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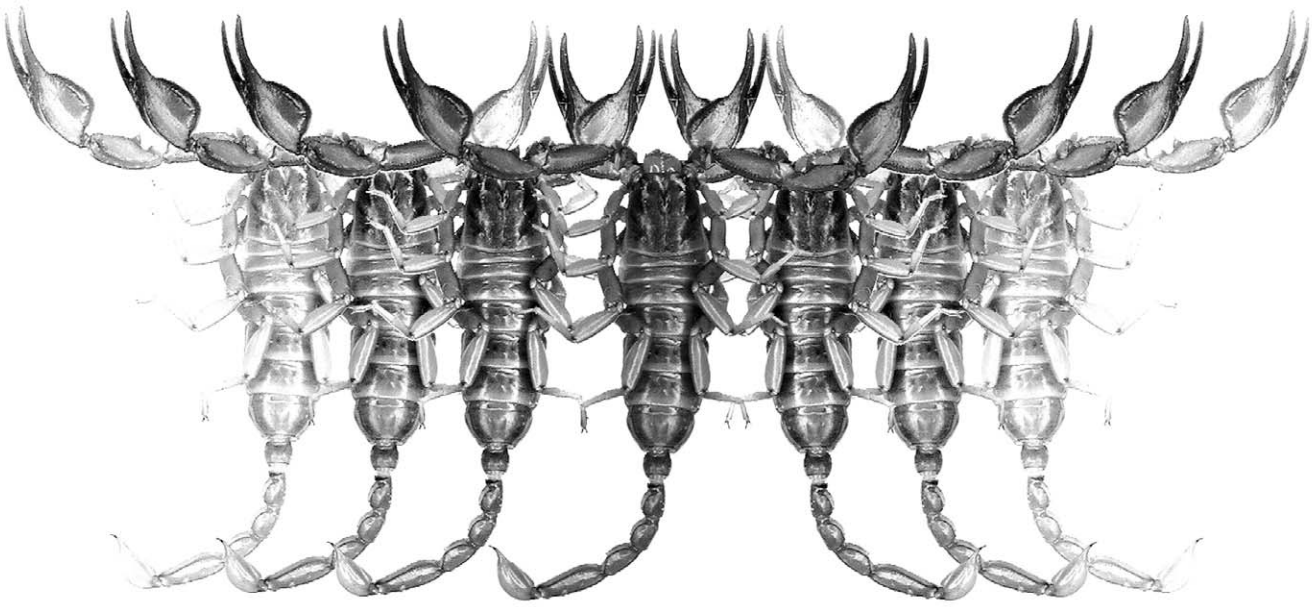

Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part XI. *Pandinurus kmoniceki* sp. n. (Scorpionidae) from Somaliland

František Kovařík, Graeme Lowe, Tomáš Mazuch, Jana Plíškova & František Šťáhlavský

April 2017 – No. 243

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Publication date: 5 April 2017

Euscorpius — Occasional Publications in Scorpiology. 2017, No. 243

Scorpions of the Horn of Africa (Arachnida: Scorpiones). Part XI. *Pandinurus kmoniceki* sp. n. (Scorpionidae) from Somaliland.

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Summary

Pandinurus kmoniceki **sp**. **n**. from Somaliland is described and fully complemented with color photos of live and preserved specimens, as well as its habitat. Hemispermatophore of *P. kmoniceki* **sp**. **n**. is illustrated and described. In addition to the analyses of external morphology and hemispermatophores, we also describe the karyotypes of *P. kmoniceki* **sp**. **n**. (2n=120).

Methods, Material & Abbreviations

Nomenclature and measurements follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974). Hemispermatophore terminology follows Kovařík et al. (2016). The terms 'external', 'internal', 'dorsal' and 'ventral' refer to somatic axes with the hemispermatophore *in situ*; the terms distal/ apical and proximal/ basal are relative to the foot as the basalmost structure. Terminology of tarsal armature follows Kovařík et al. (2017).

For chromosome preparations we used the "plate spreading" method already used for scorpions (e. g. Kovařík et al., 2009). The chromosomes were stained by 5% Giemsa solution in Sörensen phosphate buffer for 30 min. The relative length of the chromosomes of the diploid set was measured for each specimen using the software Image J 1.45r (http://rsbweb.nih.gov/ij) with the plugin Levan (Sakamoto & Zacaro, 2009) based on five metaphase I.

We intentionally use here the name Somaliland (Hargeysa) for the northern territory (Republic of Somaliland) corresponding to the former British colony (British Somaliland), which we distinguish from Somalia (Mogadisho). Somaliland has its own currency, a functional government with representation in several countries, and its officials contributed to our safe visit.

All collected material was preserved in 80% ethanol or is still alive in the first authors (FKCP) collection.

Systematics

Family Scorpionidae Latreille, 1802
Subfamily Scorpioninae Latreille, 1802
Pandinurus Fet, 1997

Pandinus (*Pandinurus*) Vachon, 1974: 953 (*nomen nudum*, type species not designated); Fet, 1997: 248; Fet, 2000: 470–473 (in part) (complete reference list until 2000).

Pandinurus: Kovařík et al., 2017: 42–100 (Figs. 5–18, 144–167, 175–181, 183, 185, 187, 194–394, 396, Table 2) (historical and taxonomic comments, complete reference list).

TYPE SPECIES. *Scorpio exitialis* Pocock, 1888.

DIAGNOSIS. Total length 70–135 mm. External trichobothria on patella number 16–21 (5–6 *eb*, 3–6 *esb*, 2 *em*, 3–4 *est*, 3 *et*); ventral trichobothria on patella number 29–59; accessory external trichobothrium *ea* on chela absent or present, internal trichobothria on chela number 1–4; ventral trichobothria on chela number 10–19. Pedipalp chela manus lobiform. Dorsoexternal carina on pedipalp chela absent. Male has pronounced median lobe on movable finger of pedipalp and larger telson than female. Pectines with fulcra. Pectinal teeth number 12–22. Sternum subpentagonal, longer than wide. Carapace without distinct carinae. Dentate margins of movable and fixed fingers of pedipalp chela with distinct

Figures 1–2: *Pandinurus kmoniceki* **sp**. **n**., male holotype in dorsal (1) and ventral (2) aspects. Scale bar: 10 mm.

granules in two parallel rows present in distal half of fingers. Proximal half of fingers almost without granules in males and with distinct granules in a row in juveniles and females. These granules do not cover whole median lobe in males, but are usually represented by only several granules on top of lobe. Tergites I–VI of mesosoma bear one carina. Stridulation organ located on pedipalp coxae and first pair of legs, but can be reduced. Metasomal segments I–IV with paired, parallel ventral submedian carinae present. Telson without subaculear tubercle. Legs with one pedal spur, retrolateral spur absent.

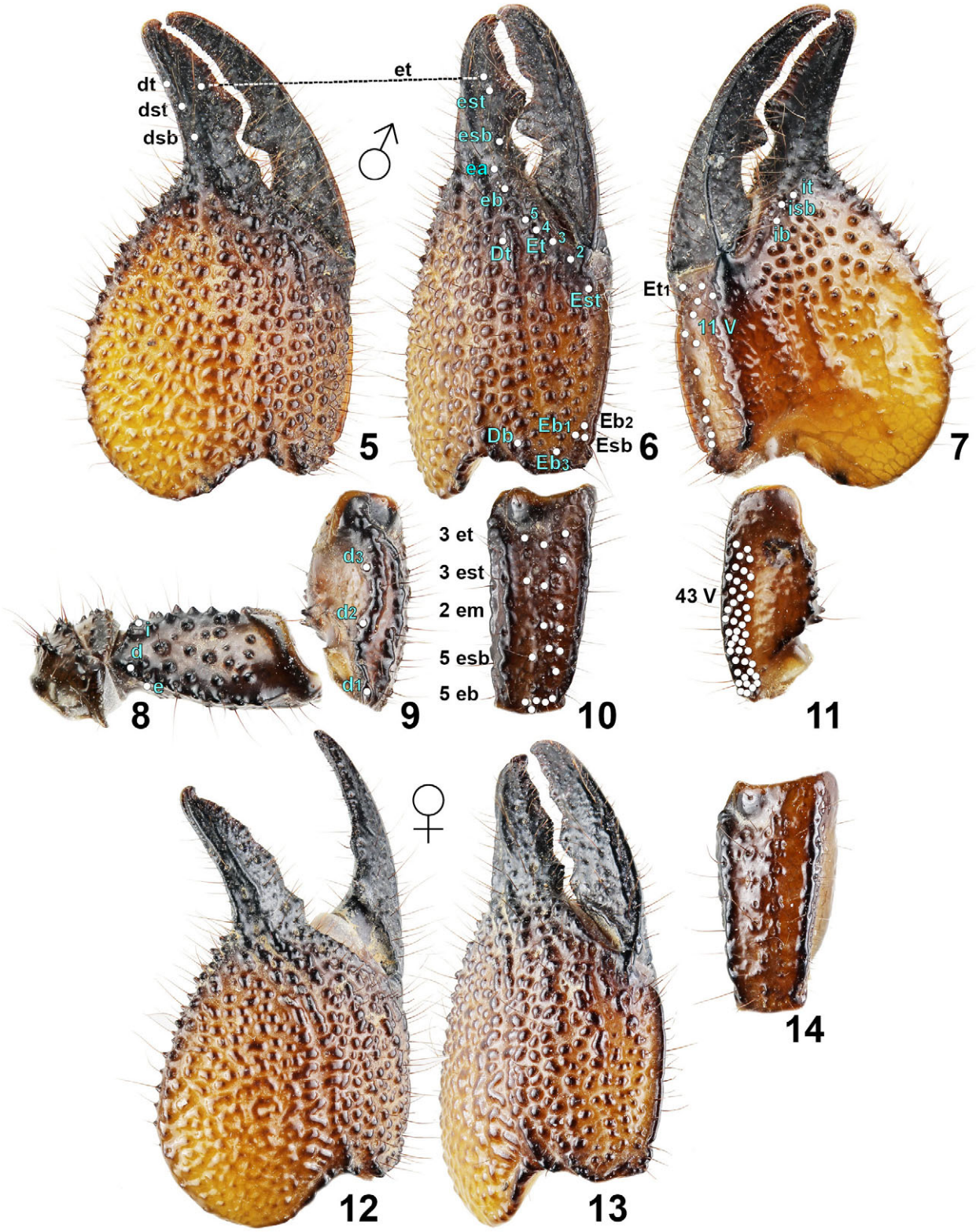
***Pandinurus kmoniceki* sp. n.**
(Figs. 1–47, Table 1)

TYPE LOCALITY AND TYPE REPOSITORY. **Somaliland**, Borama, Amound University campus, 09°56'49"N 43°13'23"E, 1394 m a.s.l.; FKCP (first authors collection).

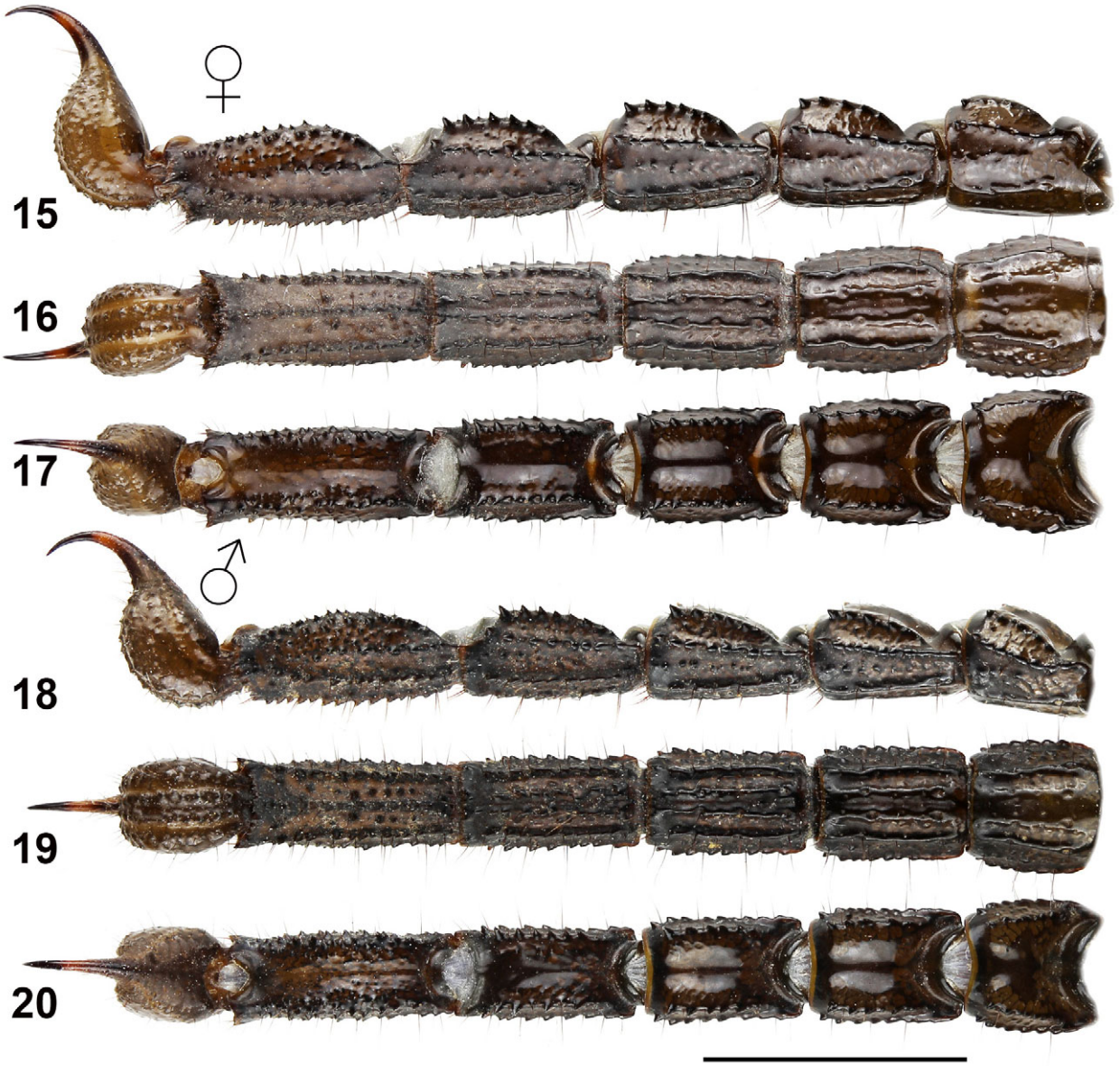
Figures 3–4: *Pandinurus kmoniceki* **sp**. **n**., female paratype in dorsal (3) and ventral (4) aspects. Scale bar: 10 mm.

TYPE MATERIAL. **Somaliland**, Borama, Amound University campus, 09°56'49"N 43°13'23"E, 1394 m a.s.l. (Locality No. **17SA**, Fig. 45), 4–5. February 2017, 1♂ (holotype, Figs. 1–2, 5–11, 18–20, 21, 23, 27, 29–32,37–43, DNA No. 1204), 1♀ (paratype, Figs. 3–4, 12–17, 22, 24–26, 28, 33–36) 1♀1juv. (paratypes alive, Fig. 44), leg. F. Kovařík et T. Mazuch.

ETYMOLOGY. It is a pleasure to name this species after Hynek Kmoníček, the leader of our Somaliland 2017



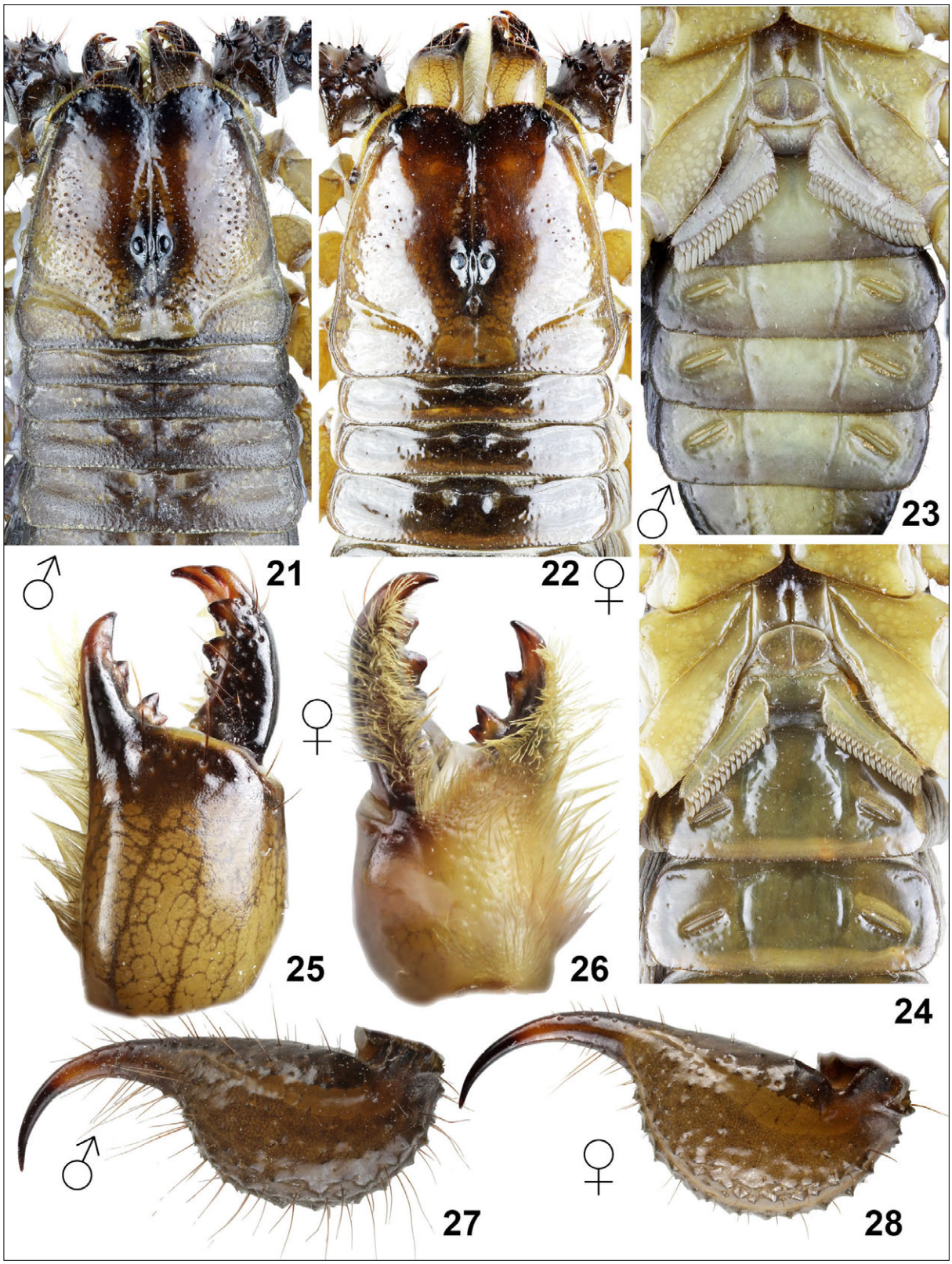
Figures 5–14: *Pandinurus kmoniceki* **sp**. **n**., pedipalp segments. **Figs. 5–11**. Male holotype. Chela dorsal (5), external (6) and ventrointernal (7). Femur dorsal (8). Patella dorsal (9), external (10) and ventral (11). Trichobothrial pattern is indicated. **Figures 12–14**. Female paratype. Chela dorsal (12) and external (13). Patella external (14).



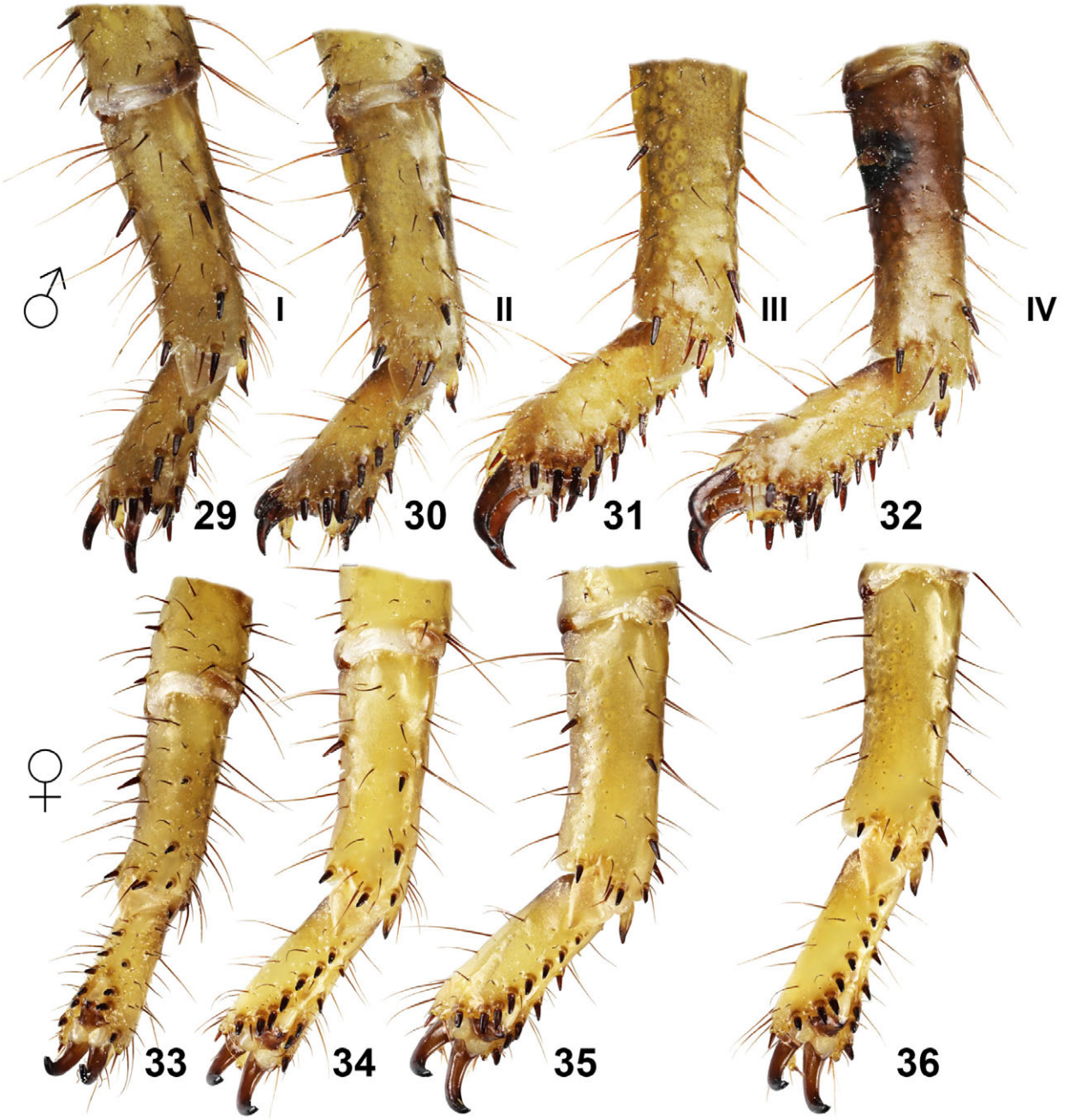
Figures 15–20: *Pandinurus kmoniceki* **sp**. **n**., metasoma and telson lateral (15, 18) ventral (16, 19) and dorsal (17, 20) views. **Figs. 15**–**17**. Female paratype. **Figs. 18**–**20**. Male holotype. Scale bar: 10 mm.

delegation, the director of the Foreign Affairs Department of the Office of the President of the Czech Republic (now Czech ambassador to the USA).

DIAGNOSIS. Total length 73 mm (♂) – 92 mm (♀). Color uniformly dark brown to reddish black, only legs, telson and chela orange to reddish brown. Chelicerae brown, reticulate, with black fingers and anterior margin. Carapace lacking carinae and sparsely granulated. External trichobothria on patella number 18–20 (5–6 *eb*, 5–6 *esb*, 2 *em*, 3 *est*, 3 *et*); ventral trichobothria on patella number 39–44, internal trichobothria on chela number 3, accessory external trichobothrium *ea* on chela present and located between trichobothria *esb* and *eb* on base of fixed finger, ventral trichobothria on chela number 11–14. Pedipalp hirsute, mainly on chela. Granules on dorsal surface of chela of pedipalp not conical and pointed, their apices often confluent. Internal surface of chela smooth, with conical granules in anterior part. Chela of male length/ width ratio is 1.74. Pectinal teeth number 15–19. Dorsal carinae on first through fourth metasomal segments sparsely granulate and terminate in a larger tooth most conspicuous on fourth segment. Spiniform formula of tarsomere II = 7/4: 8-9/4-5: 8-9/5-6: 9/6-7. Tarsomere II with 3 spiniform setae on inclined anteroventral surface. Length to width ratio of male metasomal segment V = 2.39. The habitus is shown in Figs. 1–4.



Figures 21–28: *Pandinurus kmoniceki* **sp**. **n**. **Figs. 21, 23, 27**. Male holotype, chelicerae, carapace and tergites I–IV (21), coxosternal area and sternites III–VII (23) and telson lateral (27). **Figs. 22, 24–26, 28**. Female paratype, chelicerae, carapace and tergites I–III (22), coxosternal area and sternites III–IV (24), right chelicera dorsal (25) and ventral (26), and telson lateral (28).



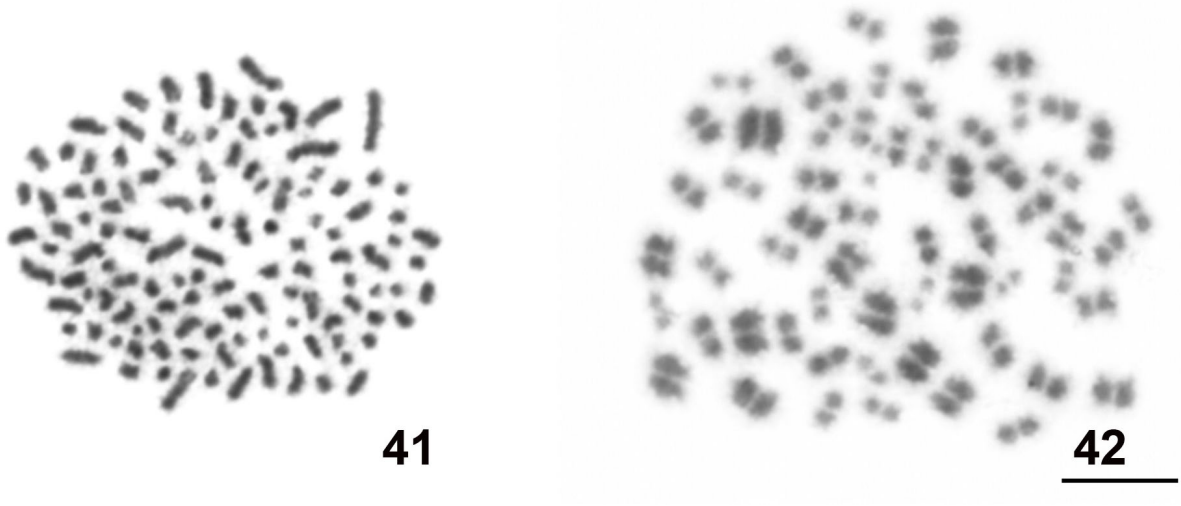
Figures 29–36: *Pandinurus kmoniceki* **sp. n.**, tarsomeres I and II of left legs I–IV, retrolateral aspects. **Figs. 29–32**. Male holotype. **Fig. 33–36**. Female paratype.

DESCRIPTION.

Coloration (Figs. 1–4). The base color is uniformly brown to reddish black, legs and telson lighter and marbled, pedipalp chelae are orange to reddish brown, chelicerae yellow on proximal manus.

Pedipalps (Figs. 5–14). The pedipalps are hirsute, mainly on chela. The femur is tuberculate dorsally and bears four carinae composed of several strong granules. The patella is smooth and rugose, there are five rather smooth carinae, only the internal is composed of from several large granules. The granules on the dorsoexternal surface of chela of pedipalp are not conical and pointed, their apices are often confluent. The margin of lobe of chela rugose, usually with the same intensity as the whole lobe of chela. The internal surface of chela smooth, with several conical granules in anterior part and two short carinae. The dentate margins of movable and fixed fingers of the pedipalp with distinct granules in a two parallel rows present in anterior half of the fingers. Posterior half of fingers almost without granules

Figures 37–40: *Pandinurus kmoniceki* **sp**. **n**., male holotype, right hemispermatophore. Dorsal (37), internal (38), ventral (39) and external (40) views. Scale bar: 1 mm.



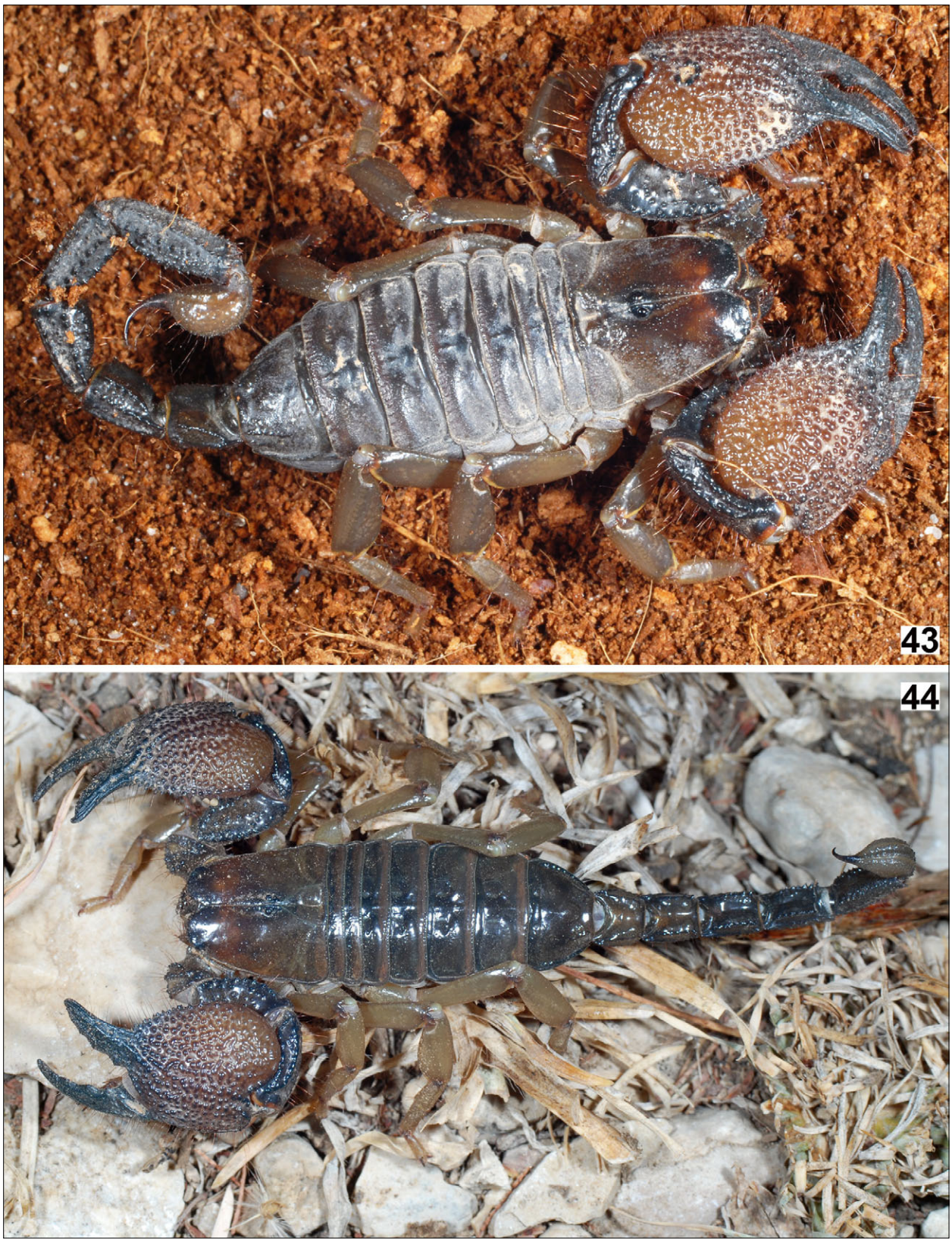
Figures 41–42: *Pandinurus kmoniceki* **sp**. **n**., chromosomes (2n=120). Mitotic metaphase (41), meiotic metaphase I (42). Scale bar: 10 μm.

Dimensions (mm)		♂ **holotype**	♀ **paratype**
Carapace	L / W	11.4 / 12.1	13.5 / 14.9
Mesosoma	L	19.2	34.5
Tergite VII	L / W	5.35 / 9.30	8.90 / 10.4
Metasoma and telson	L	42.35	43.95
Segment I	L / W / D	5.20 / 5.25 / 4.25	5.50 / 5.70 / 4.35
Segment II	L / W / D	5.95 / 4.55 / 4.05	6.05 / 5.05 / 4.10
Segment III	L / W / D	6.25 / 4.18 / 3.95	6.60 / 4.68 / 4.20
Segment IV	L / W / D	7.15 / 3.80 / 3.70	7.35 / 4.30 / 4.05
Segment V	L / W / D	8.90 / 3.73 / 3.65	9.10 / 3.85 / 4.00
Telson	L / W / D	8.90 / 3.80 / 3.75	9.35 / 3.75 / 3.50
Pedipalp	L	37.1	40.83
Femur	L / W	8.85 / 4.25	9.83 / 4.75
Patella	L / W	9.05 / 4.28	10.0 / 5.10
Chela	L	19.2	21.0
Manus	W / D	11.0 / 4.90	12.7 / 6.23
Movable finger	L	11.1	12.9
Total	**L**	**72.95**	**91.95**

Table 1: Measurements of adult types of *Pandinurus kmoniceki* **sp. n.** Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

in male and with distinct granules in a row in female. *Trichobothriotaxy* (Figs. 5–11). External trichobothria on the patella number 18–20 (5–6 *eb*, 5–6 *esb*, 2 *em*, 3 *est*, 3 *et*); accessory external trichobothrium *ea* on chela present and located between trichobothria *esb* and *eb* on base of fixed finger, ventral trichobothria on patella number 39–44; internal trichobothria on chela number 3, ventral trichobothria on chela number 11–14.

Metasoma and telson (Figs. 15–20, 27–28). The metasomal segments I–IV each bear a total of 8 carinae of which the ventral submedians on segment I are obsolete or missing; lateral median carinae are indicated on segments I–IV by incomplete rows of granules; ventral submedian carinae on segments I–III are smooth. Other carinae are sparsely granulated. Segment V has five or seven carinae developed and granulated. The dorsal and



Figures 43–44: *Pandinurus kmoniceki* **sp**. **n**., in vivo habitus. Male holotype (43) and female paratype (44).

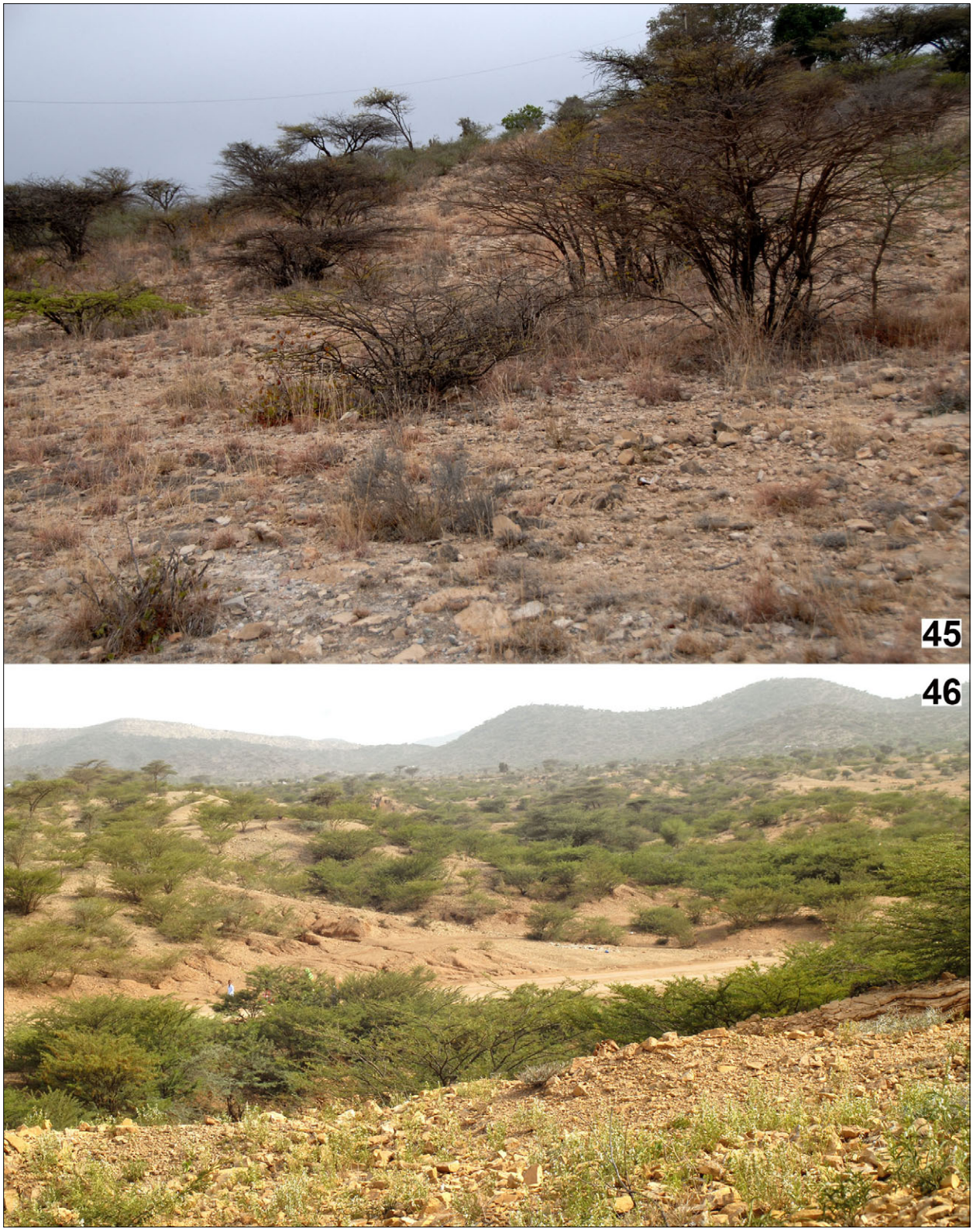


Figure 45–46: *Pandinurus kmoniceki* **sp**. **n**., the type locality. **Fig. 45**. Photo taken on 5 February 2017 after collecting the type specimens. **Fig. 46**. Photo taken on 15 July 2011.

lateral surfaces of the segments are rugose with several granules, segments IV–V are more granulated. The dorsal carinae on segments I–IV are sparsely granulate and terminate in a larger tooth most conspicuous on fourth segment. The entire metasoma and telson are sparsely hirsute with long setae. The telson is rugose, bulbous, with the aculeus shorter than vesicle.

Carapace and mesosoma (Figs. 21–24). The entire carapace is smooth in the middle, sparsely covered by granules posteriorly. The anterior margin of the carapace is bilobate, strongly emarginate medially, and bears several macrosetae. The tergites are finely granulated, more so in the male. The pectinal tooth count is 18/19 in the male, 15/17 in the female. The pectine marginal tips extend to the first quarter of the fourth sternite in the male and the third quarter of the third sternite in the female. The sternites are smooth, without carinae, but with two longitudinal furrows.

Chelicerae (Figs. 25–26). Movable finger dorsal edge with one large subdistal (*sd*) denticle; ventral edge smooth; ventral distal (*vd*) denticle longer than prominent dorsal (*dd*) denticle. Fixed finger with four denticles, median (*m*) and basal (*b*) denticles conjoined on common trunk; no ventral accessory denticles present.

Legs (Figs. 29–36). All legs without distinct carinae and smooth. The tarsomeres are hirsute with setae and macrosetae. Spiniform formula of tarsomere II = 7/4: 8-9/4-5: 8-9/5-6: 9/6-7. Tarsomere II with 3 spiniform setae on inclined anteroventral surface.

Hemispermatophore. (Figs. 37–40). Lamelliform. Distal lamina long, slightly constricted above hook, main axis straight throughout most if its length, internally angled by ca. 20° relative to trunk and capsule. Distal end of lamina abruptly deflected in external drection at ca. 50° angle relative to main axis, quickly tapering to an acuminate apex. Robust hook projecting near base of internal margin of distal lamina. Section of distal lamina proximal to hook much shorter than section distal to it, with deep, elongate longitudinal dorsal trough. Median lobe broadly rounded, surface with fine, translucent folds or ridges, and a proximal granulate-denticulate area at its concave base. Internobasal reflection of sperm duct with tubular trough basally flared, narrower distally, projecting as inner lobe with truncated end. Proximal lobe large, parabolic. Basal lobe broad, rounded in ventral aspect, surface with 5 fine translucent ridges of varying lengths. Trunk short, broad, narrower at base, with weakly sclerotized diagonal axial rib. *Dimensions* (mm): length of distal lamina above hook base 3.35; length of deflected portion of distal lamina 1.01; maximum width of distal lamina above hook base 0.43; length of proximal part of distal lamina (truncal flexure to hook base) 1.05; trunk length 1.36, width 0.60. *Morphometric ratios*: distal lamina above hook L/W 7.79; deflected portion of distal lamina L/ main axis of distal lamina above hook base L 0.38; distal lamina above hook L/ truncal flexure to hook base L 3.19; total distal lamina L/ trunk L 3.24.

Karyotype. (Figs. 41–42). We analyzed the karyotype of the holotype male. The diploid complement of this specimen is composed of 120 chromosomes (Fig. 41). In all postpachytene and metaphase I nuclei, we observed 60 bivalents (Fig. 42). The relative length of the chromosomes of the diploid set decrease from 2.09% to 0.27%. The chromosomes exhibit monocentric organization, however the exact possition of the centromere region is not clear in many chromosomes. That is the reason we are not able to specify the morphology of all chromosomes without banding technique. The karyotype contains all morphological types of the chromosomes, probably with the predominance of acrocentric chromosomes.

Measurements. See Table 1.

AFFINITIES. The described features distinguish *Pandinurus kmoniceki* **sp**. **n**. from all other species of the genus. *P. kmoniceki* **sp**. **n**. is morphologically similar to *P. afar* Kovařík et al., 2017 and *P. mazuchi* Kovařík, 2011 from which it can be unequivocally separated by: **1**) ventral trichobothria on patella number 29–35 in *P. afar* and *P. mazuchi*, vs. 39–44 in *P. kmoniceki* **sp**. **n**.; **2**) coloration, mainly of legs, is darker in *P. afar* and *P. mazuchi*, than in *P. kmoniceki* **sp**. **n**. (see figs. 230–231 and 330–331 in Kovařík et al., 2017, vs. Figs. 43–44); **3**) tarsomere II of legs with 2 spiniform setae on inclined anteroventral surface in *P. afar* and *P. mazuchi* , vs. 3 spiniform setae in *P. kmoniceki* **sp**. **n**. (Figs. 29–36).

The proportions of the hemispermatophore structures, and the form of the distal lamina with distal portion sharply deflected in the external direction, are consistent with the hemispermatophores that we previously described from other members of *Pandinurus* (Kovařík et al., 2017). This further supports our concept of the genus, and confirms the utility of these characters in the taxonomy of *Pandinus* sensu lato.

COMMENTS ON LOCALITIES AND LIFE STRATEGY. Two of the authors (FK and TM) visited the type locality **17SA** (Fig. 45) on 4 – 5 February 2017 (Winter season). At this locality, the authors recorded a daytime temperature of 24.7 ºC (4 February, 16:08), and nighttime temperatures of 21.4 ºC shortly after sunset, dropping to 19.3 ºC (minimum temperature on 5 February at 7:20). The recorded humidity was 41% on 5 February at 7:20. All specimens were collected during the night under rocks. At this locality, in addition to *P. kmoniceki* **sp**. **n**., the authors also recorded *Babycurus* cf. *somalicus* Hirst, 1907, *Neobuthus* sp. and *Parabuthus abyssinicus* Pocock, 1901.

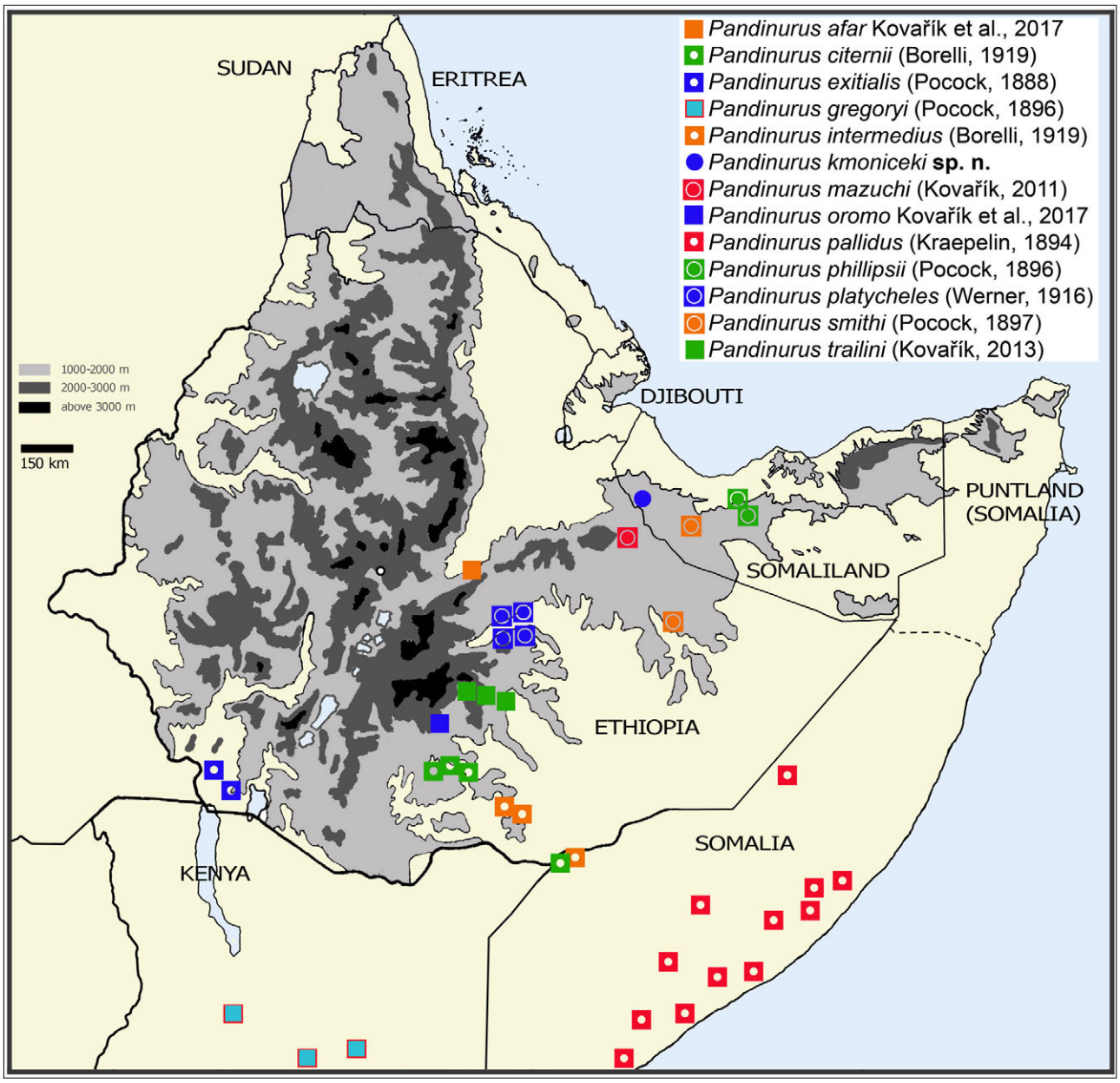


Figure 47: Map showing confirmed Horn of Africa distribution of *Pandinurus* Fet, 1997. The only member of the genus not distributed within this region is *Pandinurus sudanicus* (Hirst, 1911).

Acknowledgments

Thanks are due to Marcel Bednář, Daniel Frynta, Hynek Kmoníček, David Král, Petr Kvaček, Ilja Mazánek, Štěpán Rusňák, Ivan Svoboda, Jiří Šíma, and Rudolf Švaříček (Czech Republic), H. E. Ahmed Mohamed Silanyo (the President of the Republic of Somaliland), Abdillahi Ibraahim Habane (Minister of Education & High Studies, Republic of Somaliland), Abdirasid A. Hassan (Office of the Minister, Education & High Studies, Republic of Somaliland), Ahmed A. Boqore (Vice President, Academic Affairs of Amoud University), and Yesuf Ahmed Ali (Director General of Higher Education, Hargeysa, Republic of Somaliland) for their help. Special thanks to Omar Yussuf Hussein (Republic of Somaliland). The cytogenetic analysis was supported by a grant received from the Ministry of Education, Youth and Sports of the Czech Republic 260 434 / 2017.

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