

The Emperor is back! Rediscovery and redescription of the holotype of *Pandinus imperator* (Scorpiones: Scorpionidae)

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Abstract. The holotype of the Emperor Scorpion *Pandinus imperator* (C.L. Koch, 1841) was long believed to have been lost. In 2015, as scientists at the State Museum of Natural History in Stuttgart were digitizing its entomological collections, they rediscovered the specimen on which Koch had based his description of the scorpion in 1841.

Keywords: *Buthus imperator*, Emperor Scorpion, lost type, State Museum of Natural History Stuttgart

Zusammenfassung. Der Kaiser ist zurück! Entdeckung und Wiederbeschreibung des Holotyps von *Pandinus imperator* (Scorpiones: Scorpionidae). Der Holotypus des Kaiserskorpions *Pandinus imperator* (C.L. Koch, 1841) galt lange Zeit als verschollen. Im Zuge der Sammlungsdigitalisierung am Staatlichen Museum für Naturkunde in Stuttgart wurde das Exemplar 2015 wiederentdeckt, das Koch für seine Beschreibung 1841 zur Verfügung stand.

The Emperor Scorpion is one of the world's most famous scorpions mainly due to its large size. Its impressive size, together with the large chelate pedipalps, harmless sting and its easy breeding in captivity, led this species to become a popular pet for arachnid keepers. Therefore, the ever increasing demand of this species for breeding has led to it being added to the list of animals protected by the Washington Convention (Lourenço & Cloudsley-Thompson 1996, Rossi 2015b, 2015d).

In the wild, the species is distributed in the moist and wet tropical forests of West and Central Africa, approximately from Liberia to Cameroon (Prendini 2004, Rossi 2015b). However, its precise distribution has by no means yet been conclusively determined.

The type specimen of *Pandinus imperator* was considered lost (Moritz & Fischer 1980, Lourenço 2014). During the digitalization of the collections at the State Museum of Natural History in Stuttgart, a drawer labelled "Holotypus: *Buthus imperator* KOCH 1842" containing several scorpions turned up. One of these scorpion specimens bore great resemblance



Fig. 2: *Pandinus imperator*, photograph of the holotype (SMNS-Scor-002031) and the label attached

to Koch's description (Koch 1841) and coloured drawing (Figs 1-2).

Material and methods

The type specimen is inventoried at the SMNS as SMNS-Scor-002031. Measurements are callipered according to the plate (Fig. 3). Morphological terminology mainly follows Hjelle (1990). The classifications of family, subfamily and tribe follow Rossi (2016). High quality images of type specimen details are available at http://ent.smns-bw.org/drawer/Entomologie-drawers_Arachnida.htm. Abbreviation: SMNS = Staatliches Museum für Naturkunde, Stuttgart, Germany.

Results

Having considered all the available evidence, we conclude that the specimen in question is the holotype of *Pandinus imperator*. It agrees well with both the original description and the original illustration (colour, total length, 16 pectinal teeth, etc., see Figs. 2-4) (Koch 1841). The colour of the specimen agrees with the hand-coloured figure on Koch's plate and ranges from brown to ochre. In our opinion, this could be due to bleaching. Koch described the specimen from the Erlangen University collection, where it had possibly been presented in an earlier exhibition. Unfortunately, no locality is indicated on the label nor in the original description.

In the original description, the length is given in units, possibly lignes or Pariser Linien " (Paris lines = 1/12 pouce) and French Zoll " (inches or pouce) that were in use in various sciences after the 18th century: 1 Linie (line) = 2.2558 mm and 1 Zoll (pouce) = 2.7069949 cm.

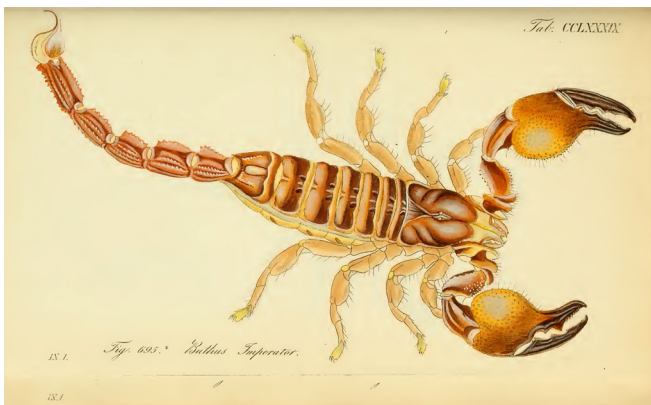


Fig. 1: *Pandinus imperator*, hand-coloured plate of the holotype specimen from Koch (1841: Plate 289)

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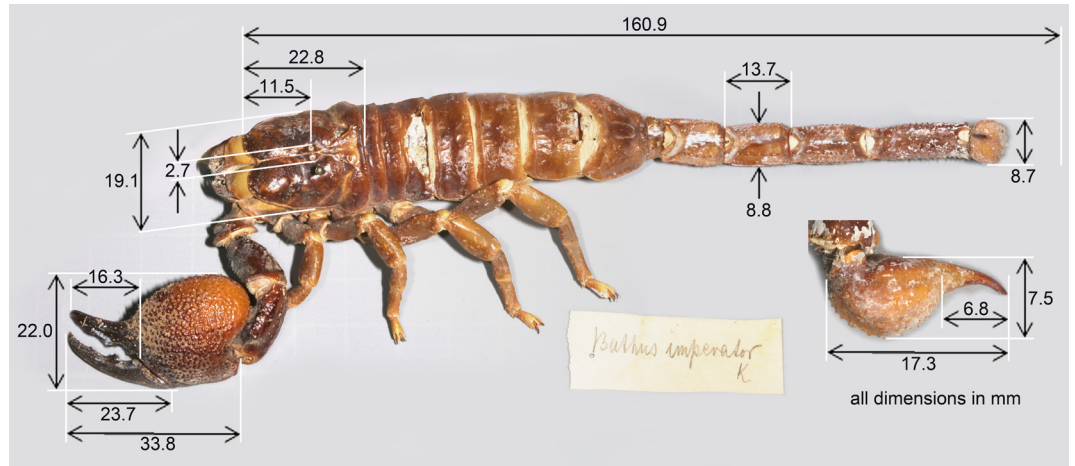


Fig. 3: *Pandinus imperator*, photograph of the holotype with measurements



Fig. 4: *Pandinus imperator*, photograph of the pectines



Fig. 5: *Pandinus imperator*, internal surface of right chela, trichobothria marked with yellow rings (yellow arrow)



Fig. 6: *Pandinus imperator*, ventral surface of right chela, trichobothria marked with yellow rings

The dimensions specified by Koch (1841) are as follows: head: $10 \frac{1}{2}'' = 23.69$ mm, body: $24'' = 54.14$ mm, tail: $36'' = 81.21$ mm, rendering a total length of 159.04 mm; Koch also reported the total length to be almost $6'' = 162.4$ mm (or 175.12 mm when using the Bavarian decimal Zoll).

Recent measurements: prosoma: 22.8 mm, mesosoma: 56.4 mm, metasoma and telson: 81.7 mm (i.e., including vesicle and aculeus, with the length of the first segment interpolated); total length: 160.9 mm (measured by a vernier calliper, in view of the fact that the telson is coiled up; see Fig. 3).



Fig. 7: *Pandinus imperator*, ventral surface of right patella, trichobothria marked with yellow rings. High quality images of these details are available at http://ent.smns-bw.org/drawer/Entomologie-drawers_Arachnida.htm

Most of the first metasomal segment of the specimen is missing. The metasoma has been torn from the mesosoma and is now connected by a straw. This was probably as a result of later handling since there is no reference to any damage in Koch's (1841) description. A comparison with the plate figure makes it clear that the tip of the stinger also suffered subsequent damage (Fig. 3).

As Koch's method of measurement for the carapace, mesosoma, metasoma and telson is not clear, the measurements do not agree completely with the specimen. It is also feasible that Koch used a different measuring unit than that assumed (e.g., 'Bavarian lines', 'Rheinland Zoll'). The total length nevertheless appears to be consistent with the value measured in the rediscovered specimen. If we take into account the missing part of the first metasomal segment and the broken aculeus, the possible total length of the specimen is approximately 170 mm, similar to that reported by Koch using the Bavarian decimal Zoll. On the other hand, if Koch used the French Zoll, the total length adheres to the values which can now be measured in the damaged specimen. This being the case, the original drawing was possibly manipulated to represent a complete specimen despite the missing parts.

Taxonomy

Family Scorpionidae Latreille, 1802

Subfamily Pandininae Thorell, 1876

Tribe Pandinini Thorell, 1876

Genus *Pandinus* Thorell, 1876

Pandinus imperator (C.L. Koch, 1841)

(for the historical references until 1998, see Fet et al. 2000)

Redescription of the holotype

Type material: ♂ holotype (dry, SMNS-Scor-002031), unknown locality.

Description: Measurements in Fig. 2. Total length 160.9 mm. [Possible total length including the missing broken parts about 170 mm.] Base colour brown to reddish brown; pedipalp brown to reddish brown with chela palm yellowish to orange-brown and fingers brown; carapace brown; tergites brown; sternites yellowish brown; pectines and genital operculum pale yellow; legs from brown (femur) to yellowish (tarsomere); chelicerae yellowish with fingers brown; metasoma brown and telson yellowish to brown. Carapace with many fine granules mainly on anterior and lateral sides. Carapace with a V furrow on its anterior border and a low triangular median depression on the posterior side. Median eyes grey and closer to posterior border of carapace. Lateral eyes three in number and grey. Tergites generally smooth with some fine granules on VII tergite. Sternites smooth. Stigmata very long and narrow. Genital operculum is damaged. Pectines with 16/16 teeth form an angle of approximately 120°. Sternum pentagonal almost identical in length and width. Coxoapophysis of reddish yellow and longer than wide. Chelicerae with two denticles on the fixed finger and four denticles on the movable finger (Vachon 1963). Pedipalps with very few and short setae, on chela fingers only. Trochanter and femur tuberculated on anterior and superior side. Patella generally smooth. Chela very wide and round, dorsally with rounded granules, rarely conical or pointed; ventral surface with several granules. Chela with 3 internal trichobothria (Fig. 5) and 9 ventral trichobothria (Fig. 6). Patella with 32 ventral trichobothria (Fig. 7). These numbers correlate on left and right pedipalp. Fixed and movable fingers all have six/seven subrows of granules which forms a single line. Type C trichobothrial pattern (Vachon 1974). Tarsomere II with 2 spines on the inclined antero-ventral surface. Spine formula of tarsomere II: 4/3: 4/3: 4-5/3: 4-5/3. Metasomal segments with 8-8-8-8-7 carinae; latero-ventral carinae almost completely absent on segments I, II, and III. Ventral carinae smooth on segments I, II, and III, with some granules on segment IV and moderately pointed on segment V. Dorsal carinae on metasomal segments pointed. All segments longer than wide but metasomal segment I badly damaged and cannot be studied. Telson with only a few short setae. Vesicle piriform; its ventral surface showing several granules. Aculeus long, but broken at the tip.

Discussion

The specimen undoubtedly belongs to what is presently known as the species *P. imperator*. In fact, it clearly differs from the two most closely related species, *Pandinus ulderigo* Rossi, 2014 from the Central African Republic and *Pandinus gambiensis* Pocock, 1900 from Senegal, Mali, Guinea-Bissau and Gambia (Vachon 1967, Rossi 2014, 2015a, 2015b, 2015c, 2015d).

There has been some confusion as to the correct year of description for *Buthus imperator*; a matter already discussed by Brignoli (1985). Although Koch's 9th Volume of "Die Arachniden" was published in 1842, the first 56 pages, containing the description of *Buthus imperator*, had already been published in 1841. Due to article 21.5 of ICZN (2017) the year 1841 is therefore correct.

The newly discovered insect drawer containing the holotype of *Buthus imperator* contains 18 other scorpion specimens, only some of which are labelled (see http://ent.smns-bw.org/drawer/Entomologie-drawers_Arachnida.htm). While further examinations revealed that the labelled specimens and their descriptions did not tally particularly well, the specimen of *Androctonus margarelon* C.L. Koch, 1838 corresponds well to Koch's (1838) description. In particular, its damaged pectines are explicitly mentioned by Koch. The type of *A. margarelon* had also been considered lost (Fet et al. 2000) and the species was treated as a junior synonym of *Hottentotta hottentotta* (Fabricius, 1787) by Kraepelin (1891). Furthermore, two specimens labelled as *Buthus reticulatus* and *Tityus hottentotta* fit Koch's descriptions (Koch 1837, 1845), while others (*Opisththalmus* [sic] *capensis* (Herbst, 1800) in Koch (1837), *Tityus mucronatus* (Fabricius, 1798) in Koch (1845), *Androctonus paris* C.L. Koch, 1838 in Koch (1838), and *Ischnurus australasiae* (Fabricius, 1775) in Koch (1837), do not seem to resemble the specimens on which his descriptions are based. The unlabeled specimens have not yet been examined.

It remains a mystery as to how these specimens found their way into the collection at the National History Museum in Stuttgart in the first place. The SMNS is starting a project to digitize its archives of printed and handwritten historical documents. We hope, these efforts will also result in hints to clarify the accession of these scorpion specimens.

References

- Brignoli PM 1985 On the correct dates of publication of the arachnid taxa described in some works by C. W. Hahn and C. L. Koch (Arachnida). – *Bulletin of the British arachnological Society* 6: 414-416
- Fet V, Sissom WD, Lowe G & Braunwalder ME 2000 *Catalog of the scorpions of the world (1758-1998)*. Entomological Society, New York. 690 pp.
- Hjelle JT 1990 Anatomy and morphology. In: Polis GA (ed.). *The biology of scorpions*. University Press, Stanford. pp. 9-63
- ICZN (International Commission on Zoological Nomenclature) 2017 Article 21.5, version July 2017. – Internet: <http://www.nhm.ac.uk/hosted-sites/iczn/code/index.jsp?nfv=true&article=21> (July 31, 2017)
- Koch CL 1837 *Die Arachniden*. Vierter Band. C. H. Zeh'sche Buchhandlung, Nürnberg. pp. 1-108 – doi: [10.5962/bhl.title.43744](https://doi.org/10.5962/bhl.title.43744)
- Koch CL 1838 *Die Arachniden*. Fünfter Band. C. H. Zeh'sche Buchhandlung, Nürnberg. pp. 1-124 – doi: [10.5962/bhl.title.43744](https://doi.org/10.5962/bhl.title.43744)
- Koch CL 1841 *Die Arachniden*. Neunter Band. C. H. Zeh'sche Buchhandlung, Nürnberg. pp. 1-56 – doi: [10.5962/bhl.title.43744](https://doi.org/10.5962/bhl.title.43744)
- Koch CL 1845 *Die Arachniden*. Elfter Band. C. H. Zeh'sche Buchhandlung, Nürnberg. 174 pp. – doi: [10.5962/bhl.title.43744](https://doi.org/10.5962/bhl.title.43744)
- Kraepelin K 1891 Revision der Skorpione. I. Die Familie der Androctonidae. – *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten* 8: 143-286
- Lourenço WR 2014 Further considerations on the identity and distribution of *Pandinus imperator* (C. L. Koch, 1841) and description of a new species from Cameroon (Scorpiones: Scorpionidae). – *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 17: 139-151
- Lourenço WR & Cloudsley-Thompson JL 1996 Recognition and distribution of the scorpions of the genus *Pandinus* Thorell, 1876 accorded protection by the Washington convention. – *Biogeographica* 72: 133-143
- Moritz M & Fischer SC 1980 *Die Typen der Arachniden-Sammlung des zoologischen Museums Berlin*. III. Scorpiones. – *Mitteilungen aus dem Zoologischen Museum in Berlin* 56: 309-326
- Prendini L 2004 On the scorpions of Gabon and neighboring countries, with a reassessment of the synonyms attributed to *Babycurus buettneri* Karsch and a redescription of *Babycurus melanicus* Kovařík. – *California Academy of Sciences Memoir* 28: 235-267
- Rossi A 2014 Notes on the distribution of *Pandinus* (*Pandinus*) Thorell, 1876 and *Pandinus* (*Pandinurus*) Fet, 1997 with the descriptions of two new species from Central African Republic and Djibouti (Scorpiones: Scorpionidae). – *Onychium* 10: 10-31
- Rossi A 2015a Sui sottogeneri di *Pandinus* Thorell, 1876 con revisione del genere *Pandinurus* Fet, 1997 stat. n. e descrizione di sette nuove specie e tre nuovi sottogeneri (Scorpiones: Scorpionidae). – *Onychium* 11: 10-66
- Rossi A 2015b Clarification of the type locality of *Pandinus ulderigoi* with notes on the scorpions protected by CITES (Scorpiones: Scorpionidae). [Proceedings of the 28th European Congress of Arachnology, Torino, 2014 August 24-29] – *Arachnologische Mitteilungen* 49: 47-54 – doi: [10.5431/aramit4905](https://doi.org/10.5431/aramit4905)
- Rossi A 2015c Una revisione preliminare del genere *Pandinus* Thorell, 1876 con la descrizione di un nuovo sottogenere e due nuove specie dall'Etiopia (Scorpiones: Scorpionidae). – *Arachnida - Rivista Aracnologica Italiana* 3: 37-52
- Rossi A 2015d Ulteriori commenti sulla tassonomia dei generi *Pandinus* e *Pandinurus*, con la definizione di un nuovo sottogenere ed una nuova specie di *Pandinurus* dalla Somalia (Scorpiones: Scorpionidae). – *Arachnida - Rivista Aracnologica Italiana* 4: 41-55
- Rossi A 2016 *Atlas of scorpions*. Volume 1 (Scorpionidae: Pandininae: *Pandinoides*). – *Arachnida - Rivista Aracnologica Italiana* 8, Supplemento: 1-148
- Vachon M 1963 De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les Scorpions. – *Bulletin du Muséum national d'Histoire naturelle, Paris* 35: 161-166
- Vachon M 1967 Le grand scorpion du Sénégal: *Pandinus gambiensis* Pocock, 1899 doit être considéré comme une véritable espèce et non comme une sous espèce de *Pandinus imperator* C. L. Koch, 1842. – *Bulletin de l'Institut fondamental d'Afrique noire (A)* 29: 1534-1537
- Vachon M 1974 Étude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). – *Bulletin du Muséum national d'histoire naturelle, Paris* 140: 857-958