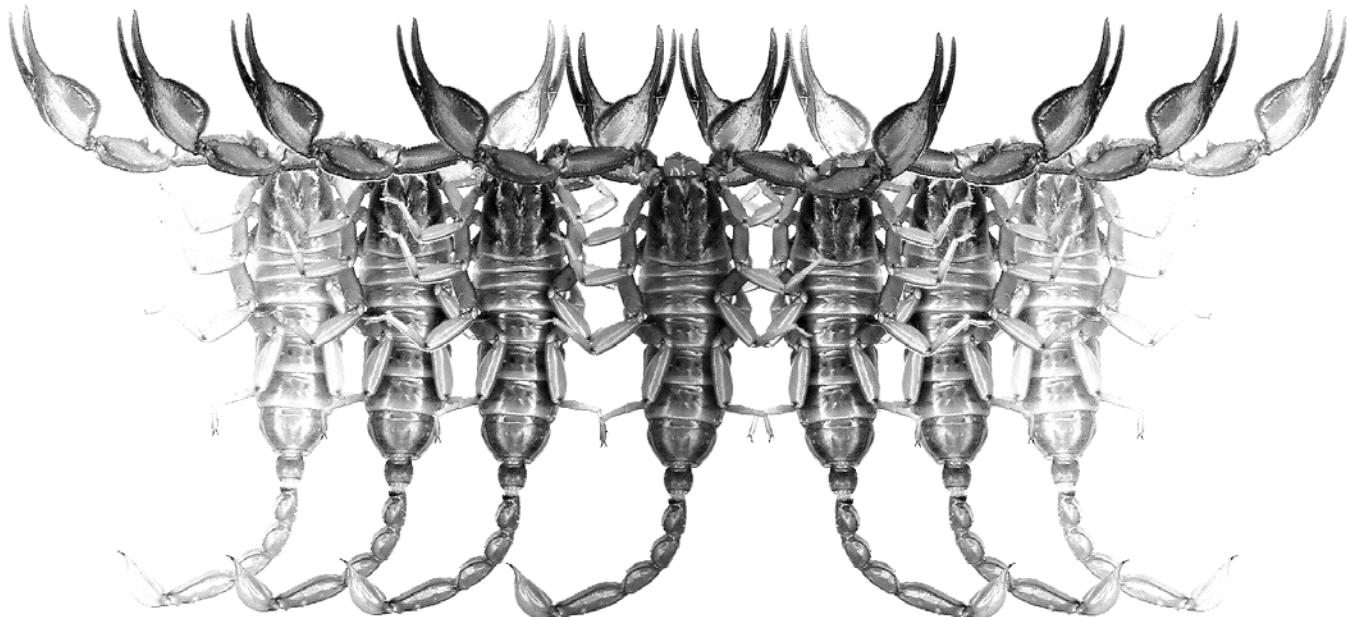


Euscorpius

Occasional Publications in Scorpiology



**Review of the Subgenus *Pandinurus* Fet, 1997 with
Descriptions of Three New Species (Scorpiones,
Scorpionidae, *Pandinus*)**

František Kovařík

July 2012 – No. 141

Euscorpius

Occasional Publications in Scorpiology

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- **ZISP**, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia
- **WAM**, Western Australian Museum, Perth, Australia
- **NTNU**, Norwegian University of Science and Technology, Trondheim, Norway
- **OUMNH**, Oxford University Museum of Natural History, Oxford, UK
- **NEV**, Library Netherlands Entomological Society, Amsterdam, Netherlands

Review of the subgenus *Pandinurus* Fet, 1997 with descriptions of three new species (Scorpiones, Scorpionidae, *Pandinus*)

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Summary

Pandinus (Pandinurus) awashensis sp. n. from Ethiopia, *P. (P.) somalilandus* sp. n. from Somaliland, and *P. (P.) lowei* sp. n. from Democratic Republic of Congo are described and compared with other species of the subgenus. *P. (P.) sudanicus* Hirst, 1911 stat. n. previously considered a synonym of *P. (P.) magrettii* Borelli, 1901 is recognized as a valid species. New data on taxonomic characters and distribution of the subgenus *Pandinurus* are presented. Also presented are a map of distribution, photos of the localities and a key to species using hitherto unpublished characters of the tarsomere spination formula and sexual dimorphism.

Introduction

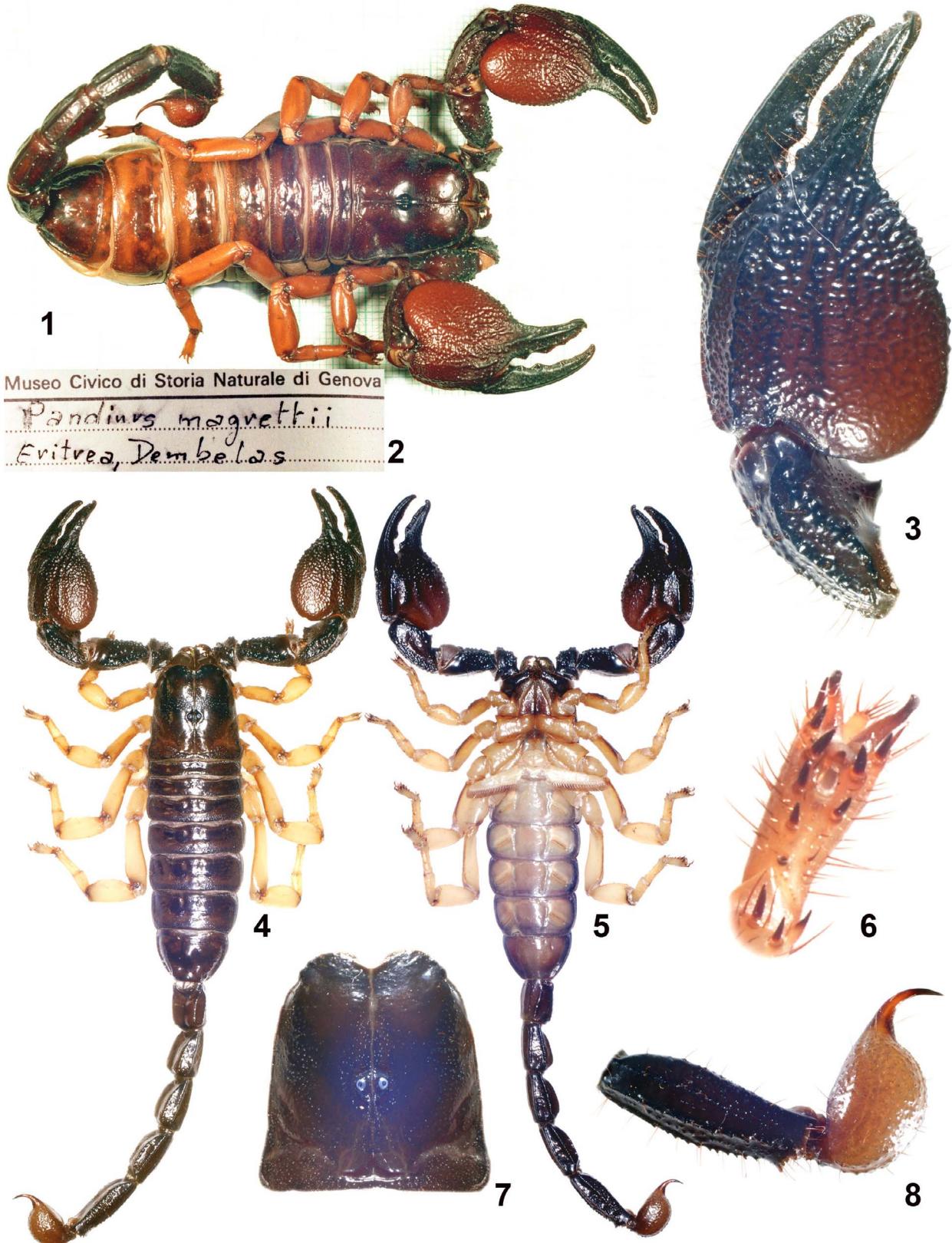
Although the genus *Pandinus* Thorell, 1876 includes some of the largest scorpions, its species and their distribution are surprisingly little known. Altogether 30 species were described between 1758 (Linné) and 1919 (Borelli), of which today 20 are deemed valid. The majority of species were described by Pocock; unfortunately, most of them were based on unique specimens without any subsequent reports. Descriptions of four more species followed only in 2000, 2003, and 2011 (Kovářík).

As well known can be considered the West African *P. gambiensis* Pocock, 1899, *P. dictator* (Pocock, 1888) and *P. imperator* (C. L. Koch, 1841) and also the Central African *P. viatoris* (Pocock, 1890) and *P. cavimanus* (Pocock, 1888). These five species are readily available in pet stores in Europe, USA and Japan, and there is extensive literature on their proper maintenance and breeding in captivity. However, the main center of species diversity of the genus is in arid areas of East Africa where density of populations tends to be much smaller. This, in combination with political / economic instability of the region, apparently is the reason why most species are based on solitary specimens of very old vintage and their descriptions often do not mention sexual dimorphism. In this regard, rich collections deposited in Italian museums become exceedingly important.

The only recent author who applied modern taxonomic characters to *Pandinus* was Vachon, who defined *P. gambiensis* and *P. imperator* on the dif-

ferences in spine formula on tarsomere of legs (figs. 1–5 in Vachon, 1967: 1535) and in trichobothrial pattern (figs. 6–11 in Vachon, 1967: 1536). Subsequently (Vachon, 1974) he divided the species of *Pandinus* into five subgenera defined by numbers of internal and ventral trichobothria on the pedipalp chela. Vachon's scheme is still used, although morphology and expressions of sexual dimorphism apparent from newly available specimens indicate relations across the subgeneric limits. Evident is for instance a close relationship of *P. (Pandinopsis) dictator* with *P. (Pandinus) gambiensis*, *P. (Pandinus) imperator* and *P. (Pandinus) ugandaensis* Kovářík, 2011 although the latter three are currently placed together with *P. (Pandinus) phillipsii* (Pocock, 1896) and *P. (Pandinus) smithi* (Pocock, 1897), whose morphology, sexual dimorphism and geographic distributions rather indicate closer relationships with most species of the subgenus *Pandinurus*, which is treated in this article. In contrast, these subgenera do not very well fit with *P. (Pandinurus) viatoris* and *P. (Pandinurus) lowei* sp. n., which have a unique sexual dimorphism in male pedipalp segment length. On the other hand, truly related appear to be species assigned to the subgenus *Pandinops* Birula, 1913, which closely resemble each other in size, morphology and sexual dimorphism.

Despite the above noted contradictions, I believe changing Vachon's subgeneric scheme would be premature. An attempt to develop a new scheme has commenced, but remains to be completed. So far, examination of rich Italian collections has allowed me to better understand (Kovářík, 2003; Kovářík & Whitman,



Figures 1–8: *Pandinus (Pandinurus) magrettii* Borelli, 1901. 1–2. Dorsal view and label, ♀(ca. 110 mm), Eritrea, Dembelas, VII.1902, det. Borelli, MCSN. 3–8. Chela, dorsal and ventral views, tarsomere of 4th leg, carapace, fifth metasomal segment and telson, ♂(98 mm), Eritrea, FKCP.

2005) and illustrate (Kovařík, 2009) all known species. A subsequent expedition to Ethiopia and Somaliland (Kovařík & Mazuch, 2011; Kovařík & Lowe, 2012) has enabled me to better understand ecology of *Pandinus* in East Africa. Whereas a preceding article (Kovařík, 2011) treats the subgenus *Pandinus*, this article is concerned with the subgenus *Pandinurus*.

Material and Methods

Abbreviations

The institutional abbreviations listed below and used throughout are mostly after Arnett et al. (1993).

BMNH, The Natural History Museum, London, United Kingdom
 FKCP, Personal collection of František Kovařík, Praha, Czech Republic
 ISNB, Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium
 MSNM, Museo Civico di Storia Naturale di Milano, Milan, Italy
 MZUF, Museo di Storia Naturale dell'Università di Firenze, Sezione di zoologia "La Specola", Florence, Italy

Systematics

Pandinus Thorell, 1876

(Figs. 1–64)

Pandinus Thorell, 1876: 12; Kraepelin, 1899: 116; Vachon, 1974: 953, figs. 113–118; Sissom, 1990: 136; Fet, 1997: 248; Fet, 2000: 465; Prendini, 2000: 44; Kovařík, 2009: 50, figs. 284–420; Kovařík, 2011: 1, figs. 1–42.

TYPE SPECIES. *Buthus imperator* C. L. Koch, 1841.

DIAGNOSIS. Total length 50–220 mm. Pedipalp femur with 3 trichobothria, only one of them on internal surface. Pedipalp patella with 13–16 external and numerous (usually about 30) ventral trichobothria. Retrolateral pedal spurs absent. Lateral margins of tarsi produced into rounded lobes. Metasomal segments I–IV with paired ventral submedian carinae. Stridulatory organ located on opposing surfaces of pedipalp coxa and first leg. Telson without subaculear tubercle.

Subgenus *Pandinurus* Fet, 1997

(Figs. 1–64)

Pandinus (Pandinurus) Vachon, 1974: 953, *nomen nudum* (type species not designated).

Pandinus (Pandinurus) Fet, 1997: 248; Fet, 2000: 470; Kovařík, 2009: 54, figs. 295–303, 336–385, 420.

TYPE SPECIES. *Scorpio exitialis* Pocock, 1888 (see notes in Fet, 2000: 470).

DIAGNOSIS: Total length 50–140 mm. Chela with 2 internal and 6–14 ventral trichobothria. Pectinal teeth number 14–24.

Pandinus (Pandinurus) magrettii Borelli, 1901

(Figs. 1–8, 64)

Pandinus magrettii Borelli, 1901: 1; Birula, 1928: 85 (in part).

Pandinus (Pandinurus) magrettii: Vachon, 1974: 953; Lamoral & Reynders, 1975: 566 (in part); Kovařík, 1998: 140; Fet, 2000: 471 (in part); Kovařík & Whitman, 2005: 114; Kovařík, 2009: 54, figs. 300, 339–346, 418–419 (in part).
 = *Brotheas hirsutus* L. Koch, 1875: 8 (syn. by Kraepelin, 1894: 70; Kovařík, 2003: 151).
 = *Scorpio africanus subtypicus* Kraepelin, 1894: 69 (syn. by Kovařík, 2003: 151).

TYPE LOCALITY AND TYPE REPOSITORY. Eritrea, Keren; MSNM.

DIAGNOSIS: Total length 90–110 mm. Chela of pedipalp bears 10–11 ventral trichobothria. Color of adults uniformly reddish black, legs yellow to yellowish, always lighter-colored than body. Pectinal teeth number 18–21. Dorsal surface of manus tuberculate. Dorsal carinae on fourth metasomal segment without discrete denticles. Chela internal with two longitudinal carinae covered by several granules. Movable finger of pedipalp and length of segments of pedipalp without sexual dimorphism. Male has bigger telson than female. Movable fingers of pedipalps do not show any noticeable sexual dimorphism. Tarsomere II with 3 spines on inclined anteroventral surface. Spination formula of tarsomere II = 6/4: 6–7/4–5: 6–7/4–5: 6–7/4–5. Tarsomere I of all legs with spina distal prosuperior (see red arrow on Fig. 59).

Pandinus (Pandinurus) sudanicus Hirst, 1911, stat. n.

(Figs. 40–41, 64)

Pandinus exitialis sudanicus Hirst, 1911: 219.

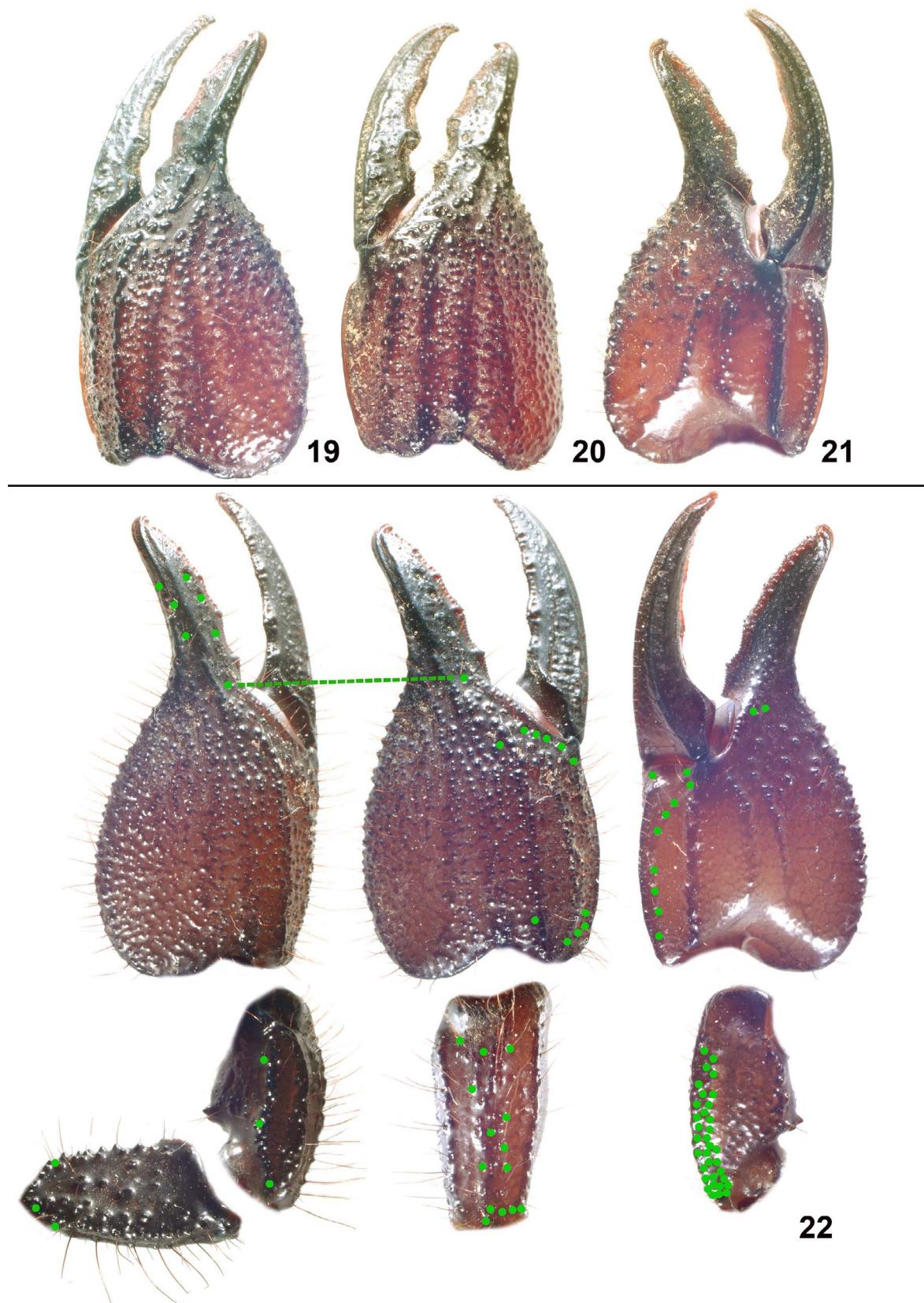
Pandinus magrettii: Birula, 1928: 85 (in part).

Pandinus (Pandinurus) magrettii (in part): Fet, 2000: 471–472; Kovařík, 2009: 54.

TYPE LOCALITY AND TYPE REPOSITORY. South Sudan, Gebel Mts., S of Obeid; BMNH.



Figures 9–18: *Pandinus (Pandinurus) awashensis* sp. n. 9–13. Dorsal and ventral views, fifth metasomal segment and telson, carapace, and pectinal area, ♂ (110 mm) holotype. 14–18. Dorsal and ventral views, fifth metasomal segment and telson, pectinal area, and carapace, ♀ (83 mm) allotype.



Figures 19–22: *Pandinus (Pandinurus) awashensis* sp. n. 19–21. Chela dorsal, external and ventral/internal views, ♂ (110 mm) holotype. 22. Trichobothrial pattern, ♀ (83 mm) allotype.

DIAGNOSIS: Total length 90–111 mm. Chela of pedipalp bears 11–12 ventral trichobothria. Color of adults uniformly reddish black, legs yellow to yellowish, always lighter-colored than body. Pectinal teeth number 16–22. Dorsal surface of manus tuberculate. Chela internal with two longitudinal carinae obviously smooth. Male has more pronounced tooth on movable finger of pedipalp. Tarsomere II with 2 spines on inclined anteroventral surface. Spination formula of tarsomere II = 5/4: 6-7/4: 6-7/4-5: 6-7/4-5. Tarsomere I of all legs with spina distal prosuperior.

COMMENTS. *P. sudanicus* stat. n. is treated here as a valid species. The previous placement of this taxon either as a subspecies of *P. exitialis* (Hirst, 1911: 219) or as a synonym of *P. magrettii* (Birula, 1928: 85) reflects its morphological affinity with these species in two respects. Males of *P. exitialis* have similarly to *P. sudanicus* stat. n. in having more pronounced tooth on the movable finger of pedipalp (Fig. 41), which is not the case of *P. magrettii* (Fig. 3). Adults of both sexes of *P. magrettii* have similarly to *P. sudanicus* stat. n. in having the dorsal surface of the manus tuberculate but without conspicuous granules (Figs. 3 and 41), which to the contrary are characteristic of *P. exitialis* (Figs. 43 and 44).

***Pandinus (Pandinurus) awashensis* Kovařík, sp. n.**
(Figs. 9–28, 60–62, 64)

TYPE LOCALITY AND TYPE REPOSITORY. Ethiopia, Awash, Awash N. P., 08°52'35.15"N 40°05'39.8"E, 981 m a.s.l.; FKCP.

TYPE MATERIAL. Ethiopia, Awash, Awash N. P., 08°52'35.15"N 40°05'39.8"E, 981 m a.s.l., 20.VII.2011, 1♂ (holotype), leg. F. Kovařík; Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m a.s.l. (Figs. 27–28), 19.VII.2011, 1♀ (allotype) 5juvs. ca. 35 mm long (paratypes, 4 of them still alive), leg. F. Kovařík and P. Novák. All types are in the author's collection (FKCP).

ETYMOLOGY. Named after Awash National Park, the type locality. The male holotype was with the help of the park's manager removed dead from a water-capture hole (Fig. 26). Other specimens (paratypes) were collected outside the park.

DIAGNOSIS. Total length 83–110 mm. Movable finger of pedipalp without noticeable sexual dimorphism. Color uniformly reddish black, only legs, telson and chela reddish brown, slightly lighter-colored than body. Chelicerae brown, reticulate, with black fingers and anterior margins. External trichobothria on patella number 15 (5 eb, 3 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number 9 to 11. Pectinal teeth number 18–22.

Spination formula of tarsomere II = 6/5: 7/5: 7-8/5: 7-8/5. Tarsomere II legs with 3 spines on inclined anteroventral surface. Tarsomere I legs I–III with spina but leg IV with seta distal prosuperior. All body sparsely hirsute, chela hirsute densely. Dorsal surface of manus with evenly sized conspicuous granules. External surface of chela smooth, with several granules in anterior part and with two granulated carinae. Chela of pedipalp length to width ratio ca. 2.1 in both sexes.

DESCRIPTION. The adults are 80–105 mm long. The habitus is shown in Figs. 9–10 and 14–15. For position and distribution of trichobothria of pedipalps see Fig. 22. External trichobothria on patella number 15 (5 eb, 3 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number 9 to 11. The male has a slightly larger telson than the female (Figs. 11 versus 16). Movable fingers of pedipalps do not show any noticeable sexual dimorphism.

COLORATION (Figs. 9–18). The color is uniformly reddish black, only the legs, telson and chela are reddish brown, slightly lighter-colored than the body. The chelicerae are brown, reticulate, with black fingers and anterior margins.

CARAPACE. The carapace (Figs. 12 and 18) lacks carinae but has a deep sagittal furrow with a forked furrow on each side in the posterior part. The surface is smooth, with sparse granules and punctures. The anteromedial margin of the carapace is strongly concave. Present are a pair of median eyes and three lateral eyes, one of them smaller. The distance ratio of the pair of median eyes from the anterior or the posterior margin of the carapace is, respectively, 0.55 or 0.45.

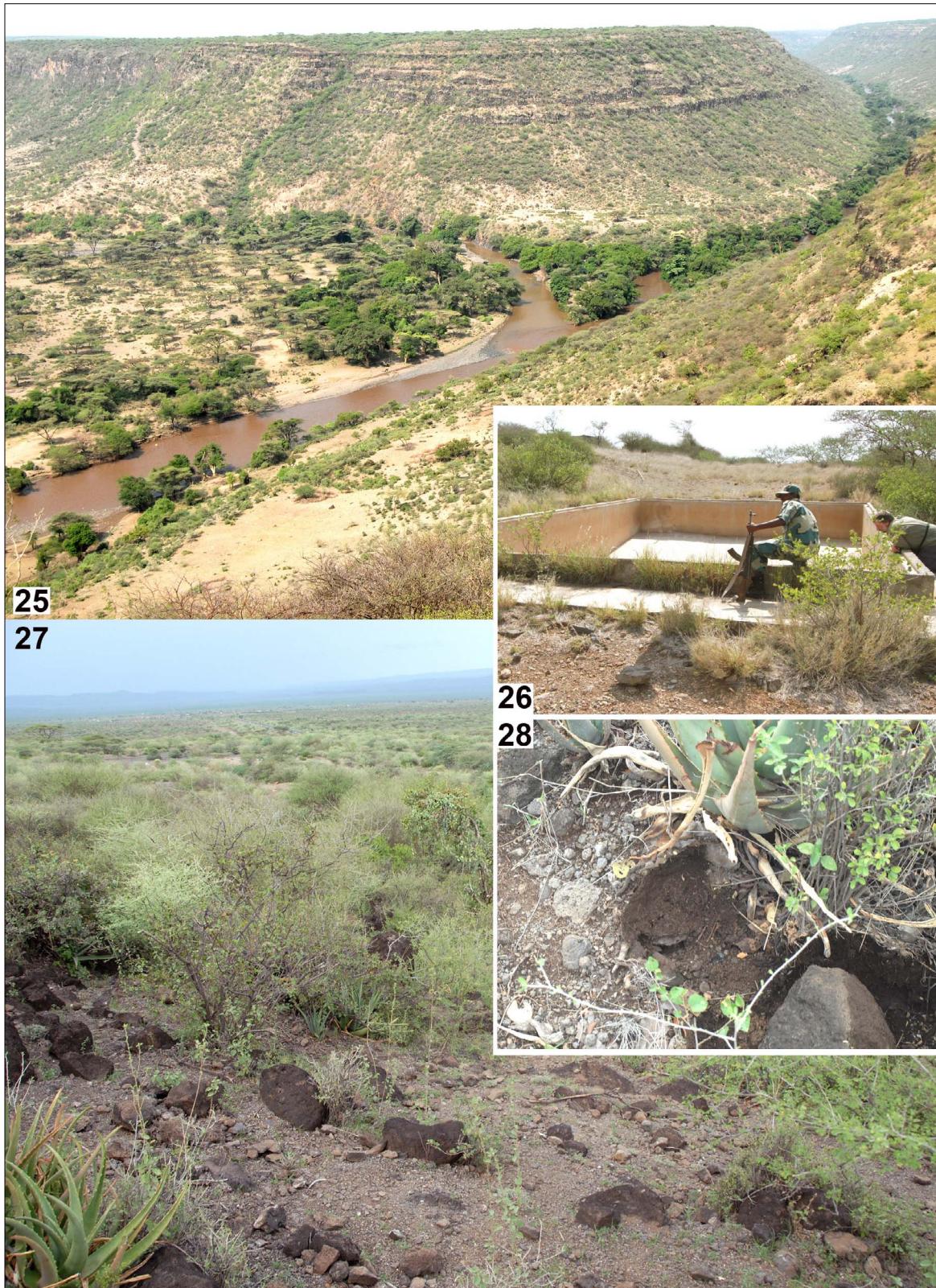
MESOSOMA. The tergites are tuberculate and finely granulated and bear an incomplete, smooth sagittal carina and shallow, symmetrical furrows. The sternites are smooth, lack carinae and bear two pronounced furrows. The pectinal teeth number 19–20 in males, 18 in females and 19–22 in juveniles. The pectines have three marginal lamellae and four middle lamellae. The fulcra are long and bear numerous white setae.

METASOMA AND TELSON. The first through fourth segments bear eight carinae. Most of the carinae are smooth. The dorsal carinae are composed of three to seven teeth of similar size. The fifth segment bears five to seven carinae of which the lateral carinae may be incomplete. All carinae on the fifth metasomal segment are composed of granules. The surface between the carinae is smooth, with solitary granules. The telson is elongate, slightly larger in the male (Fig. 11) than in the female (Fig. 16). The surface of the telson is smooth, hirsute, with several granules which compose incomplete carinae.

LEGS. The legs are smooth, hirsute, without carinae and granules. The spination formula of tarsomere II = 6/5: 7/5: 7-8/5: 7-8/5. Tarsomere II bears 3 spines on the inclined anteroventral surface (Fig. 60). Tarsomere I of



Figures 23–24: *Pandinus (Pandinurus) awashensis* sp. n., ♀ (83 mm) allotype at the locality, Ethiopia, Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m. a.s.l..



Figures 25–28: *Pandinus (Pandinurus) awashensis* sp. n. 25–26. Type locality, Ethiopia, Awash, Awash N. P., 08°52'35.15"N 40°05'39.8"E, 981 m a.s.l.. 26. Water-capture hole well that produced the dead male holotype. 27–28. Locality of allotype and paratypes, Ethiopia, Awash, 09°00'34.5"N 40°17'56.5"E, 1012 m. a.s.l.. 28. Rock under which was captured the female allotype.

legs I–III bears a spina, but on leg IV it bears a seta distal prosuperior (see red arrow on Fig. 61). PEDIPALPS (Figs. 19–22). The pedipalps are hirsute. The femur and patella bear several large granules. The femur bears four carinae composed of several large, round granules, only the exteroventral carina is smooth. The patella bears five complete carinae with granules or smooth. Several granules are only on the external surface of the patella. The chela is lobate and bears only two smooth ventral carinae. The dorsal surface of the chela bears granules that are neither conical nor pointed and whose summits may be confluent. The external surface of the chela is smooth, with several conical granules in anterior part and without carinae. The chela has a lobe. The dentate margins of the movable and fixed fingers are armed with two parallel rows of denticles extending the entire length of the finger, with larger granules which indicate five or six subrows on the movable finger and the fixed finger. The dorsal surface of the manus bears evenly sized conspicuous granules. The internal surface of the chela is smooth, with several granules in anterior part and with two granulated carinae. The dorsal and external surfaces of the chela bear four carinae; the total number of carinae on the is nine, but some of them are incomplete.

MEASUREMENTS IN MM. *Male holotype*. Total length 110; carapace length 13.8, width 15.1; metasoma and telson length 55.1; first metasomal segment length 6.4, width 6.1, depth 5.1; second metasomal segment length 7.4, width 5.5, depth 4.8; third metasomal segment length 8.3, width 5.0; fourth metasomal segment length 9.3, width 4.5; fifth metasomal segment length 12.0, width 4.1; telson length 11.7; telson width 5.3; pedipalp femur length 11.1, width 4.9; pedipalp patella length 10.8, width 5.4; chela length 23.4; manus width 11.1; movable finger length 14.8.

Female allotype. Total length 83; carapace length 12.9, width 12.9; metasoma and telson length 39.5; first metasomal segment length 4.8, width 4.5, depth 4.1; second metasomal segment length 5.5, width 4.1, depth 3.9; third metasomal segment length 5.9, width 3.8; fourth metasomal segment length 6.6, width 3.3; fifth metasomal segment length 8.7, width 3.2; telson length 8.0; telson width 3.2; pedipalp femur length 8.5, width 4.0; pedipalp patella length 9.0, width 4.5; chela length 19; manus width 9.2; movable finger length 11.3.

AFFINITIES. The described features distinguish *Pandinus awashensis* sp. n. from all other species of the subgenus *Pandinurus*. The shape and granulations of the chela distinguish *P. awashensis* sp. n. from *P. magrettii* (see key) with which it shares sexual dimorphism (the male has a larger telson than the female but movable fingers of pedipalps do not show any noticeable sexual dimorphism). This distinguishes the new species from the other two species in the region, *P. exitialis* and *P.*

sudanicus, whose males have a more pronounced tooth on the movable finger of pedipalp. It appears that the most similar species is *P. somalilandus* sp. n., which can be distinguished by the characters given in the key below.

***Pandinus (Pandinurus) somalilandus* Kovařík, sp. n.**
(Figs. 29–37, 59, 64)

TYPE LOCALITY AND TYPE REPOSITORY. Somaliland, 25 km N of Sheikh, 10°02.001'N 45°09.589'E, 763 m a.s.l.; FKCP.

TYPE MATERIAL. Somaliland, 25 km N of Sheikh, 10°02.001'N 45°09.589'E, 763 m a.s.l. (Fig. 37), 1♀ holotype, XI.2010, leg. T. Mazuch and P. Novák; 70 km from Berbera to Hargeysa, 1♀ (paratype), XI.2010, leg. T. Mazuch and P. Novák; near Sheikh, foothills of Goolis Mts., 09°59.881'N 45°09.762'E, 896 m a.s.l. (Fig. 35), 1juvenile 40 mm long (paratype), XI.2010, leg. T. Mazuch. All types are in the author's collection (FKCP).

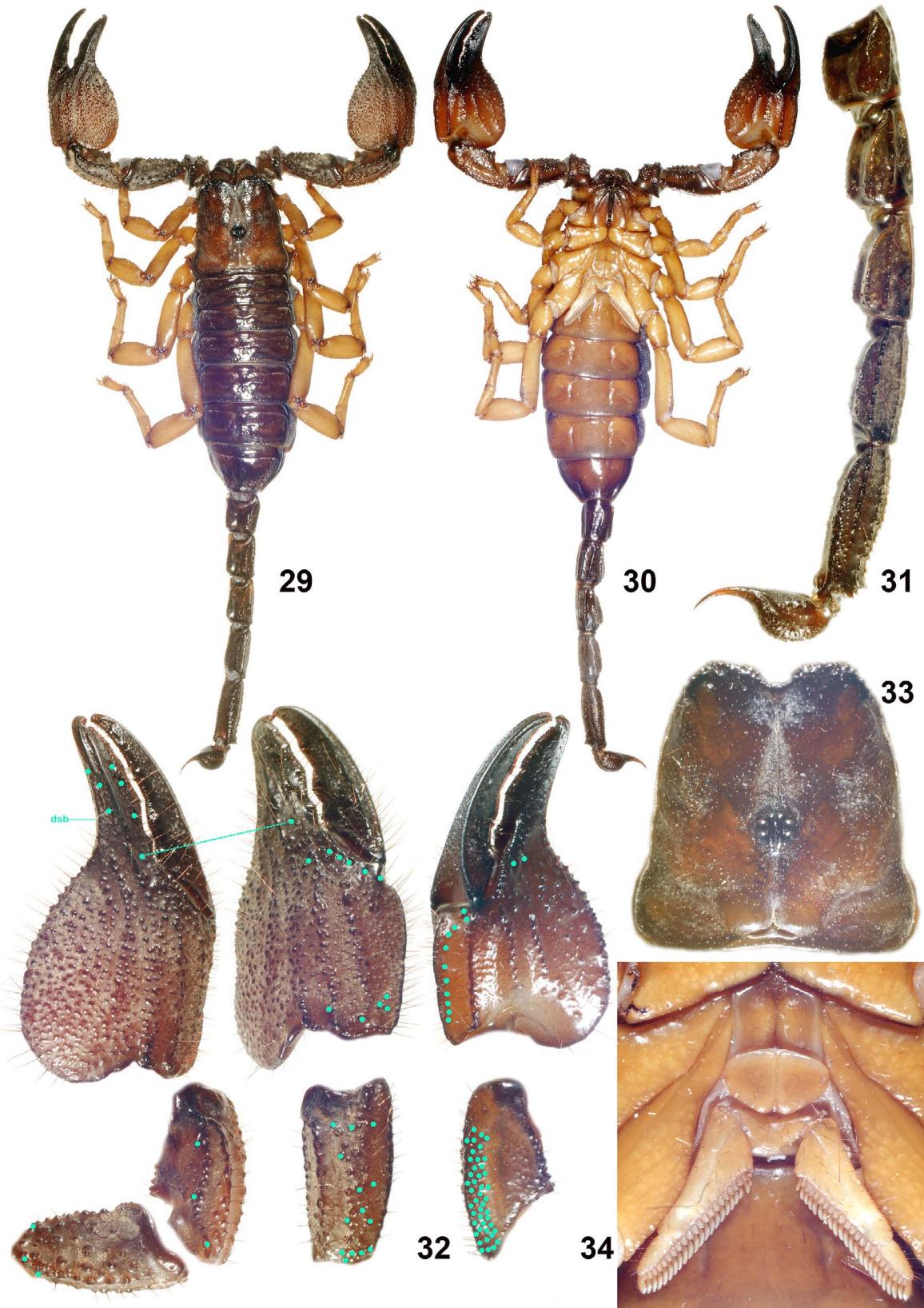
ETYMOLOGY. Named after the type locality.

DIAGNOSIS. Total length 95–110 mm. Color uniformly reddish brown to black, only legs yellow. Chelicerae brown, reticulate, with black fingers and anterior margins. External trichobothria on patella number 15 (5 eb, 3 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number 10–11. Pectinal teeth number 20–23 in females (male is unknown). Spination formula of tarsomere II = 6-7/5: 6-7/5: 7/5: 7/5. Tarsomere II of legs with 3 spines on inclined anteroventral surface. Tarsomere I of legs I–IV with spina distal prosuperior. All body sparsely hirsute, chela hirsute densely. Dorsal surface of manus with evenly sized conspicuous granules. External surface of chela smooth, with several granules in anterior part and with two granulated carinae. Chela of pedipalp length to width ratio 2.

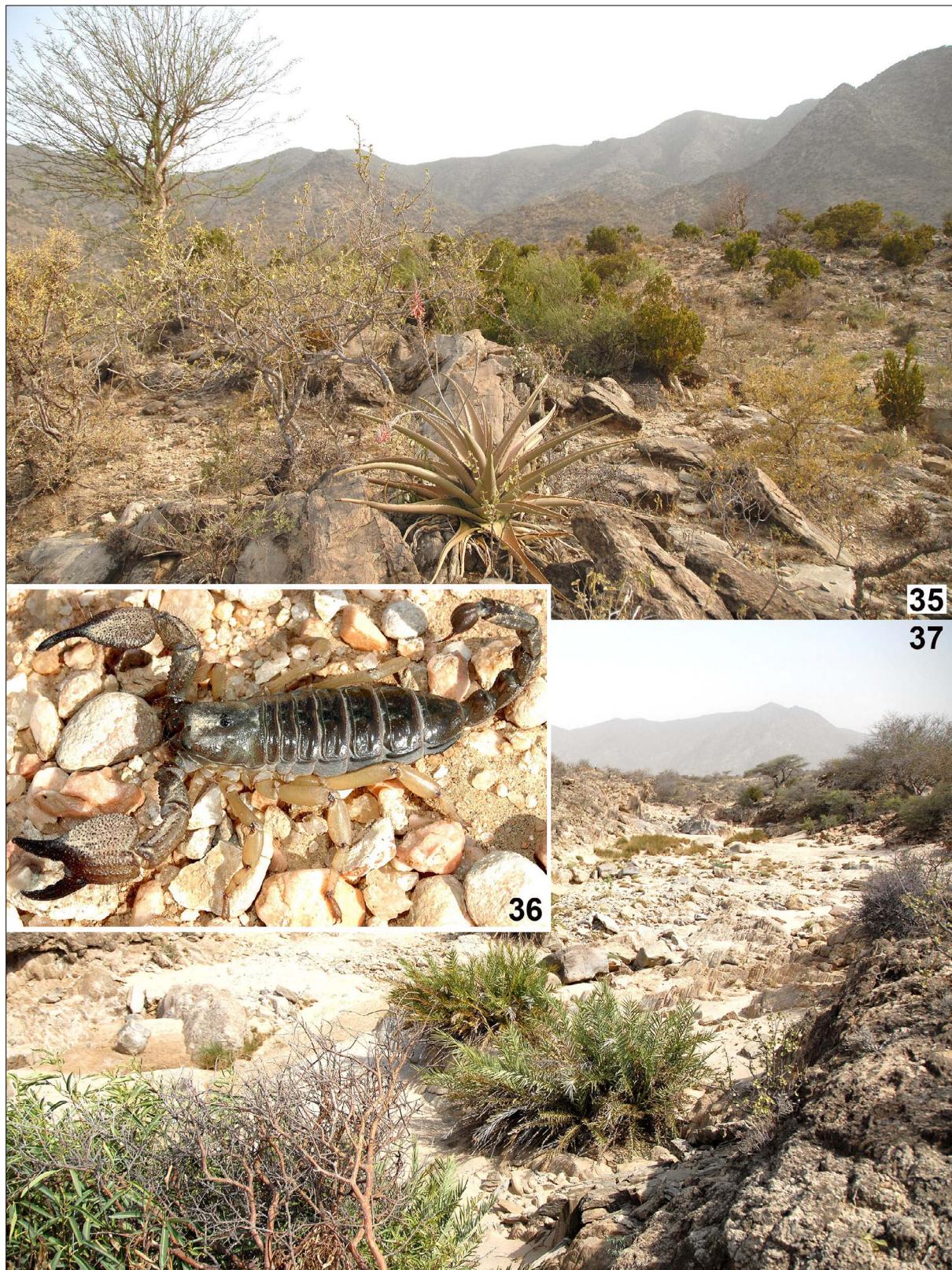
DESCRIPTION. The adults are 95–110 mm long. The habitus is shown in Figs. 29–30. For position and distribution of trichobothria on pedipalps see Fig. 32. External trichobothria on patella number 15 (5 eb, 3 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number 10–11. The male is unknown.

COLORATION (Figs. 29–30). The color is uniformly reddish brown to black, only the legs are yellow. Chelicerae are brown, reticulate, with black fingers and anterior margins.

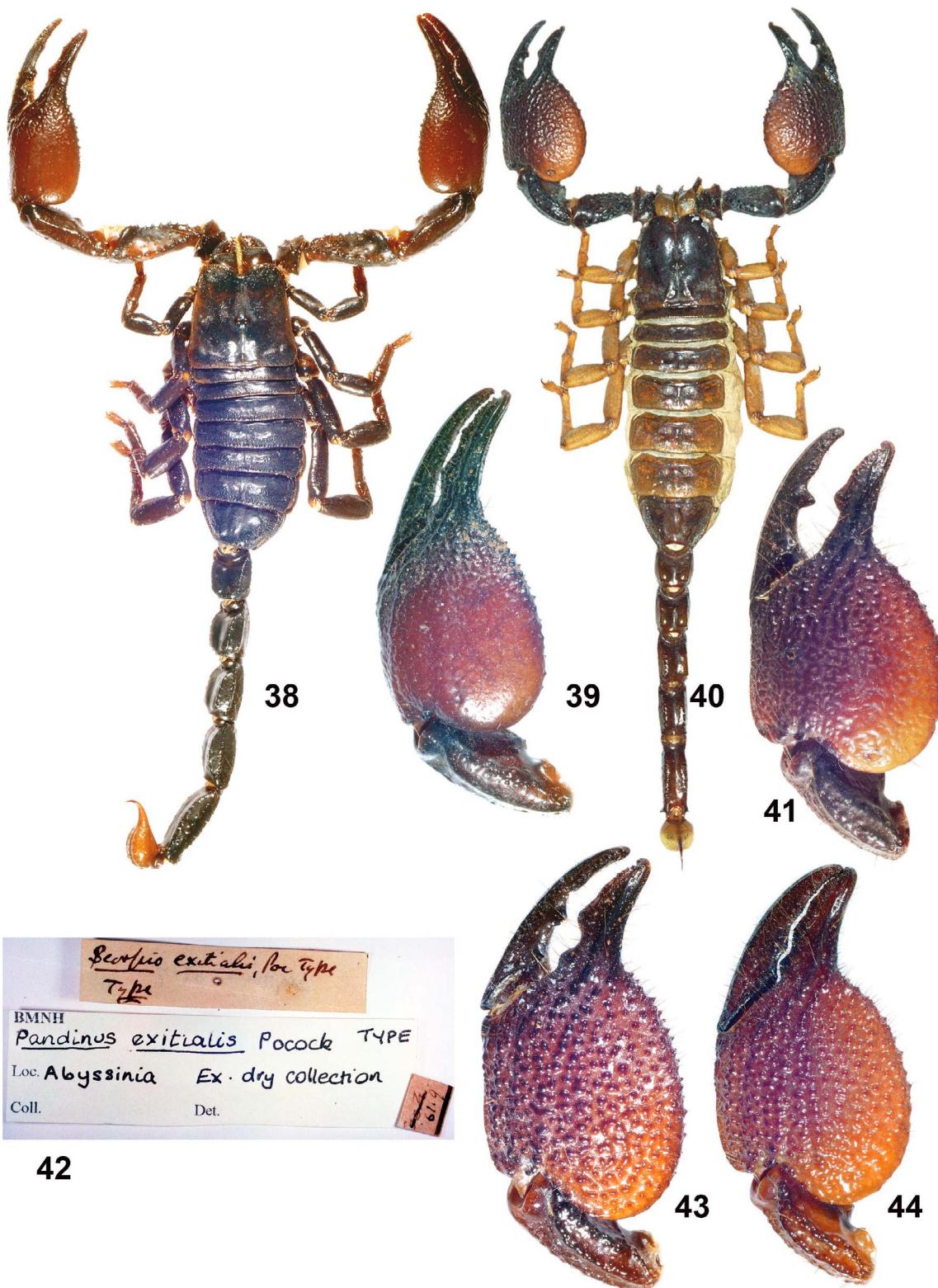
CARAPACE. The carapace (Fig. 33) lacks carinae but has a deep sagittal furrow with a forked furrow on each side in the posterior part. The surface is smooth, with sparse granules. The anteromedial margin of the carapace is strongly concave. Present are a pair of median eyes and three identical lateral eyes. The distance ratio of the pair



Figures 29–34: *Pandinus (Pandinurus) somalilandus* sp. n. Dorsal and ventral views, metasoma and telson lateral view, trichobothrial pattern, carapace, and pectinal area, ♀ (110 mm) holotype.



Figures 35–37: *Pandinus (Pandinurus) somalilandus* sp. n. 35. Locality of paratype, Somaliland, near Sheikh, foothills of Goolis Mts., 09°59.881'N 45°09.762'E, 896 m a.s.l.. 36. ♀ (110 mm) holotype at the type locality. 37. Type locality, Somaliland, 25 km N of Sheikh, 10°02.001'N 45°09.589'E, 763 m a.s.l.



Figures 38–44: 38–39: *Pandinus (Pandinurus) viatoris* (Pocock, 1890). 38. Dorsal view, ♂(120 mm), Zambia, 92 km NW of Mpika, FKCP. 39. Chela, ♀(95 mm), Zambia, 92 km NW of Mpika, FKCP. 40–41: *Pandinus (Pandinurus) sudanicus* Hirst, 1911, stat. n., dorsal view and chela, ♂(98 mm), South Sudan, Kordofan Province, Lagowa; FKCP. 42–44: *Pandinus (Pandinurus) exitialis* (Pocock, 1888). 42. Type label, BMNH. 43. Chela, ♂(120 mm), Somalia, Afgoi, FKCP. 44. Chela, ♀(110 mm), Somalia, Afgoi, FKCP.

of median eyes from the anterior or the posterior margin of the carapace is, respectively, 0.55 or 0.45.

MESOSOMA. The tergites are tuberculate and finely granulated, and bear an incomplete, smooth sagittal carina and shallow, symmetrical furrows. The sternites are smooth, lack carinae and bear two pronounced furrows. The pectinal teeth number 20–23 (in females). The pectines have three marginal lamellae with long setae and fourth to fifth middle lamella which may be united and moreover linked. The fulcra are long and bear numerous white setae and one black seta.

METASOMA AND TELSON (Fig. 31). The first through fourth segments bear eight carinae. Most of the carinae are smooth. The dorsal carinae are composed of three to seven teeth of similar size. The fifth segment bears five to seven carinae of which the lateral carinae may be incomplete. All carinae on the fifth metasomal segment are composed of granules. The surface between the carinae is smooth, with solitary granules. The telson is elongate (in female). The surface of the telson is granulated and hirsute.

LEGS. The legs are smooth, without carinae and granules, and hirsute. The spination formula of tarsomere II = 6-7/5: 6-7/5: 7/5: 7/5. Tarsomere II of legs bears three spines on the inclined anteroventral surface. Tarsomere I of legs I–IV bears spina distal prosuperior (see red arrow on Fig. 59).

PEDIPALPS (Fig. 32). The pedipalps are hirsute. The femur and patella bear with several large granules. The femur bears four carinae composed of several large, round granules, only the exteroventral carina is smooth. The patella bears five complete carinae with granules or smooth. Several granules are only on the external surface of the patella. The chela is lobate and bears two smooth ventral carinae. The dorsal surface of the chela bears granules that are neither conical nor pointed and whose summits may be confluent. The external surface of the chela is smooth, with several conical granules in anterior part and without carinae. The chela has a lobe. The dentate margins of the movable and fixed fingers are armed with two parallel rows of denticles extending the entire length of the finger, with larger granules which indicate five or six subrows on the movable finger and the fixed finger. The dorsal surface of the manus bears evenly sized conspicuous granules. The internal surface of the chela is smooth, with several granules in anterior part and with two granulated carinae. The dorsal and external surfaces of the chela bears four carinae; the total number of the carinae is nine, but some of them are incomplete.

MEASUREMENTS IN MM. Female holotype. Total length 110; carapace length 15.9, width 15.8; metasoma and telson length 51; first metasomal segment length 6.4, width 6.0, depth 4.8; second metasomal segment length 7.2, width 5.1, depth 4.4; third metasomal segment length 7.7, width 4.6; fourth metasomal segment length

8.5, width 3.9; fifth metasomal segment length 10.7, width 3.8; telson length 10.3; telson width 3.9; pedipalp femur length 11.1, width 5.1; pedipalp patella length 11.2, width 5.5; chela length 23.1; manus width 11.5; movable finger length 14.8.

AFFINITIES. The described features distinguish *Pandinus somalilandus* sp. n. from all other species of the subgenus *Pandinurus* (see key below and affinities under *P. awashensis* sp. n.). Unfortunately the male is not known, so it can only be conjectured that the sexual dimorphism is similar to that of the morphologically closest *P. awashensis* sp. n., from which *P. somalilandus* sp. n. is distinguishable by the characters given in the key below.

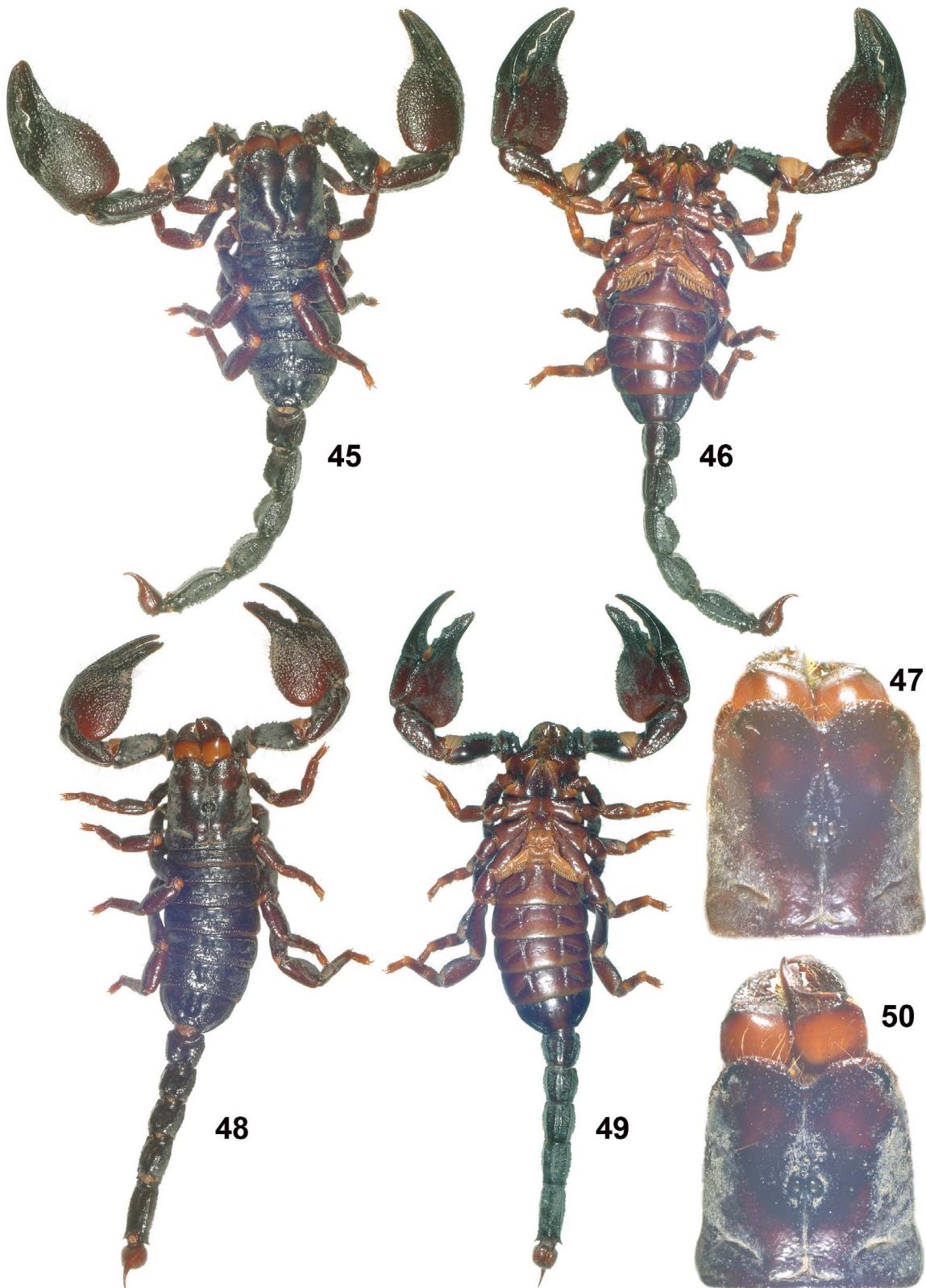
***Pandinus (Pandinurus) lowei* Kovařík, sp. n.**
(Figs. 45–57, 64)

TYPE LOCALITY AND TYPE REPOSITORY. Democratic Republic of Congo, Parc National de Upemba, Lusinga; ISBN.

TYPE MATERIAL. Democratic Republic of Congo, Parc National de Upemba, Lusinga (Coline), 1810 m a.s.l., leg. G. F. de Witte, 12.VII.1947, 7♂(holotype and paratypes), 4♀(allotype and paratypes), 32 juvs. (paratypes), ISBN, 14.III.1947, 2♂(paratypes) 5♀(paratypes), 34 juvs.(paratypes), ISBN, 3♂(paratypes) 2♀(paratypes), FKCP, 8.IV.1947, 1♂(paratype), 3♀(paratypes), 4 juvs. (paratypes), ISBN; Kapelwa, 1780 m a.s.l., 11.XII.1948, 4♂(paratypes), leg. G. F. de Witte, ISBN; Dipidi, 1700 m a.s.l., II.1949, 4♂(paratypes), 1♀ (paratype), 2 juvs.(paratypes), leg. G. F. de Witte, ISBN. All specimens det. Roewer in 1951 as *Pandinus imperator*.

ETYMOLOGY. Named after my colleague and friend Graeme Lowe, who has contributed to my knowledge of scorpions in many ways.

DIAGNOSIS. Total length 80–105 mm. Male with chela, femur and patella of pedipalp narrower and longer than in female. First metasomal segment wider than long in males. Chela of pedipalp length to width ratio in males less than 2.2. Color uniformly reddish black, only legs, telson and chela reddish brown. Chelicerae brown, non-reticulate or weakly reticulate, with black fingers and anterior margins. External trichobothria on patella number 15–16 (5 eb, 3–4 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number 6 to 8. Carapace lacks carinae and is smooth without granules, with very fine and shallow punctures. Pectinal teeth number 11–15 in males and 9–14 in females. Spination formula of tarsomere II = 3–4/3: 4/3: 4/3: 4/3. Tarsomere II of legs with 2 spines on inclined anteroventral surface. Tars-



Figures 45–50: *Pandinus (Pandinurus) lowei* sp. n. 45–47. Dorsal and ventral views, and carapace with chelicerae, ♂ (98 mm) holotype. 48–50. Dorsal and ventral views, and carapace with chelicerae, ♀ (95 mm) allotype.

mere I with seta/bristle distal prosuperior. All body sparsely hirsute. Granules on dorsal surface of chela of pedipasp not conical and pointed, their summits may be confluent. External surface of chela smooth, with several conical granules in anterior part and without carinae.

DESCRIPTION. The adults are 80–105 mm long. The habitus is shown in Figs. 45–49. For position and distribution of trichobothria on pedipalps see Fig. 51. External trichobothria on patella number 15–16 (5 eb, 3–4 esb, 2 em, 1 est, 3 et); ventral trichobothria on chela number six to eight (most often 7). The male has the chela, femur and patella of pedipalp narrower and longer than the female. Movable fingers of pedipalps, metasoma and telson do not show any noticeable sexual dimorphism.

COLORATION (Figs. 45–49). The color is uniformly black, only legs, telson and chela are reddish black. The chelicerae are brown, not at all or only weakly reticulate, with black fingers and anterior margins.

CARAPACE. The carapace (Figs. 47 and 50) lacks carinae but has a deep sagittal furrow with a forked furrow on each side in the posterior part. The surface is smooth, without granules and with very fine and shallow punctures. The anteromedial margin of the carapace is strongly concave. Present are a pair of median eyes and three lateral eyes. The distance ratio of the pair of median eyes from the anterior or the posterior margin of the carapace is, respectively, 0.52 or 0.48.

MESOSOMA. The tergites are tuberculate and granulated and bear an incomplete, smooth sagittal carina and shallow, symmetrical furrows. The sternites are smooth, lack carinae and bear two pronounced furrows. The pectinal teeth number 11–15 (7x11, 10x12, 11x13, 10x14, 3x15) in males and 9–14 (1x9, 5x11, 16x12, 7x13, 1x14) in females. The pectines have three marginal lamellae and one middle lamella, which may be united and moreover linked. The characteristic fulcra are long and bear numerous white setae.

METASOMA AND TELSON (Figs. 52 and 55). The first through fourth segments bear eight carinae. The ventral and ventralolateral carinae on the first to third or fourth segments are smooth. The other carinae are composed of three to seven teeth of similar size. The fifth segment bears five to seven carinae of which the lateral carinae may be incomplete. All carinae on the fifth metasomal segment are composed of granules. The surface between the carinae is smooth, with solitary granules. The telson is bulbous, with the aculeus shorter than the vesicle. The surface of the telson is smooth, with several granules which compose incomplete carinae.

LEGS. The legs are smooth, without carinae and granules, and sparsely hirsute. Spination formula of tarsomere II = 3–4/3: 4/3: 4/3: 4/3 (Fig. 57). Tarsomere II of legs bears two spines on the inclined anteroventral

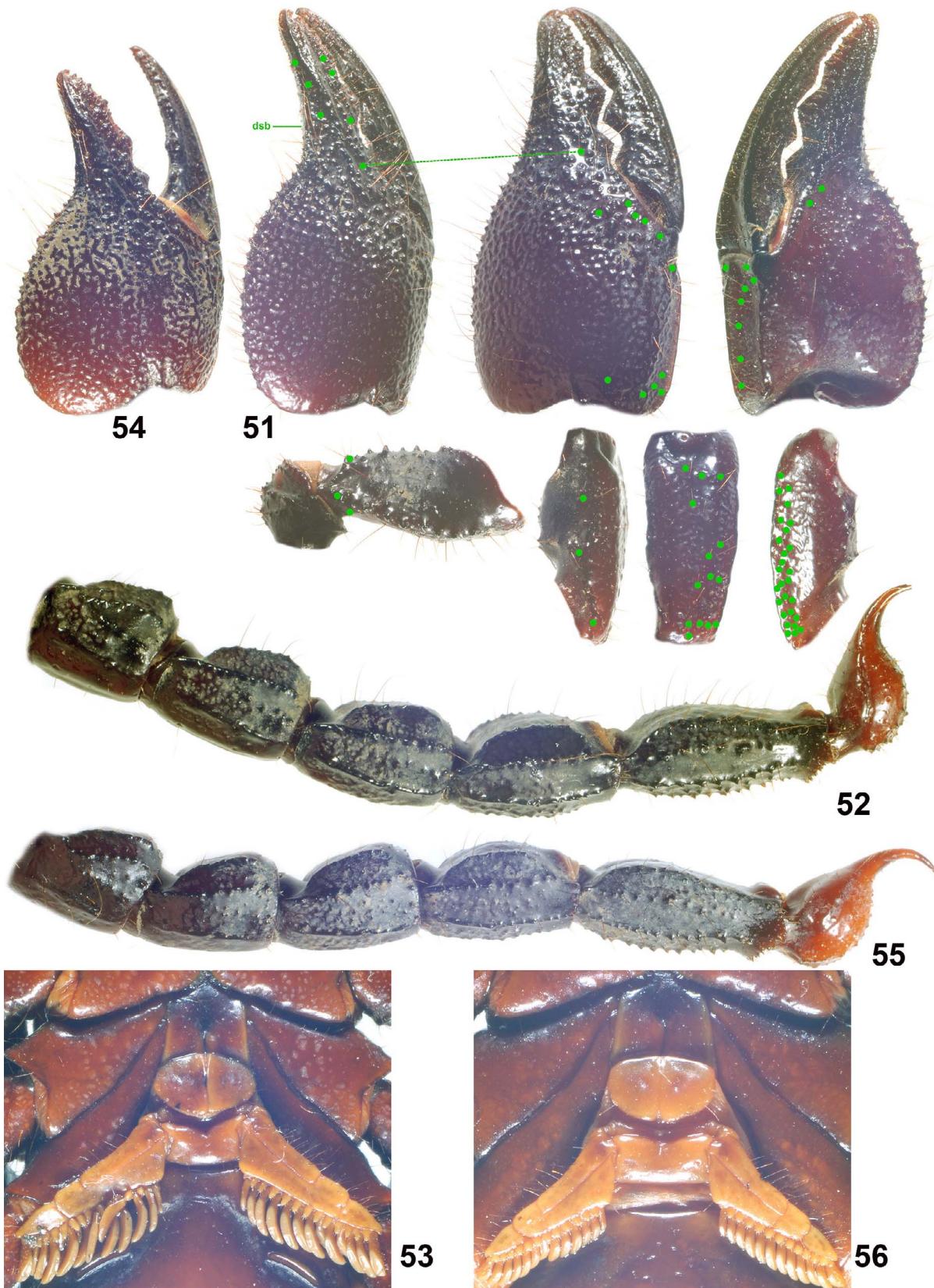
surface. Tarsomere I bears a long bristle/spina distal prosuperior (Fig. 57).

PEDIPALPS (Figs. 51 and 54). The pedipalps are sparsely hirsute. The femur and patella are smooth, with several large granules and punctures. The femur bears four carinae composed of several large, round granules, only the exteroventral carina is smooth. The patella bears four to five smooth, incomplete carinae without granules. Several granules are only on the external surface of the patella. The chela is lobate and bears only two smooth ventral carinae. The dorsal surface of the chela bears granules that are neither conical nor pointed and whose summits may be confluent. The external surface of the chela is smooth, with several conical granules in anterior part and without carinae. The chela has a lobe. The dentate margins of the movable and fixed fingers are armed with two parallel rows of denticles extending the entire length of the finger, with larger granules which indicate six or seven subrows on the movable finger and five or six subrows on the fixed finger.

MEASUREMENTS IN MM. *Male holotype.* Total length 98; carapace length 15.5, width 14.7; metasoma and telson length 50; first metasomal segment length 6.2, width 7.2, depth 6.0; second metasomal segment length 7.2, width 6.5, depth 5.9; third metasomal segment length 7.6, width 6.2; fourth metasomal segment length 8.8, width 5.7; fifth metasomal segment length 11.0, width 5.0; telson length 9.1; telson width 4.4; pedipalp femur length 13.3, width 5.3; pedipalp patella length 13.8, width 5.5; chela length 27; manus width 12.7; movable finger length 16.7.

Female allotype. Total length 95; carapace length 14.8, width 14.5; metasoma and telson length 43.1; first metasomal segment length 5.5, width 6.5, depth 4.9; second metasomal segment length 6.0, width 5.8, depth 4.5; third metasomal segment length 6.3, width 5.6; fourth metasomal segment length 7.2, width 5.0; fifth metasomal segment length 9.7, width 4.4; telson length 8.4; telson width 3.6; pedipalp femur length 9.8, width 4.6; pedipalp patella length 10.2, width 5.0; chela length 20; manus width 12.0; movable finger length 13.1.

AFFINITIES. The described features distinguish *Pandinus lowei* sp. n. from all other species of the subgenus *Pandinurus*. *P. lowei* sp. n. has the same sexual dimorphism (male with chela, femur and patella of pedipalp narrower and longer than in female, see Figs. 45–49 and figs. 379–385 in Kovařík, 2009: 125) as *P. viatoris*, from which it differs by granulation on the dorsal surface of pedipalp chela (Figs. 51 and 54 versus Figs. 38–39 and figs. 382 and 385 in Kovařík, 2009: 125). The spination formula of the fourth leg's tarsomere II is 4/3 for *P. lowei* sp. n. (Fig. 57) and 5/3 for *P. viatoris* (Fig. 58). Differences are also well apparent in the gross morphology, with males of *P. viatoris* having longer and narrower segments of pedipalps and metasoma (Fig. 38).



Figures 51–56: *Pandinus (Pandinurus) lowei* sp. n. 51–53. Trichobothrial pattern, metasoma and telson lateral view, and pectinal area, ♂ (98 mm) holotype. 54–56. Chela, metasoma and telson lateral view, and pectinal area, ♀ (95 mm) allotype.

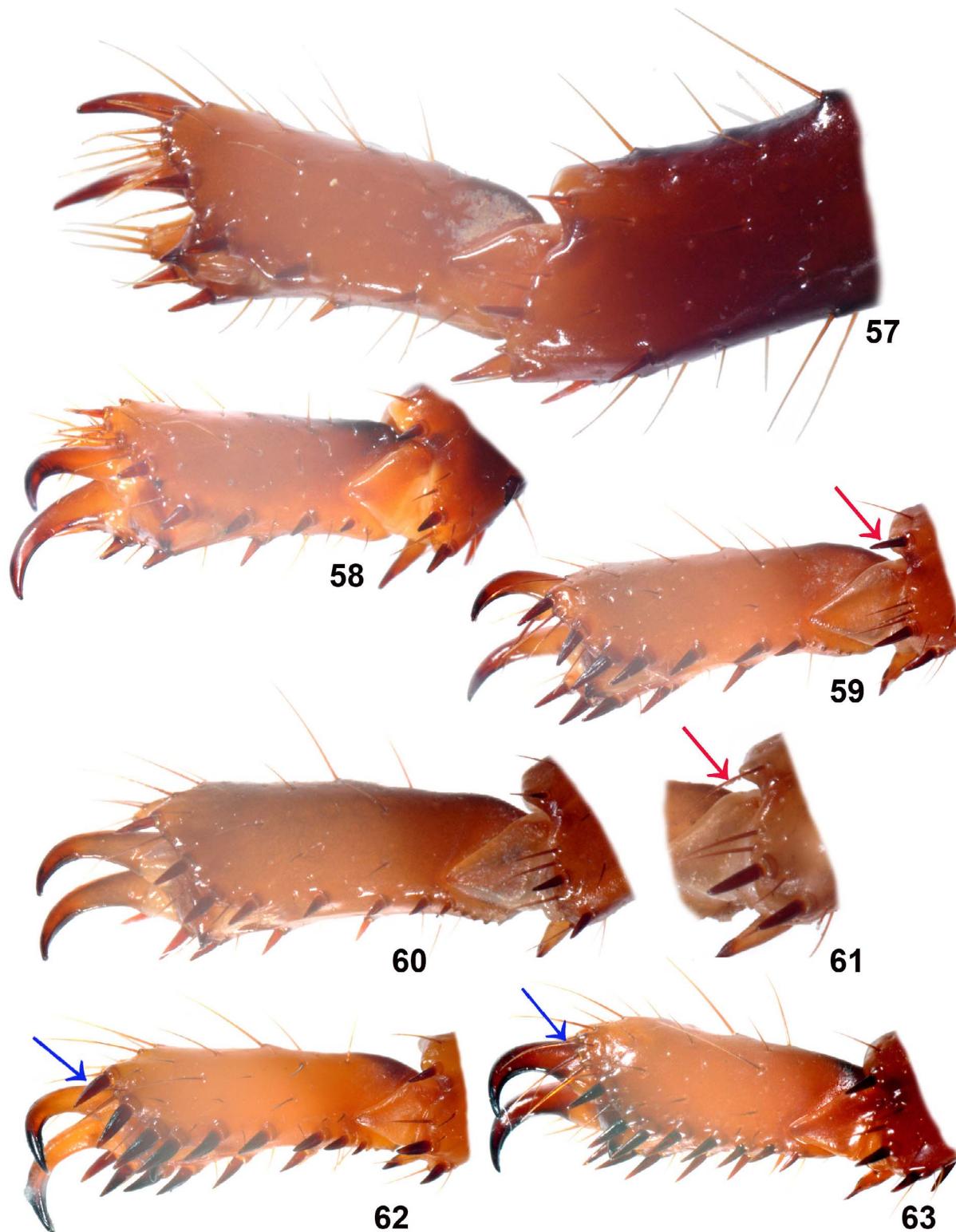
The first metasomal segment is longer than wide in males of *P. viatoris* and wider than long in *P. lowei* sp. n. (Fig. 45). The chela of pedipalp length to width ratio in males of *P. viatoris* is greater than 2.5, whereas in males of *P. lowei* sp. n. it is less than 2.2.

Key to species of the subgenus *Pandinurus* Fet, 1997

1. Tarsomere II with 3 spines on inclined anteroventral surface (see blue arrow on Fig. 62). 2
– Tarsomere II with 2 spines on inclined anteroventral surface (see blue arrow on Fig. 63). 6
2. Spination formula of tarsomere II of 4th leg = 8–9/6 (Fig. 62). Chela of pedipalp bears 12–14 ventral trichobothria. *P. meidensis* Karsch, 1879
– Spination formula of tarsomere II of 4th leg = 6–8/4–5. Chela of pedipalp bears 9–12 ventral trichobothria... 3
3. Dorsal surface of manus with evenly sized conspicuous granules (Figs. 22 and 32). Chela densely hirsute. Chela of pedipalp length to width ratio in both adult sexes between 2 and 2.2. 4
– Dorsal surface of manus of adults more or less tuberculate, without evenly sized granules (Fig. 3). Chela with only a few hairs, more lobate and wider. Chela of pedipalp length to width ratio in both adult sexes between 1.6 and 1.9. 5
4. Legs of adults yellow (Fig. 29). Tarsomere I of legs I–IV with spina distal prosuperior (see red arrow on Fig. 59). Females with 20–23 pectinal teeth.
..... *P. somalilandus* sp. n.
– Legs of adults reddish brown (Fig. 23). Tarsomere I of legs I–III with spina, but on leg IV with seta distal prosuperior (see red arrow on Fig. 61). Female with 18 pectinal teeth. *P. awashensis* sp. n.
5. Pectinal teeth number 22–24. Distribution: Yemen....
..... *P. arabicus* (Kraepelin, 1894)
– Pectinal teeth number less than 22. Distribution: Africa (Eritrea and Ethiopia). *P. magrettii* Borelli, 1901
6. Total length 50–80 mm.....
..... *P. pallidus* (Kraepelin, 1894)*
– Total length 80–130 mm. 7
7. Spination formula of tarsomere II of 4th leg = 6–8/4–5 (Fig. 63). Chela of pedipalp bears 10–14 ventral trichobothria. Male has more pronounced tooth on movable finger of pedipalp. 8
– Spination formula of tarsomere II of 4th leg = 4–5/3 (Fig. 57). Chela of pedipalp bears 6–11 ventral trichobothria. Movable finger of pedipalp without noticeable sexual dimorphism. 10
8. Dorsal surface of manus with evenly sized conspicuous granules. Chela densely hirsute.
..... *P. exitialis* (Pocock, 1888)
– Dorsal surface of manus more or less tuberculate, often with longitudinal carinae but without conical, evenly sized granules. Chela hirsute, but not densely. 9
9. Legs reddish brown. Occurs in Kenya.
..... *P. gregoryi* Pocock, 1896
– Legs yellow to yellowish, always lighter-colored than body. Distribution: South Sudan.
..... *P. sudanicus* Hirst, 1911, stat. n.
10. Male with chela, femur and patella of pedipalp narrower and longer than in female. Distribution: Africa. 11
– Length of segments of pedipalp without noticeable sexual dimorphism. Distribution: Yemen.
..... *P. percivali* Pocock, 1902
11. Dorsal surface of chela reddish black and entirely granulated (Figs. 51 and 54). Spination formula of tarsomere II of 4th leg = 4/3 (Fig. 57). First metasomal segment is wider than long in males. Chela of pedipalp length to width ratio in males less than 2.2.
..... *P. lowei* sp. n.
– Dorsal surface of chela red and smooth, with granules in anterior part only (Figs. 38 and 39). Spination formula of tarsomere II of 4th leg = 5/3 (Fig. 58). First metasomal segment longer than wide in males. Chela of pedipalp length to width ratio in males greater than 2.5 *P. viatoris* (Pocock, 1890)

* Alberto Chiarle has sent me photos of several specimens labeled as *P. pallidus*, which are deposited at the Museo Regionale di Scienze Naturali di Torino, Italy (MRSN, Nos. Sc. 360, 361, 369, 370 and 928) and were collected in Somalia around 1912 near the type locality of *P. pallidus* (labeled "Barava"; "Mogadiscio"; "Bendar"). They are adult specimens of both sexes over 90 mm long, with the dorsal surface of the manus tuberculate but without conical, evenly sized granules. This is what differentiates them from *P. exitialis*, which occurs in the same area and has the same sexual dimorphism. The legs are yellow to yellowish, always lighter-colored than the body, which differentiates them from the most similar *P. gregoryi*. Study of these specimens and their comparison with the types of *P. pallidus* may show them to be the same species, meaning that *P. pallidus* is valid but the types may be juveniles mistaken for adults, which would cause the published diagnosis of *P. pallidus* to be incorrect.

SEXUAL DIMORPHISM. Of the 12 known species of the subgenus *Pandinurus* I was able to examine both sexes of nine species and document their sexual dimorphism. I



Figures 57–63: Tarsomere II and part of tarsomere I of 4th leg of subgenus *Pandinurus*. **57.** *P. lowei* sp. n., ♂ (98 mm) holotype. **58.** *P. viatoris* (Pocock, 1890), ♂ (105 mm), Democratic Republic of Congo, Parc National de Upemba, Kapelwa, 1780 m. a.s.l., ISNB. **59.** *P. somalilandus* sp. n., ♀ (110 mm) holotype. **60–61.** *P. awashensis* sp. n. **60.** ♀ (83 mm) allotype. **61.** ♂ (110 mm) holotype. **62.** *P. meidensis* Karsch, 1879, ♂ (ca 140 mm), Somalia, Sar Uanle, about 20 km south of Chisimaio, 00°29'48"S 42°25'30"E, MZUF. **63.** *P. gregorii* Pocock, 1896, ♀ (110 mm), Kenya, Maramtu Hill, Maramtu Village, Garissa, FKCP.

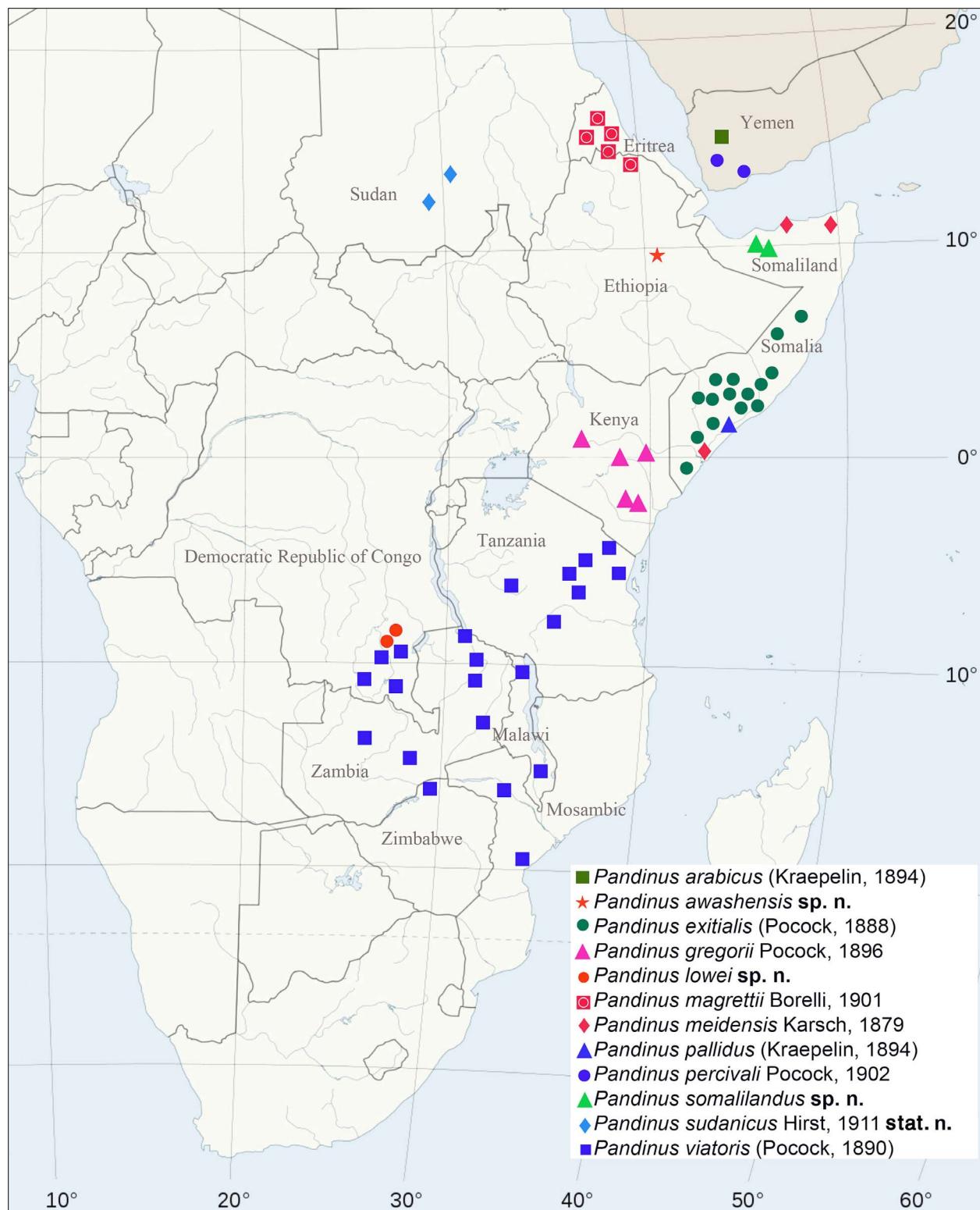


Figure 64: Distribution map of the subgenus *Pandinurus*.

noticed three expressions of sexual dimorphism: (1) The male has the chela, femur and patella of pedipalp narrower and longer than the female (Figs. 45 versus 48, *P.*

lowei sp. n. and *P. viatoris*); (2) the male has a more pronounced tooth on the movable finger of pedipalp (Fig. 41, *P. exitialis*, *P. sudanicus*, and *P. gregorii*); (3)

the male has a larger telson (Fig. 8, *P. exitialis*, *P. sudanicus*, *P. awashensis* sp. n., and *P. magrettii*). It appears the first two kinds of dimorphism are stable, whereas the third exhibits some variability. For instance some females of *P. exitialis* have the telson quite large, and also in the female of *P. awashensis* sp. n. its size does not differ markedly from that in the male. I therefore conclude that the species are more reliably separated on the first two characters. It remains to be added that none of the three expressions / characters is apparent in *P. meidensis* and *P. pallidus*. For *P. arabicus*, *P. percivali* and *P. somalilandus* sp. n. the male unfortunately remains unknown.

DISCUSSION TO THE MAP (FIG. 64) AND OCCURRENCES OF THE SUBGENUS *PANDINURUS*. Most of the previously published authors and curators encountered only solitary and often juvenile specimens in museum collections, and they tried to place those specimens in the known species. For that reason I have rejected the approach of entering all the published and often very old data. Instead, the map includes only specimens about whose correct determination and provenience I am convinced. Among the most dubious published localities are those of *Pandinus (Pandinurus) exitialis* (Pocock, 1888), *P. magrettii* Borelli, 1901 and *P. pallidus* (Kraepelin, 1894). Whereas *P. exitialis* and *P. magrettii* definitely are valid species or perhaps even complexes of several species, the validity / taxonomical position of *P. pallidus* (Kraepelin, 1894) is questionable and invites the possibility that the types are juveniles of another species. In the map I show only the type locality Barava in Somalia for *P. pallidus*, to exclude the possibility that records of this species from other countries are based on incorrectly identified juvenile specimens. This includes Egypt where the presence of the genus *Pandinus* has not been subsequently documented (Kraepelin, 1901: 270), and also Kenya and South Sudan (Fet, 2000: 472).

The type locality of *P. arabicus* (Kraepelin, 1894) is "Homran (Arabien, Yemen)" (now Amran, 15°39'45"N 43°56'39"E, city and a province in northern Yemen). However, Vachon & Kinzelbach (1987: 100) did not mention Yemen and stated without any explanation that this species comes from Saudi Arabia. In compilations summarizing published data we find both Yemen and Saudi Arabia (see El-Hennawy, 1992: 136, Fet, 2000: 470), although the species is known only from the holotype (figs. 336–338 in Kovařík, 2009: 120). Alberto Chiarle drew my attention to a female deposited at the Museo Regionale di Scienze Naturali di Torino, Italy (MRSN, No. Sc. 356, ex. 879) and sent me its photo, which shows that tarsomere II of the fourth leg has three spines on the inclined anteroventral surface. Although I have not studied this specimen, the photo convinces me that it really is *P. arabicus*. The enclosed labels do not give the date of collection, but the locality reads "Aden".

The type locality of *P. exitialis* (Pocock, 1888) is "Shoa in Abyssinia" (Fig. 42 and Pocock, 1888, 251), which is a vast area in central Ethiopia and thus cannot be denoted in the map as a locality. A population noted in the literature under the names *P. exitialis* and *P. magrettii* from South Sudan probably belongs to the hereby restored species *P. sudanicus* Hirst, 1911, stat. n. Its type locality in the map is Gebel Mts., south of Obeid, South Sudan, and the locality of FKCP specimens is South Sudan, Kordofan Province, Lagowa. Records of *P. exitialis* from near the Ethiopia / Eritrea border (Kovařík, 2003: 151 and Kovařík & Whitman, 2005: 114) are mistaken and in reality belong to *P. magrettii*. In the map *P. exitialis* thus is shown only for Somalia, from where it is documented by a rich collection deposited at MZUF. I am convinced that this species occurs in southeastern Ethiopia as well, but at this time it cannot be supported by any actual records.

P. meidensis Karsch, 1879 was named for the type locality "Meid, Somalia" (now Maydh in Sanaag Province, 11°0'N 47°7'E, Somaliland). Apart from the type locality, the map (Fig. 64) shows localities of MZUF specimens from Somalia, Sar Uanle, about 20 km south from Chisimaio, 00°29'48"S 42°25'30"E and Somalia (Puntland), Oasi di Galgala (see Kovařík & Whitman, 2005: 114).

Acknowledgments

Thanks are due to David Hegner, Tomáš Mazuch, Pavel Novák and David Vašíček (all from Czech Republic), who participated in the expedition to Ethiopia and Somaliland; Tomáš Mazuch for photo in Figure 36; Robert Lízler, Tomáš Mazuch, Pavel Novák, Václav Seichert, Miroslav Snížek, Pavel Štys and Václav Tichý for donating *Pandinurus* specimens; Janet Beccaloni (BMNH), Leon Baert (ISNB), Alberto Chiarle (MRSN), and Sarah Whitman (MZUF) for kind help and lending comparative material; and Victor Fet and Michael Soleglad for their help in processing the manuscript.

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