

Scorpions (Arachnida, Scorpiones) described by Linnaeus

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Summary

Of six scorpion species described by Linnaeus (1758, 1767) in his genus *Scorpio* L., 1758, three names are valid and widely accepted as *Scorpio maurus* L., 1758 (Scorpionidae), *Androctonus australis* (L., 1758) (Buthidae), and *Euscorpis carpathicus* (L., 1767) (Euscorpidae). However, the other three (*Scorpio afer* L., 1758, *S. europaeus* L., 1758, and *S. americanus* L., 1758) are dubious names. The names “*Scorpio italicus*”, “*S. indicus*”, “*S. africanus*” and “*S. americanus*” were used by Linnaeus only before 1758, and therefore are not available under his authorship. We designate the neotype of *Scorpio maurus* L., 1758 and the lectotype of *Androctonus australis* (L., 1758).

Introduction

Scorpions were listed in six works of Linnaeus (1748, 1754, 1758, 1759, 1764, 1767). The 10th edition of the *Systema Naturae* (Linnaeus, 1758: 624–625) included five species of scorpions among “Insecta Aptera”, all belonging to the single genus No. 238, *Scorpio*: *S. maurus*, *S. australis*, *S. afer*, *S. europaeus* and *S. americanus*. One more species, *S. carpathicus*, was described later (Linnaeus, 1767: 1038).

The currently known extant world fauna of scorpions is estimated as 160 genera and *c.* 1,300 species (Fet *et al.*, 2000, and publications after 1998). However, the morphological conservatism of this animal group, whose body plan has not changed much since the Silurian, is remarkable compared with many other orders of arachnids, and arthropods in general. Not surprising, given the brevity of Linnaean diagnoses, is the fact that his scorpion species were greatly misunderstood by many later workers. Additional confusion was created by the fact that, before 1758, Linnaeus (1748: 754) used several scorpion names different from those he published in or after 1758. These names continued to be used and ascribed to Linnaeus by a number of authors long after 1758. Below, we attempt to clarify nomenclatural questions related to scorpion species described by Linnaeus.

Linnaeus (1758) diagnosed scorpion morphology primarily on the basis of the number of teeth (plates) of the pectines, or comb organs. These modified abdominal

appendages, unique for scorpions, only recently were proved to be an array of chemo- and mechanoreceptors (Gaffin & Brownell, 1992). Like many scorpion researchers after (and before) him, Linnaeus paid attention to this easily detectable meristic trait, the number of pectinal teeth (variable across the order but normally 10 to 20 on a single comb). Linnaeus (1758) distinguished five species of the genus *Scorpio* L. mainly on the basis of the number of pectinal teeth. Pectinal organs are symmetrical structures but the number of teeth may vary slightly: it is usually given for both sides (e.g. 15–17). Such variation was not reported by Linnaeus, who gave only one figure for each species corresponding to the count for one side.

The type of *Scorpio carpathicus* L., 1767 is kept in the collection of the Linnean Society of London (LSL) (Kinzelbach, 1975; confirmed by the first author in December 2000). The fate of other Linnaean scorpion types is unclear. There are eight more scorpion specimens in the possession of LSL; none of these appears to correspond to a type. Four other specimens have been preserved at the Zoological Museum of the University of Uppsala, Sweden (UUZM) (Lönnberg, 1897, 1898a, b; Wallin, 1994); it is not clear either whether these are original Linnaean types. The UUZM specimens were pinned and labelled by Thunberg; they bear the names “*Scorpio afer*” (UUZM 63), “*Scorpio europaeus*” (UUZM 215) and “*Scorpio americanus*” (UUZM 214 and 2082). Their affiliation and importance are discussed below; see also Wallin (1994).

Valid names

Scorpio maurus L., 1758 (Fam. Scorpionidae)

Scorpio maurus Linnaeus, 1758: 625.

Scorpio maurus: Linnaeus, 1767: 1037; Fabricius, 1775: 399; 1781: 550; 1787: 348; 1793, 434; Latreille, 1806: 131; Karsch, 1879: 19; Kraepelin, 1899: 124; Birula, 1910: 115–192; Werner, 1934: 278; Vachon, 1952: 333–340; Levy & Amitai, 1980: 103–106; Fet, 2000: 473–480.

Buthus (Heterometrus) palmatus Ehrenberg in Hemprich & Ehrenberg, 1828: pl. I, fig. 1.

Heterometrus maurus: Thorell, 1876a: 12; 1876b: 163–164, 211; Simon, 1879: 115.

Heterometrus palmatus: Kraepelin, 1894: 73–77; Simon, 1910: 82.

The type of *Scorpio maurus* is lost. It was diagnosed (Linnaeus, 1758) as a scorpion with eight pectinal teeth and punctate pedipalps found in Africa. This description and the name “*maurus*”, indicating North Africa, places it clearly in the modern Scorpionidae. It was also designed “*africana*” in Linnaeus (1759). In this work, Linnaeus used no Latin binomina but designated geographical distribution by a Latin adjective such as “*africana*” given in feminine form and corresponding thus to the assumed word “species” but not to the genus *Scorpio*. Therefore, this name indicated only geographical range; it was not used by the author as a scientific binomen and therefore is not available (Article 11b of the Code; ICZN, 1999). The name *Scorpio maurus* was repeated in Linnaeus (1767).

Serious confusion surrounded the early taxonomic history of this name. Several authors reproduced the

Linnaean diagnosis (e.g. Fabricius, 1775; Latreille, 1806). However, De Geer (1778) used it for a species of *Brotheas* (Chactidae) from South America (French Guiana). The name was used (as *Scorpio maurus*, *Chactas maurus*, or *Brotheas maurus*) for a South American species on several occasions (Herbst, 1800; C. L. Koch, 1838; Gervais, 1844; Kraepelin, 1894), which could be considered misidentifications.

Ehrenberg (in Hemprich & Ehrenberg, 1828) depicted, in an excellent illustration, and named *Buthus (Heterometrus) palmatus* from Africa and the Middle East (see Braunwalder & Fet, 1998). This name was widely used until Thorell (1876a) synonymised it with *Scorpio maurus* L. (as *Heterometrus maurus*). Thorell (1876b: 163–164) argued not only that the original Linnaean specimen was from Africa but that the name *maurus* (“a Moor”) indicates North Africa; and that in this area, the number of pectinal teeth and shape of the pedipalps can point only to *Buthus palmatus* Ehrenberg, 1828. This opinion of Thorell was not questioned. Karsch (1879) designated *Scorpio maurus* L. the type species of the genus *Scorpio* L., and the name became widely accepted and used by all later taxonomists.

While the genus *Scorpio* L. is currently considered monotypic, *Scorpio maurus* L. is a highly polymorphic species with many subspecies described from Africa and the Middle East; 18 formally valid trinomina are listed by Fet (2000). Future research, including techniques of DNA systematics (Gantenbein *et al.*, 1999), should reveal whether *S. maurus* is in fact one phenotypically polymorphic species, or a complex of separate species (Lourenço & Cloudsley-Thompson, 1994). It is traditionally agreed (Birula, 1910; Vachon, 1952) that the North African populations from Algeria, Morocco and Tunisia correspond to the nominotypical subspecies (*Scorpio maurus maurus* L.).

We designate here as **neotype** of this species a female specimen from a large series collected in the ruins of ancient Utica (northwest of Carthage in modern Tunisia). It seems appropriate to designate a neotype of the first species of scorpion ever formally described from such a venerated historical site.

According to the label, this series was identified as *Scorpio maurus* first by E. Simon and then revised by K. Kraepelin; it was also redescribed in detail by M. Vachon (1952: 339–340), and is currently deposited in the collection of the Muséum national d’Histoire naturelle (Paris) (MNHN No. RS-1236, label “Ruines d’Utique Herisson 68–82 *Scorpio maurus* L. E. Simon det. 1883, K. Kraepelin rev. 1900). The series includes 16 females, 6 males and 7 juveniles, all in good condition.

We counted the number of pectinal teeth in adult females of the Utica series, which was (left–right side): 9–9 (10 specimens), 10–9 (1), 10–8 (1), 11–10 (1), 9–8 (2), and 8–8 (1). While the Linnaean diagnosis of 8 teeth is covered by this range of variation, we select the adult female neotype with 9–9 pectinal teeth as being typical for this Utica population. Males from the same series had the following numbers of pectinal teeth: 9–10 (2), 10–9 (1), 10–10 (2), 10–11 (1).

Androctonus australis (L., 1758) (Fam. Buthidae)

Scorpio australis Linnaeus, 1758: 625.

Scorpio australis: Linnaeus, 1767: 1038; Fabricius, 1775: 400; De Geer, 1778: 348–349; Fabricius, 1781: 551; 1787: 348; 1793: 436.

Androctonus funestus Ehrenberg in Hemprich & Ehrenberg, 1828: pl. II, fig. 5.

Androctonus australis: Thorell, 1876a: 7; 1876b: 211; Karsch, 1879: 18; Thorell, 1893: 356–358; Vachon, 1952: 161–163; Lamoral & Reynders, 1975: 495; Levy & Amitai, 1980: 35–40; Fet & Lowe, 2000: 67–70.

Buthus australis: Kraepelin, 1899: 15–16.

Wallin (1994) mentioned two existing specimens with a label “*Scorpio americanus*” (UZZM 214, 2082). One of them (UZZM 2082) was identified later as *Androctonus funestus* (= *A. australis* (L.)) and matched the Linnaean diagnosis (32 pectinal teeth) (Lönnberg, 1898a). It is possible that this is the genuine Linnaean type specimen of *Scorpio australis* from Africa; therefore we formally designate this specimen here as a lectotype.

The same species was given the adjective “africana” in Linnaeus (1759); however, in 1767 Linnaeus expanded its range, adding “forte etiam America”; this may explain the confusing label of the UZZM specimens.

Ehrenberg (in Hemprich & Ehrenberg, 1828) depicted and named *Androctonus (Prionurus) funestus* from Sudan (see Braunwalder & Fet, 1998). Thorell (1876b) argued that “The *Scorpio australis* of Linnaeus . . . is, I believe, the same species as *A. funestus*, which is, I believe, the *Androctonus* most generally met with in European collections”.

Although this reasoning cannot be sufficient to identify the Linnaean species with a particular member of the genus *Androctonus*, the synonymy has been widely accepted. The name *A. australis* (or *Buthus australis*) has since been used as a senior synonym; *A. funestus* and a number of other junior synonyms have not been used since the 1870s.

Androctonus australis has 23 to 20 pectinal teeth in females, and 32 to 38 in males (Levy & Amitai, 1980), which fits the Linnaean diagnosis.

Currently, *A. australis* (L.) is one of several species of the genus *Androctonus*, and the oldest published name belonging to this genus. This species is common throughout North Africa and the Middle East. Detailed descriptions can be found in Vachon (1952) and Levy & Amitai (1980).

Euscorpheus carpathicus (L., 1767) (Fam. Euscorpidae)

Scorpio carpathicus Linnaeus, 1767: 1038.

Euscorpheus carpathicus: Thorell, 1876a: 15; 1876b: 211; Simon, 1879: 108–111; Kraepelin, 1899: 164; Vachon, 1952: 361; Kinzelbach, 1975: 28–37; Fet, 1997: 106–108; Fet & Sissom, 2000: 357–366.

The holotype (a dried, pinned female) is kept in the collection of the LSL (Kinzelbach, 1975; confirmed by the first author in December 2000). According to Linnaeus (1767), it originated from “Montibus Carpathicis”. This most likely refers to the Transylvanian Alps in modern southwestern Romania. It is the only species of scorpion inhabiting this area (Bunescu, 1959; see also Vachon & Jaques, 1977).

Scorpions are not found anywhere else in the Carpathian Mountains (Fet & Sissom, 2000).

This species name has never been challenged by any other possible senior synonym (except *Scorpio europaeus* L., 1758; see below). *Scorpio carpathicus* became the type species of the genus *Euscorpius* Thorell, 1876; it is also the oldest published name for this genus. A large number of other species described from Europe were later synonymised with *Euscorpius carpathicus* (L., 1767), and this name has been widely accepted since the 1870s (Fet & Sissom, 2000).

This species, as used currently by most authors, ranges widely in southern Europe from Spain to the Balkan Peninsula and further east (Crimea, Turkey) (Fet & Sissom, 2000). The Linnaean diagnosis of 6 pectinal teeth is, in fact, a miscount since the holotype female has 7-7 teeth; however, the currently recognised value for this species normally varies in females from 6 to 7 (see e.g. Vachon & Jaques, 1977; Fet, 1997).

Since *E. carpathicus* is the type species of *Euscorpius*, confirmation of the existence and identity of the Linnaean holotype is crucial for the ongoing taxonomic revision of this genus (Gantenbein *et al.*, 1999, 2000; V. Fet, B. Gantenbein & M. E. Soleglad, in progress).

Dubious names

***Scorpio afer* L., 1758** (Fam. Scorpionidae, indeterminate, ?*Heterometrus* sp.)

A pinned specimen (UUZM 63), labelled later by Thunberg "afer, Mus. Ad. Fr." belonged to the collection presented to the Uppsala Museum by Crown Prince Adolph Frederick in 1745. A graduate student of Linnaeus, Laurentius Balk, published a diagnosis of this specimen under No. 61 as having 13 pectinal teeth ("Scorpio pectinum denticulus XIII"); the Latin binomina listed under this description were "Scorpio javanicus", "Scorpio indicus" and "Scorpio ceilonicus" (Balk, 1746: 607). The type locality of this species is not known. Linnaeus (1748, 1754) used the binomen "Scorpio indicus" combined with a diagnosis of 13 pectinal teeth for a species from "Asia".

The same specimen probably was a type of *Scorpio afer* L., 1758, to which name a diagnosis of 13 teeth was consistently applied (Linnaeus, 1758, 1764, 1767). It is unclear why Linnaeus changed the name from "indicus" to "afer" (i.e. African) while indicating that it was found only in "India" (Linnaeus, 1758: 624). In Linnaeus (1759), a diagnosis of 13 teeth is also given to a scorpion from India (adjective "indica").

Lönnerberg (1897, 1898a) examined the UUZM specimens with 13 teeth and found it to be identical to *Buthus reticulatus* C. L. Koch, 1837 from Indonesia, which is currently considered a synonym of *Heterometrus cyaneus* (C. L. Koch, 1836) (Scorpionidae). However, Couzijn (1981) found not one but two currently existing "Linnaean types" in UUZM; one of these (evidently the same specimen as seen by Lönnerberg) was indeed *Heterometrus cyaneus* (C. L. Koch); the other was *H. indus* (De Geer, 1778). This was in accordance with

Thorell (1876b) who also conducted a detailed study of UUZM specimens. It should be noted that the average number of pectinal teeth in both *H. cyaneus* and *H. indus* is, depending on sex, from 12 to 14 (Couzijn, 1981), which matches both of these species to the Linnaean diagnosis.

It is probable that both existing UUZM specimens are not genuine type specimens of Linnaeus (Couzijn, 1981; Wallin, 1994), and that the type material of *Scorpio afer* was lost. Lönnerberg (1897) argued for using this name; however, it has never been used since, while the name *Heterometrus cyaneus* (C. L. Koch, 1836) became quite common (e.g. Kraepelin, 1899; Werner, 1934; Fet, 2000). Couzijn (1981) revised the genus *Heterometrus* Ehrenberg, 1828, and recommended against the usage of *Scorpio afer* Linnaeus.

Additional confusion was caused by the fact that several authors used the pre-1758 name "Scorpio indicus" as a senior synonym of both *Scorpio afer* Linnaeus, 1758 and *Heterometrus cyaneus* (C. L. Koch, 1836). This binomen (Balk, 1746; Linnaeus, 1748, 1754) was not used by Linnaeus in or after 1758. Later, it was first mentioned by Thorell (1876b) as "*Pandinus indicus* (Linnaeus, 1748)" and then used by Karsch (1884), Pocock (1894), Thorell (1893, 1894) and Kraepelin (1894) in combination with the generic names *Pandinus* or *Scorpio*. This name is not available as authored by Linnaeus; inadvertently, Karsch (1884: 68) was the first to use it in combination with a description, therefore the name is available as *Pandinus indicus* Karsch, 1884. In the same work, Karsch (1884) stated that *P. indicus* is identical to *Buthus reticulatus* C. L. Koch, 1837, which is currently considered to be a synonym of *Heterometrus cyaneus* (C. L. Koch, 1836). This makes *Pandinus indicus* Karsch, 1884 an available junior synonym of *Heterometrus cyaneus* (C. L. Koch, 1836) (Fet, 2000).

Usage of pre-1758 binomina as available names authored by Linnaeus caused yet more confusion in relation to an African species of the family Scorpionidae, *Pandinus imperator* (C. L. Koch, 1841). This species was never named by Linnaeus in or after 1758; however, before that date Linnaeus (1748, 1754) did mention a species he called "Scorpio africanus", with 18 pectinal teeth. Thorell (1876b) was the first to use this name [as "*Pandinus africanus* (Linnaeus, 1754)"] in combination with a description, therefore it is available as *Pandinus africanus* Thorell, 1876. This name was then used by Karsch (1884), Thorell (1893) and Kraepelin (1894, 1898) in combination with the generic names *Pandinus* or *Scorpio*. It is an available junior synonym of *Pandinus imperator* (C. L. Koch, 1841) (Fet, 2000). This species has from 13 to 18 pectinal teeth (Kraepelin, 1899), which is close to the number in the above mentioned species of *Heterometrus*.

***Scorpio europaeus* L., 1758** (Fam. Buthidae, =?*Isometrus maculatus* (De Geer, 1778))

The name *Scorpio europaeus* L., 1758 was officially suppressed by the ICZN (1957) (Fet & Lowe, 2000). The

profound confusion that surrounded this name for 200 years is discussed below.

It is unclear whether a specimen labelled “*Scorpio europaeus*” by Thunberg (UUZM 215) is the Linnaean type (Lönnerberg, 1898a; Wallin, 1994). It matches the original diagnosis (Linnaeus, 1758, 1764), which includes 18 pectinal teeth and a subaculear denticle on the telson (poisonous vesicle). Without a specimen, these two characters combined would point only to the family Buthidae, but not to a particular species or even genus. Linnaeus (1758) stated that the species is found in southern Europe. However, already Fuessly (1778) explicitly stated that, contrary to Linnaeus (1758), no European species has 18 pectinal teeth and a subaculear tubercle.

The specimen UUZM 215 belongs to the species currently called *Isometrus maculatus* (De Geer, 1778) (Buthidae). In this species, the pectinal tooth number is 17 to 19 in both males and females (L. E. Koch, 1977). *Isometrus maculatus* is the most widespread scorpion species in the world. It is commonly found in all the tropics and part of the subtropics of Asia, Africa, Australia, Oceania and America (Fet & Lowe, 2000). Its indigenous range could be in Southeast Asia (which is the centre of diversity for *Isometrus*), from where it possibly was introduced to the non-Oriental parts of its range by humans. It has only once been found in Europe (southern Spain), where it was obviously introduced.

Another specimen of the same species was recently (December 2000) located by the first author in the LSL collection; however, it lacks pectines altogether, and thus it is not possible to match it to the Linnaean diagnosis, even if it represents the original type.

Lönnerberg (1898a) considered the UUZM specimen to be a true Linnaean type, and concluded that *Scorpio europaeus* Linnaeus is a senior synonym of *Isometrus maculatus* (De Geer, 1778). Kraepelin (1899: 66) was familiar with Lönnerberg’s opinion, but chose to place the Linnaean name under question, without any discussion.

The confusion continued, and the two names were used intermittently for the same species. Some authors, including quite recent ones, followed Lönnerberg (1898a) and used the combination “*Isometrus europaeus* Linnaeus, 1758” (e.g. Pocock, 1900; Takashima, 1945; Tikader & Bastawade, 1983). The majority of modern authors, however, followed Kraepelin (1899) in using the name *Isometrus maculatus* (De Geer, 1778) (e.g. Gysin & Le Corroller, 1968; Lamoral & Reynders, 1975; Armas, 1976; L. E. Koch, 1977; Fet & Lowe, 2000).

Additional confusion was caused by usage of the same name, *Scorpio europaeus*, in its pre-1758 meaning, which differed from that of the species published in 1758. While Linnaeus (1754) mentioned an American scorpion with 18 pectinal teeth (as “*Scorpio americanus*”; see below), in the same work he listed a “*Scorpio europaeus*” from Italy with 30 pectinal teeth. Earlier (Linnaeus, 1748), he even used the name “*Scorpio italicus*” for a species with 30 teeth. It is not clear which species Linnaeus (1748) had in mind; all Italian scorpions belong to the genus *Euscorpius* Thorell, 1876 (Euscorpiidae), and none of these has 30 pectinal teeth. The binomen “*Scorpio*

italicus” was also used by Roesel (1755) but became available (according to the Code) only when first published after 1758 by Herbst (1800) (see Braunwalder, 2000; Fet & Sissom, 2000).

Following this misunderstanding, several European species of the genus *Euscorpius* (Euscorpiidae) were often identified as *Scorpio* (or *Scorpius*) *europaeus* (e.g. Poda, 1761; Sulzer, 1761; Scopoli, 1763; De Geer, 1778; Latreille, 1806; Leach, 1815; Hemprich & Ehrenberg, 1829). All these cases should be considered misidentifications (Fet & Sissom, 2000). The first author after 1758 who used this name for a *Euscorpius* species was Poda (1761), who reproduced the Linnaean description and mentioned it for Styria (Austria). Scopoli (1763: 404–405) gave a description and range for *Scorpio europaeus*, which closely corresponded to *Euscorpius carpathicus* (L., 1767). Interestingly, Scopoli (1763) noticed that the number of pectinal teeth (nine) in his case did not match the description of Linnaeus (1758), and wrote “*pectines singuli dentibus 9*”, obviously trying to reconcile his observation with that of Linnaeus by assuming that Linnaeus gave the total number of pectinal teeth (18) for both sides. Fuessly (1775) noticed that *Scorpio carpathicus* from northern Italy and Switzerland is not identical with the Linnaean description of *S. europaeus* since it does not have a subaculear tubercle.

Linnaeus himself was not sure where to include common European scorpions now known as members of the genus *Euscorpius*. It seems that before he described *Scorpio carpathicus* in 1767, Linnaeus completely overlooked these species. Under the range of his *Scorpio europaeus* he wrote (Linnaeus, 1758) “*habitat in Europa maxime australi*”. Such a range could readily refer to *Euscorpius* or *Buthus occitanus* (see below) but hardly to *Isometrus maculatus*, to which refer the 18 pectinal teeth and subaculear tooth of the original diagnosis.

In his next work, however, Linnaeus (1764) placed his *Scorpio europaeus* in America and lists as its synonym a binomen “*Scorpio surinamensis*” (not an available name as it was published in synonymy). The same data were published earlier under “*Scorpio americanus*” (Linnaeus, 1754). In 1767, Linnaeus (p. 1038) described a completely new species, *Scorpio carpathicus*, with six pectinal teeth. However, he retained a confusing description of *Scorpio europaeus* which matched *Isometrus maculatus*, but still (as in 1758) mentioned only Europe as its range. Moreover, in 1767 Linnaeus added, under *Scorpio europaeus*, references to the work of Roesel (1755), Sulzer (1761), and Schaeffer (1766), who listed and even depicted European species of *Euscorpius*.

Further confusion was created by Thorell (1876a: 7) who decided that the European scorpion with 30 pectinal teeth referred to by Linnaeus (1754) was *Buthus occitanus* (Amoreux, 1789) found in southern France and Spain. Thorell (1876a) used the combination “*Buthus europaeus* Linnaeus, 1754” as a senior synonym for the species described by Amoreux. This name was used by a number of later authors (e.g. Simon, 1879, 1910; Thorell, 1893; Birula, 1900). The number of 30 pectinal teeth fits well within the range known for *Buthus*

occitanus (19 to 30 in females, 25 to 36 in males; Levy & Amitai, 1980). Thorell's description explicitly states that his species is *not* the one described as *Scorpio europaeus* Linnaeus, 1758 (with 18 teeth), therefore Thorell's name is not a misidentification, and should be treated as an available new name, *Buthus europaeus* Thorell, 1876, and a junior synonym of *Buthus occitanus* (Amoreux, 1789) (Fet & Lowe, 2000).

Our conclusion is that the name *Scorpio europaeus* Linnaeus, 1758, apart from having been misidentified many times, is dubious but most likely corresponds to *Isometrus maculatus* (De Geer, 1778). Since this name was suppressed by the little-known decision of ICZN (1957), it cannot be used as an available name; thus, any usage of it as *Isometrus europaeus* (Linnaeus, 1758) (e.g. Tikader & Bastawade, 1983) is incorrect.

***Scorpio americanus* L., 1758** (Fam. Buthidae, indeterminate)

The type of this species is probably lost. Linnaeus (1758, 1767) stated that *S. americanus* inhabits America and has 14 pectinal teeth and filiform pedipalps. Such a diagnosis matches dozens of species of Buthidae. Fuessly (1778) described in detail what was most likely a *Tityus* (Buthidae) species from Surinam or Dutch West Indies, using the Linnaean name *Scorpio americanus* but with an amended diagnosis. Later, his name was rarely used: it was mentioned, e.g. as *Androctonus americanus*, by Butler (1877) to designate a species now known as *Centruroides exsul* (Meise, 1934) (Fet & Lowe, 2000). We could not find any reference to this name after 1877. Therefore, the name *Scorpio americanus* L., 1758 is dubious as it cannot be identified with any particular species.

More confusion was created when many authors treated this name as a misspelled form, emending it to "*Scorpio americanus*", and ascribing its authorship to Linnaeus. The latter, indeed, used such a name but only in his pre-1758 work (Linnaeus, 1754) where it is said to be an American species with 18 pectinal teeth. However, already De Geer (1778) claimed that "*Scorpio americanus*" was a species published by Linnaeus (1767), listing it as a synonym of his *Scorpio maculatus*. Other authors (e.g. Fabricius, 1781, 1787, 1793) simply reproduced the Linnaean description.

C. L. Koch (1845, 1850) used the name "*Lychas americanus*" (possibly for *Isometrus maculatus* as well), again with a reference to Linnaeus (1767). Thus, the name "*Scorpio americanus*", as used by most authors, was merely an incorrect subsequent spelling of *S. americanus* Linnaeus, 1758.

Thorell (1876a, b) and Pocock (1889) used the name "*Isometrus americanus* (Linnaeus, 1754)" and considered it identical to the South American species *Scorpio (Atreus) obscurus* Gervais, 1843. The latter is itself a dubious taxon, and a possible synonym of *Tityus paraensis* Kraepelin, 1896 (Lourenço, 1984; Fet & Lowe, 2000). Pocock (1897: 510) realised that it was not possible to assign *Scorpio americanus* to any particular species and decided to discard this name.

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References

- ARMAS, L. F. de 1976: Notas sobre la distribución geográfica de *Isometrus maculatus* (De Geer) (Scorpionida: Buthidae) en las Antillas. *Miscelanea zool., La Habana* **5**: 3–4.
- BALK, L. 1746: Museum Adolpho-Fridericianum. In C. Linnaeus (ed.), *Amoenitates academicae, seu dissertationes variae physicae, medicae, botanicae*. Apud Cornelium Haak, Lugduni Batavorum (Amsterdam). (Scorpions: pp. 606–607.)
- BIRULA, A. A. 1910: Ueber *Scorpio maurus* Linné und seine Unterarten. *Trudy russk. ent. Obshch. (=Horae Soc. Ent. Ross.)* **35**: 115–192.
- BRAUNWALDER, M. E. 2000: On the zoological significance of illustrations on scorpions (Arachnida: Scorpiones) in natural sciences books and arts from the Renaissance to the eighteenth century. In G. Olmi, L. Tongiorgi Tomasi, L. & A. Zanca (eds.), *Atti del Convegno Internazionali di studi Natura-Cultura: L'interpretazione del mondo fisico nei testi e nelle immagini, Mantova, 5–8 ottobre 1996*: 325–344. Leo S. Olschki, Firenze.
- BRAUNWALDER, M. E. & FET, V. 1998: On publications about scorpions (Arachnida, Scorpiones) by Hemprich and Ehrenberg (1828–1831). *Bull. Br. arachnol. Soc.* **11**: 29–35.
- BUNESCU, A. 1959: Contributii la studiul raspindirii geografice a unor animal mediteraneene din R. P. R. Nota I. Artropode. *Probl. Geogr.* **6**: 87–107 (in Romanian).
- BUTLER, A. G. 1877: Account of the zoological collection made during the visit of H.M.S. 'Petrel' to the Galapagos Islands. Arachnida and Myriopoda. *Proc. zool. Soc. Lond.* **1877**: 75–77.
- COUZIJN, H. W. C. 1981: Revision of the genus *Heterometrus* Hemprich and Ehrenberg (Scorpionidae, Arachnidea). *Zool. Verh. Leiden* **184**: 1–196.
- De GEER, C. 1778: *Mémoires pour servir à l'histoire des Insectes* **7**. Imprimerie Pierre Hesselberg, Stockholm.
- FABRICIUS, J. C. 1775: *Systema Entomologiae, sistens Insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus*. In Officina Libraria Kortii, Flensburg et Leipzig. (Scorpions: pp. 399–400.)
- FABRICIUS, J. C. 1781: *Species Insectorum, exhibentes eorum differentias specificas, synonyma, auctorum, loca natalia, metamorphosin adiectis observationibus, descriptionibus* **1**. Impensis Carol. Ernest. Bohnii, Hamburgi et Kilonii. (Scorpions: pp. 550–551.)
- FABRICIUS, J. C. 1787: *Mantissa Insectorum sistens eorum species nuper detectas adiectis synonymis, observationibus, descriptionibus, emendationibus* **2**. Impensis Christ. Gottl. Proft, Hafniae. (Scorpions: p. 548.)
- FABRICIUS, J. C. 1793: *Entomologica Systematica emendata et aucta, secundum classes, ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus* **2**. Impensis Christ. Gottl. Proft, Hafniae.
- FET, V. 1997: A note on *Euscorpium carpathicus* (Scorpiones: Chactidae) from the Crimea. *J. Arachnol.* **25**: 106–108.
- FET, V. 2000: Family Scorpionidae C. L. Koch, 1837. In V. Fet, W. D. Sissom, G. Lowe & M. E. Braunwalder, *Catalog of the scorpions of the world (1758–1998)*: 427–495. New York Entomological Society, New York.
- FET, V. & LOWE, G. 2000: Family Buthidae C. L. Koch, 1837. In V. Fet, W. D. Sissom, G. Lowe & M. E. Braunwalder, *Catalog*

- of the scorpions of the world (1758–1998): 54–286. New York Entomological Society, New York.
- FET, V. & SISSOM, W. D. 2000: Family Euscorpidae Laurie, 1893. In V. Fet, W. D. Sissom, G. Lowe & M. E. Braunwalder, *Catalog of the scorpions of the world (1758–1998)*: 355–380. New York Entomological Society, New York.
- FET, V., SISSOM, W. D., LOWE, G. & BRAUNWALDER, M. E. 2000: *Catalog of the scorpions of the world (1758–1998)*. New York Entomological Society, New York.
- FUESSLY, J. C. 1775: *Verzeichnis der ihm bekannten Schweitzerischen Insekten, mit einer ausgemahlten Kupfertafel: nebst der Ankündigung eines neuen Insecten Werks*. Heinrich Stein, Zürich und Winterthur.
- FUESSLEY, J. C. 1778: Dr. Sulzers abgekürzte Geschichte der Insekten nach dem Linnäischen System. *Magazin Liebh. Ent.* **1**: 141–242.
- GAFFIN, D. D. & BROWNELL, P. H. 1992: Evidence of chemical signaling in the sand scorpion, *Paruroctonus mesaensis* (Scorpionida: Vaejovidae). *Ethology* **91**: 59–69.
- GANTENBEIN, B., FET, V., LARGIADÈR, C. & SCHOLL, A. 1999: First DNA phylogeny of *Euscorpius* Thorell, 1876 (Scorpiones: Euscorpidae) and its bearing on taxonomy and biogeography of this genus. *Biogeographica, Paris* **75**: 49–65.
- GANTENBEIN, B., FET, V., BARKER, M. & SCHOLL, A. 2000: Nuclear and mitochondrial markers reveal the existence of two parapatric scorpion species in the Alps: *Euscorpius germanus* (C. L. Koch, 1837) and *E. alpha* Caporiacco, 1950, stat. nov. (Euscorpidae). *Revue suisse Zool.* **107**: 843–869.
- GERVAIS, P. 1844: Remarques sur la famille des Scorpions et description des plusieurs espèces nouvelles de la collection du Muséum. *Archs Mus. Hist. nat. Paris* **4**: 201–240.
- GYSIN, J. & LE CORROLLER, Y. 1968: Contribution à l'étude systématique du Scorpion "*Isometrus maculatus*" (de Geer, 1778). *Archs Inst. Pasteur Algèr.* **46**: 64–75.
- HEMPRICH, F. W. & EHRENBERG, C. G. 1828: Zoologica II. Arachnoidea. Plate I: *Buthus*; plate II: *Androctonus*. In: *Symbolae Physicae seu icones et descriptiones animalium evertibratorum sepositis insectis quae ex itinere per Africam borealem et Asiam occidentalem. Friderici Guilelmi Hemprich et Christiani Godofredi Ehrenberg, medicinae et chirurgiae doctorum, studio novae aut illustratae redierunt. Percensuit et regis iussu et impensis edidit Dr. C. G. Ehrenberg. Decas prima*. Venditur a Mittlero, Berolini ex Officina Academica (plates only).
- HEMPRICH, F. W. & EHRENBERG, C. G. 1829: Vorläufige Uebersicht der in Nord-Afrika und West-Asien einheimischen Skorpione und deren geographischen Verbreitung. *Verh. Ges. Naturf. Freund. Berl.* **1**: 348–362.
- HERBST, J. F. W. 1800: Naturgeschichte der Skorpionen. In: *Natursystem der ungeflügelten Insekten* **4**: 1–86. Gottlieb August Lange, Berlin.
- ICZN (International Commission on Zoological Nomenclature) 1957: Direction 60. Designation under the Plenary Powers of a type species for the genus *Scorpio* Linnaeus, 1758 (Class Arachnida) in harmony with accustomed usage and suppression under the same Powers of the specific name *europaeus* Linnaeus, 1758, as published in the combination *Scorpio europaeus* (amendment of a Ruling given in *Opinion* 104). In F. Hemming (ed.), *Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature* **1**(E.1): 3–12. London.
- ICZN (International Commission on Zoological Nomenclature) 1999: *International Code of Zoological Nomenclature* (4th ed.). International Trust for Zoological Nomenclature, London.
- KARSCH, F. 1879: Scorpionologische Beiträge. II. *Mitt. münch. ent. Ver.* **3**: 97–136.
- KARSCH, F. 1884: Ueber einige neue und minder bekannte Arthropoden des Bremer Museums. *Abh. naturw. Ver. Bremen* **9**: 65–71.
- KINZELBACH, R. 1975: Die Skorpione der Ägäis. Beiträge zur Systematik, Phylogenie und Biogeographie. *Zool. Jb. (Syst.)* **102**: 12–50.
- KOCH, C. L. 1838: *Die Arachniden* **4**(6): 109–144. C. H. Zeh'sche Buchhandlung, Nürnberg.
- KOCH, C. L. 1845: *Die Arachniden* **12**: 1–166. C. H. Zeh'sche Buchhandlung, Nürnberg.
- KOCH, C. L. 1850: Scorpionen. In: *Uebersicht des Arachnidensystems* **5**: 86–92. J. L. Lotzbeck, Nürnberg.
- KOCH, L. E. 1977: The taxonomy, geographic distribution and evolutionary radiation of Australo-Papuan scorpions. *Rec. West. Aust. Mus.* **5**: 83–367.
- KRAEPELIN, K. 1894: Revision der Scorpione. II. Scorpionidae und Bothriuridae. *Jb. hamb. wiss. Anst.* **11**: 1–248.
- KRAEPELIN, K. 1898: Neue Pedipalpen und Skorpionen des Hamburger Museums. *Jb. hamb. wiss. Anst.* **15**: 39–44.
- KRAEPELIN, K. 1899: Scorpiones und Pedipalpi. *Tierreich* **8**: 1–265.
- LAMORAL, B. & REYNDERS, S. 1975: A catalogue of the scorpions described from the Ethiopian faunal region up to December 1973. *Ann. Natal Mus.* **22**: 489–576.
- LATREILLE, P. A. 1806: *Genera Crustaceorum et Insectorum, secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata* **1**. Amand Koenig, Parisiis et Argentorati. (Scorpions: pp. 130–132.)
- LEACH, W. E. 1815: A tabular view of the external characters of four classes of animals, which Linné arranged under Insecta; with the distribution of the genera composing three of these classes into orders, etc. and descriptions of several new genera and species. *Trans. Linn. Soc. Lond.* **11**: 306–400.
- LEVY, G. & AMITAL, P. 1980: Arachnida. I. Scorpiones. *Fauna palaest.* 1–130.
- LINNAEUS, C. 1748: *Systema Naturae, sistens regna tria naturae, in classes et ordines, genera et species redacta* (ed. 6, emendata et aucta). Impensis Godofr. Kiesewetteri, Stockholmiae.
- LINNAEUS, C. 1754: *Museum S. R. M. Adolphi Friderici Regis Svecorum, etc. in quo Animalia rariora imprimis, et exotica: Quadrupedia, Aves, Amphibia, Pisces, Insecta, Vermes describuntur et determinantur, Latine et Svetice cum iconibus*. Typographia Regia, Holmiae (Stockholm).
- LINNAEUS, C. 1758: *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus differentiis, synonymis, locis* (ed. 10) **1**: 1–821. Laurentii Salvii, Holmiae (Stockholm).
- LINNAEUS, C. 1759: *Animalium specierum, in classes, ordines, genera, species methodica dispositio, additis characteribus, differentiis atque synonymis, accommodata ad Systema Naturae & in formam enchyridii redacta, secundum decimam Holmensem editionem*. Apud Theodore Haak, Lugdini Batavorum (Leyden).
- LINNAEUS, C. 1764: *Museum Ludovicae Ulricae Reginae Svecorum, in quo Animalia rariora, exoticae imprimis Insecta et Conchilia describuntur et determinantur*. Laurentii Salvii, Holmiae (Stockholm).
- LINNAEUS, C. 1767: *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis* (ed. 12) **1**(2): 533–1327. Laurentii Salvii, Holmiae (Stockholm).
- LÖNNBERG, E. 1897: Skorpioner och pedipalper i Upsala Universitets Zoologiska Museum. *Ent. Tidskr.* **18**: 175–192.
- LÖNNBERG, E. 1898a: A revision of the Linnaean type specimens of scorpions and pedipalps in the Zoological Museum of the Royal University of Upsala. *Ann. Mag. nat. Hist.* (7) **1**: 82–89.
- LÖNNBERG, E. 1898b: Noch einmal über die Linné'schen Arten der Gattung *Scorpio*. *Zool. Anz.* **21**: 549–552.
- LOURENÇO, W. R. 1983: La faune des Scorpions de Guyane Française. *Bull. Mus. natn. Hist. nat. Paris* (Zool., Biol. Écol. Anim.) **5**: 771–808.
- LOURENÇO, W. R. & CLOUDSLEY-THOMPSON, J. L. 1994: The origin of desert faunas. *Biogeographica, Paris* **79**: 183–192.
- POCOCK, R. I. 1889: On *Isometrus americanus* (Linn.), with a description of a new species of the genus. *Ann. Mag. nat. Hist.* (6) **4**: 53–59.
- POCOCK, R. I. 1894: Scorpions from the Malay Archipelago. In M. Weber (ed.), *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien* **3**: 84–99. E. J. Brill, Leiden.
- POCOCK, R. I. 1897: Descriptions of some new species of scorpions of the genus *Tityus*, with notes upon some forms allied to *T. americanus* (Linn.). *Ann. Mag. nat. Hist.* (6) **19**: 510–521.

- POCOCK, R. I. 1900: Arachnida. *Fauna Br. India*: 1–279.
- PODA, N. 1761: *Insecta Musei Graecensis, quae in ordines, genera et species juxta Systema Naturae Caroli Linnaei digessit Nicolaus Poda*. Typis Haeredum Widmanstadtii, Graecii (Graz).
- ROESEL, A. J. 1755: *Der monatlich herausgegebenen Insecten-Belustigung* **3**: 377–384, pl. 66. Johann Joseph Fleischmann, Nürnberg.
- SCHAEFFER, J. C. 1766: *Elementa Entomologica*. 135 pls. Typis Weissianis, Ratisbonne (Regensburg). (Scorpions: pl. 2, figs. 1–3; pl. 103, figs. 1–3.)
- SCOPOLI, J. A. 1763: *Entomologia Carniolica, exhibens Insecta Carnioliae indigena et distributa in ordines, genera, species, varietates, methodo Linnaeana*. Ioannis Thomae Trattner, Vindobonae (Vienna).
- SIMON, E. 1879: 3e Ordre. Scorpiones. In: *Les Arachnides de France* **7**: 79–115. Roret, Paris.
- SIMON, E. 1910: Révision des Scorpions d'Égypte. *Bull. Soc. ent. Égypte* **1910**: 57–87.
- SULZER, J. H. 1761: *Die Kennzeichen der Insekten, nach Anleitung des Königl. Schwed. Ritters und Leibarzts Karl Linnaeus, durch XXIV. Kupfertafeln erläutert und mit derselben natürlichen Geschichte Begleitet von J. H. Sulzer*. Heidegger, Zürich.
- TAKASHIMA, H. 1945: [Scorpions of Eastern Asia]. *Acta arachn. Tokyo* **9**: 68–106 (in Japanese).
- THORELL, T. 1876a: On the classification of scorpions. *Ann. Mag. nat. Hist* (4)**17**: 1–15.
- THORELL, T. 1876b: Études scoriologiques. *Atti Soc. ital. Sci. nat.* **19**: 75–272.
- THORELL, T. 1893: Scorpiones exotici R. Musei Historiae Naturalis Florentini. *Boll. Soc. ent. ital.* **25**: 356–387.
- THORELL, T. 1894: Förteckning öfver Arachnider fran Java och närgränsande Öar. *Bih. K. svenska Vetensk.Akad. Handl.* **20**: 4–63.
- TIKADER, B. K. & BASTAWADE, D. B. 1983: Scorpions (Scorpionida: Arachnida). *Fauna India* **3**: 1–670.
- VACHON, M. 1952: *Études sur les scorpions*. Institut Pasteur d'Algérie, Alger.
- VACHON, M. & JAQUES, M. 1977: Recherches sur les Scorpions appartenant ou déposés au Muséum d'Histoire naturelle de Genève. 2. Contribution à la connaissance de l'ancienne espèce *Scorpius banaticus* C. L. Koch 1841, actuellement considérée comme synonyme de *Euscorpius carpathicus* (Linné 1767) (Fa. des Chactidae). *Revue suisse Zool.* **84**: 409–436.
- WALLIN, L. 1994: *Uppsala University Zoological Museum. Catalog of type specimens (Version 4). 4. Linnaean specimens*. Uppsala. (Scorpions: p. 13.)
- WERNER, F. 1934: Scorpiones, Pedipalpi. In H. G. Bronn (ed.), *Klassen und Ordnungen des Tierreichs* **5(4) 8**: 1–316. Akademische Verlagsgesellschaft, Leipzig.