. Vachon (1973: 910) reports the absence of τEb_3 on the pedipalp hand. Examination of all available material has revealed that Eb_3 is present but that its areola is extremely small, smaller than that of Esb , and its trichium very short, making this τ difficult to find other than under high magnification. In a few specimens, Eb_3 is absent on one chela, but usually present on the other. In all the scorpions of the family Buthidae I have examined, τit of fixed finger occupies a relatively distal position, but in *K. methueni* it is almost median (Fig. 76) and this represents the most basal position observed in Buthidae.

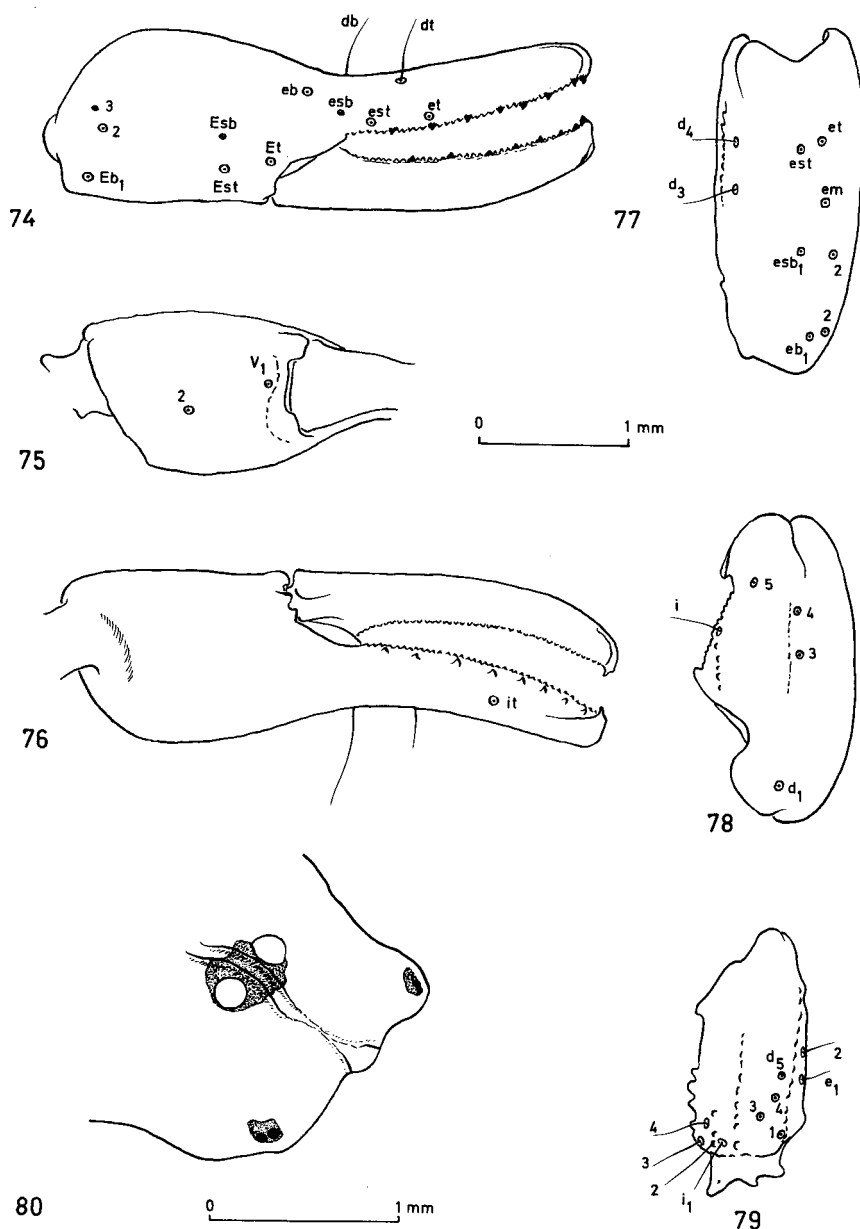
Hemispermaphore: See Figs 84–86 and generic diagnosis.

Variation: Sexual dimorphism: Male genital aperture without genital papillae. The total absence of genital papillae is a rare occurrence in scorpions and this represents the first recorded case in the Afrotropical region. This absence has led to previous difficulties in sexing adult specimens. Specimens can be sexed using the following key:

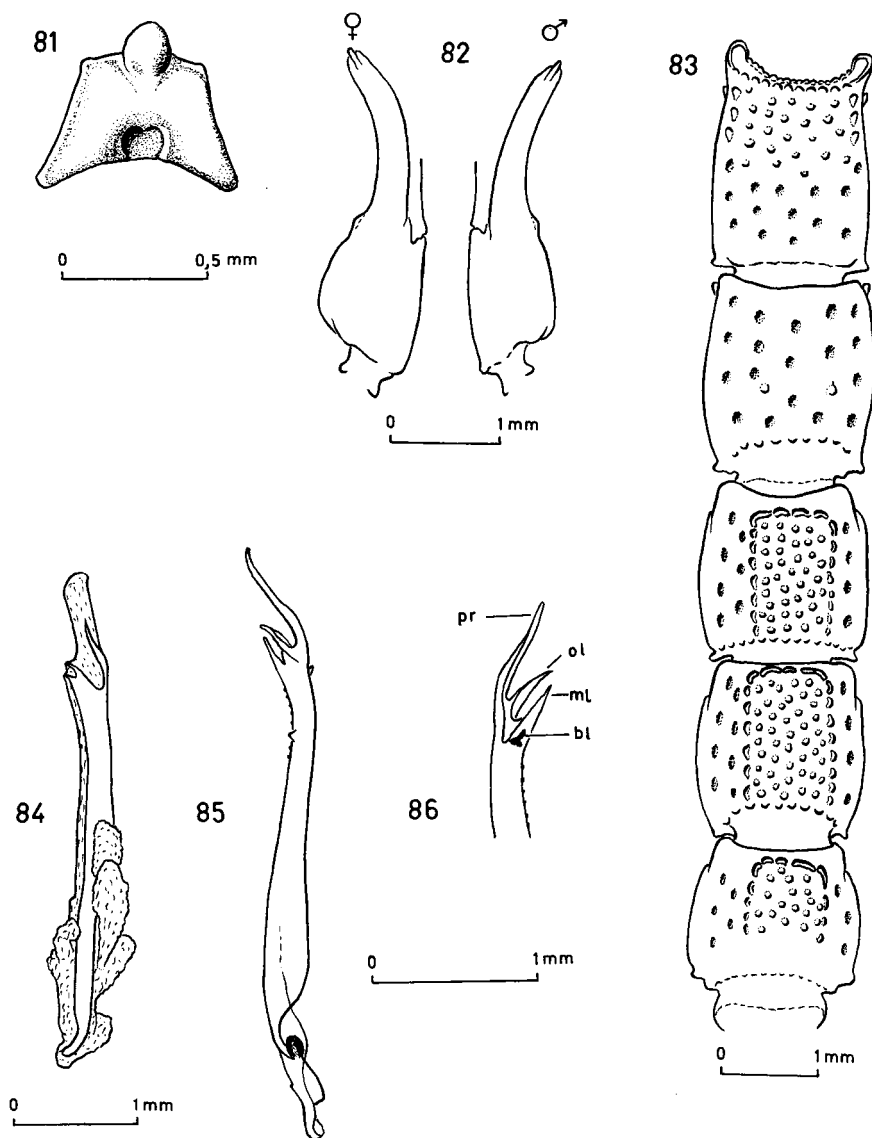
1. Pectinal teeth 14–16 per pecten; caudal segment length/carapace length ratios 0,60 for cauda I, 0,68 for II, 0,72 for III, 0,76 for IV, 0,80 for V; width sternite V/carapace length ratio 1,0 **males**
- Pectinal teeth 11–13 per pecten; caudal segment length/carapace length ratios 0,48 for cauda I, 0,56 for II, 0,60 for III, 0,64 for IV, 0,68 for V; width sternite V/carapace length ratio 1,40 **females**

In addition adult males differ from females in the following character states: ♂ cauda longer and more slender; ♂ total body length subequal; ♂ pedipalp hand more slender (Fig. 82) with mean ratios of hand width/carapace length 0,30 for ♂ and 0,40 for ♀, representing a difference of 25%; ♂ carapace and tergites more heavily granular than ♀; sternites III to VI with very fine and scattered granules near lateral border in ♂, completely smooth and shiny in ♀; sternite VII granular over whole surface in ♂, over posterior two-thirds in ♀.

Intraspecific variation: Hewitt's types came from the central parts of the known species range and the following variation should be taken into account when examining material from other parts of the range: U-shaped rows of crescent-like granules on lateral and posterior margins of ventral surfaces of cauda I–III very poorly-developed, and occasionally almost entirely absent on cauda I in some specimens, and scattered granules on ventral surfaces of these segments usually similarly reduced; number and distribution of punctations found on lateral surfaces of cauda II–V and ventral surfaces of IV–V and telson vesicle subject to local variations ranging from numerous to very few. The most important variation encountered is in the occurrence of a strikingly pilose cauda described under the section on setae above for four specimens (NM 10919 and 10920) from the Richtersveld and Ai Ais. Another specimen from Ai Ais (1 ♀ SAIMR) does not have this striking pilosity and the caudal segments have the normal vestiture described for typical forms. Were it not for this, one could speculate that specimens from Ai Ais and the Richtersveld are possibly samples of populations deserving separate species status. Only access to new material from intermediate



Figs 74–80. *Karasbergia methueni*. 74–79, lectotype ♀ (TM 1870); 74–76, right hand; 74, outer aspect; 75, ventral aspect; 76, inner aspect; 77–78, right pedipalp tibia; 77, outer aspect; 78, dorsal aspect; 79, right pedipalp femur, dorsal aspect; 80, prosoma, anterior dorso-lateral aspect showing position of lateral and median eyes, ♂ from Tses (NM 10566). Scales: 74–79, upper; 80, lower.



Figs 81-86. *Karasbergia methueni*. 81, sternum, ventral aspect, lectotype ♀ (TM 1870); 82, right and left hands of ♀ (NM 10567) and ♂ (NM 10566) respectively, dorsal aspects; 83, cauda I-V, ventral aspect, ♀ lectotype; 84-86, ♂ (NM 10566); 84, right paraxial organ, outer aspect; 85-86, right hemispermatophore; 85, outer aspect; 86, inner aspect of distal end.

and marginal localities along the Fish River and between Ai Ais and the Richtersveld will elucidate this striking variation.

Type material: Hewitt described *K. methueni* from 3 ♀ syntypes (1038, 1039, 1041) which were deposited in the Transvaal Museum. Two of these TM 1869 (ex 1038) and 1870 (ex 1041) have been studied while the third is missing. Specimen TM 1870 (ex 1041) is hereby selected as lectotype and TM 1869 (ex 1038) as paralectotype and labelled accordingly.

Material examined: ♀ lectotype, Narudas Süd (TM 1870 ex 1041); ♀ paralectotype, Kuibis (Quibis) (TM 1869, ex 1038). 1 ♀, Arigap River, Sep 1925, K. Barnard (NM 9968); 1 ♂, Upington, Jan 1956 (SAIMR 858); 18 ♂, Tses, 24 Feb 1973, B. Lamoral (NM 10566); 7 ♂ 1 ♀, Aar, 29 Feb 1976, B. Lamoral (NM 10893); 3 ♀ 6 ♂, Narudas Süd, 23 Feb 1976, B. Lamoral (NM 10890); 3 ♀ 6 ♂, Narudas Süd, 22 Feb 1976, B. Lamoral (NM 10889); 5 ♀ 15 ♂, Vredenhof 301, 21 Feb 1976, B. Lamoral (NM 10888); 1 ♂ 1 ♀, Vredenhof 301, id. (NM 10887); 2 ♂, Kuibis North 168, 28 Feb 1976, B. Lamoral (NM 10892); 2 ♀ 4 ♂, 10 km S of Berseba, 27 Feb 1976, B. Lamoral (NM 10891); 1 ♀, Blinkoog 30, 14 Oct 1970, J. Batista (SMN 370); 1 ♀, Blinkoog 30, 14 Oct 1971 (SMN 311); 1 ♀, Naus 27, 6 Oct 1972, H. Straus (SMN 389); 1 ♀, Ortmanbaum, 26 Jan 1973, B. Lamoral (NM 10567); 1 ♀, Ai Ais, 25 June 1974, J. Lensing (SAIMR 868); 1 ♂, Ai Ais, 4 Feb 1973, B. Lamoral (NM 10920); 1 ♀ 2 ♂, Springbok Vlaktes, Richtersveld, 21 Feb 1973, B. Lamoral (NM 10919).

Distribution: See distribution of genus.

Bionomics: Nocturnal. It is hemiedaphic and its habitat is infralapidicolous in regions of hard and gritty soils in areas of vegetation type 9 and the eastern fringe of 3A (Fig. 4). It has never been found on sandy substrata within these areas and has not been observed to dig burrows or shallow scrapes in open ground. Because of its small size it is almost impossible to spot with ordinary field lights and 95% of specimens were caught using ultra-violet light. This explains the paucity of material in collections. The larger ratio of males to females captured suggests that females are more sedentary than males. Courtship behaviour was observed in the field on three occasions and mating on one occasion. During the latter, the spermatophore was fastened to a horizontal rock slab. The overall behaviour was the same as that described for the genus *Parabuthus* by Alexander (1959).

Genus *Parabuthus* Pocock, 1890a

Type species: *Androctonus liosoma* Hemprich & Ehrenberg, 1829, by original designation.

Diagnosis: *Parabuthus* is separated from the other genera of the family Buthidae by the following combination of characters: two teeth on ventral proximal margin of fixed finger of chelicerae; dorsal surface of cauda I, and to a lesser extent II, with a stridulatory area composed of fine to coarse granules, sometimes forming transverse ridges; tergites with one weakly developed median keel; carapace granulated but without keels; no subaculear tubercle on telson

vesicle; anterior margin of carapace very slightly procurved and always with a very small median projection; distal end of hemispermatophore of male with a *pars recta* and *pars reflecta* to flagellum.

Distribution: Angola, Namibia, Botswana, South Africa, Zimbabwe, Eastern and North-eastern Africa and southern Arabia.

Parabuthus brachystylus Lawrence, 1928

See after *P. villosus*, page 616.

Parabuthus brevimanus (Thorell, 1877). Figs 87–94, 97–99

Buthus brevimanus Thorell, 1877: 110–113.

Parabuthus cristatus Pocock, 1901: 284–285. *Syn. n.*

Diagnosis: *P. brevimanus* is most closely related to *P. kuanyamarum* but can be separated from it and other species of the genus by the following combination of characters: Cauda, Fig. 94: cauda V, distal half of ventro-lateral keels composed of distinctly lobate processes; cauda IV, dorsal keels weakly developed to obsolete, lateral and ventral surfaces coarsely granular without longitudinal keels, antero-ventral margin demarcated by a transverse row of 5–6 strongly elevated crescent-shaped tubercles; cauda II–III, distal section of ventro-lateral keels and postero-ventral margin composed of strongly elevated crescent-shaped tubercles, forming a broad U-shaped pattern.

Description: The following account supplements Thorell's comprehensive original description and Purcell's (1901: 149–151) supplement.

Cauda: Figs 87, 88, 94. Dorsal surface of cauda I and II with well-developed stridulatory areas composed of granules reaching the posterior margins.

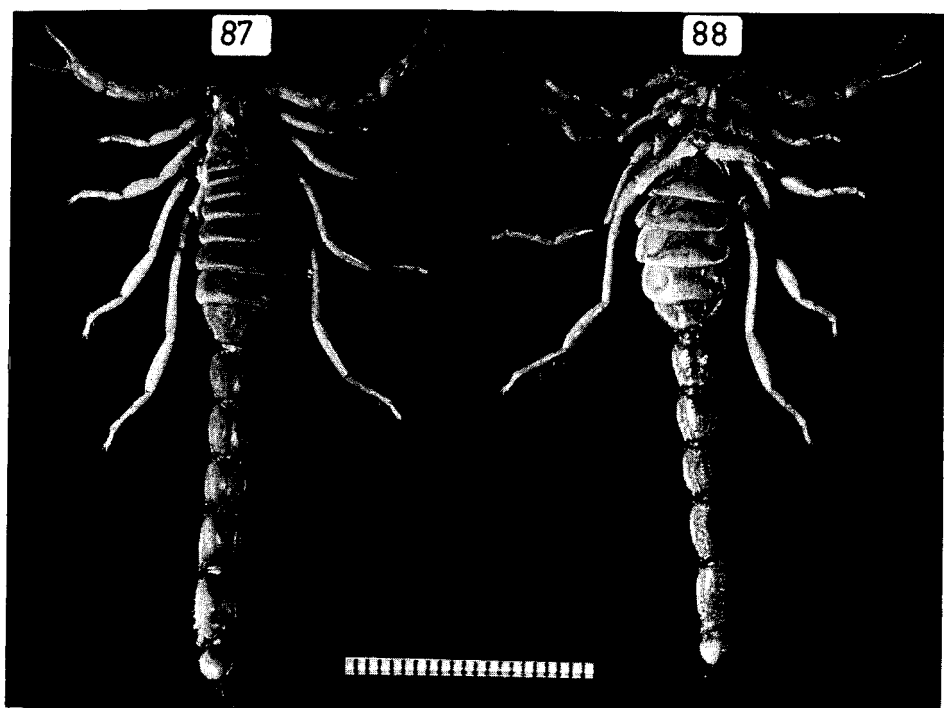
Pectines: ♂ 28–32 and ♀ 21–25 teeth per pecten.

Trichobothria: Figs 89–93. Orthobothriotaxic for group A. Pedipalp hand: τ *Esb* dorsal to *Eb*₂–*Et* alignment. Pedipalp femur: τ *d*₂ on proximo-dorsal side of dorso-internal keel: τ *d*₄ much closer to *d*₅ than to *d*₁; *e*₁ proximal to *d*₅; τ *d*₂ distal to *i*₁; τ *d*₃ closer to *d*₁ than *d*₄.

Hemispermatophore: Figs 97–99. *Pars reflecta* about one-third of hemispermatophore length; *pars recta* parallel to hemispermatophore axis; outer lobe rounded and not obtuse as in *P. gracilis*; basal lobe shorter than median lobe.

Variation: Sexual dimorphism: In adults, males differ from females in the following character states: ♂ proportionately smaller and more slender with width sternite V/carapace length ratios 1,10 (1,04–1,17) for ♂ and 1,40 (1,36–1,45) for ♀; ♂ pedipalp hand fingers shorter, handback wider and longer with movable finger length/handback length ratios 1,15 (1,05–1,23) for ♂ and 1,55 (1,48–1,61) for ♀ while mean chela length is only 3% less in ♂; lateral and ventral intercarinal surfaces of cauda I–III occasionally with few scattered granules in ♂; first proximal middle lamella of each pecten sub-triangular and truncate in ♂, sub-circular and lobate in ♀.

Intraspecific variation: Overall coloration fairly uniform strong yellow No. 84 but specimens from Karasberg Mountains, Namaland, Maltahöhe district, central Namib, western Damaraland and Kaokoveld uniformly darker with following



Figs 87-88. *Parabuthus brevimanus*, ♀ homotype (NM 10010), Scale in mm.

surfaces infuscated (deep yellowish-brown No. 75): triangular area between lateral and median eyes and posterior margin of carapace; tergites I-VII; stridulatory regions of cauda I and II, ventral and lateral surfaces of cauda IV and V; dorsal keels, distal dorsal and external regions of pedipalp femur; dorsal, internal and external surfaces of femur and dorso internal surfaces of legs II-IV. Specimens from northern Kaokoland and south-western Angola have better developed dorsal keels with a distal enlarged pointed spine in cauda I-IV and traces of an accessory dorsal keel in cauda V.

Measurements: Carapace length of adult ♂ 4,6 mm (4,0-4,8), of adult ♀ 5,55 (5,20-5,70) mm. One of the smaller species of *Parabuthus*.

Type material: As the type series consists of a pair of syntypes, I hereby designate the ♀ as lectotype and the ♂ as paralectotype and have labelled them accordingly.

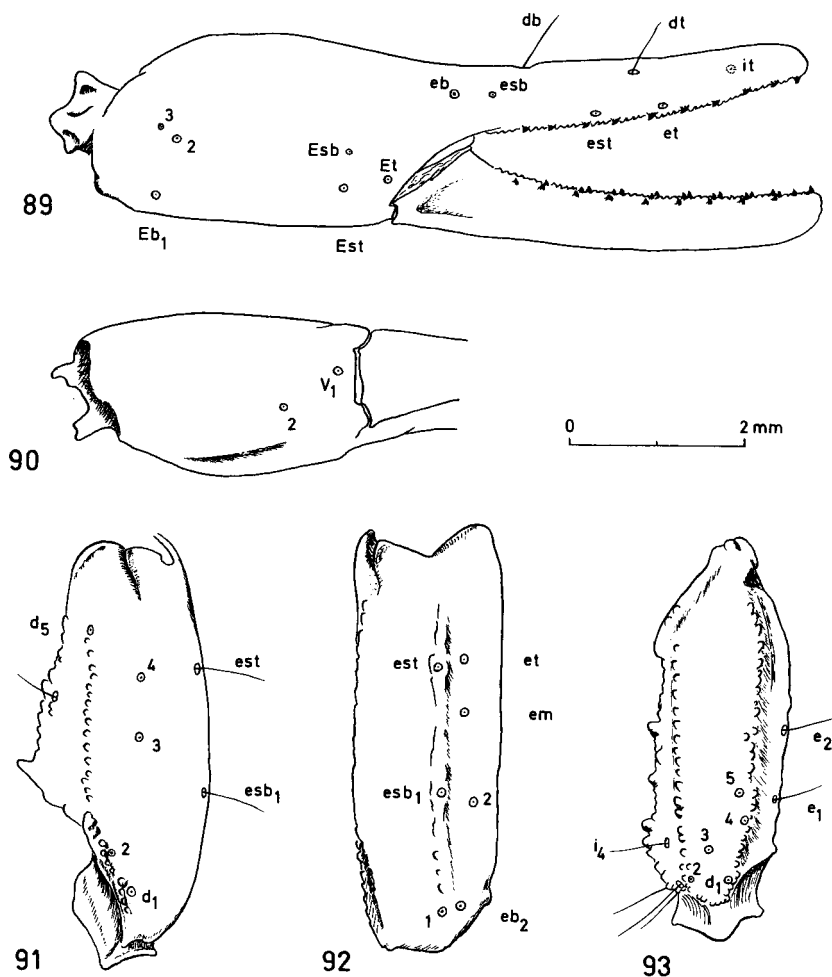
Homotype: I have designated a homotype which is deposited in the Natal Museum (NM 10010).

Material examined: ♀ lectotype, Southern Africa, 28 Nov 1864, Ch. Anderson (GNM); ♂ paralectotype, Caffraria, 1840-1845, J. Wahlberg (NRS, Col. Thorell

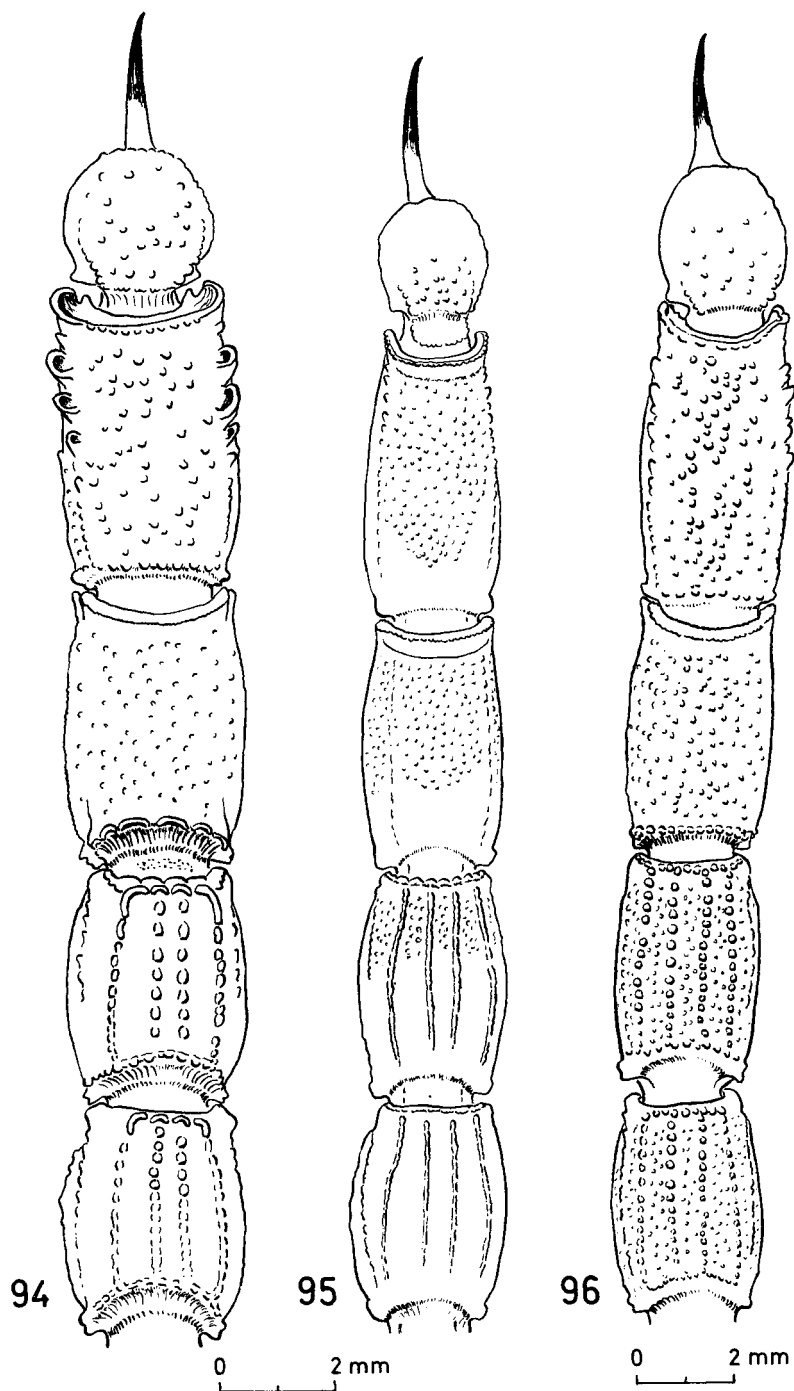
38/8); *P. cristatus* ♀ holotype, Congo (BM); ♀ homotype, Sandamap farm, 13 Feb 1969, B. Lamoral (NM 10010). 1 ♀, Gobabeb, Jan 1970, R. Jones (TM 9579); 2 ♀ 1 juv ♀, Espinheira, 29 Sep 1969, C. Coetzee (SMN 166); 23 ♂ 4 ♀ 10 juv, Kranzberg 59, 23 Mar 1976, B. Lamoral (NM 10819); 1 ♂, Tinkas Mountains, Feb 1972, B. Lamoral (NM 10367); 1 ♂, Ortmansbaum farm, Jan 1973, B. Lamoral (NM 10366); 1 ♂, Curocua, 19–21 Oct 1969, C. Coetzee (SMN 162); 1 ♂, Oncocua, 6–7 Oct 1969, J. Batista (SMN 342); 1 ♂, Otjansasemo, 10 Nov 1970, B. Kensley (SMN 226); 1 ♀, Hoas 273, 11 May 1973, M-L. Penrith (SMN 444); 1 juv ♂, Otjitundua, 28 Nov 1970 (SMN 210); 2 ♂, Noachabeb, 6 Feb 1973, B. Lamoral (NM 10365); 1 ♂ 2 juv ♂, Sandamap farm, 13 Feb 1969, B. Lamoral (NM 10930); 3 ♂ 1 ♀ 1 juv ♀, Springbokvlakte, 20–21 Feb 1973, B. Lamoral (NM 10442); 1 ♂, Iona, 3 Oct 1969, C. Coetzee (SMN 161); 1 ♂, Ombombo, 23 Aug 1973, M-L. P. (SMN 471); 1 ♀, Barby 26, 2–8 Oct 1972 (SMN 392); 2 ♀, Bloedkoppie, 1–10 July 1970, Natal University students (SMN 220); 1 ♀, Marienfluss, 22 Nov 1970, E. Mokgoabone (SMN 254); 1 ♀, Goreangab Dam, 12 Feb 1971 (SMN 270); 1 ♀, Ovamboland border, Oct 1961, P. Buys (SMN 146); 2 ♂, Paulinenhof 72, 20–22 Nov 1972 (SMN 403); 1 juv ♀, Warmquelle, 7 Oct 1968, P. Olivier (SMN 118); 1 ♂, Sesriemfarm, June 1973, G. Sander (NM 10380); 1 ♀, Klein Karasburg, 10 Feb 1974, L. Wingate (NM 10547); 1 ♂, Palmfontein farm, 25 Feb 1969, B. Lamoral (NM 10009); 2 ♂, Omatjenguma, 25 Nov 1970, E. Mokgoabone (SMN 223); 1 ♀ 1 ♂, Swartboys Drift, Dec–Feb 1972, J. Menge (TM 10438–9); 1 ♂, Huab 261, 29–30 Nov 1972, C. Coetzee (SMN 415); 1 ♂ Annabis farm, 24–25 Feb 1969, B. Lamoral (NM 10008); 1 ♂, Khumib River, 2 Feb 1969, C. G. C. (SMN 221); 3 ♂, Pastoril do Sul, 8–9 May 1974, M. J. P. (SMN 522); 1 juv ♀, Orumana, 10 Feb 1975 (SMN 594); 2 ♂ 1 ♀, Pastoril do Sul, 20–22 Nov 1974, M-L. P. (SMN 538); 2 ♂, Pastoril do Sul, 20–22 Nov 1974, M-L. P. (SMN 533–4); 1 ♀, Kamombonde Oos 86, 5 Jan 1975 (SMN 590); 1 ♂, Orupembe, 9 July 1975, R. Griffin (SMN 564); 1 ♂ 1 ♀, Messum Crater, 26 Mar 1976, B. Lamoral (NM 10847); 2 ♂, Huns 106, 29 Sep–4 Oct 1974, Museum staff (SMN 524); 1 ♀, Okahandja, Aug 1960, F. Gaerdes (NM 7319); 1 juv ♀, Otjitambi, Sep 1960, F. Gaerdes (NM 7324); 1 ♀, Kunene River, Nov 1960, F. Gaerdes (NM 7326); 1 ♂, South West Africa (NM 10928); 1 ♂, Twyfelfontein, Aug 1966, F. Gaerdes (NM 9124); 1 ♂, Goodhouse, 30 Jan 1973, B. Lamoral (NM 10364); 1 ♂ 1 subad ♂, Augrabies Falls, 4 Apr 1970, B. Lamoral (NM 10368); 1 ♀ 2 ♂, Narib 4, 9 Mar 1976, B. Lamoral (NM 10777); 1 ♂ 1 ♀, Kuibis North 168, 28 Feb 1976, B. Lamoral (NM 10781); 2 ♀ 7 ♂ 1 juv, Narudas Süd 268, 23 Feb 1976, B. Lamoral (NM 10769); 1 subad ♀, Berseba, 28 Feb 1976, B. Lamoral (NM 10782); 1 ♂ 1 ♀ 2 juv ♂, Berseba, 24 Feb 1976, B. Lamoral (NM 10771); 2 ♂ 1 ♀ 2 juv, Bergkranz 370, 22 Mar 1976, B. Lamoral (NM 10851); 1 ♂, Pastoril do Sul, 20–22 Nov 1974, M-L. P. (SMN 536); 1 juv ♀, Excelsior 286, 26 Jan–2 Feb 1975 (SMN 554); 1 ♂, Noordoewer, E. Griffin (SMN 587); 1 subad ♂, Kos 28, 20–27 Feb 1975 (SMN 562); 1 ♀, Rostock 393, 20–27 Feb 1975 (SMN 563); 1 juv ♂, Ruacana, 26–27 Aug 1973, M-L. P. (SMN 476); 1 ♀, Windhoek, 14 Aug 1973, A. du Toit (SMN 479); 1 subad ♀, Kaoko Otavi, 22 Aug 1973, M-L. P. (SMN 470); 1 juv ♀, Ondarusu Falls, 26 Oct 1971, M. Penrith (SMN 449); 1 ♂, Brandkaros (NM 10937).

Distribution: North-western Cape Province of South Africa, throughout Namibia, southern and south-eastern Angola.

Bionomics: Nocturnal, hemiedaphic and digs shallow burrows at the base of shrubs in sandy to consolidated sandy soils. A few specimens have occasionally been found in shallow scrapes under rocks. Seldom found in regions of hard and gritty soils. Comb-like rows of long setae on the posterior edges of tibia, basitarsi, and telotarsi of legs I, II and to a lesser extent III indicate a semi-psammophilous adaptation. *P. brevimanus* is often sympatric with closely related species *kuanyamarum*, *gracilis* and *nanus*.



Figs 89-93. *Parabuthus brevimanus*, ♀ (NM 10010). 89-90, right hand; 89, outer aspect; 90, ventral aspect; 91-92, right pedipalp tibia; 91, dorsal aspect; 92, outer aspect; 93, right pedipalp femur, dorsal aspect.



Figs 94-96. *Parabuthus* species, ventral aspects of cauda II-V and telson. 94, *P. brevimanus*, ♀ homotype (NM 10010); 95, *P. kuanyamarum*, ♀ (NM 10430); 96, *P. gracilis*, ♀ holotype (NM 10925).

***Parabuthus gracilis* sp. n. Figs 96, 103–104, 107–116**

Derivation: Gracilis (L.) = slender.

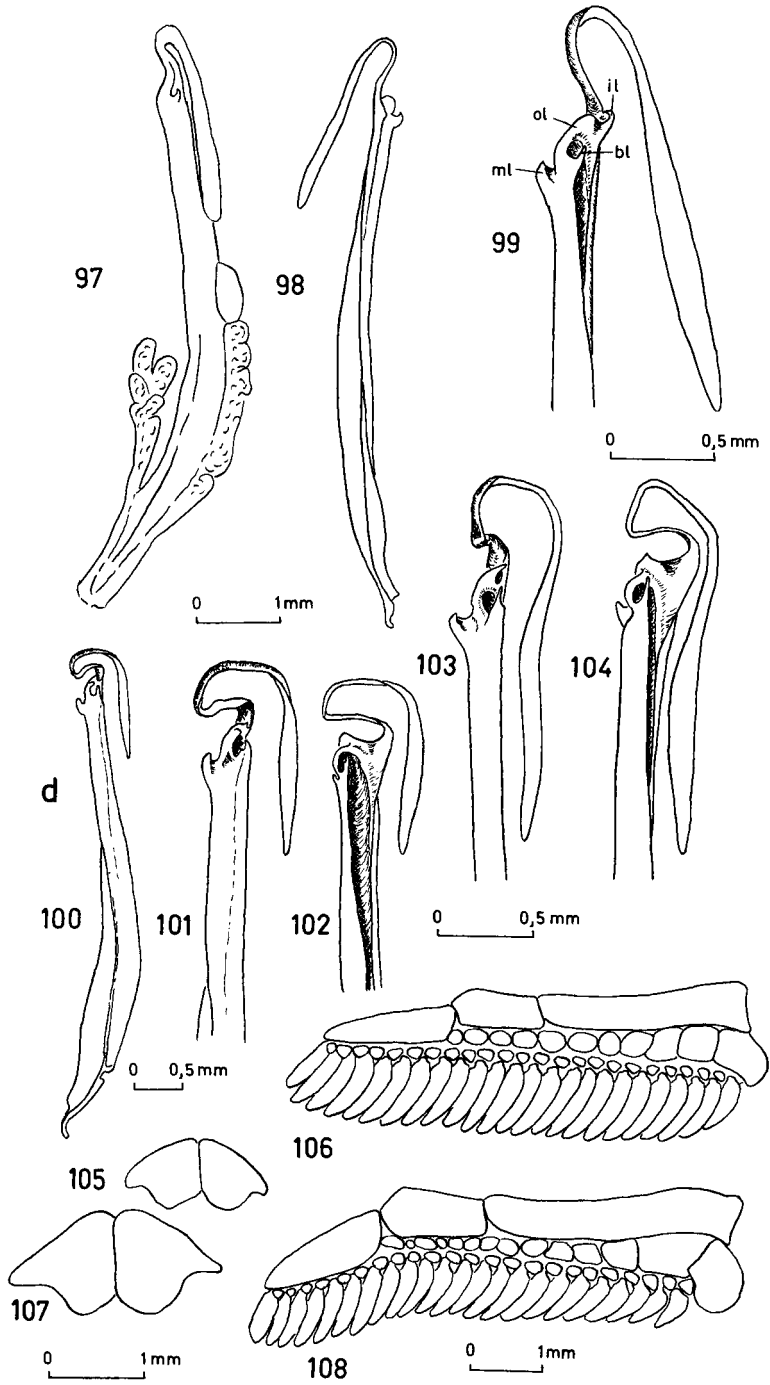
Diagnosis: *P. gracilis* can be separated from other species of the genus by the following combination of characters. Cauda, Fig. 96: cauda V, distal half of ventro-lateral keels composed of well-developed, sub-spinose, non-lobate processes, antero-ventral margin demarcated by a transverse row of isolated, round granules; cauda II–III, postero-ventral margins demarcated by a distinct transverse row of isolated, round granules; cauda I–III, dorsal keels poorly developed to obsolete; cauda IV, ventral and lateral surfaces granular and matt, no traces of any longitudinal keels. Sternum: greatest width/greatest length 0,58 (0,55–0,60) for adult ♂ and ♀. One of the smaller species of *Parabuthus*, it is most closely related to *nanus*. These two are in turn closely related to *brevimanus* and *kuanyamarum*.

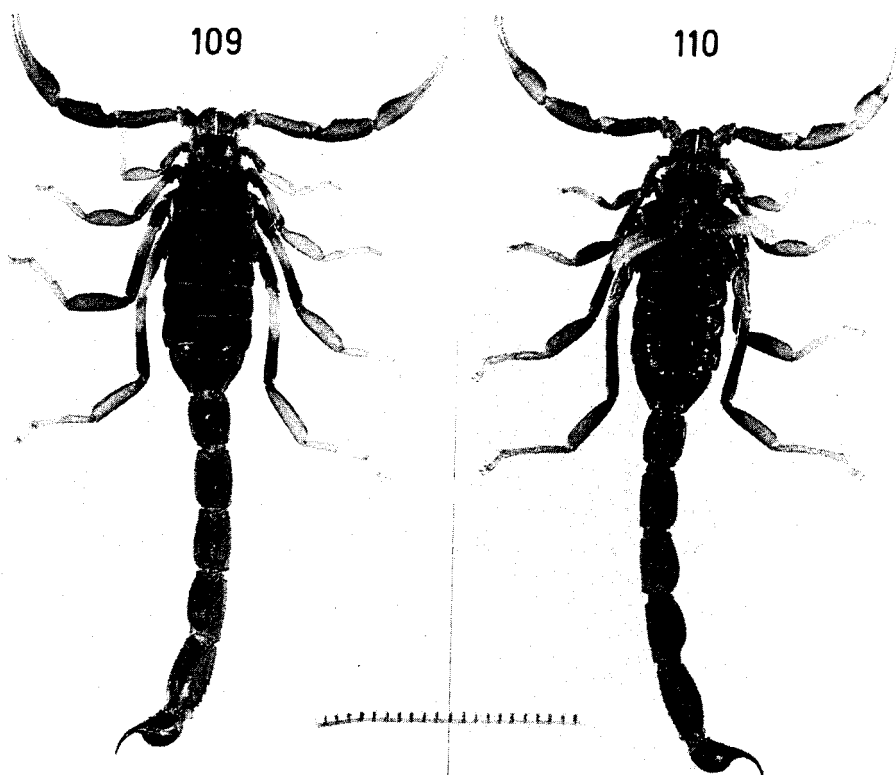
Description: The type series consists of males and females. The following description is based on the ♀ holotype, unless otherwise indicated.

Colour: Overall, variably moderate yellowish brown No. 77, with tergites, carapace, distal half femur I–IV and external distal half pedipalp femur infuscated and darkly patterned (Figs 109–110); surface between lateral eyes and median eyes more darkly infuscated than rest of carapace, forming a dark triangle. Legs I–IV and distal half of pectines light yellow No. 86.

Granulation: Cauda II–III and to a lesser extent cauda I, ventral and ventro-lateral keels composed of isolated round granules; cauda I–III, lateral and ventral intercarinal surfaces granular and matt; also see Fig. 96 and diagnosis. Following surfaces microscopically shagreened with overall unburnished appearance and few, scattered small granules: pedipalp hand and fingers; dorsal, external and ventral intercarinal surfaces of pedipalp tibia and femur; outer surfaces of femur I–IV. Following surfaces smooth and shiny: inner surfaces of femur I–IV; patella, tibia, basitarsus, telotarsus of legs I–IV. Middle and marginal lamellae of pectines punctate and shiny. Sternites III–VI, shallowly wrinkled to punctate in posterior half, otherwise smooth and shiny; sternite III with two medio-longitudinal rows of punctations; sternite VII sparsely punctate and granular, no traces of longitudinal keels. Carapace: coarsely granular, without distinct keels. Tergites I–VI, posterior half coarsely granular, anterior half finely granular, median keel present and well-developed, no lateral keels; tergite VII, median and first lateral keels obsolete, second lateral keel present.

Figs 97–108. *Parabuthus* species. 97–99, *P. brevimanus* (NM 10365); 97, right paraxial organ, ventral aspect; 98–99, right hemispermatophore; 98, ental aspect; 99, detail of ental distal portion; 100–102, *P. nanus* sp. n. paratype (NM 10702), right hemispermatophore; 100, ectal aspect; 101, detail of ectal distal portion; 102, dorsal aspect of distal portion; 103–104, *P. gracilis* sp. n. paratype (NM 10848), right hemispermatophore distal portion; 103, ectal aspect; 104, dorsal aspect; 105–106, *P. nanus* ♀ holotype (NM 10926); 105, genital operculi; 106, right pecten; 107–108, *P. gracilis* ♀ holotype (NM 10925); 107, genital operculi; 108, right pecten. *Scales:* 97–98, upper left; 99, upper right; 100, centre left; 101–104, centre right; 105–107, lower left; 108, lower right.





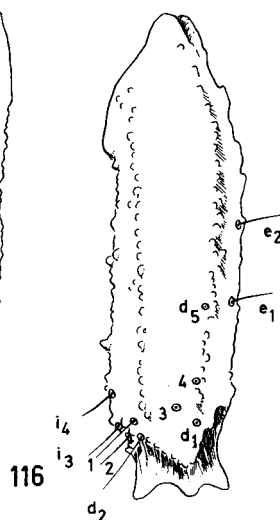
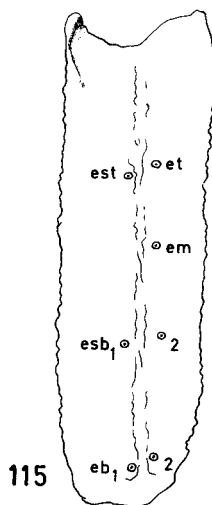
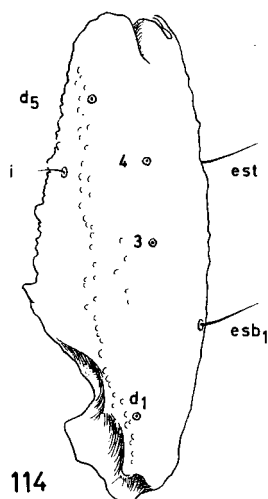
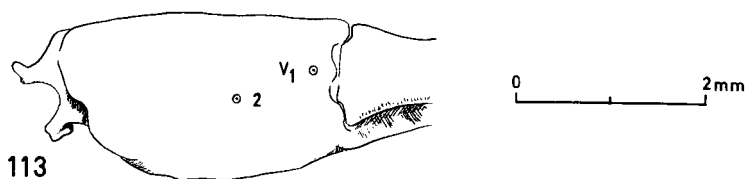
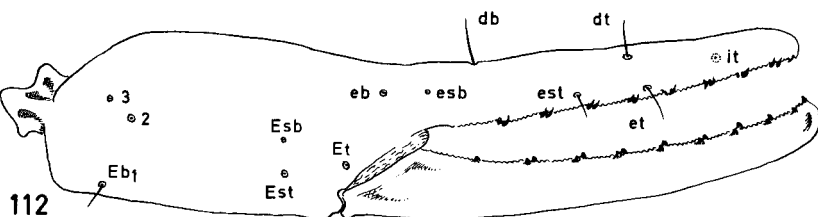
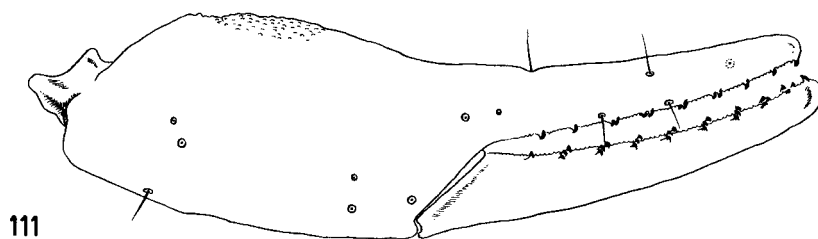
Figs 109–110. *Parabuthus gracilis* sp. n., ♀ holotype (NM 10925). Scale in mm.

Cauda: Ventrally as in Fig. 96. Stridulatory patch: cauda I narrow, consisting of fine granules reaching posterior margin; cauda II almost obsolete, barely reaching posterior margin. Cauda I: width percentage of length 76% (74–77%) for adult ♂; 82% (80–84%) for adult ♀.

Pectines: 22 and 23 teeth. Also see Fig. 108. In paratypes, ♀ and ♂ 21–25 teeth per pecten. First proximal middle lamella of ♀ distinctly enlarged and lobate; distal marginal lamella of ♂ and ♀ distinctly out of alignment with middle lamellae axis.

Setation: Overall, moderately pilose as in *P. kuanyamarum*, differing as following. Pedipalp: hand and fingers, tibia, internal and external surfaces femur, ventral and internal surfaces trochanter and coxa with numerous short setae. Genital operculi, marginal and middle lamellae and fulcra of pectines with numerous short setae. Lateral and posterior margins sternites III–VI and anterior margin carapace with a row of short setae. Posterior edges tibia, basitarsi and telotarsi of legs I–III with a row of comb-like long setae. Ventral surface telotarsi I–IV with a poorly developed pad of setae. Inner surface chelicera hand and proximal region of fixed finger with a brush of short setae. Carapace, tergites and sternites apilose.

Trichobothria: Figs 111–116. (–) neobothriotaxic for group A with d_2 of tibia missing. Pedipalp hand: τ *Esb* dorsal to Eb_2 –*Et* alignment.



Figs 111–116. *Parabuthus gracilis* sp. n. 111, paratype ♂ (NM 10906), right hand outer aspect; 112–116, ♀ holotype (NM 10925); 112–113, right hand; 112, outer aspect; 113, ventral aspect; 114–115, right pedipalp tibia; 114, dorsal aspect; 115, outer aspect; 116, right pedipalp femur, dorsal aspect.

Pedipalp femur: τd_2 on proximo-internal side of dorso-internal keel; τd_4 much closer to d_1 than to d_5 ; τe_1 slightly distal to d_5 ; τd_2 proximal to i_1 ; τd_3 closer to d_1 than to d_4 .

Hemispermatothore: Figs 103–104. *Pars reflecta* one-third of hemispermatothore length; *pars recta* S-shaped and not parallel to hemispermatothore axis as in *P. brevimanus* and *kuanyamarum*; outer lobe obtuse; basal lobe longer than median lobe.

Variation: Sexual dimorphism: Holotype and paratypes. In adults, males differ from females in the following characters: carapace width greater than length in ♂, subequal in ♀, width/length ratio 1,13 (1,10–1,15) for ♂ and 1,01 (0,98–1,04) for ♀; telson vesicle proportionately smaller and more slender in males, lengths vesicle/aculeus ratio 1,25 (1,22–1,27) in ♂ and 1,5 (1,46–1,53) in ♀, width cauda V/telson ratio 1,47 (1,45–1,50) in ♂ and 1,20 (1,17–1,22) in ♀, while aculeus length is the same in both sexes; ♂ pedipalp hand fingers shorter, movable finger length/handback length ratio 1,25 for ♂ (1,17–1,33), 1,55 for ♀ (1,46–1,61); ♂ pedipalp handback length and width greater while mean chela length is only 4% less; first proximal middle lamella of each pecten sub-triangular and truncate in ♂, sub-circular and lobate in ♀; ♂ 28–33, ♀ 20–25 teeth per pecten.

Intraspecific variation: Mainly in the degree of infuscation. Specimens from Messum Crater and inland of Torra Bay (NM 10860) with infuscations described as for the holotype. Specimens north of Cape Cross distinctly paler than holotype in overall coloration and infuscations only present on interocular surface and legs. Specimens from near Möwebaai distinctly paler than holotype in overall coloration (moderate yellow No. 87), without any infuscations on body and appendages but with cauda IV–V and telson lightly to moderately infuscated.

Measurements: Carapace length of adult ♂ 4,8 mm (4,2–5,2 mm), of adult ♀ 5,8 mm (5,1–6,0 mm).

Type material: Holotype and paratypes in Natal Museum collection. Some of the paratypes from Messum Crater area (ex NM 10848) have been deposited in the following institutions: State Museum, Windhoek, Namibia; Museum national d'Histoire naturelle, Paris, France; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, United States.

Material examined: ♀ holotype, Messum Crater, 26 Mar 1976, B. Lamoral (NM 10925). Paratypes: 1 ♂, Messum Crater, 26 Mar 1976, B. Lamoral (NM 10926); 8 ♂ 2 ♀ 4 juv, Messum Crater, 26 Mar 1976, B. Lamoral (NM 10848); 1 juv ♀ 1 subad ♀, Möwebaai, 28 Mar 1976, B. Lamoral (NM 10857); 2 ♂, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10854); 1 ♂ 1 juv ♂, Torra Bay, 30 Mar 1976, B. Lamoral (NM 10860); 3 ♂ 1 ♀ 4 juv, Möwebaai, 29 Mar 1976, B. Lamoral (NM 10859).

Distribution: Skeleton Coast, between Möwebaai and Cape Cross.

Bionomics: Nocturnal, hemiedaphic and digs shallow burrows at the base of small, shrub-bearing dunes and under rocks on sandy to gritty plains (soil categories IV–V of Table 2) in areas of vegetation type 1 such as shown in Fig. 5. Comb-like rows of long setae on the posterior edges of tibia basitarsi and

telotarsi of legs I, II and to a lesser extent III indicate a semi-psammophilous adaptation. *P. brevimanus*, is sympatric with *gracilis* in the Messum Crater area, but *kuanyamarum* and *nanus* are allopatric. Excepting the Messum Crater area, *Uroplectes teretipes* is sympatric with *gracilis*.

Parabuthus granulatus (Hemprich & Ehrenberg, 1828). Figs 117–124

Androctonus granulatus Hemprich & Ehrenberg, 1828: Plate XIX, Figs 3–4.

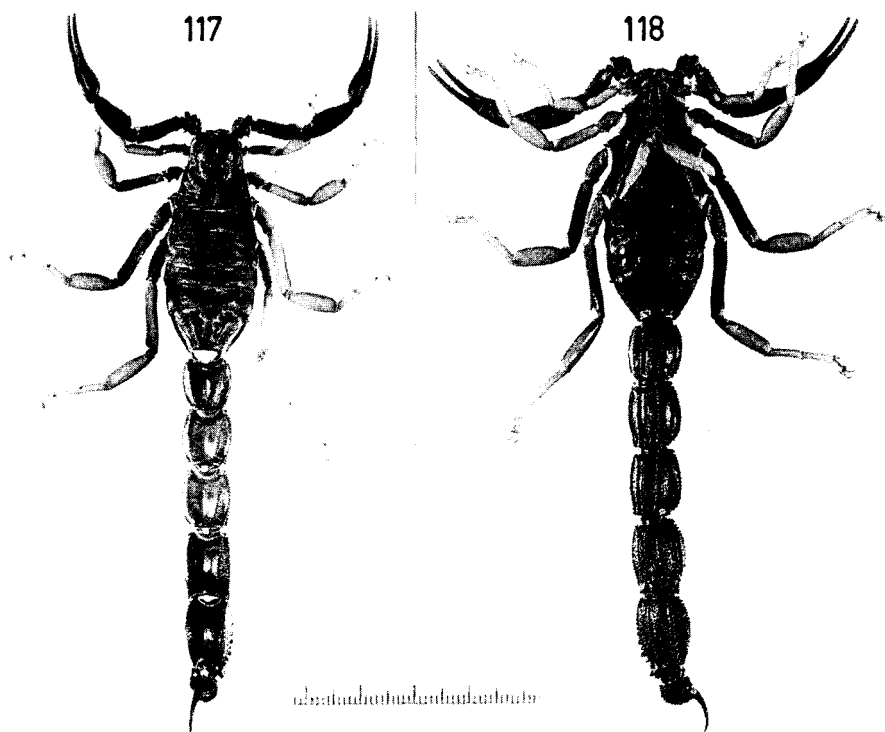
Buthus fulvipes E. Simon, 1887: 378–379; *Parabuthus fulvipes* (E. Simon), Kraepelin, 1899: 30;

Parabuthus granulatus fulvipes (E. S.), Werner, 1936: 177–178. *Syn. n.*

Parabuthus granulatus bergeri Werner, 1916: 83–84; *Parabuthus bergeri*, Werner, 1936: 178. *Syn. n.*

Parabuthus granulatus fuscus Pocock, 1901: 285. *Syn. n.*

Diagnosis: The following combination of characters separates *P. granulatus* from other species of the genus. Caudal segments, Figs 117, 118: cauda IV, with 8 distinct granular keels, median lateral keels obsolete to absent, ventrals posteriorly obsolescent; cauda II, dorsal stridulatory area narrow, poorly developed, and not reaching posterior margin; adult ♂ & ♀, telson small, width 69% (65–72%) of cauda V width. Pedipalp chela, Figs 119, 120: τ *dt* distal to *et*. One of the larger species of *Parabuthus*, it is most closely related to *P. kalaharicus*.



Figs 117–118. *Parabuthus granulatus*. ♀ from Tses (NM 10513). Scale in mm.

Description: Hemprich & Ehrenberg's description is based on plate XIX, Figs 3 & 4 published in 1828 and text published in 1831. I have seen the plates but not the text and have been unable to find page references to the text in any available reference catalogue. Purcell (1901: 168–173) has given a very comprehensive redescription of the species and the following account supplements this.

Colour: See variation below.

Cauda: Mean width percentage of length for cauda I–V, 100, 92, 92, 73, 60, respectively. Cauda I, dorsal stridulatory area, narrow, reaching posterior margin in some populations; cauda V, accessory dorsal crest absent, distal half of ventro-lateral keels composed of distinctly enlarged, sub-lobate processes.

Trichobothria: Orthobothriotaxic for group A. As in Figs 119–123. Pedipalp chela, τdb much closer to *est* than *esb* in ♀, medial in ♂. Pedipalp femur: τd_2 on proximo-dorsal side of dorso-internal keel; τd_3 distinctly distal to d_2 .

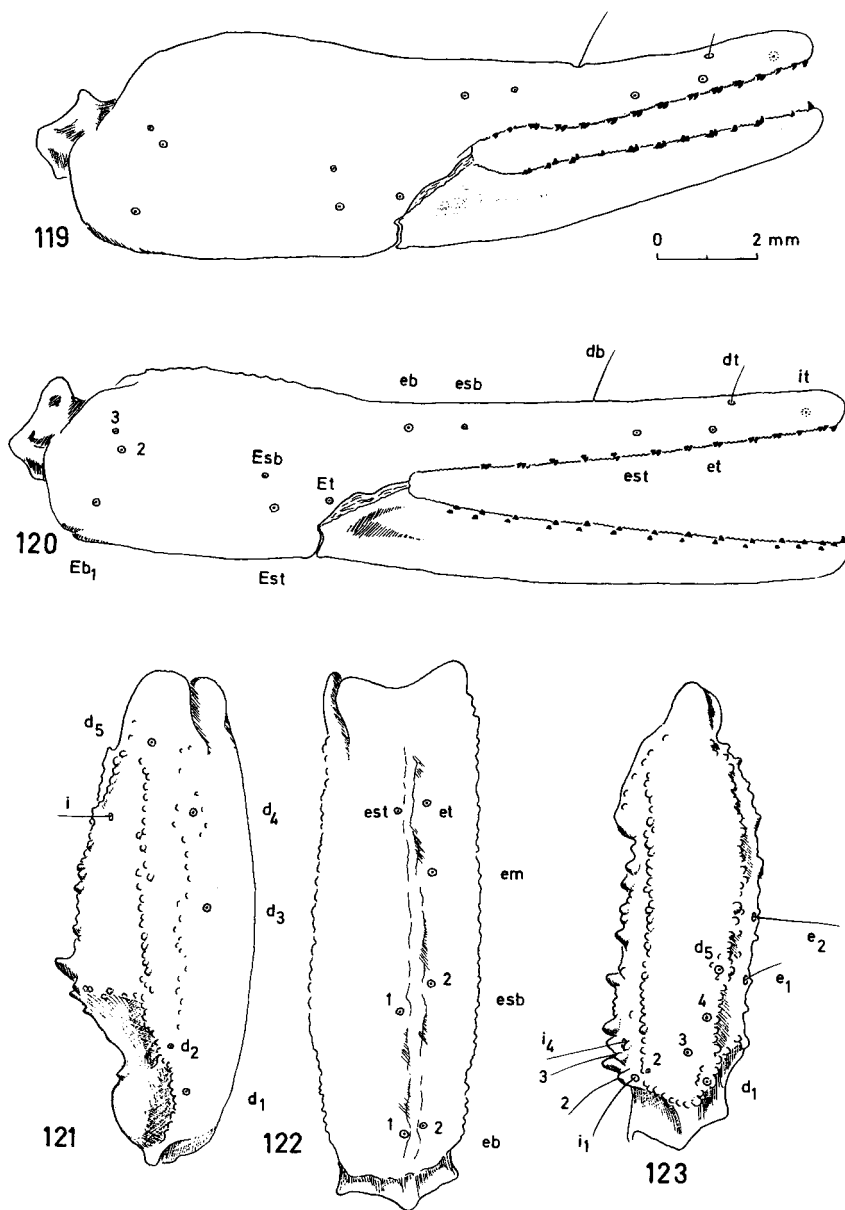
Hemispermaphore: As for species in couplets 6–9 of key and not differing diagnostically from any of these.

Variation: Sexual dimorphism: In adults, males differ from females in the following characters: ♂ proportionately smaller and slightly more slender with width sternite V/carapace length ratios 1,25 (1,19–1,29) for ♂ and 1,35 (1,30–1,41) for ♀; ♂ pedipalp hand fingers shorter, handback wider and longer with movable finger length/handback length ratios 1,50 (1,43–1,55) for ♂ and 2,00 (1,94–2,07) for ♀ while chela length is only 6% less in ♂; proximal dentate margin of fixed and movable fingers slightly emarginated in ♂ (not as distinctly as in *P. kalaharicus*), linear in ♀; ♂, with 28–35 and ♀ 24–32 teeth per pecten; first proximal middle lamella of each pecten supports 2–3 teeth in ♂, none in ♀; first proximal middle lamella of each pecten in ♂ sub-rectangular with mesial margin angular, in ♀ sub-oval with mesial margin arcuate (not enlarged and lobate).

Intraspecific variation: Referring to the regions arbitrarily delimited in Fig. 124, the variation observed is as follows: Regions i, ii & iii: overall colour of body and pedipalps strong yellowish brown No. 74, legs dark orange yellow No. 72; ♂ with 30–32 and ♀ 25–28 teeth per pecten; granular keels of cauda I–V less well-developed than specimens from regions iv, v & vi. Region iv: overall colour of body and appendages much darker, ranging from dark brown No. 59 to dark olive brown No. 96 for body and pedipalps, and deep yellow brown No. 75 to light olive brown No. 94 for legs; in specimens from southern parts of this region pedipalps and legs much lighter in colour, tending towards deep yellow No. 85. Regions v and vi: overall colour of body and appendages lighter than in specimens from northern and central parts of region iv, more like that of specimens from southern parts of region iv.

Measurements: Carapace length of adult ♂ 10 mm (9–11 mm), of adult ♀ 12 mm (10–14 mm).

Type material: Hemprich & Ehrenberg's unsexed holotype was presumed lost. It was rediscovered in the collection of the Zoologisches Museum Berlin, in east Berlin and found to be a male. It had originally been mounted dry on a pin but was reclaimed and transferred to alcohol. Its accession number is ZMB 132.



Figs 119–123. *Parabuthus granulatus*. 119, ♂ (NM 10731), right hand, outer aspect; 120–123, ♀ (NM 10513); 120, right hand, outer aspect; 121–122, right pedipalp tibia; 121, dorsal aspect; 122, outer aspect; 123, right pedipalp femur, dorsal aspect.

Homotype: I have designated a ♂ homotype which is deposited in the Natal Museum collection (NM 10900).

Material examined: ♂ Holotype, Promont b. sp. (= abbreviation for *promontorium bona spes*—Peninsula of Good Hope), Lichtenstein (ZMB 132); *Buthus fulvipes* ♀ holotype, Kalahari (MNHP RS 0311); *Parabuthus granulatus bergeri* 3 ♂ 4 ♀ syntypes, Berseba (NMW 1046) and 1 ♂ & 3 juv, Gochas/Haruchas (NMW 1047); *Parabuthus granulatus fuscus* ♀ holotype, Kalahari (BM 1894.5.3.4); ♂ homotype, Frischgewaagd, 20 Mar 1976, B. Lamoral (NM 10900). The roman numerals used below refer to material from the different regions in Fig. 124.

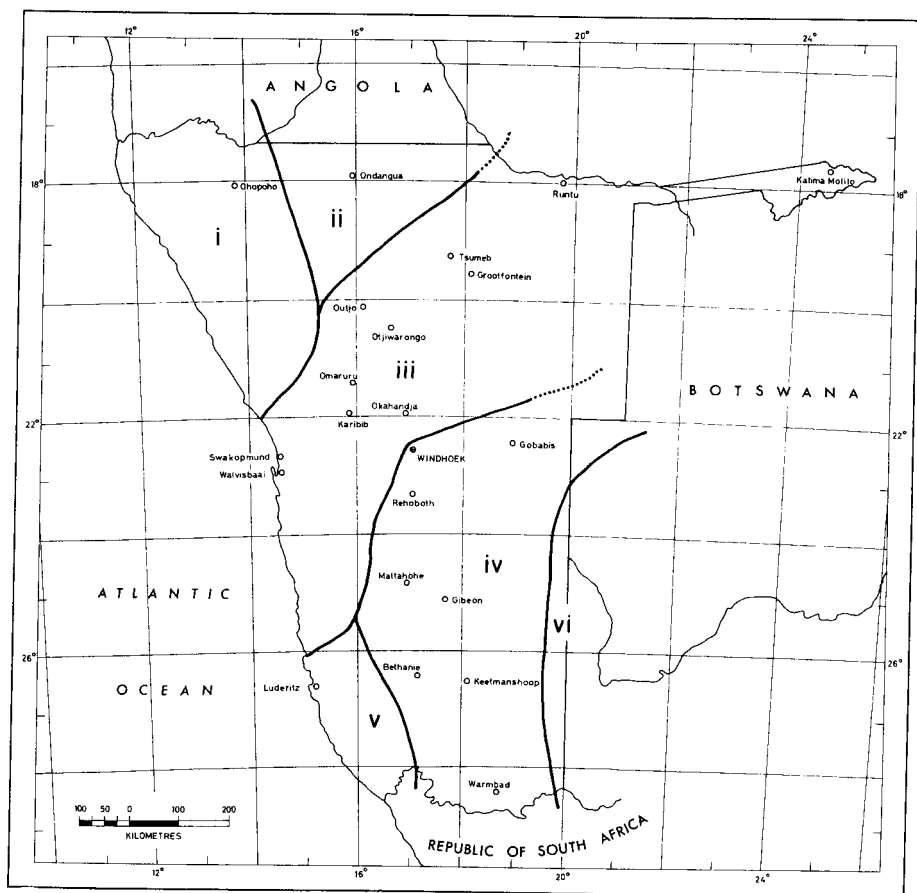


Fig. 124. *Parabuthus granulatus*. Approximate distribution ranges of intraspecific variants described in the text. Dotted lines indicate supposed extensions of solid lines.

(i)

1 ♀ 1 ♂, Swartboys drift, Dec–Feb 1972, J. Menge (TM 10435); 1 ♂, Sesfontein, 4 Apr 1976, B. Lamoral (NM 10910); 1 subad ♂, Sarusas, 6 Oct 1968, P. Olivier (SMN 120); 1 ♀, Hartmanberge, 18 Aug 1973 (SMN 463); 1 juv ♂, Ondarusu Falls, 17 Oct 1973, M. J. P. (SMN 492); 1 subad ♂, Otjinungwa, 19–21 Aug 1973, State Museum (SMN 467); 2 ♂, Vrede 719, 31 Mar 1976, B. Lamoral (NM 10908–9); 1 ♀, Vrede 719, 31 Mar 1976, B. Lamoral (NM 10899); 1 ♀, Ohopoho, 7 Feb 1975, S. Endrödy Younga (TM 11098); 1 ♀, Fazenda Valle, 28–29 Nov 1974, J. B. (SMN 542); 1 ♂, Ombazu, 22 Feb 1973, J. Malan (SMN 434); 1 ♀, Swartboys Drift, Dec–Feb 1972, J. Menge (TM 10437); 1 ♂, Vrede 719, 31 Mar 1976, B. Lamoral (NM 10905); 4 ♂ 5 ♀ 9 juv, Vrede 719, 31 Mar 1976, B. Lamoral (NM 10836); 3 ♂ 1 ♀, Sesfontein, 4 Apr 1976, B. Lamoral (NM 10835); 2 ♂, Okonjombo, 21 May 1963, P. Buys (SMN 246); 1 ♂ 1 ♀, Oncucua, 6–7 Oct 1969, C. Coetzee (SMN 165); 1 ♂, Espinheira, 29 Sep 1969, C. Coetzee (SMN 166).

(ii)

1 ♂ 1 juv ♀, Sukses Dam, 2 Mar 1969, B. Lamoral (NM 10075).

(iii)

1 juv ♀, Hoas, 1971, J. Labuschagne (TM 10144); 1 juv ♀, Hoas 1971, J. Labuschagne (TM 10145); 1 juv ♀, Hoas, 1971, J. Labuschagne (TM 10147); 1 ♀, Hoas, 1971, J. Labuschagne (TM 10139); 1 ♀, Kamombonde Oos 86, 5–7 Jan 1975 (SMN 589); 1 ♂, Brandberg, 15 Aug 1968, P. Buys (SMN 121); 1 ♂, Uis, Mar 1969, J. Nel (NM 10448); 1 juv ♀, between Onanis and Walvis Bay, 4 Mar 1960, P. Buys (SMN 153); 1 juv, Hentiesbaai, 14 Aug 1961, E. Rusch (SMN 149); 1 juv ♀, Emeritus 123, 9 June 1967, Kapt. Pietersen (SMN 64); 1 juv ♂ 1 juv ♀, Gobabeb, 5 Jan 1963, P. Buys (SMN 171).

(iv)

1 ♂, Kam River, Oct–Dec 1937, J. Bell-Marley (TM 9743); 1 ♂, Twilight 113, Apr 1973, L. Rothkegel (TM 10741); 1 juv, Saffier 148, 5 Mar 1976, B. Lamoral (NM 10783); 1 juv, Ghobab 381, 12 Mar 1976, B. Lamoral (NM 10767); 1 ♀, Noachabeb 97, 22–28 Apr 1972, M-L. P. (SMN 364); 1 ♂, Naukluft, 11 Nov 1968, P. van der Westhuizen (SMN 263); 1 ♂, Frischgewaagd 289, 20 Mar 1976, B. Lamoral (NM 10900); 1 ♂, Kangas 371, 14 Mar 1976, B. Lamoral (NM 10849); 1 ♂, Neisip 34, 20 Oct 1970, F. Burger (SMN 180); 1 ♀, Aandster 147, 6 Mar 1976, B. Lamoral (NM 10799); 1 ♀, Richthofen 126, 16 Feb–2 Mar 1975, M. Penrith (SMN 559); 1 ♀, Springbokvlakte, 20–21 Feb 1973, B. Lamoral (NM 10943); 1 ♀, Vrede 719, 31 Mar 1976, B. Lamoral (NM 10901); 1 juv ♂, Augrabies Falls, 9 Apr 1970, B. Lamoral (NM 10454); 1 ♂ 1 ♀, Namuskluft 88, 12–15 Sep 1973 (SMN 530); 9 ♂ 3 ♀ 4 juv, Berseba, 27 Feb 1976, B. Lamoral (NM 10731); 2 ♂ 1 ♀, Ghobab 381, 12 Mar 1976, B. Lamoral (NM 10811); 1 ♂, Warmbad, 3 Sep 1959 (SMN 77); 1 ♂, Noachabeb 97, 22–28 Apr 1972, J. Batista (SMN 363); 1 ♂ 1 juv ♂, Huams farm, 1 Feb 1969, B. Lamoral (NM 10459); 1 ♂, Noachabeb, 7–12 Jan 1972 (SMN 322); 2 ♂, Na Sukkel, 8 Nov 1965, G. Chatwind (SMN 135); 1 ♂ 1 ♀ 1 juv ♀, Twilight, 8 Feb 1966, L. Rothkegel (SMN 79); 1 ♀, Leonardville, 11 Oct 1963, P. Buys (SMN

66); 1 juv, Goreangab Dam, 19 Dec 1973, C. G. C. (SMN 501); 5 ♂, Schwarzkuppen farm, 8 Feb 1973, B. Lamoral (NM 10520); 1 ♀ 1 ♂ 1 juv ♂, De Waal farm, 17 Mar 1969, B. Lamoral (NM 10043); 2 ♂, Plateau 38/Aar 16, 15–18 Jan 1972 (SMN 321); 1 ♂, De Waal farm, 17–18 Mar 1969, B. Lamoral (NM 10076); 1 ♂ 1 ♀, Barby 26, 2–8 Oct 1972 (SMN 391); 1 ♀, Twilight 113, 9 Dec 1971, Rothkegel (SMN 349); 1 ♀, Arnheim 222, 23 Oct 1972, H. Strauss (SMN 411); 1 ♂, Isabis 19, Dec 1974, L. Lester (SMN 597); 1 ♀, Tses, 23–24 Feb 1973, B. Lamoral (NM 10513); 1 ♂, Plateau 38, 28 Feb 1976, B. Lamoral (NM 10920); 1 ♀ 3 ♂, Skaap river, Mar 1973, C. Coetzee (NM 10511); 1 ♂ 1 ♀, Ortmsbaum, 1971 (SMN 315); 3 ♀ 2 ♂, Saffier 148, 4 Mar 1976, B. Lamoral (NM 10728); 3 ♂, Blaaskranz farm, 2 Feb 1969, B. Lamoral (NM 10014); 2 ♂, Goodhouse, 30 Jan 1973, B. Lamoral (NM 10516); 4 ♂ 1 ♀, Perdepan, 17 Feb 1969, P. Buys (SMN 221); 1 ♀ 1 ♂, Sesriem 137, 5–8 Apr 1972, M-L. P. (SMN 351); 1 ♂ 1 ♀ 3 juv, Sterkstroom farm, 19–20 Mar 1969, B. Lamoral (NM 10031).

(v)

1 ♂, Rosh Pinah, Dec 1971, A. Maritz (TM 10539); 1 ♀, Rosh Pinah Mine, Dec 1971, A. Maritz (TM 10544); 1 ♀, Rosh Pinah, 9 June 1971, D. van Garderen (TM 10118); 1 ♀, Rosh Pinah, July 1972, A. Maritz (TM 10556); 1 juv, Tsrub 13, 3 Mar 1976, B. Lamoral (NM 10786); 1 ♀, Rosh Pinah, 17 Feb 1973, B. Lamoral (NM 10922); 1 ♂, Rosh Pinah, 17 Feb 1973, B. Lamoral (NM 10523); 1 juv ♀, Gorrasis 99, 14 Feb 1973, C. G. C. (SMN 430); 1 ♂, Obib dunes, 16–20 Sep 1973, E. Mokgoabone (SMN 485); 1 ♀, Aus, 16 Jan 1972, E. Eastwood (NM 10458); 3 ♀, Swartpoort, Feb 1974, R. Faber (NM 10502); 2 ♂ 2 ♀, Plateau 38, 29 Feb 1976, B. Lamoral (NM 10804).

(vi)

1 ♂, Upington, 25 Jan 1971, S. Engelbrecht (NM 10456); 1 ♂, Mata Mata, 24 Apr 1970, B. Lamoral (NM 10447); 2 ♂ 1 juv, Kalahari Gemsbok Park, 10 Jan 1972, E. Eastwood (NM 10450); 4 ♀, Twee Rivieren, 1960–1970, le Riche family and staff (NM 10457 & 10455).

Distribution: North-western Cape Province of South Africa, the whole of Namibia and southern Angola.

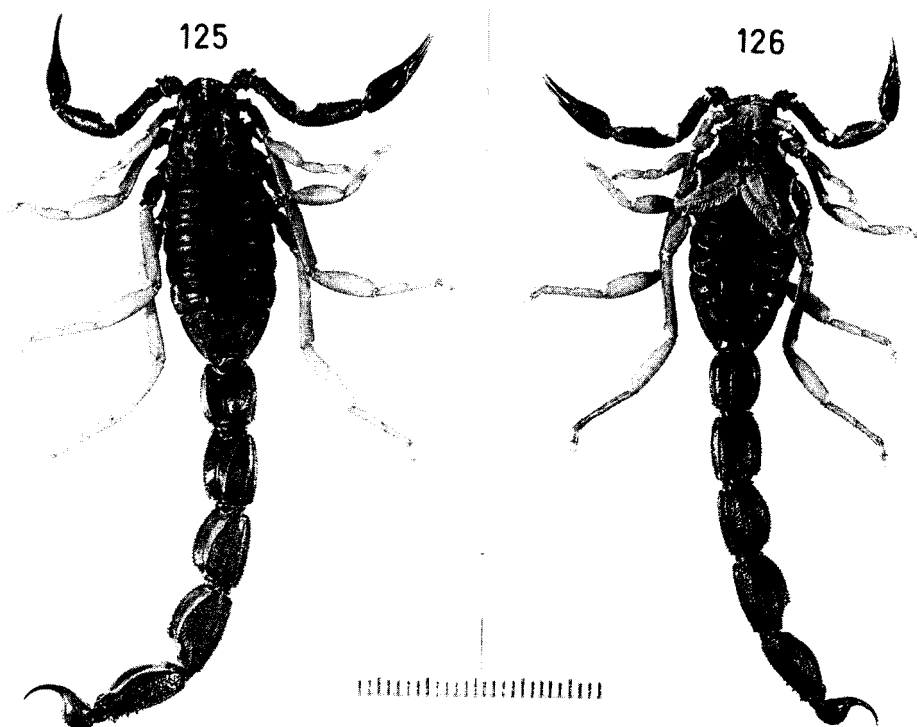
Bionomics: Same as for *P. villosus* with the exception that *granulatus* also digs shallow burrows at the base of shrubs in sandy to consolidated sandy soils. Like *P. villosus*, *granulatus* is one of the more commonly found buthid scorpions of Namibia and it is also often found in human habitations.

Parabuthus kalaharicus Lamoral, 1977. Figs 125–132

Parabuthus kalaharicus Lamoral, 1977: 101–107.

Diagnosis: The following combination of characters separates *P. kalaharicus* from *P. granulatus*, its most closely related species and from other species of the genus. Pedipalp chela, Figs 127–129, τ *dt* distinctly proximal to *et* and never level with or distal to *et* as in most species of *Parabuthus* from southern Africa.

Description: The following account includes the more important character states taken from Lamoral's (1977) description.



Figs 125–126. *Parabuthus kalaharicus*, ♂ holotype (NM 10945). Scale in mm.

Colour: Body and appendages, excepting legs and pectines, deep brown No. 56 with tergites and carapace dark brown No. 59; distal portion of pedipalp chela handback and proximal half of fixed and movable fingers distinctly infuscated; legs and pectines deep orange-yellow No. 69.

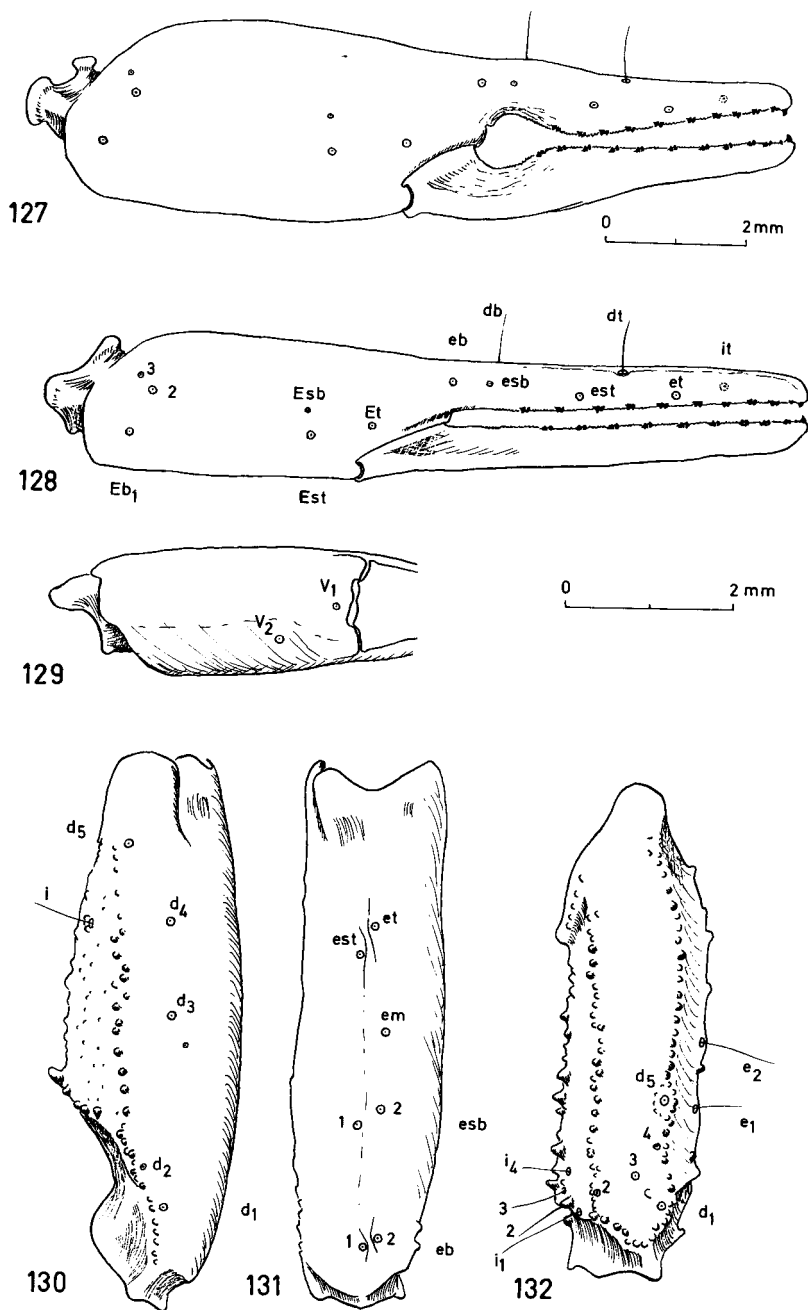
Pectines: Fig. 126. ♂ 22–27 and ♀ 18–20 teeth per pecten. First proximal middle lamella of each pecten in ♀ not enlarged and lobate as in most species of *Parabuthus*.

Setation: As in *P. granulatus*, sparsely pilose, cauda virtually apilose.

Trichobothria: Figs 127–132. One of the two ♀ paratypes (NM 10946) has an additional small trichobothrium on the dorsal surface of the right tibia only, situated just proximally to d_3 (Fig. 130); this is unusual and has not been found in any of the other types. Pedipalp tibia, Fig. 131: τet distinctly distal to est ; τem medial between est and esb_2 . Pedipalp femur, Fig. 132: τd_2 on proximo-dorsal side of dorso-internal keel; d_3 distinctly distal to d_2 and closer to d_4 than d_1 .

Hemispermaphore: As in *P. granulatus*.

Variation: Sexual dimorphism: In adults, males differ very little from females except in the following characters: movable finger length/handback length ratio in ♂ 0.45 lower than in ♀; proximal dentate margin of fixed and movable fingers distinctly emarginated in ♂, linear in ♀; ♂ have 22–27 and ♀ 18–20 teeth per



Figs 127-132. *Parabuthus kalaharicus*. 127, ♂ holotype (NM 10945), right hand, outer aspect; 128-132, ♀ paratype (NM 10946); 128-129, right hand; 128, outer aspect; 129, ventral aspect; 130-131, right pedipalp tibia; 130, dorsal aspect; 131, outer aspect; 132, right pedipalp femur, dorsal aspect. Scales: 127, upper; 128-132, lower.

pecten; first proximal middle lamella of each pecten supports 2–3 teeth in ♂, none in ♀.

Intraspecific variation: Mainly in overall coloration and degrees of infuscation. Overall coloration either darker or lighter than holotype. In some paratypes cauda IV, V and telson are lightly infuscated. In subadults, the telson varies from deep brown to deep orange-yellow. These colour variations occur within samples of populations from all available localities.

Measurements: Carapace length of adult ♂ 7.3 mm (6.7–7.9 mm), ♀ 7.9 mm (only 2 ♀ collected). *P. kalaharicus* is a medium-sized species with total body length of adult ♀ and ♂ about one-third shorter than *P. granulatus*.

Type material: Holotype and paratypes in Natal Museum collection. Series of four paratypes from NM 10439 & 10455 have been deposited in each of the following institutions: South African Museum, Cape Town; Transvaal Museum, Pretoria; Kalahari Gemsbok Park Museum; Museum national d'Histoire naturelle, Paris, France; British Museum (Natural History), London, England; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.; California Academy of Sciences, San Francisco, U.S.A.

Material examined: Holotype ♂, Twee Rivieren, Kalahari Gemsbok National Park, Mar 1970, B. Lamoral (NM 10945, type no. 2104). Paratypes: 2 ♀, Twee Rivieren, Mar 1970, B. Lamoral (NM 10946, type no. 2105); 80 ♂, Twee Rivieren, Mar 1970, B. Lamoral (NM 10439, type no. 2106); 9 ♂, Sterkstroom farm, 19 Mar 1969, B. Lamoral (NM 10947, type no. 2106); 29 ♂, Mata Mata, 24 Apr 1970, B. Lamoral (NM 10948, type no. 2106); 4 ♂, Twee Rivieren, Mar 1970, B. Lamoral (NM 10452, type no. 2106); 1 juv ♂, Mata Mata, 27 Apr 1970, B. Lamoral (NM 10453, type no. 2106); 70 ♂, Twee Rivieren, 1960–1970, le Riche family and staff (NM 10455, type no. 2106).

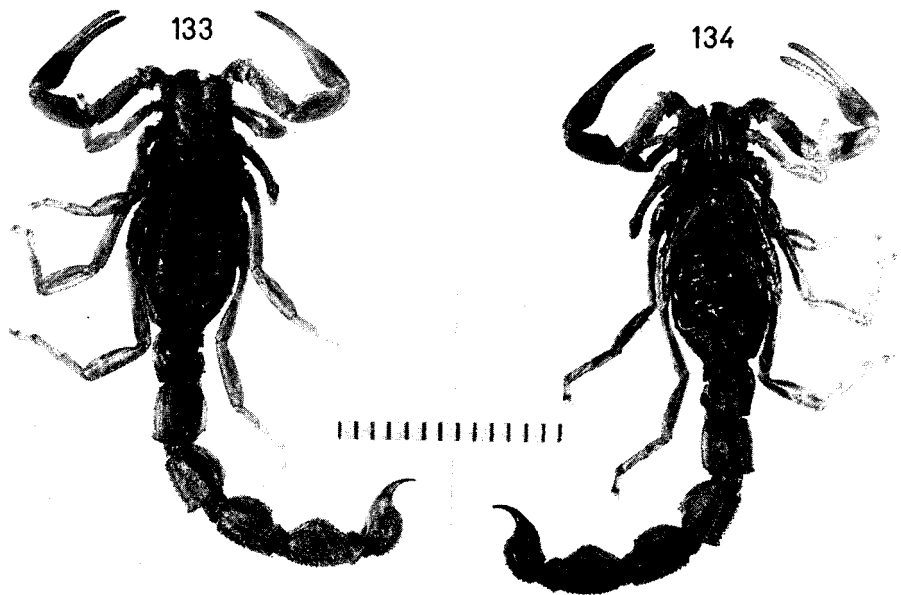
Distribution: Kalahari Gemsbok Park in South Africa and south-eastern Namibia.

Bionomics: Nocturnal, hemiedaphic and digs shallow burrows at the base of shrubs and under rocks on sandy to gritty soils in the shallow interdune valleys of the Kalahari sand dune system. Comb-like rows of setae on the posterior edges of tibia, basitarsi and telotarsi of legs I–II and to much lesser extent III, indicate a semi-psammophilous adaptation. *P. kalaharicus* and its most closely related species *P. granulatus*, are sympatric in the Kalahari Gemsbok Park.

Parabuthus kraepelini Werner, 1902. Figs 133–139

Parabuthus kraepelini Werner, 1902: 599.

Diagnosis: The following combination of characters separates *P. kraepelini* from other species of the genus. Cauda, Figs 133–134: cauda II, dorsal stridulatory patch reaching posterior margin; cauda II–IV, dorsal aspect of dorso-lateral keels convex; cauda IV, V and telson not darker than receding segments. Legs IV, not reaching further than posterior end of cauda I. One of the larger species of *Parabuthus*, it is most closely related to *P. namibensis*.



Figs 133–134. *Parabuthus kraepelini*. ♀ holotype (WUS 2080). Scale in mm.

Description: The following account supplements Werner's original description and Hewitt's (1918: 108–111) supplement.

Colour: Body and appendages, except legs and pectines, dark orange yellow No. 72 to deep yellow brown No. 75, with carapace, tergites and telson usually darkest and sternites lightest; legs brilliant orange yellow No. 67; pectines light orange yellow No. 70.

Granulation: Tergites very finely and evenly granular. Carapace more coarsely granular than tergites, interocular surface granular in ♂ and ♀. Pedipalp chela smooth and matt. Lateral intercarinal surfaces of cauda I–III and lateral surfaces of cauda IV–V, matt, lightly to moderately and evenly granular; cauda IV, median lateral keel well-developed; cauda V, accessory dorsal crest present, composed of distinct blunt tubercules.

Cauda: Figs 133–134. Cauda I, antero-median surface of stridulatory patch sharply inclined to the anterior descending portion. Cauda I–V, width percentage of length 103% (100–106%) for I, 93% (90–96%) for II, 88% (84–92%) for III, 81% (78–84%) for IV, 73% (69–77%) for V.

Sternites: Smooth and shiny. Sternite VII, median keels obsolete, lateral keels present but poorly developed.

Pectines: ♀ 29–32 and ♂ 33–36 teeth per pecten.

Setation: Cauda, legs and pedipalps lightly to sparsely pilose. Lateral and posterior margins of sternites with a row of sparsely distributed setae. Medial third of sternites III and IV with a few scattered setae arising out of small punctations. Cauda I–V and telson sparsely pilose. Trichobothria: As in Figs

135–139. Orthobothriotaxic for group A. Pedipalp chela: τeb proximal to base of dentate margin; τdt distal to et ; τdb closer to est than esb . Pedipalp femur, Fig. 139: τd_2 on proximo-internal side of dorso-internal keel.

Hemispermaphore: not differing diagnostically from those of related species and the *P. villosus* group.

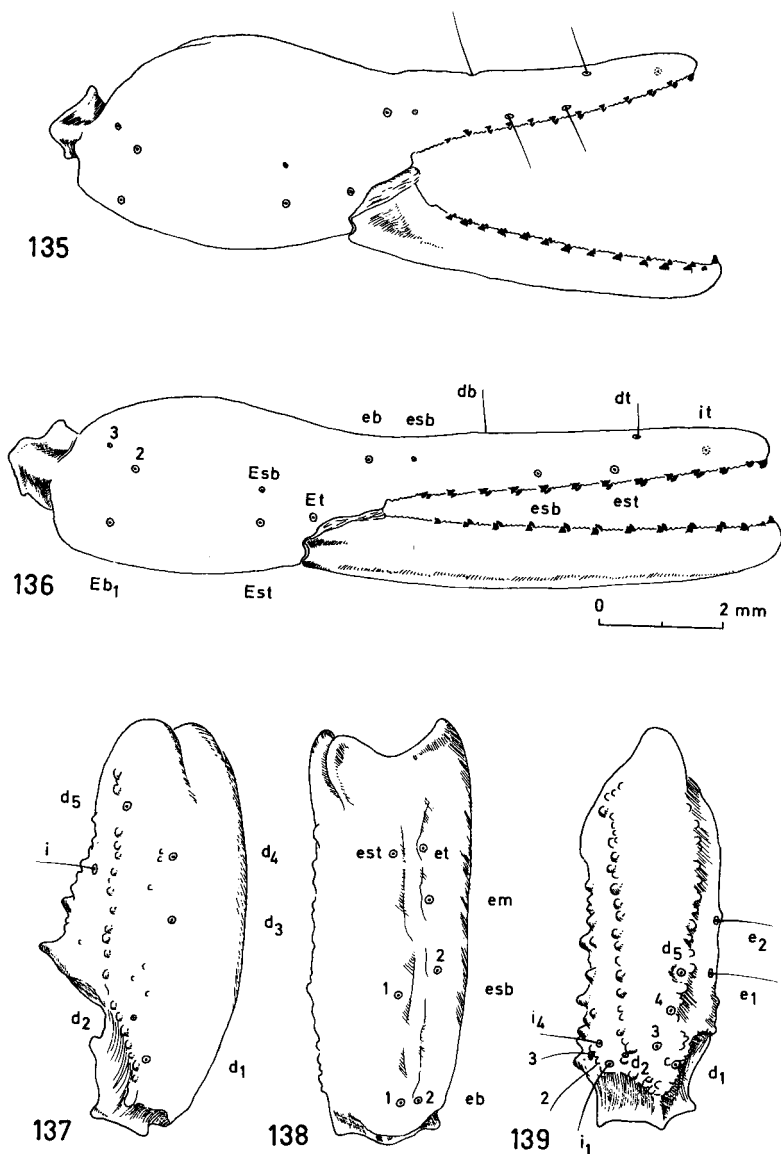
Variation: Sexual dimorphism: In adults, males differ from females in the following characters: δ proportionately smaller and more slender with width sternite V/carapace length ratios 1,12 (1,07–1,17) for δ and 1,30 (1,26–1,35) for η ; δ pedipalp fingers shorter, handback bulbous, wider and longer with movable finger length/handback length ratios 1,40 (1,36–1,44) for δ and 2,05 (2,00–2,10) for η while mean chela length is proportionately 8% longer in δ ; first proximal middle lamella of each pecten sub-rectangular, mesially angular and not enlarged in δ , sub-oval, mesially enlarged and lobate in η .

Intraspecific variation: Little or no variation between populations. Populations from localities in the northern and north-western regions of the species range are darker in overall coloration, deep yellow brown No. 75 to dark yellow brown No. 78 with the distal segments of the cauda and telson progressively darker.

Measurements: Carapace length of adult δ 8,0 mm (7,0–9,0 mm) of adult η 10,5 mm (9,0–12,0 mm).

Type material: Werner's η holotype is a juvenile but it undoubtedly belongs to this species. Although deposited in the Zoological collection of the Vienna University, it bears the following accession data: 'Coll. Musei Vindobonensis Inv. No. 2080.'

Material examined: η holotype, Windhoek (WUS 2080). 1 δ , Ghaub, 19–30 Nov 1972, H. Strauss (SMN 419); 1 juv η , Sukses Dam, 2 Mar 1969, B. Lamoral (NM 10013); 1 juv δ , Warmquelle, 7 Oct 1968; P. Olivier (SMN 118); 2 δ , Keres, 5 Dec 1960, P. Pretorius (SMN 50) 1 δ 1 η , Onanis, 4 Mar 1960, P. Buys (SMN 153); 1 η , Uis, 30 Mar 1969, J. Nel (SAIMR 860); 1 η 3 juv η 3 juv δ , Hoffnung 66, 3 Feb 1971 (SMN 264); 2 juv δ , Okawas, 5 Mar 1969, B. Lamoral (NM 10015); 2 subad η , Otjitambi 25, 14–15 Feb 1972, M-L. Penrith (SMN 337); 1 η 2 juv δ , Sandamap farm, B. Lamoral (NM 10017); 3 η 1 δ , Paulinenhof 72, 20–22 Nov 1972 (SMN 403); 1 δ , Ovambo Grens, Oct 1961, P. Buys (SMN 148); 1 δ , Windhoek, 6–13 June 1972, P. Olivier (SMN 382); 3 subad δ , Sesfontein, 4 Apr 1976, B. Lamoral (NM 10858); 1 η , Hoffnung 66, 3 Feb 1971 (SMN 265); 1 η 1 juv η , Waltersdorf farm, 11–12 Mar 1969, B. Lamoral (NM 10023); 1 subad δ , Windhoek, 16 Dec 1963, W. Snyman (SMN 26); 1 δ , Kangas 371, 14 Mar 1976, B. Lamoral (NM 10850); 1 juv δ , Windhoek, 5 Feb 1962, W. Giess (SMN 5); 1 η , Aus, Etosha Game Park, 2–6 Mar 1969, B. Lamoral (NM 10022); 1 η , Otjiwe, 30 Apr 1961, P. Buys (SMN 144); 1 subad δ , Emeritus 123, 9 June 1967, Kapt. Pietersen (SMN 64); 2 η , Gembokvlakte, 4 Mar 1969, B. Lamoral (NM 10019); 1 juv δ , Goreangab Dam, 19 Dec 1973, C. G. C. (SMN 502); 1 juv η , Gollschau 20, 14–17 Dec 1973, C. Coetzee (SMN 495); 1 juv, Okahandja, May 1960, F. Gaerdes (NM 7304); 1 subad η , Kranzberg, 23 Mar 1974, B. Lamoral (NM 10852); 1 δ , Okahandja, Mar 1966, F. Gaerdes (NM 9114); 1 η , Welwitschia, Jan 1963, F. Gaerdes (NM 9050); 1 η , Okahandja, Mar 1966, F. Gaerdes (NM 9113); 1 δ 2 η ,



Figs 135–139. *Parabuthus kraepelini*. 135, ♂ (SMN 382), right hand, outer aspect; 136–139, ♀ (TM 10430); 136, right hand, outer aspect; 137–138, right pedipalp tibia; 137, dorsal aspect; 138, outer aspect; 139, right pedipalp femur, dorsal aspect.

Okahandja, May 1960, F. Gaerdes (NM 7308–7310); 1 ♂, Otjitanda, 24 Feb 1973, J. Malan (SMN 435); 1 ♀, Windhoek, July 1970, G. Newlands (TM 10430); 1 ♀, Sesfontein, 4 Apr 1976, B. Lamoral (NM 10732); 1 juv ♂, Windhoek (WUS 2079).

Distribution: Northern half of Namibia, excluding the Namib and Kalahari sand systems. The southernmost record is from near the Tropic of Capricorn.

Bionomics: A moderately uncommon species, *P. kraepelini* though nocturnal is occasionally found wandering in the open in daytime. It is hemiedaphic, and digs shallow scrapes under rocks or fallen trees in moderately hard to hard soils in areas with vegetation types 4, 5, 6, 7, 8 and 10 (Fig. 4). It is occasionally sympatric with *P. villosus*, *granulatus* and *brachystylus*, but not *namibensis*, its sister species.

Parabuthus kuanyamarum Monard, 1937. Figs 95, 140–147

Parabuthus kuanyamarum Monard, 1937: 258–259.

Diagnosis: The following combination of characters separates *P. kuanyamarum* from other species of the genus. Cauda, Fig. 95: cauda V, distal half of ventro-lateral keels composed of weakly developed subspinose processes; cauda IV, antero-ventral margin smooth and not demarcated by a transverse row of granules; cauda II–III, postero-ventral margins not demarcated by a distinct transverse row of isolated, round granules; cauda IV, proximo-ventral surface smooth and shiny, remaining ventral and entire lateral surfaces finely granular and shiny, no traces of any longitudinal keels excepting faint traces of ventro-laterals in some specimens. One of the smaller species of *Parabuthus*, it is most closely related to *brevimanus*. These two are in turn most closely related to the *gracilis-nanus* group.

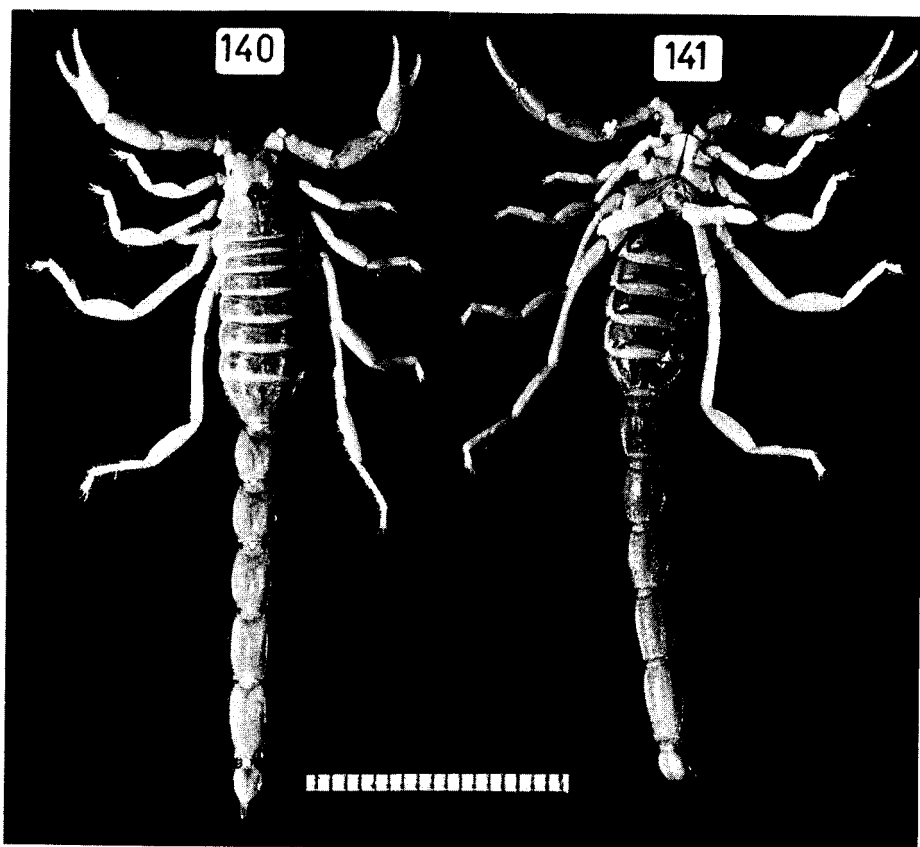
Description: The following account supplements Monard's original description. Colour: Overall, fairly uniform strong yellow No. 84 with the pedipalps, chelicerae, legs and telson slightly lighter.

Cauda: Figs 95, 140–141. Dorsal surface of cauda I and II with well-developed stridulatory areas composed of granules reaching the posterior margins; cauda II–III and to a lesser extent cauda I, ventral and ventro-lateral keels costate; cauda I–III, ventral intercarinal surfaces smooth and shiny, excepting granular distal half of cauda III, lateral surfaces lightly granular, dorsal keels poorly developed to obsolete.

Trichobothria: Figs 142–147. Orthobothriotaxic for group A. Pedipalp hand: τ *Esb* dorsal to *Eb*₂–*Et* alignment. Pedipalp femur, Fig. 147: τ *d*₂ on proximo-internal side of dorso-internal keel; τ *d*₄ much closer to *d*₅ than to *d*₁; τ *e*₁ transversely halfway between *d*₄ and *d*₅; τ *d*₂ distal to *i*₁; τ *d*₃ closer to *d*₄ than to *d*₁.

Hemispermaphore: As in *P. brevimanus*.

Variation: Sexual dimorphism: In adults, males differ from females in the following characters: while only slightly smaller, males are more slender with width sternite V/carapace length ratio 1,10 (1,04–1,16) for ♂ and 1,25 (1,21–1,31) for ♀; pedipalp hand, movable finger length/handback length ratio 1,10 (1,07–1,12) for ♂, 1,45 (1,40–1,49) for ♀; handback of ♂ distinctly bulbous, width and breadth respectively 18% and 16% greater than ♀; lateral intercarinal surfaces cauda I–III



Figs 140–141. *Parabuthus kuanyamarum*, ♀ (NM 10430). Scale in mm.

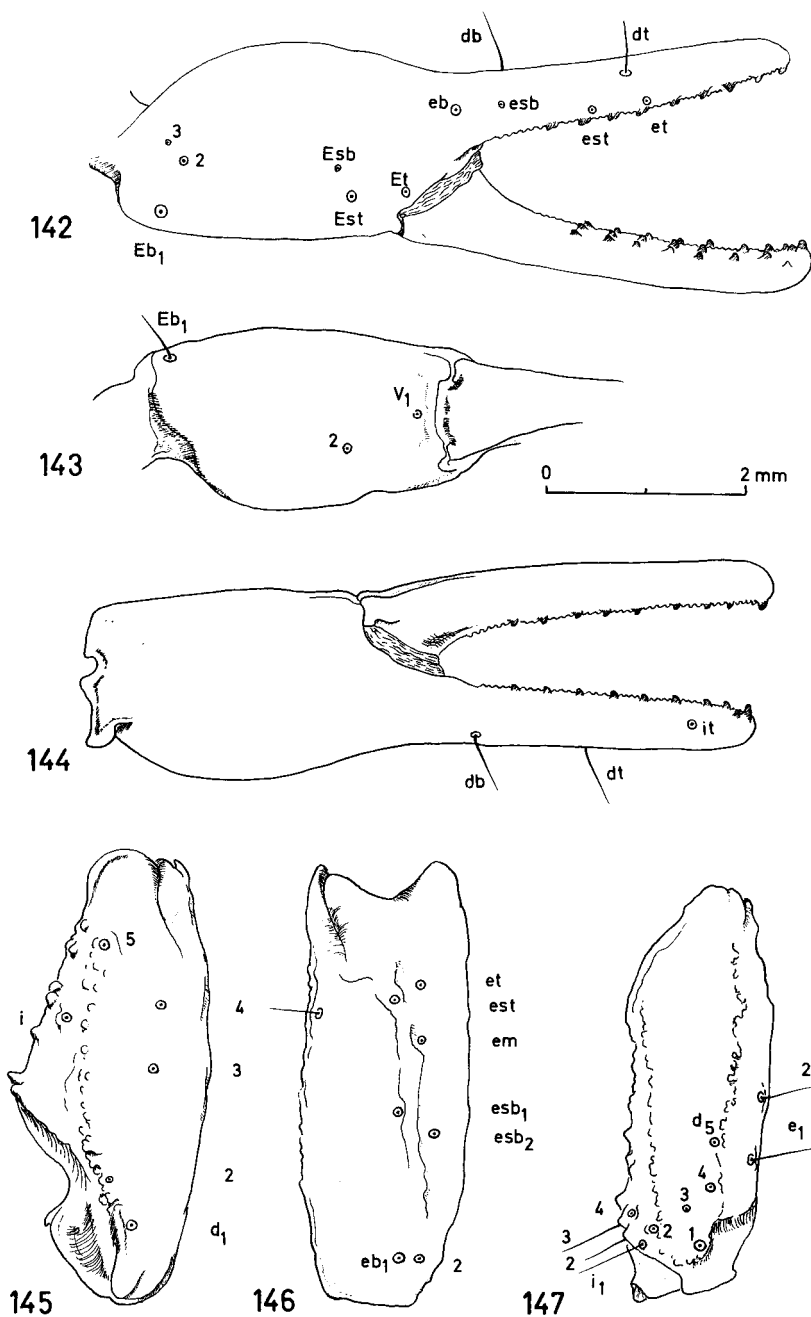
♂ more heavily granulated than ♀; first proximal middle lamella of each pecten sub-triangular and truncate in ♂, sub-circular and lobate in ♀; ♂ 28–32 and ♀ 20–24 teeth per pecten.

Intraspecific variation: Little or no variation between populations from different localities except for the slightly darker overall coloration of populations in the southern regions of the species range. No infuscated patterns, as described for certain populations of *P. brevimanus*, have been observed.

Measurements: Carapace length of adult ♂ 5,0 mm (4,5–5,2 mm), of adult ♀ 5,3 mm (4,8–5,6 mm).

Type material: Monard's syntypes consisted of 3 ♀ and 4 ♂ deposited in the Museum de Histoire naturelle de La Chaux de Fonds, Switzerland. 1 ♀ was found in the collection of the Museum national d'Histoire naturelle in Paris, France, and I have designated this specimen as the lectotype of *Parabuthus kuanyamarum*. The remaining syntypes could not be found in the Museum of the La Chaux de Fonds.

Homotype: I have selected a ♀ homotype which is deposited in the Natal Museum collection (NM 10430).



Figs 142–147. *Parabuthus kuanyamarum*, ♀ holotype (NM 10430). 142–144, right hand; 142, outer aspect; 143, ventral aspect; 144, inner aspect; 145–146, right pedipalp tibia; 145, dorsal aspect; 146, outer aspect; 147, right pedipalp femur, dorsal aspect.

Material examined: ♀ lectotype, Mupanda, Angola, 1933, A. Monard, (MNHP RS); ♀ homotype, Mata Mata, 24 Apr 1970, B. Lamoral (NM 10430). 2 ♂ 2 ♀ 5 juv, Swartmodder farm, 25–26 Feb 1973, B. Lamoral (NM 10441); 4 ♂, Katima Molilo, Oct 1970, W. Haacke (TM 9969–9972); 13 ♂ 2 ♀ juv, Ghobab, 12 Mar 1976, B. Lamoral (NM 10813); 2 ♀, Rhodesia, 1910, Ellenberger (MNHP RS 0365); 1 ♀, Gangwe Pan, 3 Apr 1972, W. Haacke (TM 10653); 2 ♂, Katima Molilo, Oct 1970, W. Haacke (NM 10695); 1 ♀, Gobabis, 4 Mar 1972, W. Haacke (TM 10636); 4 ♂ 1 ♀ 1 juv ♂ 1 juv ♀, De Waal farm, 17–18 Mar 1969, B. Lamoral (NM 10929); 1 ♀ juv, Ghobab, 12 Mar 1976, B. Lamoral (NM 10812); 1 ♂, Farm Gemsbok, 23 Feb 1970, R. Huey (ex TM 10406); 1 juv ♂, Vaalbank, 19–22 May 1973, M-L. Penrith (SMN 452).

Distribution: Eastern regions of Namibia, Kalahari Gemsbok Park in South Africa and south-eastern Angola, in association with the Kalahari sand system (Fig. 20). No records of *P. kuanyamarum* have been published since Monard's original description, based on material from Angola, 42 years ago. The list of material examined, given above has considerably extended the known range of the species. The presence of *P. kuanyamarum* in Namibia was unsuspected before this revision. In addition, available material had been misidentified as *P. brevipennis*.

Bionomics: *P. kuanyamarum* is nocturnal, hemiedaphic, and burrows in the side of sand dunes (soil categories III–V of Table 2) of the Kalahari sand system. It very seldom burrows in sandy interdune valleys and never under rocks in sandy areas or in regions of hard and gritty soils. Distinct comb-like rows of long setae on the posterior edges of tibia, basitarsi and telotarsi as well as a dorso-ventral compression of these segments in legs I–III are evidence of psammophilous adaptations. *P. brevipennis*, a closely related species, is sympatric with *kuanyamarum* in some areas but *gracilis* and *nanus* are allopatric.

Parabuthus laevisfrons (E. Simon, 1887). Figs 148–154

Buthus laevisfrons E. Simon, 1887: 379–380.

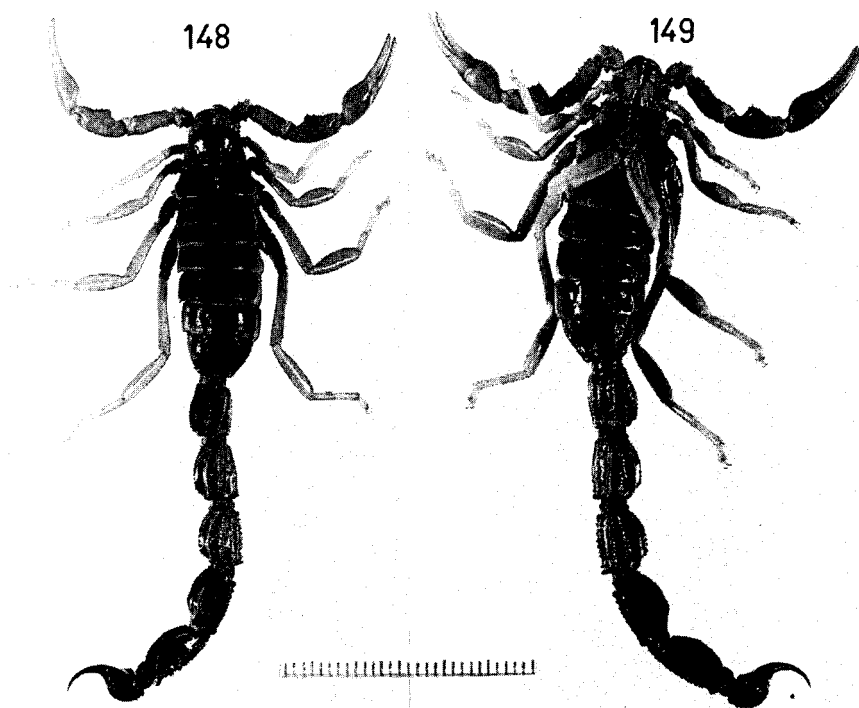
Parabuthus ibelli Werner, 1916: 84–86. *Syn. n.*

Parabuthus laevisfrons australis Hewitt, 1918: 105, 177. *Syn. n.*

Diagnosis: The following combination of characters separates *P. laevisfrons* from other species of the genus. Cauda, Figs 148–149: cauda II, dorsal stridulatory patch reaching posterior margin; telson vesicle distinctly narrower than cauda V; cauda IV, V and telson usually infuscated. Legs IV, not reaching further than posterior end of cauda II. One of the medium-sized species of *Parabuthus*, it is most closely related to *stridulus*.

Description: The following account supplements E. Simon's original description and Purcell's (1901: 151–155) comprehensive supplement.

Colour: Body and cauda I–III dark orange yellow No. 72; cauda IV–V and telson deep brown No. 56 to brown black No. 65; pedipalp light orange yellow No. 70; legs light yellow No. 86, pectines pale yellow No. 89.



Figs 148–149. *Parabuthus laevifrons*, ♀ neotype (NM 10436). Scale in mm.

Granulation: Carapace granular, excepting interocular area in females only which is smooth or very sparsely granular. Tergites very finely granular in anterior two-thirds, granular in posterior third. Pedipalp chela smooth and shiny. Lateral intercarinal surfaces of cauda I–III and lateral surfaces of cauda IV–V smooth and shiny, rarely with a few scattered granules; cauda V, accessory dorsal crest obsolete to absent.

Sternites: Smooth and shiny. Sternite VII, median and lateral keels obsolete.

Cauda: Figs 148–149. Cauda I, antero-median surface of stridulatory patch sharply inclined to the anterior descending portion; cauda II–IV, dorsal aspect of dorso-lateral keels convex; cauda I–V, width percentage of length 91% (86–96%) for I, 83% (79–87%) for II, 79% (74–84%) for III, 68% (65–71%) for IV, 57% (55–59%) for V; cauda IV, median lateral keel obsolete; telson vesicle width percentage of cauda V width 81% (77–85%).

Pectines: ♀ 31–36 and ♂ 36–41 teeth per pecten.

Setation: Almost entirely apilose excepting as follows: ventral, and to a lesser extent lateral surfaces of caudal segments and telson with a few scattered setae, lateral and posterior margins of sternites with a sparse row of setae; posterior edge of telotarsi, basitarsi and tibia of legs I–II and to a lesser extent III with a row of long stiff setae; anterior edge of basitarsi I–III with a similar, but less well endowed row of setae.

Trichobothria: As in Figs 150–154. Orthobothriotaxic for group A. Pedipalp chela: τeb proximal to base of dentate margin; τdt proximal to or rarely level with et ; τdb closer to esb than est . Pedipalp femur, Fig. 154: τd_2 on proximo-dorsal side of dorso-internal keel.

Hemispermaphore: As for *P. kraepelini*.

Variation: Sexual dimorphism: In adults, males differ from females in the following characters: ♂ smaller but proportionately more robust, with width sternite V/carapace length ratios 1,17 (1,14–1,20) for ♂ and 1,08 (1,04–1,12) for ♀; ♂ pedipalp fingers shorter, handback much wider, unusually bulbous and longer with movable finger length/handback length ratios 1,15 (1,10–1,20) for ♂ and 1,47 (1,40–1,55) for ♀ while mean chela length is proportionately 10% longer in ♂; first proximal middle lamella of each pecten sub-triangular, mesially obtuse but not enlarged in ♂, sub-oval, mesially enlarged and lobate in ♀.

Intraspecific variation: Populations from localities listed under (i) in the list of material examined are all fairly typical and show little morphological variation. Specimens from localities under (ii), however, show the following differences: caudal segments more slender and width percentages of lengths all fall within lower values of ranges supplied in diagnosis; cauda IV, V and telson not infuscated and the same colour as I–III; stridulatory patch of cauda II is narrower and is shallowly excavated; the handback of pedipalp chela in males is even more bulbous than in the typical forms.

Measurements: Carapace length of adult ♂ 6,7 mm (6,0–7,5 mm), of adult ♀ 8,5 mm (7,0–10,0 mm).

Type material: Simon's ♂ holotype was supposed to be in the collection of the Muséum national d'Histoire naturelle, Paris. A thorough search of the collection failed to yield the type. Prof. M. Vachon joined the search and communicated the following report:

Première note Vachon–Lamoral

Paris, Le 12 septembre 1975

Parabuthus laevifrons Simon (1887) décrit en 1887 sous le nom de *Buthus laevifrons* in: *Ann. Soc. entom. France*, 6ème sér. tome 7. P.379; le type est un ♂, collecté par le Dr. Hans Schlinz de Zurich. Station imprécise: sud-ouest Afrique.

Toutes mes recherches faites dans le matériel inventorié comme *Parabuthus* et *Buthus* me conduisent à admettre que le type est perdu.

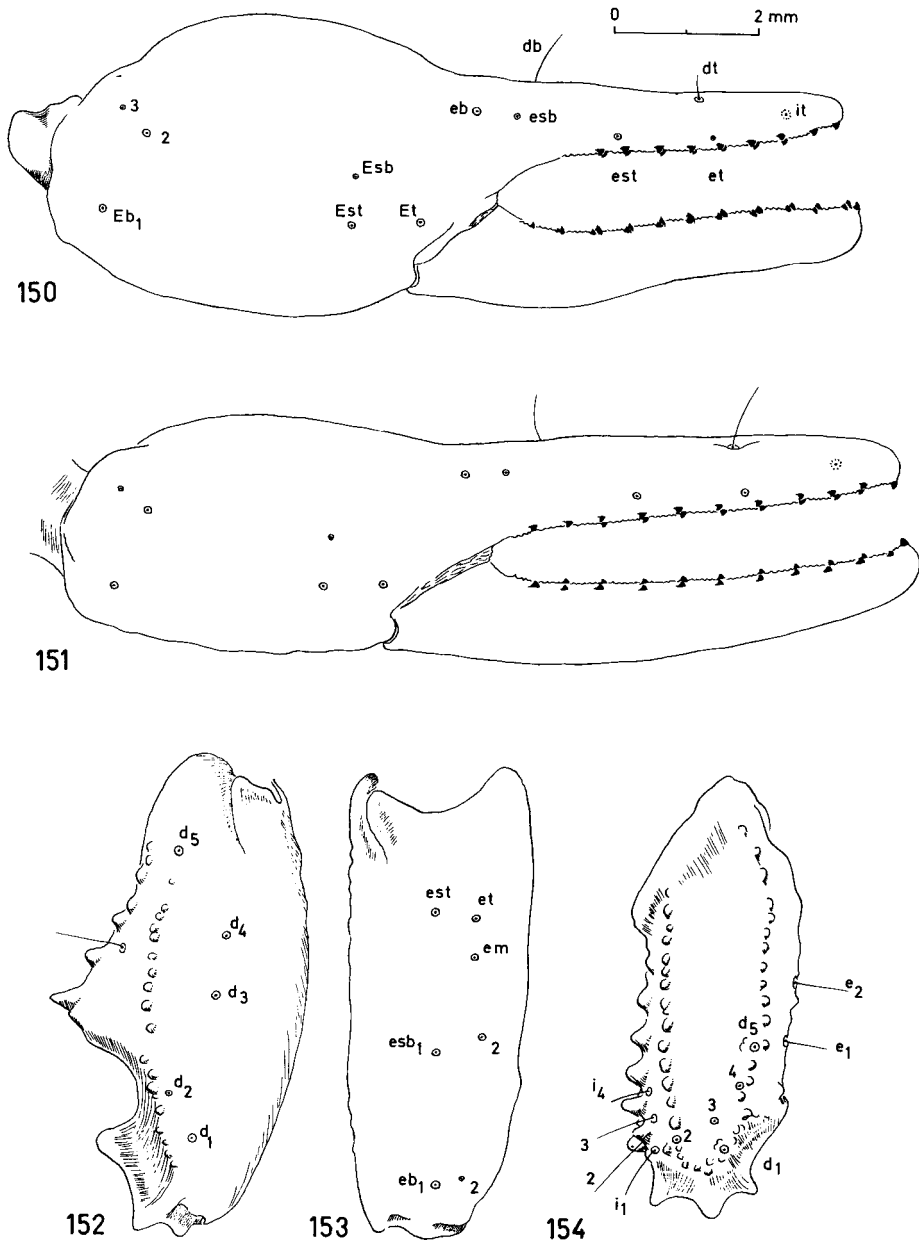
J'ajoute à cette réponse négative, les renseignements suivants qui corroborent ce fait:

1° dans son catalogue des Scorpions du Muséum national d'Histoire naturelle de Paris in: *Bull. Mus. hist. nat. Paris*, 1901, No 6, PP.262–274; K. KRAEPELIN ne mentionne pas cette espèce aussi bien dans la liste des espèces de *Buthus* que dans celle des *Parabuthus*. Or KRAEPELIN, en 1900 a revu tous les Scorpions du Muséum.

2° la consultation du cahier où Eugène SIMON inventoriait les espèces qu'il possédait et qui portaient toutes, un numéro (appelé par nous numéro collection Simon), aucune mention n'est faite d'un spécimen portant le nom de *laevifrons*.

Dans ces conditions, il faut créer un néotype en tenant compte du fait que, dans sa diagnose, E. Simon ne précise pas le lieu de capture.

The loss of Simon's type therefore appears to have been established beyond reasonable doubt and the following specimen is hereby selected and designated as the neotype of *Parabuthus laevifrons*: 1 ♀, Hardap Dam, Mariental, October 1968, R. F. Lawrence (NM 10436). It has been labelled accordingly and is deposited in the type collection of the Natal Museum.



Figs 150–154. *Parabuthus laevifrons*. 150, ♂ (NM 10435), right hand, outer aspect; 151–154, ♀ neotype (NM 10436); 151, right hand, outer aspect; 152–153, right pedipalp; 152, dorsal aspect; 153, outer aspect; 154, right pedipalp femur, dorsal aspect.

Simon's description of his type leaves no doubt that it was a ♀ and not a ♂ as stated by him. Taking into account that Simon did not supply a more definite locality other than 'Sud-ouest Afrique', the neotype was selected so as to match as closely as possible Simon's original description.

Material examined: ♀ neotype, Hardap Dam, Oct 1968, R. Lawrence (NM 10436); *Parabuthus ibelli* 1 ♀ & 1 ♂ syntypes, Berseba (NMW 1056 & 1057); *P. laevifrons australis* 1 ♂ & 1 ♀ syntypes, South of Orange River, 1 ♂ syntype, Upington, South Africa (AM).

The roman numerals used below refer to material discussed under variation.

(i)

1 ♂, Onderste Narries farm, 23 Jan 1973, B. Lamoral (NM 10462); 1 ♀, Swartmodder farm, Feb 1971, B. Lamoral (NM 10438); 1 juv ♀, Vredenhof 301, 21 Feb 1976, B. Lamoral (NM 10785); 1 ♀, Kwang, 10 Jan 1972, I. Rautenbach (TM 10651); 1 ♀, Louwshoop farm, 4 Feb 1973, B. Lamoral (NM 10525); 1 ♂, Keimasmund farm 88, 25 May 1972, M. Jensen (NM 10428); 1 ♂, Twee Rivieren, 13 Dec 1962, Oosthuizen (TM 10006); 2 ♂, Noachabeb farm, 6 Feb 1973, B. Lamoral (NM 10050); 1 juvenile ♂, Neisip 34, 21 Oct 1970, F. Burger (SMN 183); 3 ♀ 1 ♂, Belda farm, 1 Feb 1973, B. Lamoral (NM 10512); 1 ♂, Ortmanbaum 120, 18–21 Oct 1971, M-L. Penrith (SMN 307); 1 ♂ 1 juv ♂, Goodhouse, 30 Jan 1973, B. Lamoral (NM 10941); 1 ♂, Ortmanbaum 120, 19–22 Oct 1971 (SMN 310); 1 ♂, Hardap Dam, Oct 1968, R. Lawrence (NM 10435); 1 ♂, Blinkoog 30, 14–18 Oct 1971, J. Batista (SMN 368); 4 ♂, Noachabeb 97, 7–12 Jan 1972 (SMN 324); 2 ♀ 1 ♂ 1 juv ♂, Koa Valley, 29–31 Jan 1973, B. Lamoral (NM 10522); 2 ♀ 1 ♂ 3 juv, Louwshoop farm, 3 Feb 1973, B. Lamoral (NM 10515); 3 ♂ 1 ♀, Hardap Dam, Oct 1968, R. Lawrence (NM 10942); 2 ♂ 1 ♀ 1 juv ♀ 1 juv ♂, Ortmanbaum farm, 26–28 Jan 1973, B. Lamoral (NM 10509); 1 ♀, Swartmodder farm, Jan 1972, Engelbrecht (NM 10437); 4 ♀ 2 ♂ 2 juv ♂ 1 juv ♀, Berseba, 27 Feb 1976, B. Lamoral (NM 10800); 8 ♀ 4 ♂, Tses, 23–24 Feb 1973, B. Lamoral (NM 10521); 4 ♂ 1 ♀, 3 juv ♂, Schwarzkuppen farm, 8 Feb 1973, Lamoral (NM 10510); 5 juv, Swartmodder farm, 25–26 Feb 1973, B. Lamoral (NM 10533); 1 ♂, Inkle Pan, 8 Feb 1970, W. Haacke (TM 9583); 1 juv ♂, Klein Spitzkoppe, 14 May 1972, O. Prozesky (TM 10491); 1 ♂, Kwang, 10 Jan 1972 (TM 10288).

(ii)

3 ♀ 6 ♂ & juvs, Saffier 148, 4 Mar 1976, B. Lamoral (NM 10729); 2 ♂ 2 ♀ 6 juv, Aandster 147, 6 Mar 1976, B. Lamoral (NM 10776); 1 ♀, Farm Plateau, Oct 1973, H. Erni (NM 10498); 2 juv ♂ 2 juv ♀, Okahandja, Feb 1963, F. Gaerdes (NM 8383); 1 ♀, Avasib dunes, 29–30 Jan 1974, C. G. C. (SMN 528).

Distribution: The southern half of Namibia with the exclusion of the interior highland mountains (1 500 metres plus in Fig. 19) and the Namib and Kalahari sand systems. The northernmost records are Okahandja and Klein Spitzkoppe. *P. laevifrons* has also been recorded South and North of the Orange River in the northern Cape Province of South Africa.

Bionomics: Like *P. kraepelini*, *laevifrons* is a fairly uncommon species. It is hemiedaphic and digs shallow scrapes under rocks in soils ranging from consoli-

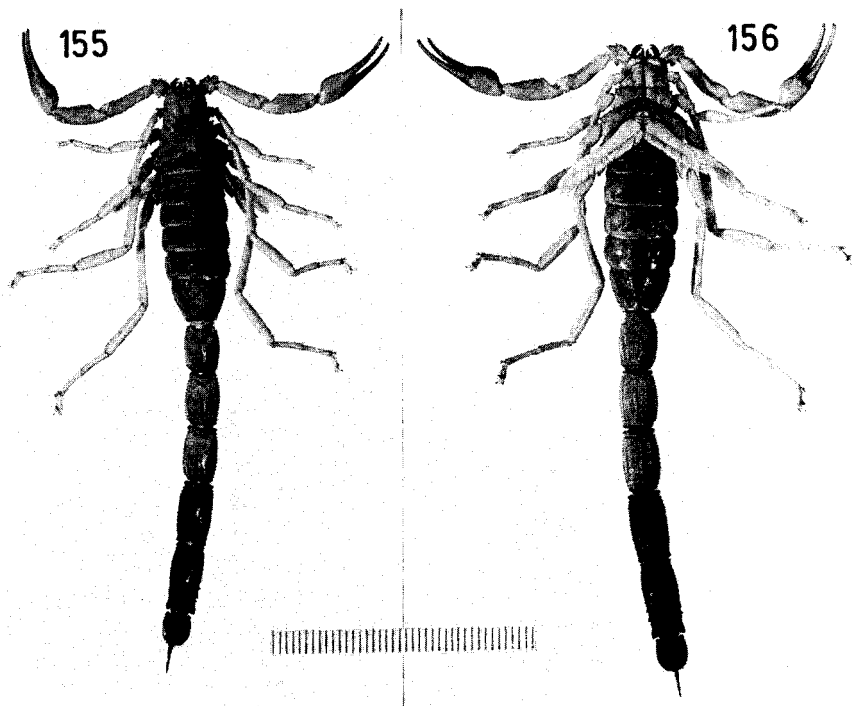
dated sand to moderately hard and gritty soils in regions with vegetation types 4, 7 (southern reaches) and 9 (Fig. 4). The rake-like rows of setae on the posterior edges of tibia, basitarsi and telotarsi and slight dorso-ventral compression of these segments suggest a semi-psammophilous adaptation. This adaptation probably explains why on occasion *laevifrons* marginally intrudes the sand systems of the Kalahari and the Namib. *P. laevifrons* is occasionally sympatric with *villosus*, *granulatus*, *schlechteri* and *brevimanus*.

***Parabuthus namibensis* sp. n. Figs 155–163**

Derivation: From Namib Desert.

Diagnosis: *P. namibensis* can be separated from other species of the genus by the following combination of characters. Cauda, Figs 155–156: cauda II, dorsal stridulatory patch reaching posterior margin; cauda II–IV, dorsal aspect of dorso-lateral keels subparallel; cauda IV, V and telson deeply infuscated. Legs IV, long and slender, reaching posterior end of cauda III. One of the larger species of *Parabuthus*, it is most closely related to *kraepelini*.

Description: The type series consists of the ♀ holotype and 3 ♂ paratypes. The following description is based on the ♀ holotype, unless otherwise indicated.



Figs 155–156. *Parabuthus namibensis* sp. n., ♂ paratype (TM 9787). Scale in mm.

Colour: Tergites, carapace, chelicerae and sternites moderate olive brown No. 95; cauda I–III light olive brown No. 94, cauda IV, V and telson dark olive brown No. 96; pedipalps strong yellow No. 84; legs and pectines moderate yellow No. 87.

Granulation: Pedipalp: chela smooth and matt; tibia with granules and tubercles of keels as in Figs 161–162, ventral surface lightly granular, otherwise smooth and matt; femur with keels as in Fig. 163, dorsal and inner surfaces lightly granular, otherwise smooth and matt. Legs I–IV smooth and shiny excepting outer surfaces of femora II–IV. Coxae legs I–VI smooth and shiny. Carapace moderately granular, interocular surface smooth with a few scattered granules. Tergites: I–VII, finely granular in anterior two-thirds, more coarsely granular in posterior third; I–VI, median keel poorly developed; VII, median and lateral pairs of keels moderately developed. Sternites: II–VI smooth and shiny; VII, median and lateral pairs of keels poorly developed, surface between lateral keels smooth and shiny, surfaces between lateral keels and lateral margins lightly granular. Cauda: all keels well-developed and granular, except anterior third of median lateral and posterior third of ventrals in cauda IV and medial third of dorsals in cauda V; cauda V, accessory dorsal crest present, consisting of 3–6 short, blunt tubercles; intercarinal surfaces of cauda I smooth and matt with a few scattered granules laterally, remaining segments progressively more granular with V evenly granular; telson bulbous, with four longitudinal rows of interspersed granules, lateral and dorsal surfaces lightly punctate and shiny; cauda I, dorsal stridulatory patch oblong in shape with a slight posterior constriction, composed of fine granules reaching posterior margin; cauda II, dorsal stridulatory patch narrow, shallowly excavated, reaching posterior margin, composed of fine granules, a few of which posteriorly form short ridges which do not span more than halfway across the patch.

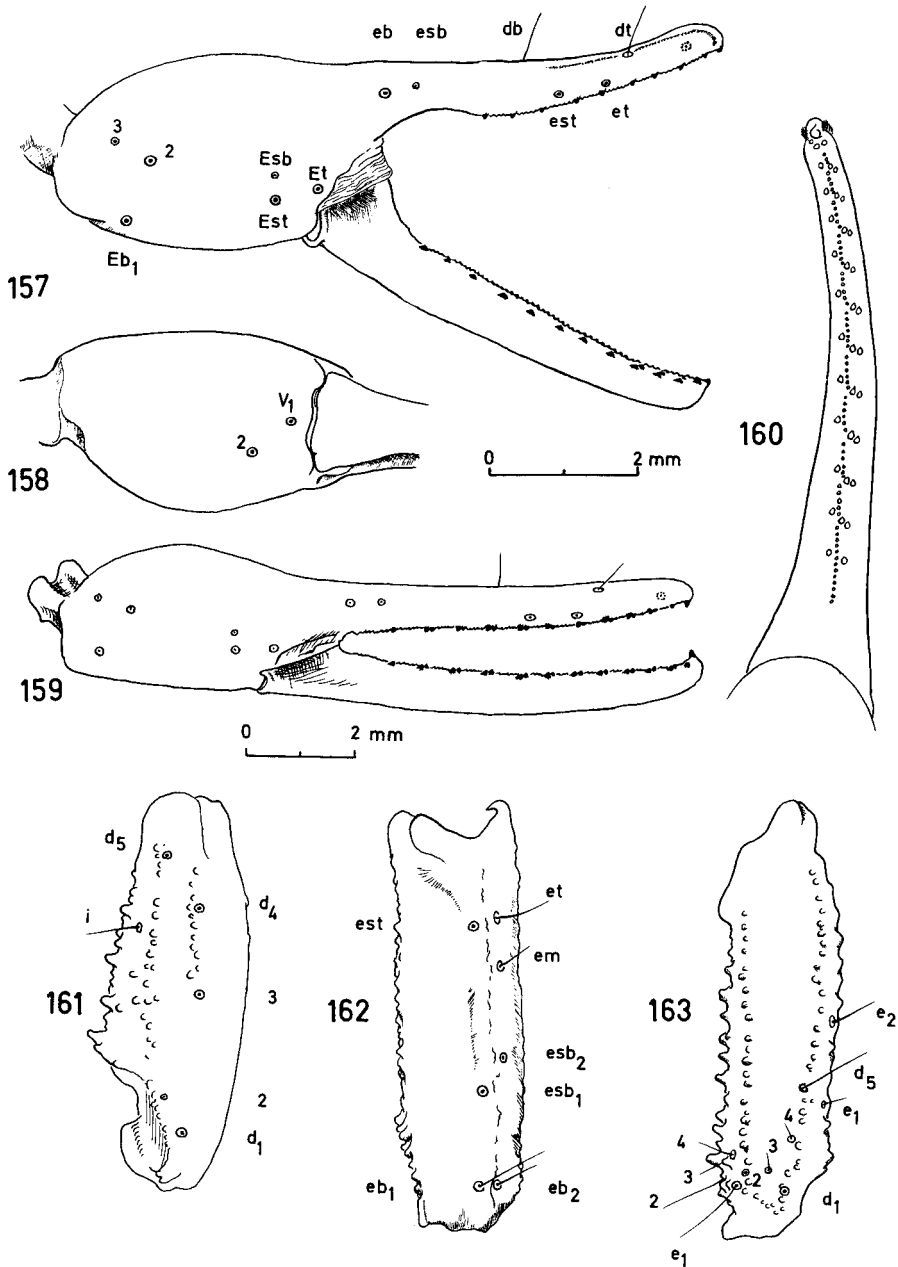
Cauda: Figs 155–156. Cauda I, antero-median surface of stridulatory patch gently inclined to the anterior descending portion; cauda I–V, width percentage of length 79% (77–81%) for I, 68% (65–71%) for II, 64% (63–65%) for III, 55% (54–56%) for IV and 51% (50–52%) for V, giving the cauda a slender appearance. Pectines: 40–41 teeth per pecten. First proximal middle lamella of each pecten sub-oval, mesially enlarged and lobate.

Sternum: Sub-trapezoidal, greatest length equal to greatest width.

Setation: Overall sparsely to moderately pilose as for *P. kraepelini*. Posterior edges of telotarsi, basitarsi and tibia I and II with rake-like rows of long fine setae. Ventral surfaces of telotarsi I–IV with pads of fine setae. Sternites III and VII with scattered fine setae. Lateral and posterior margins of sternites III–VII with a row of sparsely distributed setae.

Trichobothria: As in Fig. 159 for holotype. The trichobothriotaxy of the holotype does not differ from that of the ♂ paratype illustrated in Figs 157–158, 161–163. Orthobothriotaxic for group A. Pedipalp hand: τeb level with or slightly distal to base of dentate margin. Pedipalp femur, Fig. 163: τd_2 on proximo-dorsal side of dorso-internal keel.

Hemispermaphore: Not differing diagnostically from *P. kraepelini* and related species.



Figs 157–163. *Parabuthus namibensis* sp. n. 157–158, ♂ paratype (TM 9787), right hand; 157, outer aspect; 158, ventral aspect; 159, ♀ holotype (NM 10822), right hand, outer aspect; 160–163, ♂ paratype (TM 9787); 160, right hand movable finger, mesial aspect; 161–162, right pedipalp tibia; 161, dorsal aspect; 162, outer aspect; 163, right pedipalp femur, dorsal aspect. Scales: 157–159, 161–163, lower; 160, upper.

Variation: Sexual dimorphism: Holotype and paratypes. In adults males differ from females in the following characters: ♂ pedipalp fingers shorter, handback longer, wider and swollen, with movable finger length/handback length ratios 1,58 (1,50–1,66) for ♂ and 2,19 (2,15–2,23) for ♀ while mean chela length is proportionately 9% longer in ♂; ♂ proportionately more slender with width sternite V/carapace length ratios 1,10 (1,08–1,12) for ♂ and 1,20 for ♀; first proximal middle lamella of each pecten subtriangular, mesially obtuse but not enlarged in ♂, sub-oval, mesially enlarged and lobate in ♀; ♂ with 42–47 and ♀ with 40–41 teeth per pecten.

Intraspecific variation: Excepting infuscated cauda IV, V and telson, all the ♂ paratypes are much lighter in colour, with tergites, carapace, sternites and cauda I–III strong yellow No. 84, pedipalps and legs brilliant yellow No. 83 and pectines light yellow No. 86.

Measurements: ♀ holotype (in mm): pedipalp chela as in Fig. 159; pedipalp tibia width 3,8, length 7,8; pedipalp femur width 2,0, length 7,0; Carapace, length 8,8, anterior width 6,0, posterior width 9,2, distance of median eyes from anterior margin 3,8; sternite V width 10,4; cauda I to V width and length, I 5,0 & 6,2, II 4,8 & 7,0, III 4,8 & 7,2, IV 4,8 & 8,2, V 4,6 & 9,2; telson vesicle height 4,0, width 4,4, length 6,2, aculeus length 4,6.

Type material: ♀ holotype and 1 ♂ paratype (NM 10822) in Natal Museum collection, other paratypes in Transvaal Museum collection.

Material examined: ♀ holotype 1 ♂ paratype, 5 km north of Cape Cross on Skeleton Coast, 25 Mar 1976, B. Lamoral (NM 10822); 1 ♂ paratype, Gobabeb, Jan 1970, R. Jones (TM 9787); 1 subad ♂ paratype, 32 km from Gobabeb on way to Mirabib, 28 Feb 1975, S. Endrödy Younga (TM 11086).

Distribution: Central and northern Namib Desert.

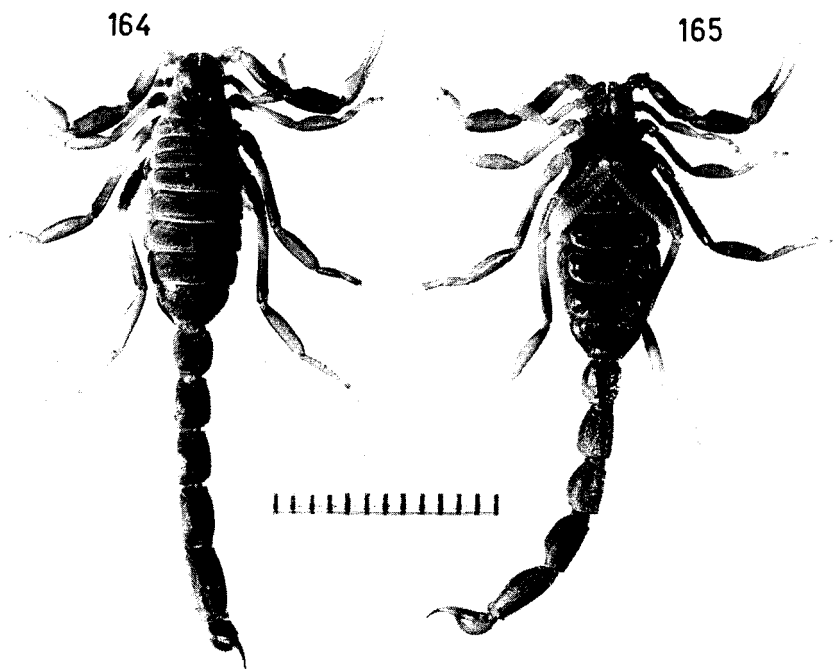
Bionomics: Verly little is known about the bionomics of this species. The holotype and paratype from Cape Cross were caught while collecting at night with an ultra-violet light on the gravel plains near the area shown in Fig. 6. The soil surface was consolidated sand mixed with grit. No ecological data accompany the two paratypes from the Transvaal Museum collection.

***Parabuthus nanus* sp. n. Figs 100–102, 105–106 & 164–172**

Derivation: Nanus, m. (L.) = a dwarf.

Diagnosis: *P. nanus* can be separated from other species of the genus by the following combination of characters. Caudal segments, keels, granulation and surface texture as in *P. gracilis* but dimensions proportionally 75% smaller in adults of *nanus*. Cauda I, width percentage of length 91% (90–93%) for adult ♂, 95% (94,0–96,5%) for adult ♀. Sternum greatest width/greatest length 1,00 for adult ♂ and ♀ (0,95–1,04). The smallest species of *Parabuthus* so far described, it is most closely related to *gracilis*. These two are in turn most closely related to the *brevimanus*–*kuanyamarum* group.

Description: The type series consists of females and males. The following description is based on the holotype ♀, unless otherwise indicated.



Figs 164–165. *Parabuthus nanus* sp. n., ♀ holotype (NM 10926). Scale in mm.

Granulation: As for *P. gracilis*. Sternites III–VI not wrinkled as in *P. gracilis*, but with numerous shallow punctations over posterior half between stigmata; sternite VII with shallow punctations over two-thirds of postero-median surface, without lateral keels.

Colour: Overall, variably moderate yellowish brown No. 77, with surface between lateral and median eyes, dorsal and external distal half pedipalp femur, distal half femur legs I–IV very lightly infuscated.

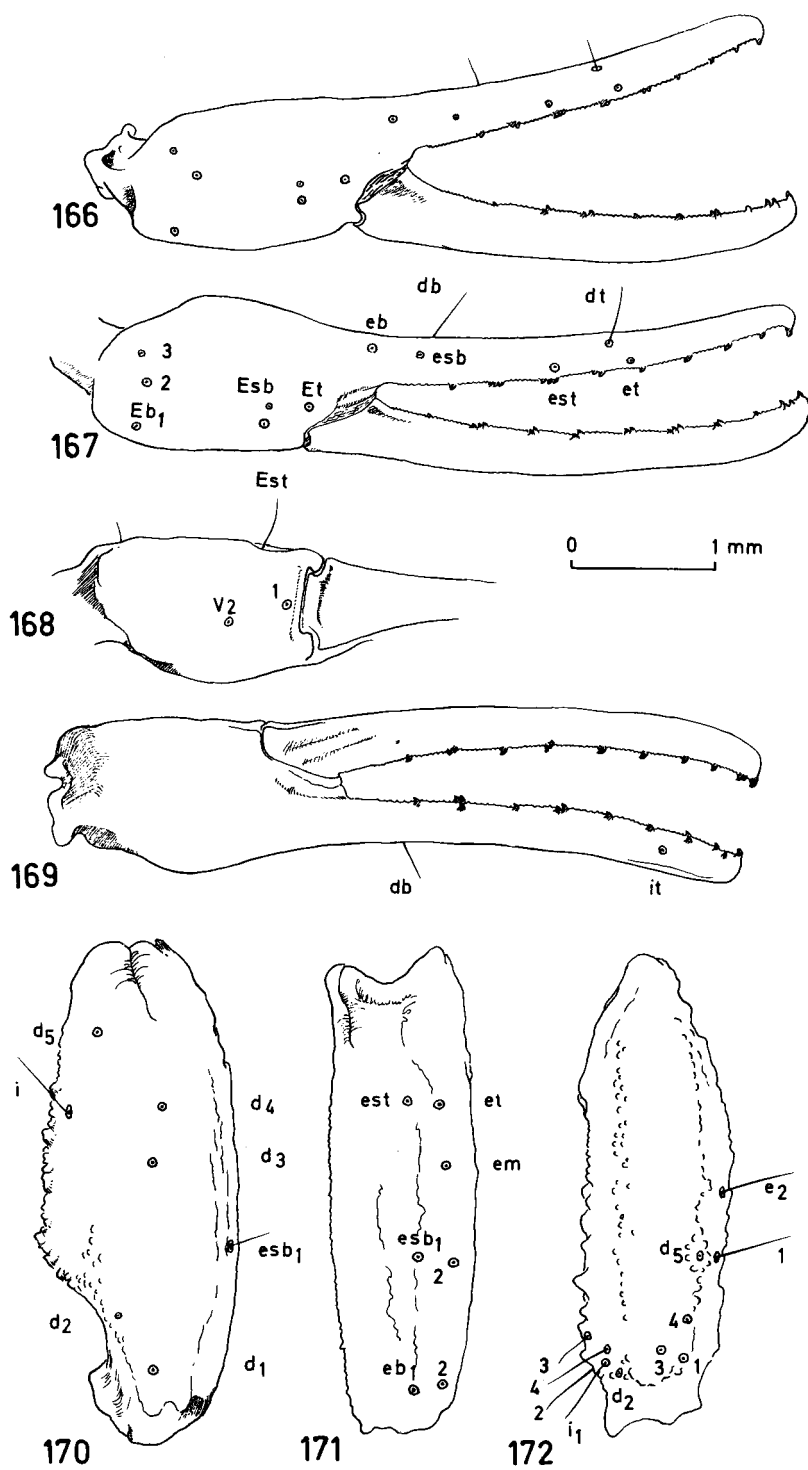
Cauda: Ventrally as for *P. gracilis*. Stridulatory patch: cauda I, consisting of fine granules, flaring anteriorly, narrowing medially and slightly flaring posteriorly, reaching posterior margin; cauda II almost obsolete and not reaching posterior margin.

Pectines: 24 and 24 teeth, Fig. 106. In paratypes, ♀ 23–25, ♂ 23–25 teeth per pecten. First proximal middle lamella of ♂ and ♀ in alignment with middle lamella axis.

Sternum: Width equal to length and almost sub-pentagonal in shape.

Setation: As for *P. gracilis*, but with setae on surface of sternites, arising out of shallow punctations described above.

Trichobothria: Figs 166–172, orthobothriotaxic for group A. Pedipalp hand: τ *Esb* ventral to *Eb*₂–*Et* alignment. Pedipalp tibia: τ *d*₂ present and small. Pedipalp femur, Fig. 172: τ *d*₂ on proximo-internal side of dorso-internal keel; τ *d*₄ much closer to *d*₁ than to *d*₅; τ *e*₁ very slightly distal to *d*₅; τ *d*₂ proximal to *i*₁; τ *d*₃ closer to *d*₁ than to *d*₄.



Paraxial organ: As for *P. brevimanus*.

Hemispermaphore: Figs 100–102. *Pars reflecta* one-quarter of hemispermaphore length; *pars recta* as in *P. gracilis*; outer lobe obtuse; basal lobe with a small inner process and subequal in length to median lobe, not longer as in *P. gracilis*.

Variation: Sexual dimorphism: Holotype and paratypes. In adults, males differ very little from females, except in the following characters. Carapace and total body lengths 15% shorter. Although adult males are smaller than females, there are no proportional differences between ♂ and ♀, consequently, adult specimens of equal size can be sexed only by the presence in ♂, and absence in ♀, of genital papillae. Pedipalp hand, Figs 166–167: movable finger length/handback length ratio 2,00 (1,93–2,08) for ♂ and ♀.

Intraspecific variation: Specimens from the southern parts (Belda farm, NM 10702) of the known species range have slightly darker infuscations than the holotype and the anterior half of each caudal segment lightly infuscated. Specimens from south of the Orange River (NM 10700 and 10703) and from the western margin of the species range (Tsirub farm NM 10772) are paler than the holotype in overall coloration and non-infuscated.

Measurements: Carapace length of adult ♂ 3,1 mm (2,9–3,3 mm), of adult ♀ 3,5 mm (3,3–3,8 mm).

Type material: Holotype and paratypes in Natal Museum collection. Paratypes have been deposited in the following institutions: State Museum, Windhoek, Namibia; Museum national d'Histoire naturelle, Paris, France; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, United States of America.

Material examined: ♀ holotype, Noachabeb farm, 6 Feb 1973, B. Lamoral (NM 10926); Paratypes: 1 ♂, Noachabeb farm, 6 Feb 1973, B. Lamoral (NM 10926); 2 ♂, Noachabeb farm, 6 Feb 1973, B. Lamoral (NM 10927); 1 ♂ 1 subad ♀ 1 juv ♂, Noachabeb, 8 Feb 1973, B. Lamoral (NM 10698); 1 subad ♂, Belda farm, 1 Feb 1973, B. Lamoral (NM 10701); 1 ♀, Louwshoop farm, 3 Feb 1973, B. Lamoral (NM 10699); 1 ♂ 1 ♀, Tsirub 13, 3 Mar 1976, B. Lamoral (NM 10772); 1 ♂ 1 ♀ 2 subad ♂, Belda farm, 28 Jan 1973, B. Lamoral (NM 10702); 1 ♀, Goodhouse, 30 Jan 1973, B. Lamoral (NM 10700); 1 ♂, Goodhouse, 29–31 Jan 1973, B. Lamoral (NM 10703).

Distribution: South central parts of Namibia and south of the Orange River in the north-western Cape Province of South Africa.

Bionomics: Nocturnal, hemiedaphic and digs shallow burrows at the base of small shrubs and under rocks on consolidated sandy to gritty soils (soil categories IV–VI of Table 2) in areas of vegetation types 9 and 3A (Fig. 4). *P. brevimanus*, a fairly closely related species, is sympatric with new species C in the central parts of its range (Noachabeb farm NM 10926), but *kuanyamarum* and *gracilis* are allopatric.

Figs 166–172. *Parabuthus nanus* sp. n. 166, ♂ paratype (NM 10365), right hand, outer aspect; 167–172, ♀ paratype (NM 10365); 167–169, right hand; 167, outer aspect; 168, ventral aspect; 169, inner aspect; 170–171, right pedipalp tibia; 170, dorsal aspect; 171, outer aspect; 172, right pedipalp femur, dorsal aspect.

Parabuthus raudus (E. Simon, 1887). Figs 173–180

Buthus raudus E. Simon, 1887: 377–378.

Diagnosis: *P. raudus* can be separated from the other species of the genus by the following combination of characters. Caudal segments, Figs 173–174: cauda I and II, dorsal stridulatory area as in *P. schlechteri*; adult ♂ & ♀, telson width 80% (75–85%) of cauda V width; cauda V, accessory dorsal crest composed of blunt tubercles in ♀ and spiniform ones in ♂, dorso-lateral keels almost obsolete medially, ventral aspect of ventro-lateral keels sub-trapezoidal tapering posteriorly, posterior width 10% (7–13%) narrower than anterior width, otherwise as in *P. schlechteri*; cauda I–IV all almost the same width, cauda IV as wide as I, seldom slightly wider; cauda II and III, distal granules of ventral and ventro-lateral keels not enlarged and elevated, lateral and ventral intercarinal surfaces flat, fairly densely and evenly granulated, never smooth. One of the larger species of *Parabuthus*, it is most closely related to *P. schlechteri*.

Description: The following account supplements E. Simon's original description and Kraepelin's (1908: 252–254) supplement.

Colour: Body and appendages, excepting pedipalps, legs and pectines, strong yellowish brown No. 74 to deep yellowish brown No. 75 with carapace and tergites usually darkest and sternites lightest; cauda V and telson or telson alone dark yellowish brown No. 78 in some specimens; pedipalps and chelicerae strong yellowish brown No. 74 to dark orange yellow No. 72; legs moderate orange yellow No. 71 to strong yellow No. 84; pectines light yellow No. 86.

Sternites: Smooth and shiny. Sternite VII, lightly granular between lateral longitudinal keels and lateral margins, smooth and shiny medially between lateral keels; lateral keels poorly developed, median keels obsolete to absent.

Cauda: Cauda I wider than long, width percentage of length 109% (106–112%); cauda II–IV narrower than long, width percentage of length 93% (90–97%) for II and III, 78% (74–82%) for IV;

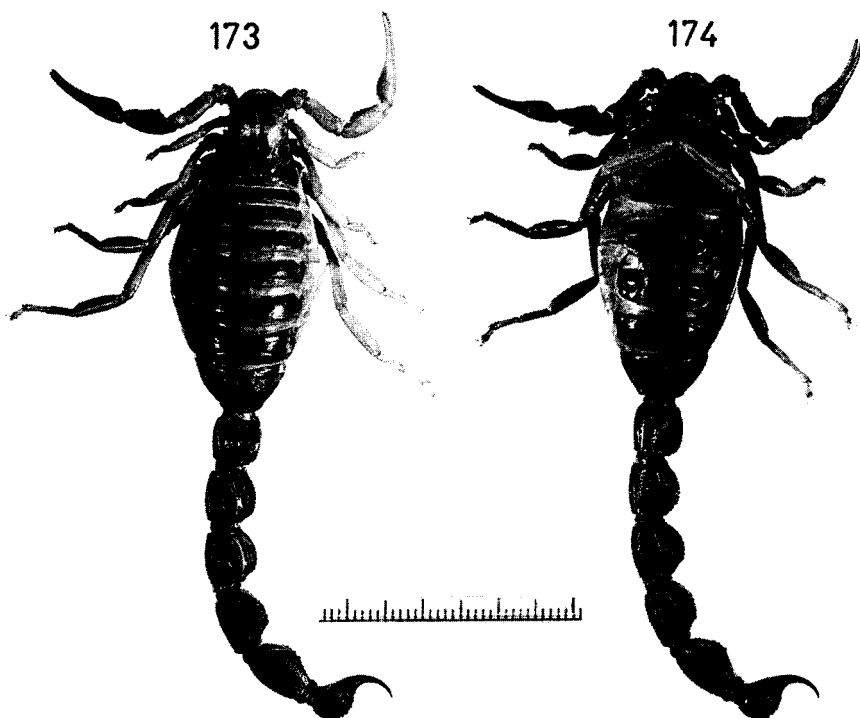
Pectines: ♀ 34–45 and ♂ 38–50 teeth per pecten. Simon's lectotype ♀ has 36–37 teeth per pecten and not 26 as stated in his original description. Marginal and middle lamellae punctate.

Setation: Anterior margin and ventral surface of pectines, lateral and posterior margins of sternites moderately pilose. Patella, tibia of legs I–IV and basitarsi and telotarsi of III–IV moderately pilose; basitarsi of legs I–II ventrally apilose; posterior edges of telotarsi, basitarsi and tibia of legs I–II with a rake-like row of long stiff setae; ventral surfaces and dorsal median lobes of telotarsi I–IV with thick vestitures of fine setae. All other body and appendage surfaces almost apilose.

Trichobothria: As in Figs 175–180. Orthobothriotaxic for group A. Pedipalp chela, *eb* proximal to basal dentate margin of fixed finger.

Hemispermaphore: Not differing diagnostically from those of *P. schlechteri* and related species, very closely resembling that of *P. villosus* (Fig. 28).

Variation: Sexual dimorphism: In adults, males differ from females in the following characters: ♂ 20% (14–26%) smaller but not proportionately more



Figs 173–174. *Parabuthus raudus*, ♀ holotype (MNHP RS 0340). Scale in mm.

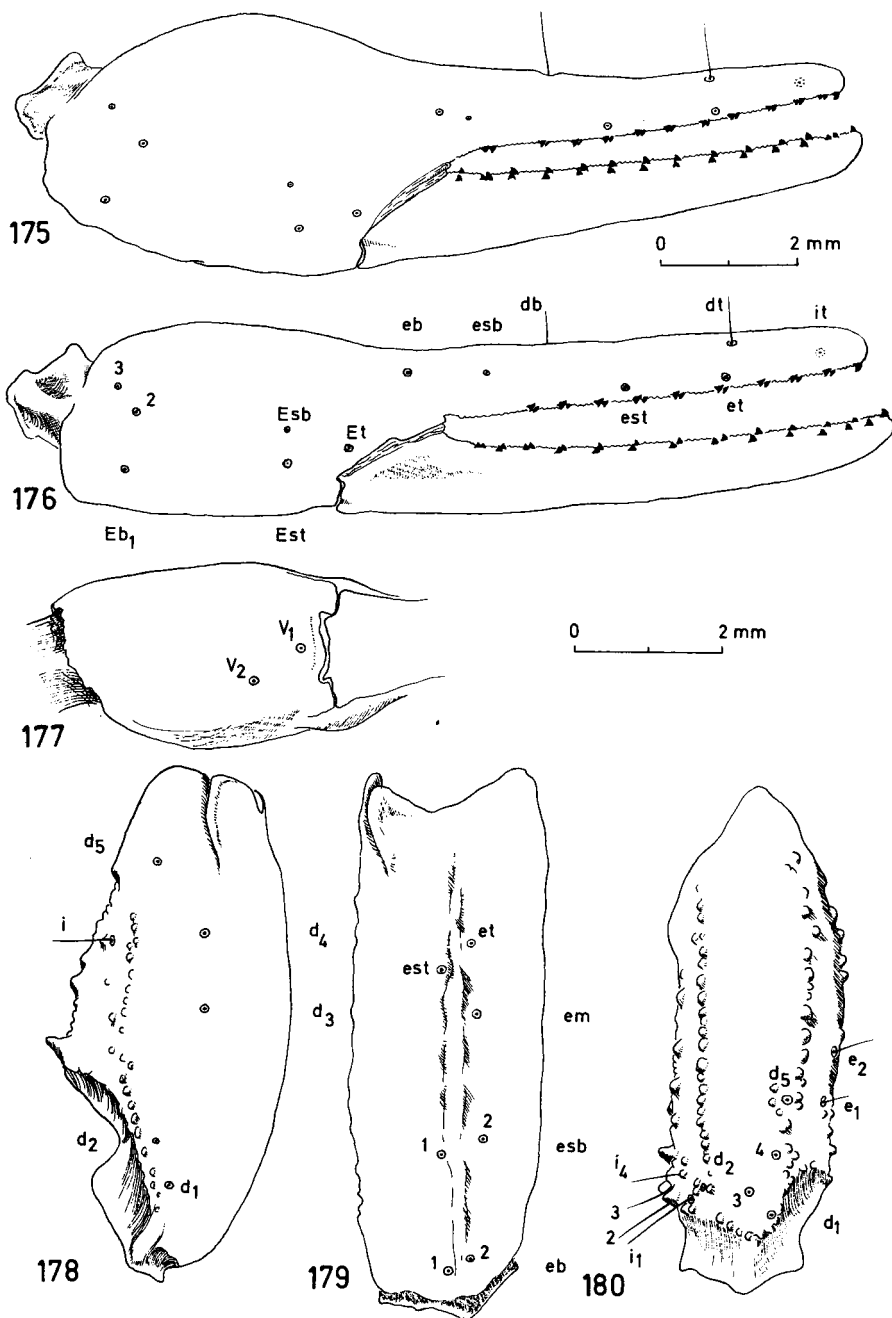
slender since width sternite V/carapace length ratios are 1,30 (1,25–1,35) for both sexes; ♂ pedipalp chela fingers shorter, handback wider and longer with movable finger length/handback length ratios 1,65 (1,60–1,70) for ♂ and 2,25 (2,20–2,30) for ♀, while mean chela length is proportionately 7% longer in ♂.

Intraspecific variation: Little or no variation between populations from different localities except as follows: Specimens from the northern regions of the species range have distinctly infuscated cauda IV and telsons. Within certain populations τest and et of pedipalp chela are separated by two outer flanking teeth instead of three as shown in Figs 175–176.

Measurements: Carapace length of adult ♂ 9,30 mm (8,25–10,00 mm), of adult ♀ 11,5 mm (10,0–13,0 mm).

Type material: The ♀ and ♂ syntypes of *P. raudus* were presumed lost according to Hewitt (1918: 108) and Lawrence (pers. comm., 1976). The ♀ syntype was rediscovered in the collection of the Museum national d'Histoire naturelle, Paris. It is hereby selected as the lectotype of *Parabuthus raudus* and it has been labelled accordingly. The male syntype could not be found.

Homotype: I have selected a ♀ homotype which is deposited in the Natal Museum collection (NM 10444).



Figs 175–180. *Parabuthus raudus*. 175, ♂ (NM 10533), right hand, outer aspect; 176–180, ♀ holotype (MNHP RS 0311); 176–177, right hand; 176, outer aspect; 177, ventral aspect; 178–179, right pedipalp tibia; 178, dorsal aspect; 179, outer aspect; 180, right pedipalp femur, dorsal aspect. Scales: 175, upper; 176–180, middle

Material examined: ♀ lectotype, no specific locality except 'sud-ouest de l'Afrique' (Namibia), 1884–1886, Hans Schinz; ♀ homotype, Mata Mata, Apr 1970, B. Lamoral (NM 10444). 1 ♂ 1 ♀, Scheidthof 293, 14–17 Nov 1972 (SMN 401); 2 ♀, Kalahari Gemsbok Park, 24 Apr 1970, B. Lamoral (NM 10445); 1 ♀, Otjituo, 3 Aug 1965, P. Mungonena (SMN 232); 1 ♀, Rundu, 30 July 1965, W. Steyn (SMN 117); 1 ♀, Swartmodder farm, 14 Apr 1976, B. Lamoral (NM 10433); 1 ♀, Frischgewaagd 289, 22 Mar 1976, B. Lamoral (NM 10912); 1 ♀, Moorivier, 5 May 1969, H. Brown (TM 10401); 1 ♀, Auob River (NM 10434); 11 ♂ 9 ♀, Mata Mata, 24 Apr 1970, B. Lamoral (NM 10449); 2 juv ♂ 1 juv ♀, Richthofen 126, 19 Feb–2 Mar 1975 (SMN 561); 1 ♀, Richthofen 126, 19 Feb–2 Mar 1975 (SMN 560); 1 ♀, Twilight 113, Apr 1973, L. Rothkegel (TM 10739); 1 ♀, Avro, 10 June 1966, C. van der Hooven (SMN 60); 1 ♂, Richthofen 126, 26 Jan–2 Feb 1975 (SMN 555); 1 ♀, Twee Rivieren, Apr 1970, B. Lamoral (NM 10427); 1 ♀, Katima Molilo, July 1970, D. Badenhorst (SMN 376); 1 ♂, Frischgewaagd 289, 20 Mar 1976, B. Lamoral (NM 10897); 3 juv ♂ 1 juv ♀, Moravet, 24 Apr 1972, B. Lamoral (NM 10429); 1 juv ♂ 1 juv ♀, Katimo Molilo, Oct 1970, W. Haacke (TM 9964, 9965); 1 juv ♂, Katimo Molilo, 24 Oct 1970 (TM 10190); 1 ♂, Twilight 113, Apr 1973, L. Rothkegel (TM 10740); 90 ♂ ♀ juv, Ghobab 381, 12 Mar 1976, B. Lamoral (NM 10807); 1 ♂, Frischgewaagd 289, 20 Mar 1976, B. Lamoral (NM 10902); 2 ♂ 1 ♀, Mata Mata, 24 Apr 1970, B. Lamoral (NM 10931); 1 ♂, Twee Rivieren, 1960–1970, le Riche & staff (NM 10432); 3 ♂ 2 ♀, Swartpoort, Feb 1974, R. Faber (NM 10924); 1 ♂, Richthofen 126, Windhoek, 1–31 Jan 1975, M.-L. P. (SMN 549); 1 ♀, Richthofen 126, 2–19 Feb 1975, M. J. P. (SMN 557); 1 ♀, Ramboekas Pan, 1 May 1970, B. Lamoral (NM 10506); 1 ♂, Richthofen 126, 16 Feb–2 Mar 1975, M. J. P. (SMN 559); 1 ♂, Frischgewaagd 289, 20 Mar 1976, B. Lamoral (NM 10837); 1 juv ♀, Kalahari Gemsbok Park, 10 Jan 1972, E. Eastwood (NM 10431); 6 ♀ 8 ♂ 4 juv, Frischgewaagd 289, 20 Mar 1976, B. Lamoral (NM 10817); 1 ♂ 1 ♀, Na Sukkel, 8 Nov 1965, G. Chatwind (SMN 135); 1 ♂, Rosh Pinah, Jan 1971, J. Botha (TM 10073); 1 ♂, Rosh Pinah, Apr 1971, J. Botha (TM 10106); 1 ♂, Nabas, Sep 1968, W. Haacke (TM 10411); 1 ♀, Rosh Pinah, 13 July 1969, Jan Botha (TM 10109); 1 ♂, Groot Aarpan, 30 Jan 1970, R. Huey (TM 9895); 1 ♂, Twee Rivieren, 1960–1970, le Riche family and staff (NM 10446); 3 ♂, Swartpoort, Apr 1967, W. Haacke (NM 10932); 75 ♂ & ♀, Swartmodder farm, 25–26 Feb 1973, B. Lamoral (NM 10533); 1 juv ♂, Sibinda, Jan 1974, K. Porter (NM 10933); 1 ♀, S.W.A. Administration Borehole 6453 (SMN 249); 3 ♀ 7 ♂, Katima Molilo, Oct 1970, W. Haacke (TM 9954–9963); 1 ♂, Gwaai River Hotel, 29 Oct 1970, W. Haacke (TM 9966); 1 ♂ 2 ♀, Katima Molilo, 29 Oct 1970, H. Brown (TM 10187–10189); 1 ♂, Rooidag Gate, 8 Apr 1970, W. Haacke (TM 9840); 1 juv ♀, Rooidag Gate, 8 Apr 1970, W. Haacke (TM 9841); 1 juv ♂, Corner Beacon of W. Caprivi strip, 11 Apr 1970 (TM 9846); 1 juv ♀, Beacon 39, S.W.A.–Angola Border, 18 Apr 1970, W. Haacke (TM 9837); 1 ♂, Aarpan (TM 9896); 1 ♂, Farm Gemsbok, 23 Feb 1970, R. Huey (TM 10406); 1 ♂, Nossob–Auob junction, 28 Nov 1969, Huey (TM 9508); 1 ♀, Aarpan, 30 Jan 1970, Huey (TM 9890); 1 ♀, Aarpan, 29 Jan 1970, L. Coons (TM 9894); 1 juv ♀, Kuruman, 6 May 1969, L. Schultze (TM 10410); 1 ♀, Nossob camp, Jan 1972, I. Rautenbach (TM 10337); 1 ♀, Dankbaar, 16 Jan 1972, I. Rautenbach (TM 10475); 2 ♀, Dutlwe, Botswana,

17 June 1969, T. Schofield (NM 9951); 1 ♀, Ghanzi, Oct 1961, W. Haacke (NM 8361); 1 subad ♂, Kalahari, Sep 1920, Jacson (SAM B5363); 1 ♂, Twee Rivieren, 3 Jan 1967, W. Haacke (BM 1972.703); 1 ♂, Mata Mata, Apr 1970, B. Lamoral (NM 10440).

Distribution: Most of Kalahari sand system (Fig. 20), and sandy areas north and south of the Orange River in the north-western Cape Province of South Africa. All specimens collected in the south-western region of Namibia were found on sandy areas near Rosh Pinah but none were caught in the shifting sand dunes of the Namib sand system (Fig. 20).

Bionomics: *P. raudus* is nocturnal, hemiedaphic, occasionally epigeic on shrubs while hunting, and digs shallow burrows at the base of shrubs in sandy soils in regions with vegetation types 11, 12 & 13 (Fig. 4). A few specimens have occasionally been found in shallow scrapes under rocks or fallen trees but never under the loose bark of such trees. *P. raudus* has never been found in regions of hard and gritty soils. Rake-like rows of long setae on the posterior edges of tibia, basitarsi and telotarsi of legs I, II and to a lesser extent III indicate a semi-psammophilous adaptation. *P. raudus* is the largest and most commonly found species of *Parabuthus* in the Kalahari sand system where it is occasionally sympatric with *villosus*, *granulatus* and *kalaharicus*.

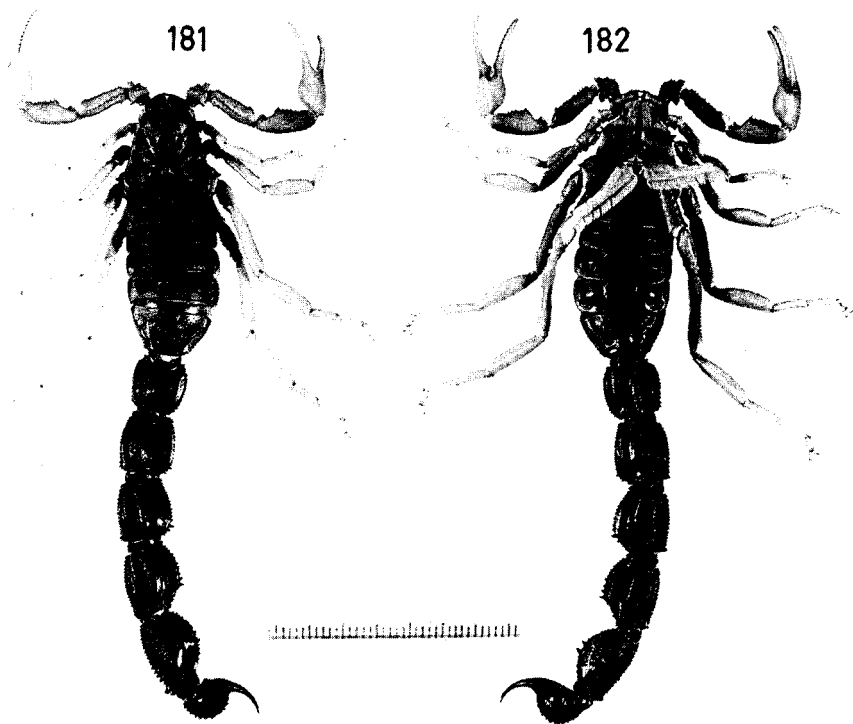
Parabuthus schlechteri Purcell, 1899b. Figs 181–187

Parabuthus schlechteri Purcell, 1899b: 434.

Diagnosis: *P. schlechteri* can be separated from the other species of the genus by the following combination of characters. Caudal segments, Figs 181–182: cauda IV with 10 distinct granular keels, ventrals almost obsolete posteriorly; cauda I and II, dorsal stridulatory area as in *P. villosus*; adult ♂ & ♀ telson width 94% (90–98%) of cauda V width; cauda V, accessory dorsal crest composed of spiniform tubercles, dorso-lateral keel well developed throughout, distal half of ventro-lateral keels with moderately enlarged, laterally compressed sub-spinose processes; cauda V, ventral aspect of ventro-lateral keels sub-trapezoidal, tapering anteriorly, anterior width 15% (13–17%) narrower than posterior width; cauda I–IV progressively increasing in width, cauda IV 14% (8–20%) wider than I; Cauda I–III, distal granule of dorsal keel enlarged in ♂ only; cauda II–III, distal granules of ventral keels, and to a lesser extent ventro-lateral keels, distinctly enlarged, obtuse and elevated; cauda II & III, lateral and ventral intercarinal surfaces slightly concave, very sparsely granulated to smooth. One of the larger species of *Parabuthus*, it is most closely related to *P. raudus*.

Description: The following account supplements Purcell's brief original description and his (1901: 164–168) comprehensive supplement.

Colour: Body and appendages, excepting pedipalps, legs and pectines, dark brown No. 59 to brownish black No. 65 with carapace and tergites usually darkest and sternites lightest: pedipalps, deep yellowish brown No. 75 to strong yellowish brown No. 74; legs dark orange yellow No. 72 to light yellow No. 86; pectines moderate yellow No. 87.



Figs 181–182. *Parabuthus schlechteri*, ♂ (SMN 322). Scale in mm.

Legs: Moderately pilose. Posterior edges of telotarsi, basitarsi and to a lesser extent tibia of legs I and II with a rake-like row of stiff setae.

Sternites: smooth and shiny. Male sternites very sparsely punctate. Sternite VII lightly granular, with traces of median and lateral longitudinal keels.

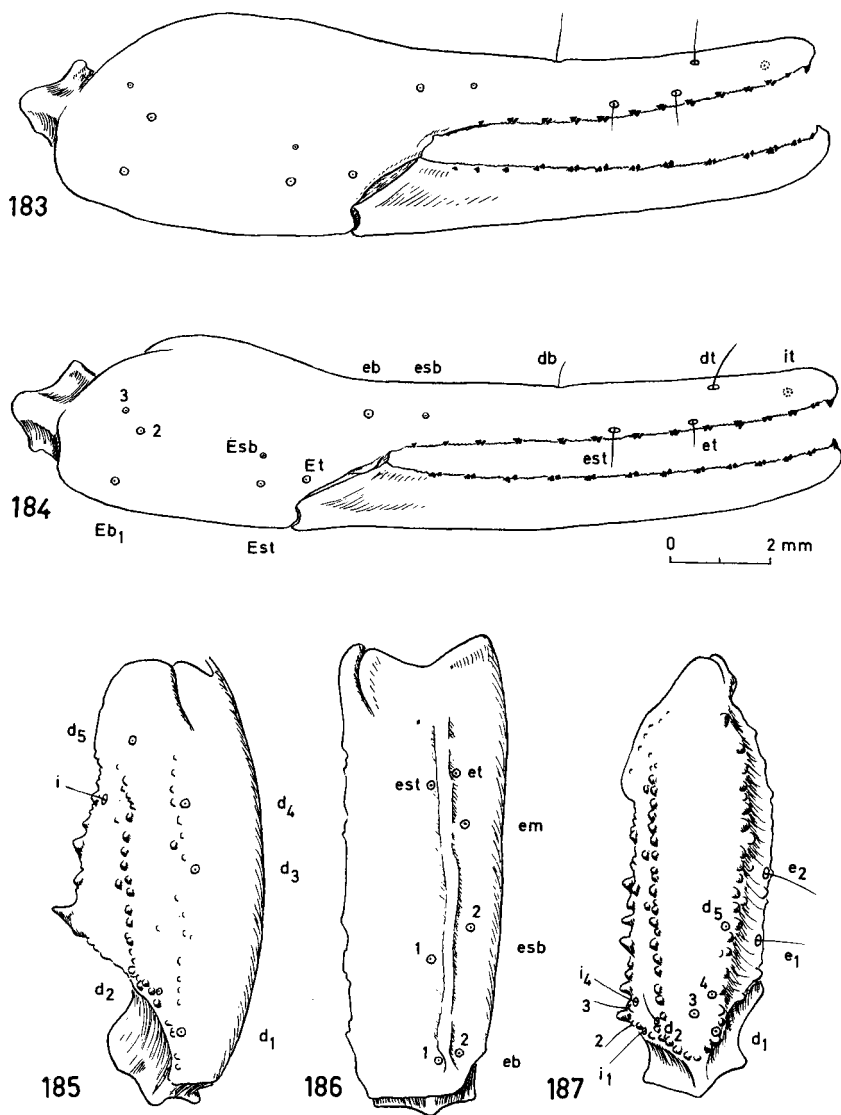
Cauda: I–III wider than long, width percentage of length 118% (113–123%) for cauda I and 105% (103–107%) for cauda II and III; cauda IV narrower than long, width percentage of length 92% (87–97%); cauda V, width percentage of length 75% (70–89%); cauda II–IV, dorsal aspect of dorso-lateral keels distinctly convex.

Pectines: ♀ 38–45 and ♂ 44–52 teeth per pecten. Marginal and middle lamellae punctate.

Trichobothria: As in Figs 183–187. Orthobothriotaxic for group A. Pedipalp chela: τeb proximal to basal dentate margin of fixed finger.

Hemispermaphore: Not differing diagnostically from *P. raudus* and related species.

Variation: Sexual dimorphism: In adults, males differ little from females except in the following characters: ♂ pedipalp chela fingers shorter, handback wider and longer with movable finger length/handback length ratios 1,45 (1,40–1,53) for ♂ and 2,20 (2,14–2,28) for ♀ while mean chela length is proportionately only 3% less in ♂; ♂ cauda proportionally longer with caudal segments I–II of ♂ 16,0%



Figs 183–187. *Parabuthus schlechteri*. 183, ♂ (SMN 322), right hand, outer aspect; 184–187, ♀ (SMN 322); 184, right hand, outer aspect; 185–186, right pedipalp tibia; 185, dorsal aspect; 186, outer aspect; 187, right pedipalp femur, dorsal aspect.

(15,0–17,5%) and 12% (10,5–13,5%) and III to V 9,0% (7,5–10,5%) longer than ♀. First proximal middle lamella of each pecten sub-rectangular, mesially angular and not enlarged in ♂, sub-oval, mesially enlarged and lobate in ♀.

Intraspecific variation: Little or no variation between populations from different localities except in colour as follows: Populations from localities in the south-central regions of the species range, namely most of region with vegetation type 9 (Fig. 4), are coloured as described earlier, while populations from localities south of the Orange River are much lighter in overall colour with the body deep yellowish brown No. 75 to strong yellowish brown No. 74.

Measurements: Carapace length of adult ♂ 10,0 mm (8,5–11,0 mm), of adult ♀ 11,8 mm (10,0–13,5).

Type material: Purcell described *P. schlechteri* on 'A female (type, No. 2177) and a male from Little Bushmanland (between Henkries and Wolftoon, Max Schlechter). Also two others from Great Bushmanland.' The only types remaining in the collections of the South African Museum are the former two, kept in the same jar and both with accession numbers 2177. They are unfortunately completely dismembered and it is impossible to allocate the various segments to any particular specimen. It is therefore impossible to designate a lectotype from Purcell's syntypes. As the specimens are not completely destroyed, one cannot designate a neotype, although this would be desirable.

Homotype: I have selected a ♂ homotype which was collected near the locality of the syntypes and it is deposited in the Natal Museum collection (NM 10935).

Material examined: 1 ♀ 1 ♂ syntypes, between Henkries and Wolftoon, 1 Dec 1897, M. Schlechter (SAM 2177); 1 ♂ homotype, south of Goodhouse, 30 Jan 1973, B. Lamoral (NM 10935). 1 subad ♀, Daan Viljoen Game Reserve, Feb 1971, C. Coetzee (SMN 302); 1 ♂, Tses, 23 Feb, B. Lamoral (NM 10934); 1 juv ♂, Berseba, 28 Feb 1976, B. Lamoral (NM 10770); 1 ♂, Huams farm, 1 Feb 1969, B. Lamoral (NM 10061); 2 subad ♂, Berseba, 24 Feb 1976, B. Lamoral (NM 10768); 1 ♂, Augrabies Falls, 4 Feb 1969, W. Bruwer (SMN 215); 1 ♀, Upington, 27 Jan 1969, B. Lamoral (NM 10062); 1 ♂, Schwarzkuppen farm, 8 Feb 1973, B. Lamoral (NM 10923); 2 ♀ 2 ♂, Noachabeb, 7–12 Jan (SMN 322); 1 ♂ 1 ♀ 2 juv, Berseba, 27 Feb 1976, B. Lamoral (NM 10798); 1 ♀ 1 juv ♂, between Onanis & Walvis Bay, 4 Mar 1960, P. Buys (SMN 153); 1 ♀, De Waal farm, 17 Mar 1969, B. Lamoral (NM 10060); 1 ♀, Mariental townlands, 5 Mar 1972, W. Haacke (NM 10936); 2 juv ♀, Keetmanshoop, 7–12 Jan 1972 (SMN 325); 1 juv ♀, Neisip, 1 May 1972, L. Schultz (TM 10538); 1 ♂, Upington, Dec 1962, W. Haacke (NM 9067); 1 juv ♀, Bethanie, Aug 1959, F. Gaerdes (NM 7278); 1 ♀, Upington, Sep 1920, Fr. Sollier (SAM B5362); 1 ♂, Vogelfontein farm, Apr 1929, A. Hesse (SAM B7311); 2 ♀, Fraserburg, Jan 1930, A. Hesse (SAM B7329).

Distribution: Central regions of southern half of Namibia (with northernmost record at the Daan Viljoen Game Reserve, west of Windhoek—SMN 302), and northern regions of the Cape Province in South Africa.

Bionomics: Although fairly widespread in distribution within its range, *P. schlechteri* is not a commonly found species as indicated by the relatively low

number of specimens collected. *P. schlechteri* is nocturnal, hemiedaphic and digs shallow scrapes under rocks, in soils of variable hardness and texture ranging from consolidated sand to moderately hard and gritty soils in regions with vegetation types 2, 4, 8 and 9 (Fig. 4). There are no records of *schlechteri* in regions with vegetation types 3, 3A, 12 and 13.

Parabuthus stridulus Hewitt, 1913. Figs 188–197

Parabuthus stridulus Hewitt, 1913: 146–147.

Parabuthus laevifrons militum Hewitt, 1918: 105. *Syn. n.*

Parabuthus laevifrons concolor Hewitt, 1918: 176–177. *Syn. n.*

Diagnosis: The following combination of characters separates *P. stridulus* from other species of the genus. Cauda, Figs 188–191: cauda II, dorsal stridulatory patch reaching posterior margin and composed largely of transverse ridges some of which, particularly in the posterior half, extend across the surface; telson vesicle very distinctly and deeply excavated along longitudinal half of dorso-proximal surface. Legs IV, long and slender, reaching anterior portion of cauda III. This species of *Parabuthus* is most closely related to *laevifrons*.

Description: The following account supplements Hewitt's original description.

Colour: Carapace, chelicerae, pedipalps, tergites and sternites light olive brown No. 94 to dark orange yellow No. 72; cauda dark yellow No. 88 to strong yellow brown No. 74; legs and pectines moderate yellow No. 87 to moderate orange yellow No. 71.

Granulation: Intercarinal surfaces of cauda I–V lightly, evenly and finely granular; cauda V, accessory dorsal crest obsolete to absent, dorsal keels obsolete except in anterior one-fifth. Pedipalp: chela smooth and shiny; tibia with keels, granules and tubercles as in Figs 195–196, outer surface smooth and shiny; femur with keels as in Fig. 197, inner, dorsal and outer surfaces lightly granular. Carapace finely granular, interocular surface smooth and shiny, occasionally with a few scattered granules in ♀, finely granular in ♂. Tergites: I–VII finely granular throughout; I–VI, median keel poorly developed; VII, median and lateral pairs of keels poorly developed. Sternites: III–VI smooth and shiny; VII smooth and shiny medially, lightly granular laterally, median and lateral pairs of keels obsolete.

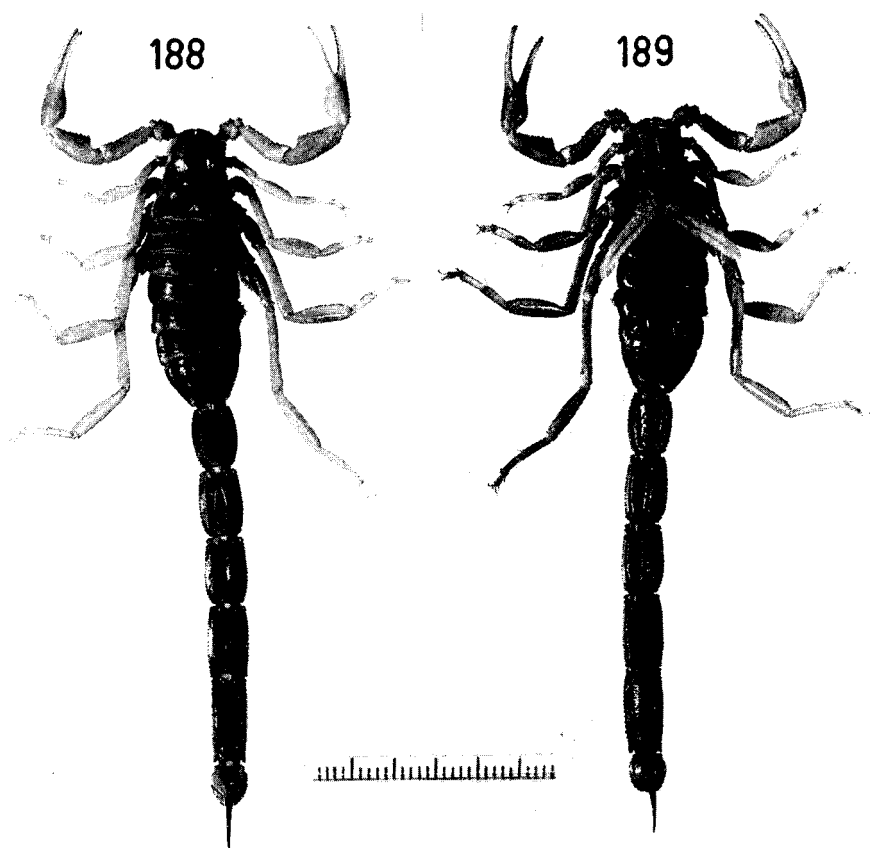
Cauda: Figs 188–191. Cauda I, antero-median surface of stridulatory patch sharply inclined to the anterior descending portion; cauda II–IV, dorsal aspect of dorso-lateral keels sub-parallel; cauda I–V, width percentage of length 84% (81–87%) for I, 72% (69–75%) for II, 72% (69–75%) for III, 60% (58–62%) for IV, 50% (47–53%) for V, giving the cauda a slender appearance; cauda IV, median lateral keel weakly developed through entire length.

Pectines: ♀ 31–37 and ♂ 37–42 teeth per pecten.

Setation: As for *P. laevifrons*.

Trichobothria: As in Figs 192–197. Orthobothriotaxic for group A. Pedipalp chela: τ_{eb} proximal to base of dentate margin; τ_{dt} distal to *et*. Pedipalp tibia, Fig. 196: τ_{esb_2} proximal to or level with esb_1 . Pedipalp femur, Fig. 197: τ_{d_2} on proximo-dorsal side of dorso-internal keel.

Hemispermaphore: Not varying diagnostically from those of related species.



Figs 188–189. *Parabuthus stridulus*, ♀ (NM 10519). Scale in mm.

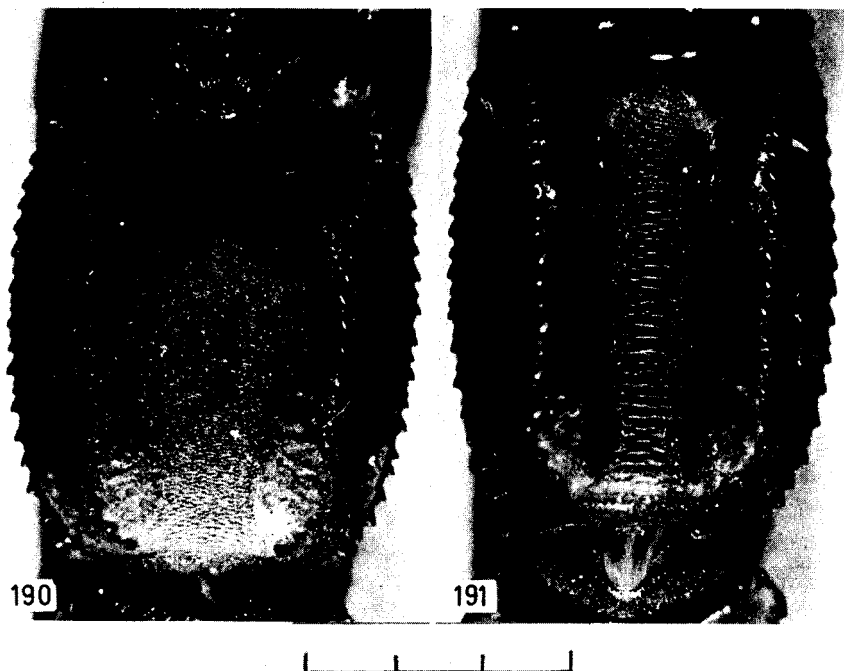
Variation: Sexual dimorphism: In adults, males differ from females in the following characters: ♂ smaller and proportionately more slender with width sternite V/carapace length ratios 1,03 (1,00–1,06) for ♂ and 1,18 (1,15–1,21) for ♀; ♂ pedipalp fingers shorter, handback much wider, bulbous and longer with movable finger length/handback length ratios 1,28 (1,25–1,31) for ♂, 1,55 (1,49–1,61) for ♀, while mean chela length is proportionately 13% longer in ♂; first proximal middle lamella of each pecten sub-circular, mesially angular but not enlarged in ♂, sub-circular, mesially enlarged and lobate in ♀.

Intraspecific variation: Only in overall colour which fluctuates between the ranges described above. One specimen from Tsirub farm, south-west of Aus, has cauda IV and V very lightly infuscated.

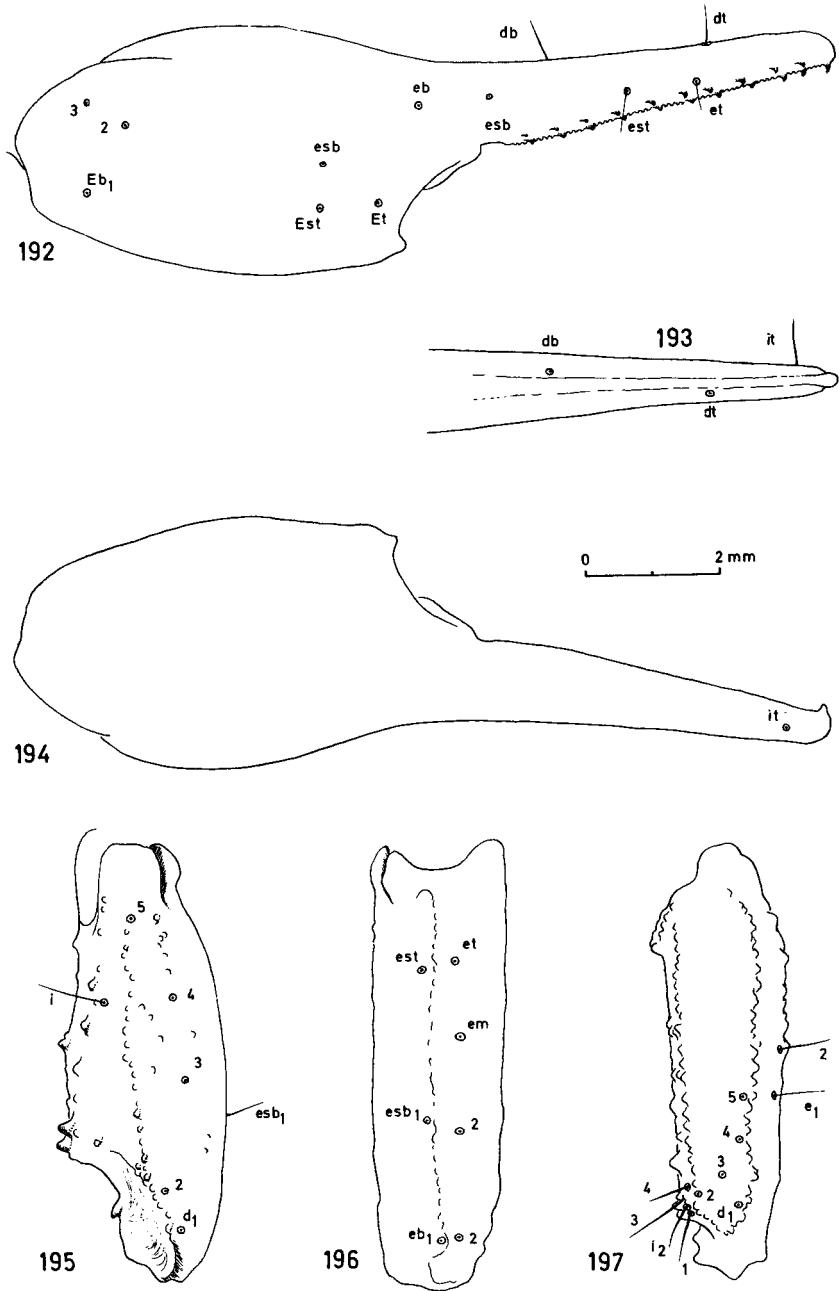
Measurements: Carapace length of adult ♂ 9,5 mm (8–11,0 mm), of adult ♀ 12,3 mm (10,0–14,5 mm).

Type material: Hewitt's holotype ♂ is in good condition in the collection of the Transvaal Museum and bears the accession number TM 1868 (ex 1030).

Material examined: ♂ holotype, Lüderitzbucht, 26 Nov 1912 (TM 1868); *Parabuthus laevifrons militum* ♂ holotype, Aus (AM); *P. laevifrons concolor* 2 ♀ syntypes, Keetmanshoop (AM). 1 ♂, Ugab River mouth, 18 Feb 1969, B. Lamoral (NM 10856); 1 ♀, Lüderitzbucht, 1927, Tesdorff (NM 10006); 1 ♂, Henties Bay, May 1960, F. Gaerdes (NM 7307); 1 juv ♂, Chamais, June 1973, C. Coetzee (NM 10463); 1 ♀, Numaskluft, 12 Oct 1970, F. Burger (SMN 186); 2 ♂, Saddle Hill, 2 Nov 1965, Dr Steyn (SMN 257); 1 ♀, Grosse Bucht, 24 Apr 1965, W. Steyn (SMN 72); 1 subad ♀, Saddle Hill, 19 Feb 1966, W. Schauch (SMN 230); 1 ♂, Saddle Hill, 2 Nov 1965, Dr Steyn (NM 10704); 1 ♀, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10907); 1 ♀, Smithfield beach, June 1973, C. Coetzee (NM 10499); 2 ♂, Kolmanskop, Mar 1973, C. Coetzee (NM 10501); 1 ♂, Tsirub 13, 3 Mar 1976, B. Lamoral (NM 10778); 1 ♀, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10898); 1 ♂ 1 ♀, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10903-4); 1 ♂ 1 subad ♀ 1 subad ♂, Ugab River mouth, 18 Feb 1969, B. Lamoral (NM 10039); 3 ♀ 6 juv, Agate Beach, 13 Feb 1973, B. Lamoral (NM 10519); 2 ♀ 1 ♂, Agate Beach, Feb 1973, B. Lamoral (NM 10573); 2 ♂ 1 ♀, Swakopmund (AM 6421); 1 ♀, Swakopmund (AM 6486); 2 ♀ 1 ♂, Swakopmund (AM 6361); 2 ♂ 2 ♀, Swakopmund (AM 6387); 4 ♂ 3 ♀, Swakopmund (AM 6537); 1 ♂, Wlotzkabaken, 25 Mar 1971, J. Gaerdes (TM 10060); 1 ♂, Gobabeb, E. Holm (TM 10059); 1 subad ♂, Sesriem, 2 May 1972, O. Prozesky (TM 10494); 9 ♂ 3 ♀ 2 subad ♀,



Figs 190-191. *Parabuthus stridulus*, ♂ holotype (TM 1868), dorsal aspects of caudal segments with their anterior margins at the top. 190, Cauda I; 191, cauda II. Scales in mm.



Figs 192–197. *Parabuthus stridulus*, ♂ holotype (TM 1868). 192–194, right hand; 192, outer aspect; 193, dorsal aspect of fixed finger; 194, inner aspect; 195–196, right pedipalp tibia; 195, dorsal aspect; 196, outer aspect; 197, right pedipalp femur, dorsal aspect.

Spencer Bay Water, 11–16 Jan 1974, W. Haacke (TM 10861–3, 10872–3, 10876–9, 10881–3, 10885–6); 1 ♀, Saddle Hill, 17 Jan 1974, W. Haacke (TM 19887); 1 subad ♀, Nordhuk, 11 Jan 1974, W. Haacke (TM 10865); 1 subad ♀, Spencer Bay Water, 11 Jan 1974, M. Kassel (TM 10871); 1 ♂, Nordhuk, 11 Jan 1974, W. Haacke (TM 10866); 1 ♂, Hottentot Bay, 10 Jan 1974, W. Haacke (TM 10860); 1 ♂ 1 juv ♀, Saddle Hill, Mar 1973, C. Coetzee (NM 10508); 1 juv ♀, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10855); 2 ♂, Swakopmund, 24 Mar 1976, B. Lamoral (NM 10853); 1 ♀, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10737); 1 ♂, Cape Cross, 25 Mar 1976, B. Lamoral (NM 10756).

Distribution: The Namib sand system (Fig. 20) with the northernmost record being the Ugab River mouth and the southernmost just north of the Orange River. In the southern Namib the easternmost record is Tsiub farm (south-west of Aus) and in the central Namib, Gobabeb.

Bionomics: Nocturnal but specimens have occasionally been found wandering in the open in daytime. It is hemiedaphic, psammophilous and digs shallow burrows at the base of small dunes which have become consolidated by perennial vegetation such as shown in Fig. 6 and its distribution is confined to regions with vegetation type 2, 3 and 3A (Fig. 4). In addition, within these areas of distribution *stridulus* is seldom found far from the littoral zone where it is the most commonly found species of *Parabuthus*. At Cape Cross, *stridulus* is sympatric with *namibensis* and *Uroplectes pilosus*. In vegetation zone 2 it is sympatric with *Opisthophthalmus litoralis*.

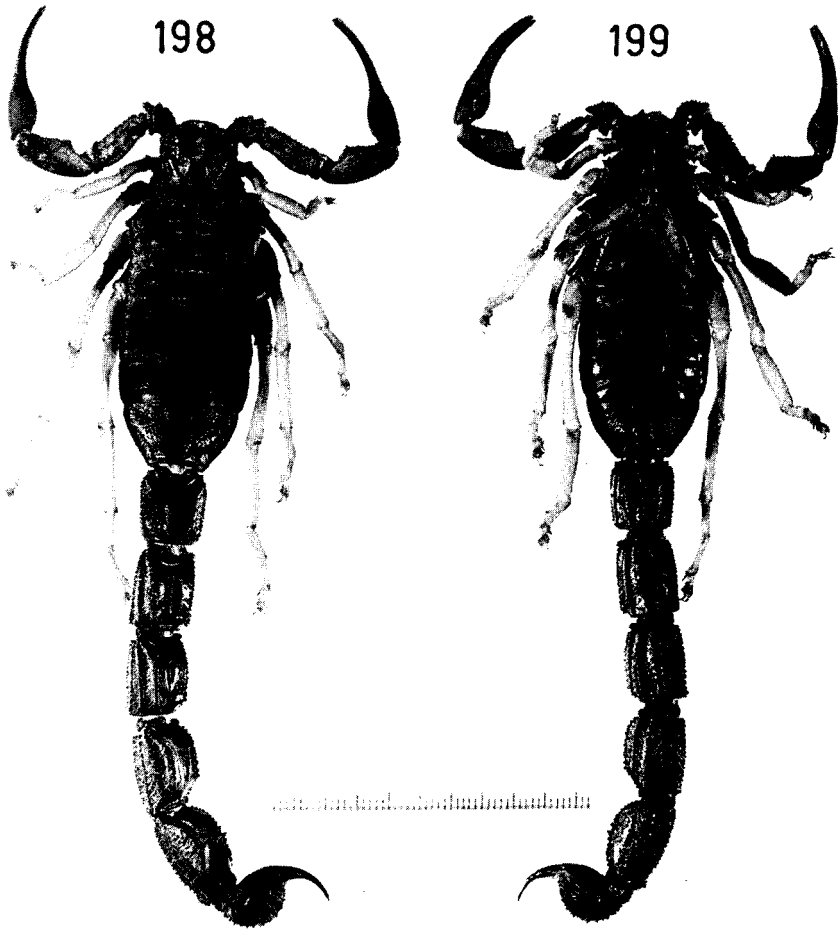
Parabuthus villosus (Peters, 1862). Figs 198–204 & 206–207

Buthus villosus Peters, 1862: 26.

Diagnosis: The following combination of characters separates *P. villosus* from other species of the genus. Caudal segments, Figs 198–199: cauda IV, with 10 distinct granular keels, ventrals posteriorly undefined; cauda I, dorsal stridulatory area, well developed, consisting of round to slightly crescent-shaped fine granules reaching the posterior margin; cauda II, dorsal stridulatory area narrow, finely granulated and not reaching posterior margin; cauda I–V and telson densely pilose. The largest species of *Parabuthus* from Namibia, *villosus* is most closely related to *P. brachystylus*, its sibling species.

Description: The following account supplements Peters's original description and Purcell's (1901: 158–162) comprehensive supplement.

Colour: Specimens from localities within region ii in Fig. 207 and list of material examined have the following coloration: body and appendages, excepting pedipalps, legs and pectines, dark brown No. 59 to brownish black No. 65 with tergites and carapace usually the darkest; pedipalps, deep brown No. 56 to dark brown No. 59; legs, strong yellow No. 84 to dark orange yellow No. 72; pectines moderate yellowish brown No. 77. Specimens from region i have brownish black No. 65 bodies and appendages. Specimens from region iii have dark brown No. 59 to brownish black No. 65 bodies but brilliant yellow No. 83 to strong yellow pedipalps, legs and pectines while the sternites are intermediately lighter than the



Figs 198–199. *Parabuthus villosus*, ♀ (NM 10025). Scale in mm.

body but darker than the appendages. Specimens from region iv are similar to those from region iii but have progressively darker appendages towards the coastal areas, some specimens being nearly as dark as those from region i. Specimens from all four regions have a wide triangular pallid marking medially on the posterior margin of sternite V.

Sternites: In ♀ only, sternite III, with a prominent antero-medial subcircular gibbose swelling, pallid in most specimens.

Cauda: adult ♂ & ♀, telson width 97% (94–101%) of cauda V width; cauda V, accessory dorsal crest composed of spiniform tubercles, distal half of ventro-lateral keels with moderately enlarged, laterally compressed subspinose processes; cauda I–IV progressively decreasing in width, cauda IV 9% (8–10%) narrower than I; cauda I–III longer than wide, width percentage of length 95% (92–98%), 85% (80–89%) and 82% (78–85%) respectively; cauda V, width per-

centage of length 60% (56–64%); cauda II–IV, dorsal aspect of dorso-lateral keels subparallel; cauda I–III, distal granule of dorsal keel enlarged; cauda II–III, distal granule of ventral keels, and to a lesser extent ventro-lateral keels, distinctly enlarged, obtuse and elevated.

Pectines: ♀ 34–41 and ♂ 36–42 teeth per pecten.

Trichobothria: As in Figs 200–204. Orthobothriotaxic for group A. Pedipalp chela: τeb distal to basal dentate margin of fixed finger; τdb much closer to est than esb . Pedipalp femur, Fig. 204: τd_2 on proximo-internal side of dorso-internal keel; τd_3 level with, to slightly distal to d_2 ; τd_4 closer to d_3 than d_5 .

Hemispermaphore: Hemispermaphore as in Fig. 28, not differing diagnostically from related species.

Haemolymph electrophoresis: Phoregrams were prepared from haemolymph of specimens collected from three different localities in each of regions i to iv delimited in Fig. 207. The distribution and number of bands obtained are illustrated in Fig. 206. No significant differences were found between males and females and between samples from the four different regions. R_M values were found to be consistent. The differences between the phoregrams of *P. villosus* and *brachystylus* are discussed in the description of *brachystylus*.

Variation: Sexual dimorphism: In adults, males differ from females in the following characters: ♂ proportionately smaller and slightly more slender with width sternite V/carapace length ratios 1,10 (1,06–1,14) for ♂ and 1,25 (1,20–1,31) for ♀; ♂ pedipalp chela fingers shorter, handback wider and longer with movable finger length/handback length ratios 1,55 (1,46–1,62) for ♂ and 2,06 (1,97–2,16) for ♀ while mean chela length is only 5% less in ♂; first proximal middle lamella sub-rectangular, mesially angular and not enlarged in ♂, sub-oval, mesially enlarged and lobate in ♀. ♂ illustrated in frontispiece.

Intraspecific variation: Mainly in coloration as described earlier.

Measurements: Carapace length of adult ♂ 11 mm (10–13 mm), of adult ♀ 15 mm (13–17 mm).

Type material: Peters' syntypes were presumed lost. They were rediscovered in the collection of the Zoologisches Museum Berlin, in east Berlin. It is not known how many syntypes there are. One ♂ from sample ZMB 2303 was examined and is hereby selected as the lectotype of *Parabuthus villosus*.

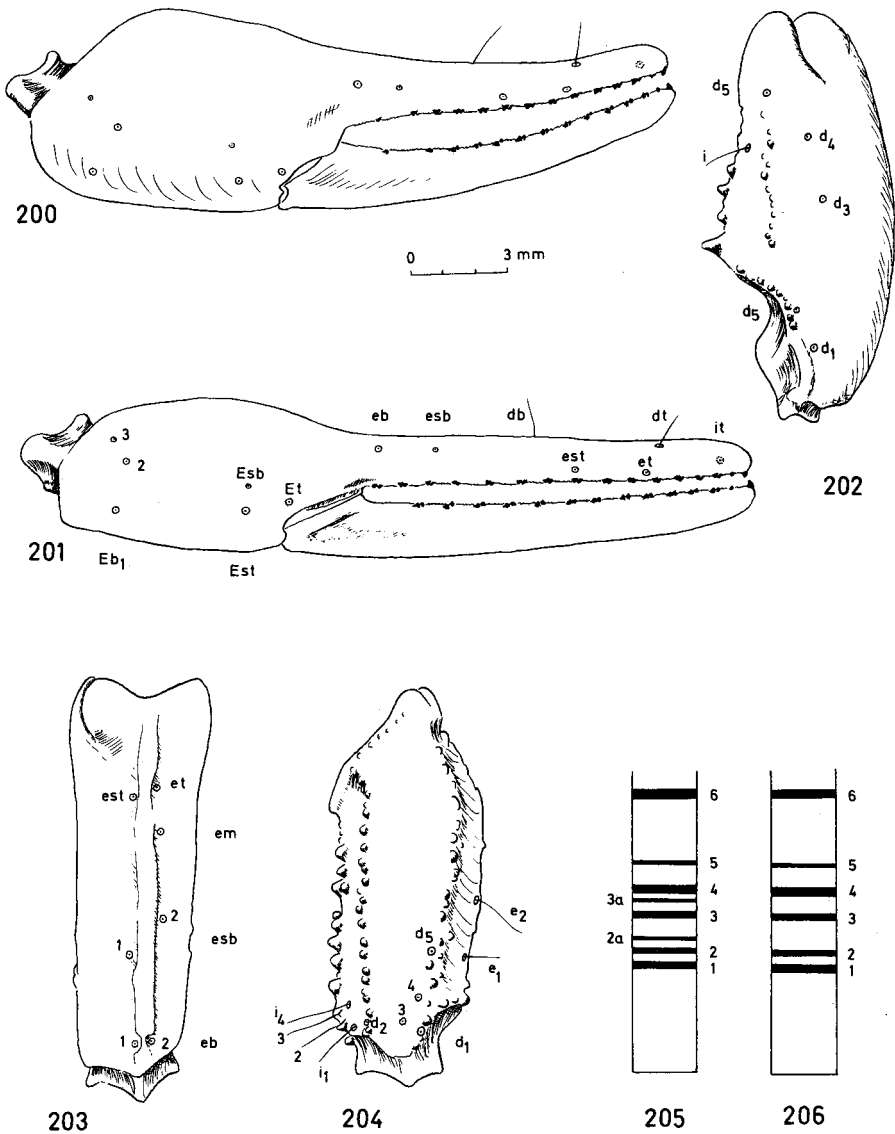
Homotype: I have selected a ♂ homotype which is deposited in the Natal Museum collection (NM 10531).

Material examined: ♂ lectotype, 'Neu Barmen' (Note: this locality cannot be found in any gazetteer or map consulted) no date, Hahn (ZMB 2303); ♂ homotype, Vioolsdrift, February 1973, B. Lamoral (NM 10531).

The Roman numerals used below refer to material from the different regions in Fig. 207.

(i)

1 ♀, Gobabeb, Feb 1973, B. Lamoral (NM 10740); 1 ♂, Gobabeb, Feb 1973, B. Lamoral (NM 10765); 1 ♂, id. (NM 10764); 1 ♀, Gobabeb, Feb 1972, B. Lamoral (NM 10527); 1 ♂, Emeritus farm, 18 Mar 1968, Kapt. Pietersen (SMN 67); 1 ♀,



Figs 200–206. *Parabuthus* species. 200–204, *P. villosus*; 200, ♂ right hand, outer aspect (SMN 34); 201–204, ♀ (NM 10025); 201, right hand, outer aspect; 202–203, right pedipalp tibia; 202, dorsal aspect; 203, outer aspect; 204, right pedipalp femur, dorsal aspect; 205–206, diagrammatic representation of phoregrams from haemolymph; 205, *P. brachystylus*; 206, *P. villosus*.

Gonab, 16 Sep 1971 P. Olivier (SMN 355); 1 ♀, Gobabeb, 1 Dec 1971, R. Taylor (NM 10535); 1 ♂, Gobabeb, 25 Nov 1971, A. Durr (NM 10535); 1 ♂ 1 ♀ 1 juv ♂, Gobabeb, 5 Mar 1963, P. Buys (SMN 105); 1 subad ♂ 1 juv ♂ 1 juv ♀, Gobabeb, 6 Mar 1963, P. Buys (SMN 103); 2 ♂ 1 ♀, Albrechtshohe, 9 Mar 1970, H. Mitten-dorf (SMN 160); 1 ♀, Aus (Lüderitz), 16 Jan 1972, Eastwood (NM 10451); 1 ♂, Namibflache, 1938, Dr Ross (NM 10093); 1 ♀, Uis Tinmyn, 3 Sep 1963, Hass (SMN 82); 1 ♀, Uis, Dec 1968, J. Nel (TM 10046); 1 ♀, Uis, 1969, J. Bezuidenhout (TM 10110); 1 ♂, Uis (TM 9393); 1 ♀, Rooiberg, 17 July 1970, G. Newlands (TM 10126); 1 ♀, Ugab-drif, 6 Mar 1966, P. Swart (SMN 127); juv ♀, Cape Cross, 8 June 1963, H. Els (SMN 69); 1 ♂, Gobabeb, Feb 1972, B. Lamoral (NM 10528); 1 ♂, Cape Cross, 22 Dec 1965, S. Steyn (SMN 71); 1 ♀, Gobabeb, Feb 1973, B. Lamoral (NM 10761); 1 ♀, Gobabeb, May 1959, R. Lawrence (NM 7264); 1 ♂, Gobabeb, Dec 1963, C. Koch (NM 9061); 1 juv ♂, Namib, Jan 1962, F. Gaerdes (NM 8334); 1 ♂, Swakopmund, Mar 1962, F. Gaerdes (NM 8373); 1 ♂, Gobabeb, Dec 1963, C. Koch (NM 9060); 1 juv ♀, Tchab, May 1959, R. Lawrence (NM 7266); 2 ♂, Gobabeb, Dec 1963, C. Koch (NM 9062-9063).

(ii)

1 ♀, Portsmut 33, 19 Sep 1972, Jones (TM 10467); 1 ♂, Valencia 42, Mar 1970, A. Kemp (TM 9873); 1 ♀, Valencia, Mar 1970, A. Kemp (TM 10058); 1 ♂, Wlotzkabaken, 25 Mar 1971, J. Gaerdes (TM 10061); 1 ♀, Valencia 42, Mar 1970, A. Kemp (TM 9874); 1 ♂, Rosh Pinah, Apr 1971, J. Nel (TM 10105); 1 ♀, Tumas Mountain, 9 May 1972, Prozesky (TM 10487); 1 ♀, Swakopmund, 24 June 1971, Ben Benade (TM 10081); 1 juv ♀, Valencia 42, 7 Mar 1970, A. Kemp (TM 9875); 2 juv ♀, Portsmut 33, 19 Apr 1972, Jones (TM 10466, 10468); 2 ♀, Plateau, 1972, H. Erni (TM 1053-4); 1 ♂, Plateau, 1972, H. Erni (TM 10526); 1 ♀, Portsmut 33, 19 Apr 1972, Jones (TM 10471); 1 ♀, Aus (Lüderitz), Erni (TM 9735); 1 juv ♀, Swartbank, 20 Jan 1971, A. Strydom (TM 10025); 1 ♂, Rosh Pinah, Dec 1972, A. Maritz (TM 10672); 1 ♀, Rosh Pinah, Dec 1972, A. Maritz (TM 10673); 1 ♀, Gobabeb, Erni, (TM 9737); 1 juv ♂, Portsmut 33, 19 Apr 1972, Jones (TM 10469); 1 ♀, Rosh Pinah, 9 June 1971, A. Maritz (TM 10119); 1 juv ♀, Portsmut 33, 19 Apr 1972, Jones (TM 10470); 1 ♀, Rosh Pinah, Jan 1971, A. Maritz (TM 10243); 1 ♀, Rosh Pinah, Mar 1971, J. Botha (TM 10050); 1 ♀, Windhoek, 12 Dec 1966, J. Boshoff (SMN 42); 1 ♀, Kochenau, 11 Mar 1971 (SMN 267); 2 juv ♂ 1 juv ♀, Portsmut 33, 19 Apr 1972, Jones (NM 10526); 2 ♀, Portsmut, 7 Feb 1969, B. Lamoral (NM 10074); 1 ♀, 2 ♂, Valencia, 6 Feb 1969, B. Lamoral (NM 10025); 1 ♂, Valencia, 6 Feb 1968, A. Port (NM 10024); 2 ♀, Aar 38, 16 Oct 1970, P. Buys (SMN 179); 1 ♀, Windhoek, Graf zu Castell (SMN 37); 1 ♀, Rostock 393, 29 Aug 1966, J. Hugo (SMN 51); 1 ♀ 1 ♂, Lichtenstein Mitte, 1 Sep 1962, E. Rush (SMN 86); 1 ♂, Windhoek, J. Tromp (SMN 34); 1 ♀, Matchless Myn, 8 Sep 1961, P. Buys (SMN 65); 1 ♀, Windhoek, Sep 1961, Schenker (SMN 18); 1 ♀, Daan Viljoen Game Reserve, 21 July 1966, N. du Plessis (SMN 88); 2 ♀, Tantus, 8 Feb 1966, W. Mannengresser (SMN 56); 1 ♂, Windhoek, Oct 1961, J. Honguta (SMN 28); 1 ♀, Berseba, 18 Aug 1965, W. Steyn (SMN 75); 1 ♀, Klein Windhoek, 16 Mar 1971 (SMN 266); 1 ♀, Windhoek, 21 Mar 1963, J. Cloete (SMN 38); 1 ♀, Windhoek, 5 Feb 1962, W. Giess (SMN 41); 1 ♀, Windhoek, Feb 1971 (SMN

273); 1 ♀, Windhoek, 25 Sep 1962, W. Giess (SMN 6); 1 ♀, Alte Feste, 25 Aug 1967, A. Isaacs (SMN 1); 1 juv ♀, Tantis, 16 Nov 1966, W. Kannegiesser (SMN 48); 1 ♀, Windhoek, 11 Mar 1963 (SMN 19); 1 ♂, Eros, 3 Nov 1963, Erasmus (SMN 13); 1 ♂, Kranzberg, 23 Mar 1976, B. Lamoral (NM 10911); 1 Juv ♂, Lichtenstein Mitte, 21 Jan 1960, E. Rusch (SMN 87); 2 ♀, Goreangab Dam, 19 Dec 1973, C. G. C. (SMN 499); 1 juv ♂, Goreangab Dam, 12 Feb 1971 (SMN 271); 1 ♀, Daan Viljoen Game Reserve, C. Coetzee (SMN 302); 2 ♀ 2 ♂, Goreangab Dam, 18 May 1972, P. G. O. (SMN 380); 1 subad ♂, Windhoek, 2 July 1970, J. Viljoen (SMN 157); 1 juv ♀, Windhoek, 5 Nov 1964, J. Angula (SMN 15); 1 ♂, Windhoek, 28 June 1961, W. Giess (SMN 7); 1 juv ♂, Otjombane, 8 Sep 1961, P. Buys (SMN 142); 2 ♀, 145 km along Uspass Road from Gobabeb side (22° 50' S, 16° 50' E), 15 Nov 1974, S. Endrödy-Younga (TM 11092, 11094); 1 ♂, Rudenau Nord, 14 Mar 1974, J. Tebje (SMN 518); 1 juv ♂, Djab, 14 Aug 1961, E. Rusch (SMN 143).

(iii)

1 ♀, Fish River Canyon, 16 July 1971, S. Reynders (NM 10529); 1 ♀, Hardop Dam, 15 Nov 1967 (SMN 375); 1 ♀, Naus, 6 Oct 1972, H. Strauss (SMN 390); 1 ♀, Sandmund, Dec 1968, C. Steenkamp (NM 10536); 1 ♀, Neisip, 18 Oct 1970, I. Mokgoabone (SMN 193); 1 ♂, Kuibis North 168, 28 Feb 1976, B. Lamoral (NM 10775); 1 ♀, Fish River Canyon, 25 June 1974, J. Lensing (SAIMR 870); 1 juv ♀, Fish River Canyon, 8 Apr 1976, B. Lamoral (NM 10831); 1 subad ♀, Guruchab River, 10 Feb 1974, L. Wingate (NM 10545); 1 ♂, Narudas Sud 268, 22 Jan 1976, B. Lamoral (NM 10774); 1 ♀, Gorrasis 99, 29 Jan 1974, C. G. C. (SMN 509); 2 ♀, Blinkoog, 14–17 Oct 1971 (SMN 314); 1 ♂, Upington, 25 Jan 1971, S. Engelbrecht (NM 10530); 1 ♀, Ai Ais, 29 Apr 1966, Natuurbewaring (SMN 177); 1 ♂, Ortman'sbaum farm, 26–28 Jan 1973, Lamoral (NM 10517); 1 ♀, Amnisfontein, 21 Nov 1975, E. Griffin (SMN 568); 1 ♀, Swartmodder farm, Jan–Feb 1973, S. Engelbrecht (NM 10514); 1 ♀, Richtersveld, July 1973, van Dyck (NM 10534); 1 juv ♀, Narudas Sud 268, Dec 1975, Maritz (NM 10773); 1 juv ♀, Narudas Sud 268, 23 Feb 1976, B. Lamoral (NM 10784); 2 juv ♀, Barby 26, 2–8 Oct 1972, State Museum staff (SMN 391); 1 ♀ 1 ♂, Bethanie, Aug 1959, F. Gaerdes (NM 7275–7276).

(iv)

1 ♀, Rosh Pinah, Apr 1971, J. Botha (TM 10055); 1 subad ♀, Swartberg, June 1973, C. Coetzee (NM 10497); 1 ♀ juv ♀ 1 juv ♂, Bakers Bay, June 1973, C. Coetzee (NM 10507); 3 ♀ 1 ♂, Plateau 38, 29 Feb 1976, B. Lamoral (NM 10805); 1 ♀, Kubub 15, 2 Mar 1976, B. Lamoral (NM 10779); 2 ♀ 1 ♂, Tsurub 13, 3 Mar 1976, B. Lamoral (NM 10730); 3 ♀, Plateau farm, 14 Feb 1973, B. Lamoral (NM 10461); 1 ♂, Aar 16, 29 Feb 1976, B. Lamoral (NM 10780); 1 ♂, Namuskluft 88, 11 Sep 1970, F. Burger (SMN 185); 1 ♀, Plateau, 15–18 Jan 1972 (SMN 320); 1 ♀, Bakers Bay, 30 Apr 1972, C. Coetzee (SMN 367); 1 ♂, Rosh Pinah, Feb 1971, J. Botha (NM 10921); 1 ♀, Zuidsivier, Feb 1972, B. Lamoral (NM 10532); 1 nymph ♀, Koichab pan, 20 July 1966, P. Wiplinger (SMN 170); 1 ♂ 6 ♀, Plateau farm, Oct 1973, H. Erni (NM 10503); 1 ♀ 1 juv ♂, Namuskluft 88, 21–22 Sep 1973, M-L. Penrith (SMN 486); 1 ♀, Namuskluft 88, 20 Sep 1973, M-L. Penrith (SMN

489); 1 juv ♂, Obib Dunes, 16–20 Sep, E. Mokgoabone (SMN 485); 1 ♀, Richtersveld, June 1923, Smith (NM 11034).

Distribution: North-western Cape Province of South Africa and as in Fig. 207 for Namibia.

Bionomics: *P. villosus* is predominantly nocturnal but specimens have occasionally been found wandering in the open around midday in the Namib Desert Park. It is hemiedaphic, digs shallow scrapes under rocks in soils of widely variable hardnesses and texture, ranging from consolidated sand to hard and gritty soils. This wide adaptability probably accounts largely for its extensive distribution in Namibia. With *P. granulatus*, *villosus* is one of the more commonly found buthid scorpions of Namibia and both are often found in human habitations. *P. villosus* is often sympatric with *granulatus*, and occasionally *kalaharicus*, *schlechteri* and *raudus*.

Parabuthus brachystylus Lawrence, 1928. Figs 205, 207

Parabuthus brachystylus Lawrence, 1928: 270–273

Diagnosis: *Parabuthus brachystylus* is a sibling species of *P. villosus*, but can be separated from the latter by the following combination of morphological characters: dorsal stridulatory area of cauda II reaching posterior margin; cauda I wider than long, width percentage of length 106% (103–109%). The two species are further separated by the differences in the number of haemolymph protein bands in phoregrams as shown in Figs 205–206.

Description: Lawrence's original description was based on 2 ♀ and 3 ♂. Access to additional material from a wide selection of localities has shown that most of the diagnostic characters selected by Lawrence are so variable as to bridge the particular character sets proposed by him for *P. brachystylus* and *villosus* and that the only reliable morphological characters available are those listed in the diagnosis.

Colour: Specimens from localities near the southern limits of the species range have a slightly lighter overall colour than that described by Lawrence, and they do not differ markedly from specimens of *P. villosus* from adjacent region i in Fig. 207.

Trichobothria and hemispermaphore: As for *P. villosus*.

Haemolymph electrophoresis: Phoregrams were prepared from haemolymph of specimens collected from four different localities across an approximately north–south axis of the species range. The distribution and number of bands obtained are shown in Fig. 205. No significant differences were found between males and females and the R_M values were found to be consistent. Fig. 205 shows that *P. brachystylus* has two additional bands, labelled 2a and 3a, which are not present in phoregrams of *P. villosus*.

Goyffon & Lamy (1973: 138–144 and Fig. 1) have shown that in zones of sympatry, serological hybrids are occasionally found. *P. brachystylus* and *villosus* have identical R_M values for bands 1–6 and hybrids would therefore be impossible to detect. In any case, from available locality records, the two species appear to be allopatric. Finally no indication could be found that the differences

Variation: Mainly in coloration as described earlier.

Material examined: ♀, lectotype, Kamanjab, 1926, R. Lawrence (SAM 6087); 1 ♀, 3 ♂, paralectotypes, Kaoko Otavi, 1926, R. Lawrence (SAM 6794). 1 ♂, Equimina, 15 Oct 1970, I. Connell (TM 10034); 1 ♀, Hoas, 1971, J. Labuschagne

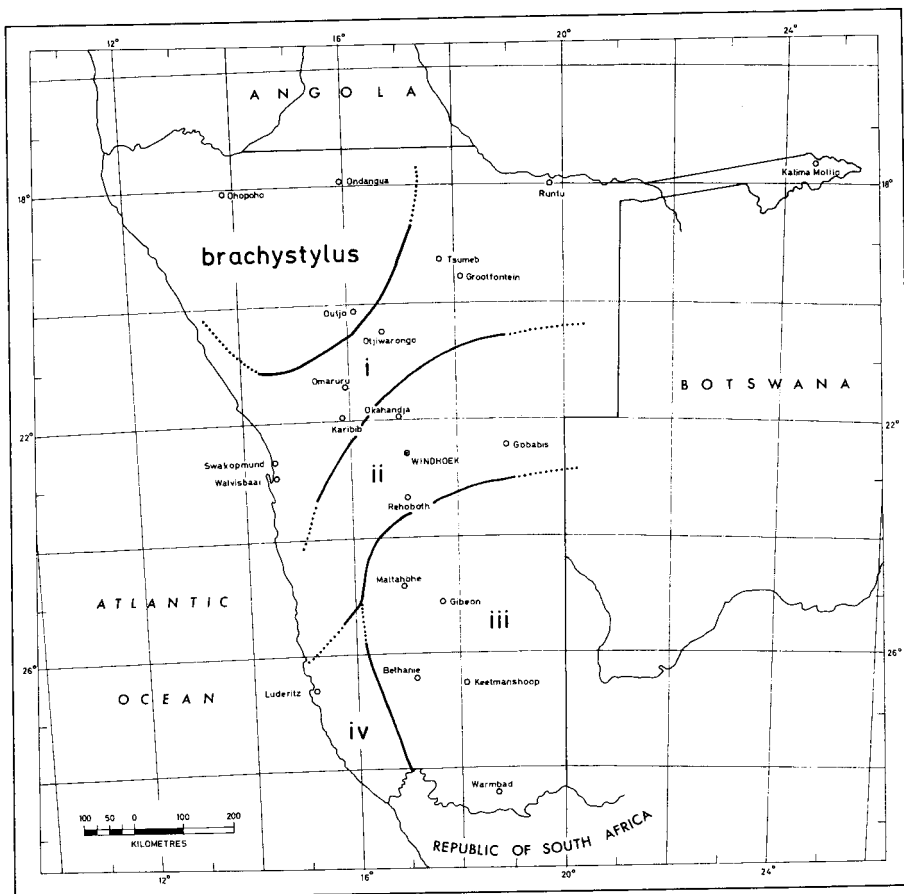


Fig. 207. Approximate distribution ranges of *Parabuthus villosus* (i to iv) and *P. brachystylus*. i to iv indicate ranges of intraspecific variants described in the text. Dotted lines indicate supposed extensions of solid lines.

(TM 10143); 1 ♂, Twyfelfontein, 25 June 1963, Dr Scherz (SMN 104); 1 juv ♀, Kaoko Otavi, 27 Nov 1970, P. Olivier (SMN 238); 2 ♀ 1 juv, Kaokoveld (SAM 6794); 1 ♀, Kamanjab, 5 Apr 1976, B. Lamoral (NM 10833); 1 ♂, Grootberg 191, 2 Apr 1976, B. Lamoral (NM 10913); 1 ♀, Orupembe, 14 Nov 1965, W. Steyn (SMN 114); 1 ♀, Messum Crater area, 26 Mar 1976, B. Lamoral (NM 10823); 1 ♂ 1 subad ♀, Kamanjab, 25 Feb 1969, B. Lamoral (NM 10044); 1 ♂, Kaoko Otavi, 27 Nov 1970, P. Olivier (SMN 237); 1 ♀, Orupembe, June 1965, P. Buys (SMN 113); 1 juv, Welwitschia, Aug 1960, F. Gaerdes (NM 7321); 1 ♀, Kaoko Otavi, Apr 1966, W. Coaton (NM 9116); 1 juv ♀, Messum Crater 26 Mar 1976, B. Lamoral (NM 10846); 1 ♂, Ohopoho, Mar 1972, Erasmus (SMN 344); 1 subad ♂, Sesfontein, 3 Apr 1976, B. Lamoral, (NM 10733).

Remark: The following locality should be regarded as extremely dubious: 1 ♂, Gobabeb, no date, no collector's name (TM 9363).

Distribution: As in Fig. 207.

Bionomics: Although one of the larger species of *Parabuthus*, *P. brachystylus* is not a commonly occurring species, as indicated by the relatively low number of specimens collected. It is nocturnal, hemiedaphic, occasionally epigeic on shrubs and small trees when hunting, and digs shallow scrapes under rocks or fallen trees, in soils of variable hardness and texture, ranging from consolidated sand to moderately hard and gritty soils. A few specimens have been found under the loose bark of fallen trees, sharing this habitat with *Buthotus conspersus*.

Genus *Uroplectes* Peters, 1861

Type species: *Uroplectes ornatus* Peters, 1861, by original designation.

Diagnosis: *Uroplectes* is separated from the other genera of the family Buthidae by the following combination of characters: no teeth on ventral proximal margin of fixed finger of chelicerae; no stridulatory area on dorsal surface of cauda I and II; telson vesicle with or without subaculear tubercle; tergites with a median keel, with or without lateral accessory keels; carapace without keels or with only vestigial posterior median keels; carapace anterior margin always very slightly recurved, with a very small median projection; granular rows of fixed and movable fingers of pedipalp with at least one inner and one outer flanking tooth; sternum subtriangular in shape; distal end of hemispermatophore of male with *pars recta* and *pars reflecta* to flagellum.

Distribution: Most of Afrotropical faunal region (excepting Zaïre basin and regions west and north-west of Cameroun) and Oriental faunal region.

Uroplectes carinatus (Pocock, 1890a). Figs 208–215, 217, 225–226, 229

Lepreus carinatus Pocock, 1890a: 129.

Uroplectes alstoni Purcell, 1901: 180–182. *Syn. n.*

Uroplectes carinatus mediotriatus Kraepelin, 1908: 257–258. *Syn. n.*

Diagnosis: The following combination of characters separates *U. carinatus* from other species of the genus. Pedipalp hand, Figs 210–212: movable finger length/handback length ratio 1.55 or less in adult ♀ & ♂; proximo-mesial cutting edge of movable finger distinctly procurved in ♀, distinctly recurved in ♂;