Euscorpius

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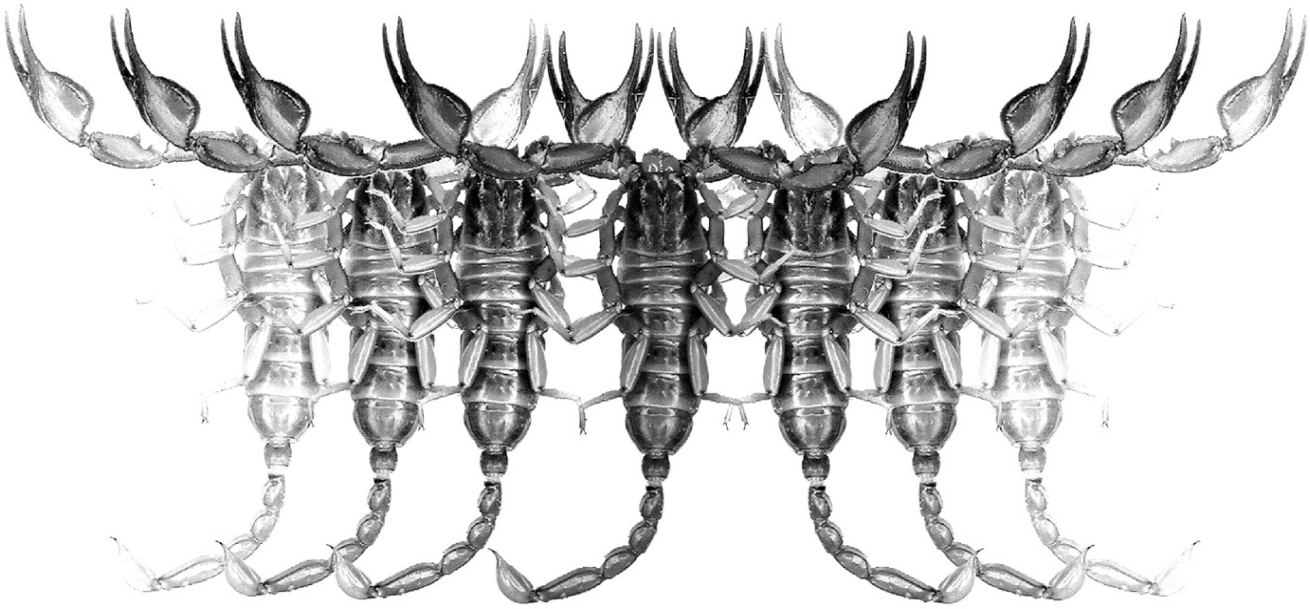

Scorpions of China: an updated checklist with comments on some taxonomic issues (Arachnida: Scorpiones)

Victoria Tang

June 2022 — No. 355

Euscorpius

Occasional Publications in Scorpiology

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Publication date: 24 June 2022

http://zoobank.org/urn:lsid:zoobank.org:pub:5E073791-C96B-431C-BF34-C3057AB42C6D

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Scorpions of China: an updated checklist with comments on some taxonomic issues (Arachnida: Scorpiones)

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Summary

An updated checklist of scorpions of China (52 species belonging to 13 genera and six families) is provided, with Chinese name equivalents and an illustrated map of all localities. Colored photos of the Chinese population of *Mesobuthus thersites* (C. L. Koch, 1839) and one *Olivierus* sp. *in vivo* habitus are provided for the first time. The recent taxonomic changes are summarized. The monotypic genus *Tibetiomachus* (Hormuridae) with its single species *T. himalayensis* is considered a *nomen dubium*. The validity of the previously synonymized *Scorpiops atomatus* Qi et al., 2005 and *S. validus* (Di et al., 2010) (Scorpiopidae) is questioned, although they are not formally restored from synonymy. *Olivierus hainanensis* (Birula, 1904) (Buthidae) is possibly a junior synonym of *O. martensii* (Karsch, 1879); a reanalysis of the syntypes is warranted. The name "*Scorpiops jingshanensis* Li, 2016" is a *nomen nudum*. Additional comments are made upon two unavailable names that appear in an unpublished MS thesis (Zhang, 2009; in Chinese): "*Mesobuthus beijiangensis*" and "*M. nanjiangensis*". A revision is needed of several species with weakly supported diagnostic characters, such as *Olivierus bolensis* (Sun et al., 2010) and *Scorpiops puerensis* (Di et al., 2010). The applicability of the diagnostic characters proposed for *Olivierus bolensis* (Sun et al., 2010) and *O. longichelus* (Sun & Zhu, 2010) is found to be unstable, based on the examination of some new specimens from Xinjiang. Their relationship with another two recently described species (*O. mikhailovi* Fet et al., 2021 and *O. tarabaevi* Fet et al., 2021), as well as the misidentified "*Mesobuthus caucasicus intermedius*" in China, remains unclear until a molecular study is accomplished.

Introduction

China is a vast territory covering an area of approximately 9.6 million sq.km. and crosses different geographic zones, ranging from deserts in the north to subtropical forests in the south and showing diverse climate. Being one of the 17 megadiverse countries, lying within two of the world's major biogeographic realms (the Palearctic and the Oriental), China exhibits a high level of biodiversity. The earliest records of scorpions in China trace back to 2000 years ago in the first dictionary in China, *Er Ya* (尔雅) or *Literary Expositor* (Tang, 2022a). The modern systematic study of scorpions in China began around 2004, although already Xianwen Wu (伍献文) was the first to describe scorpions in a scientific way (Wu, 1936) and later, Daxiang Song (宋大祥) et al. (1982) provided a detailed description of a wide-ranging species, *Olivierus martensii* (Karsch, 1879) (Buthidae). The current scorpion fauna in China is not so diverse compared to its geographic territory and landscape diversity. Our current list includes 52 species (excluding five doubtful records, one presumed synonym and six potentially new species) belonging to 13 genera and six families recorded in China. The most speciose genus is *Scorpiops* Peters, 1861 (Scorpiopidae), followed by *Chaerilus* Simon, 1877 (Chaerilidae) and *Olivierus* Farzanpay, 1987 (Buthidae). Scorpions in China generally are distributed in the southwest and northwest (Figs. 1–2), with Xizang (= Tibet, especially the southeast part), Yunnan (mostly in the southwest), and Xinjiang (mostly in the north) showing the highest level of scorpion diversity. The north of the country is predominantly occupied by three buthid species, *Mesobuthus thersites* (C. L. Koch, 1839), *Olivierus martensii* and *O. przewalskii* (Birula, 1897). No scorpions have yet been found in the frigid region in the northeast (approximately above 43°N). *O. martensii* is the most widely distributed species, covering northern, northeastern, central and eastern China.

The species composition of the Chinese scorpiofauna

All currently recorded scorpion species are listed below. Maps of all localities are provided (Figs. 1–2); new localities reported by the local people are added. Validity of several species is in question; e.g., *Olivierus bolensis* (Sun, Zhu & Lourenço, 2010) is probably a junior synonym of *O. longichelus* (Sun & Zhu, 2010) (Tang, pers. obs.; see below). Five species, which have been mentioned in previous papers (e.g., Di et al., 2014) with ambiguous records, are excluded from the list: *Hottentotta alticola* (Pocock, 1895), *Orthochirus scrobiculosus* (Grube, 1873), *Scorpiops longimanus* Pocock, 1893, *Heterometrus longimanus* (Herbst, 1800) and *Heterometrus silenus* (Simon, 1884) (as *H. petersii* (Thorell, 1876)). Detailed history of Chinese scorpiology has been elaborated in Di et al. (2014). However, it is important to clarify the records and taxonomy of some species included in the current list.

Chaerilus assamensis Kraepelin, 1913 was poorly described based on the type from Assam (India); its record in China is hereby based on its junior synonym, *C. dibangvalleycus* Bastawade, 2006 (syn. by Kovařík, & Ojanguren 2013). *Reddyanus hainanensis* (Lourenço et al., 2005) was described (as *Isometrus* (*R.*) *hainanensis*) based on a male holotype and a female paratype collected in 1931. The type locality was roughly labeled as "Southeast region". Lourenço et al. (2005) considered this species to be close to *Reddyanus petrzelkai* (Kovařík, 2003), but differing by a paler pigmentation and other non-measurable characters. Kovařík & Ojanguren (2013) refuted the stability of pigmentation and synonymized *R. hainanensis* with *R. petrzelkai*. Later, Kovařík & Šťáhlavský (2019) suggested that this synonymization was not valid and that topotypes are needed to compare with the types. The only previously confirmed species of Heterometrinae (Scorpionidae) in China, *Heterometrus tibetanus* Lourenço et al., 2005, was described from Pulan County and later synonymized with *Deccanometrus bengalensis* (C.L. Koch, 1841) by Prendini & Loria (2020). Finally, *Lychas scutilus* C. L. Koch, 1845 was recorded based on a single female specimen collected in Shanghai in 1878 (presumably introduced), but then assumed to be extinct (Fet et al., 2000; Kovařík & Whitman, 2004). Another congeneric species has also been collected in a new region, which appears to be the only endemic *Lychas* species in China (Tang, in prep.).

Discussion on the validity and availability of several taxa described from China

Genus *Tibetiomachus* Lourenço & Qi, 2006

Tibetiomachus himalayensis Lourenço & Qi, 2006 from Tibet, belonging to a monotypic genus, was assumed to be a synonym of *Liocheles nigripes* (Pocock, 1897) (Kovařík, 2009, 2018). This species was allegedly diagnosed by the absence of the trichobothrium *dt* (Lourenço & Qi, 2006: 291), yet this trichobothrium was explicitly illustrated twice in the original description (figs. 20 and 21, p. 293). However, since the synonymization was not confirmed, a re-examination of the holotype is warranted. The name is currently retained in the list below but considered a *nomen dubium*.

Genus *Scorpiops* Peters, 1861

The Asian genus *Scorpiops* is of the highest richness in China, however, identity of some species is doubtful. Kovařík et al. (2020) synonymized several genera with this genus based on extensive morphological comparison, including one that is found in China (*Euscorpiops* Vachon, 1980). The present contribution will follow the genus-level taxonomy proposed by these authors. The records of *Scorpiops asthenurus* Pocock, 1900 and *S. kamengensis* (Bastawade, 2006) are taken from the map in Di & Qiao (2020a), despite the fact that the Chinese specimens of these two species are poorly known. Similarly, for *S. leptochirus* Pocock, 1893, also a little-known species in China, the data taken from Di & Qiao (2020b). The records of *S. petersii* Pocock, 1893 are taken from Di et al. (2013b); this taxon was initially recorded by Kishida (1939), although Di et al. (2013b) could not confidently distinguish their Chinese specimens from *S. hardwickii* (Gervais, 1843), except for the larger size (which is variable).

Di et al. (2011a) published a description of an unidentified "*Scorpiops* sp." based on two juvenile specimens from the Huzhaoshan Mountains in Jingshan County, Hubei Province (collected on 3 June 2007) which was considered to be belonging to the "*hardwickii*" complex based on the following characters: 6–8 ventral and 17 external trichobothria on the patella; pectinal teeth count (below, PTC) 4–9; pectines without fulcra; chela manus length to width ratio about 1; tegument coarse. The specimens were compared to *S. jendeki* due to their close geographical proximity but differed as follows: carapace more granular than in *S. jendeki*; dorsoexternal carinae on pedipalp chelae more developed than in *S. jendeki*; pedipalp movable finger with a basal lobe proximally (cutting edge flexed/curved) (vs. absence of a lobe in *S. jendeki*). Although Di et al. (2011a) suggested that the specimens belonged to the "*hardwickii*" complex, their locality was far from the known range of that complex (the geographically closest species, *S. langxian*, is found about 1775 km away). With all these diagnostic characters and the isolated distribution, no formal name was designated for the Hubei specimens in the original publication since they were juvenile. Li (2016) mentioned these specimens in a book *Scorpion Biology and Toxins* (published in Chinese) and offered the name "*Scorpiops jingshanensis*" (published in Latin), as a "new species" (roughly translated here from Chinese):

> "The collectors, Dr. Xie Guangling, along with his students, discovered and collected two scorpion specimens during their internship in Huzhaoshan [Mountains]. Since the specimens were small and the genitals were destroyed by the needle, the maturity cannot be determined. They were not named in the report by Di et al. (2011a), but only described as a euscorpiid species newly recorded from Central China. Fet and Lourenço (pers. comm., 2012) considered that the specimens should be examined based on the re-analysis of *S. hardwickii*, and they both thought it could be a new species as speculated from the geography."

However, since no description was published by Li (2016) together with the new name he offered, the name "*Scorpiops jingshanensis* Li, 2016" is *not available* according to ICZN publication criteria (Article 13); this name represents a *nomen nudum* and does not enter synonymy. At the same time, the Hubei population of *Scorpiops* in China is intriguing, and likely indeed represents a new species. Recent reports by the local people suggest that this genus occurs in both Hubei and adjacent Chongqing Provinces in central China, where it is found mainly along the river system. Future collections of adult specimens would provide a more comprehensive and formal description of this taxon.

Two species synonymized by Kovařík et al. (2020), namely *Scorpiops atomatus* Qi, Zhu & Lourenço, 2005 and *S. validus* (Di et al., 2010), are retained in our list and the map for the purpose of providing the geographical information (Fig. 2), but not formally revalidated. *S. atomatus* was synonymized with *S. tibetanus* Hirst, 1911 without studying

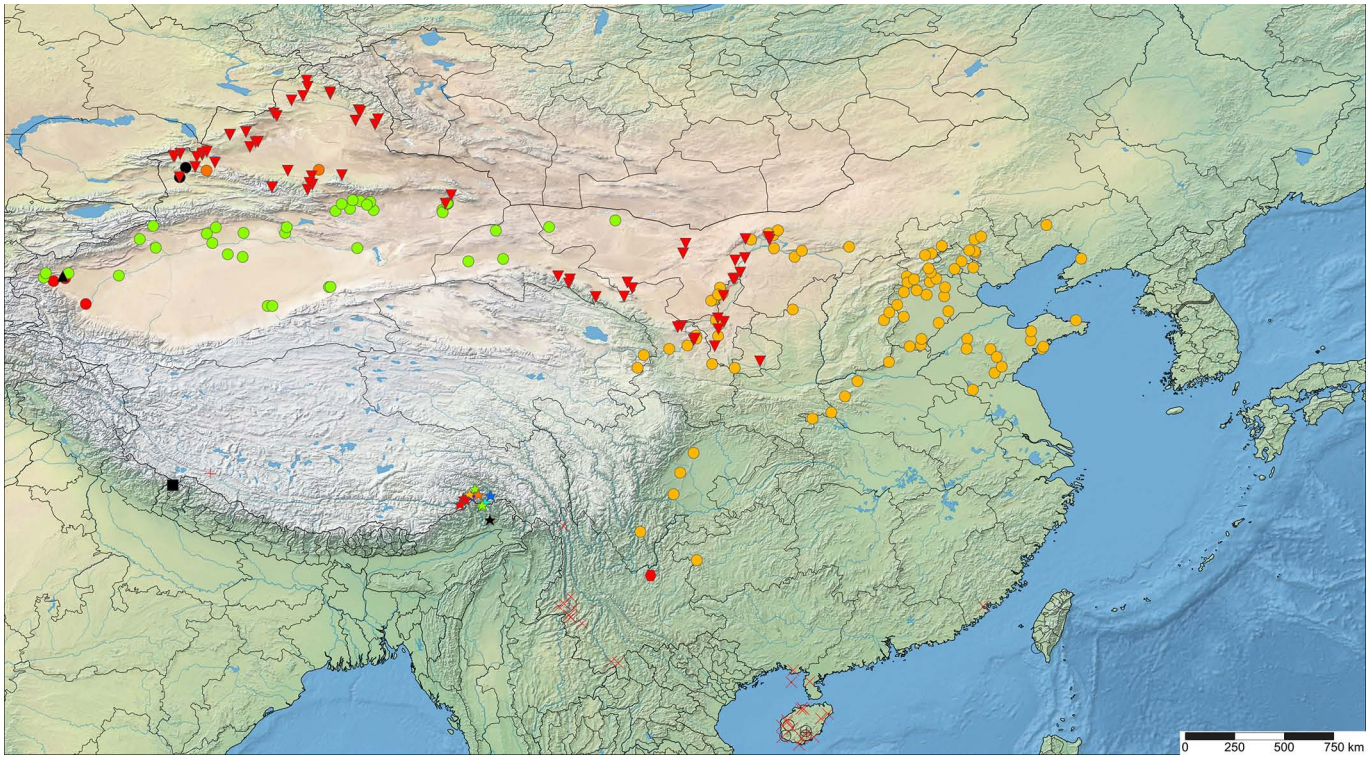

Figure 1. Map showing known distribution of the parvorder Buthida in China: *Chaerilus* (star), *Qianxie* (hexagon), *Lychas* (cross), *Isometrus* (hollow circle), *Reddyanus* (plus), *Olivierus* (solid circle), *Mesobuthus* (inverse triangle), *Hottentotta* (square), and *Razianus* (triangle). *Chaerilus assamensis* (★), *C. conchiformus* (★), *C. mainlingensis* (★), *C. pseudoconchiformus* (★), *C. tessellatus* (★), *C. tricostatus* (★), *C. tryznai* (★), *C. wrzecionkoi* (★, largely covered by *C. pseudoconchiformus*); *Qianxie solegladi* (⬢, only the type locality is provided); *Lychas mucronatus* (×); *Isometrus maculatus* (○); *Reddyanus hainanensis* (+, accurate location unknown), *R. tibetanus* (+); *Olivierus bolensis* (●, one covered by *Mesobuthus thersites*), *O. karshius* (●, one covered by *O. przewalskii* and *R. xinjiangensis*), *O. longichelus* (●), *O. martensii* (●), *O. przewalskii* (●); *M. thersites* (▼); *Hottentotta songi* (■); *Razianus xinjiangensis* (▲).

holotype or topotypes. The only reason for synonymization mentioned by Kovařík et al. (2020) was that the measurement of pedipalp chela by Di et al. (2010) was incorrect. Judging from the original descriptions, both the numbers of ventral trichobothria of pedipalp patella and PTC fall in the range of *S. tibetanus*. However, the total length of *Scorpiops atomatus* is much smaller (♂ 34.94 mm and ♀ 36.48 mm) and was considered in the original diagnostic keys. Zhiyong Di (pers. comm.), who had checked *S. atomatus* types, believes that it is distinct from *S. tibetanus*.

Scorpiops validus (Di et al., 2010) was synonymized with *S. vachoni* (Qi et al., 2005) by Kovařík et al. (2020), also based only on the original descriptions. The ratio of pedipalp chela *S. vachoni* was most certainly mismeasured by Qi et al. (2005), and several characters of both species overlap with each other (e.g., total length, number of ventral and external patellar trichobothria, and PTC). Nevertheless, Kovařík et al. (2020) synonymized the two species without studying the type specimens. At the same time, the morphometric values of *Scorpiops puerensis* (Di et al., 2010) also overlap with that of *S. validus* except for the length/width ratio of pedipalp chela, yet Kovařík et al. (2020) maintained it valid in their revision. Di (pers. comm.) suggested that *S. vachoni* and *S. validus* differ from each other in the shape of pedipalp chela (rounded in *S. vachoni*, and dorsoventrally flattened in *S. validus*) but not in the length/width ratio. Since Kovařík et al. (2020) have not studied the types or topotypes (the type localities of these two species are distant from each other), these two species are retained in this paper for the purposes of the faunal list and distributional map. We do not formally restore *S. atomatus* and *S. validus* from synonymy since for a definitive conclusion one needs to examine the types. However, if the subsequent study on the holotype or the topotypes confirms the synonymy of *S. atomatus* and *S. validus*, the validity of other species (e.g., *S. puerensis*) could also be questioned. Nevertheless, in the current checklist, all these dubious species are listed and illustrated separately for distributional information.

According to Kovařík et al. (2020), one male paratype of *Scorpiops vachoni* from Bayi Town, Linzhi District, Xizang, was inferred as a different species, which, very likely, was *S. novaki* (Kovařík, 2005). However, since the specimen was not studied, it is included in our list as *S. vachoni* (a dubious record). The species of *Scorpiops* are very uniform, and important diagnostic characters can either overlap interspecifically (e.g., number of trichobothria) or be easily influenced by the consistency of measuring method used by different authors (e.g., for length/width ratio of pedipalp chela, a slight deviation of angle could lead to a great difference), therefore pending further reanalysis based on DNA sequence comparisons.

Most recently, Lourenço & Ythier (2022) revalidated five taxonomic groups at the subgeneric level in addition

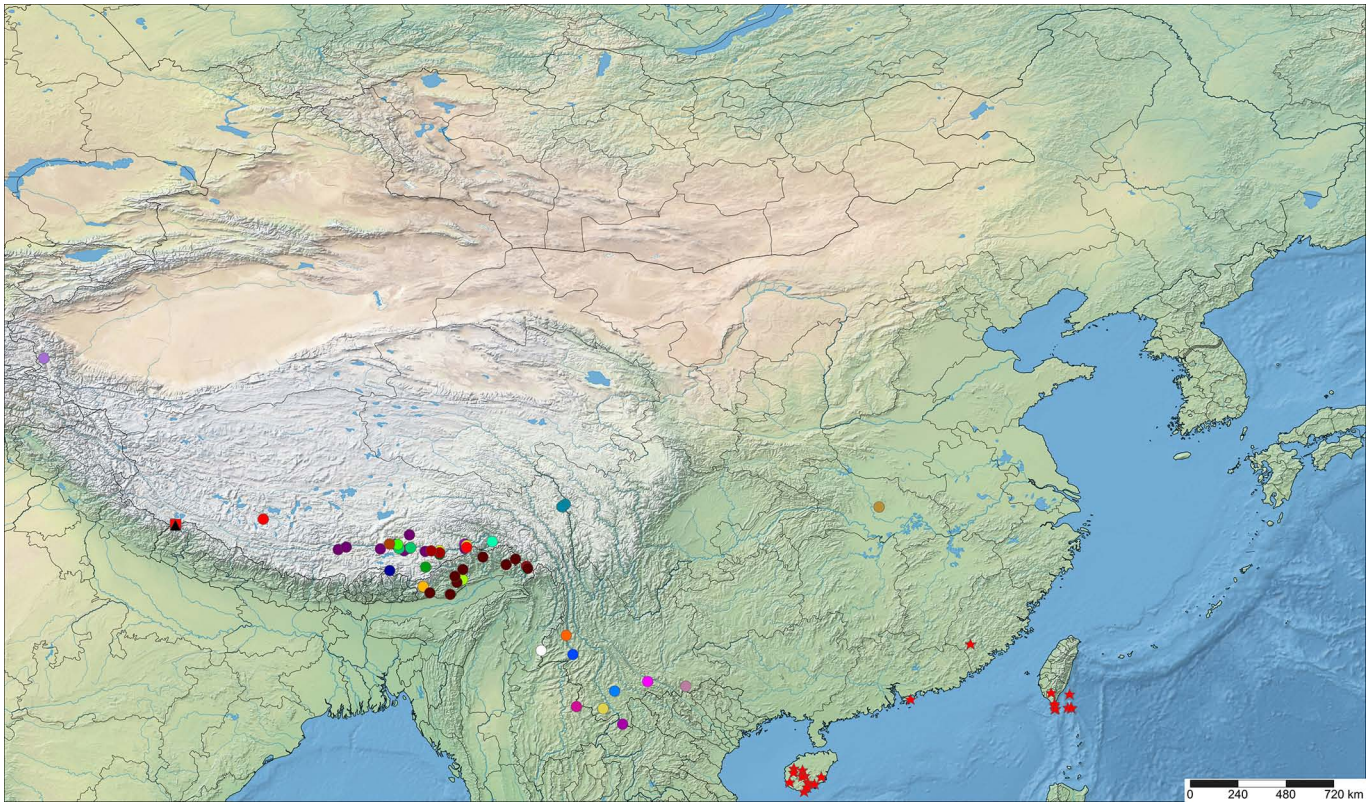

Figure 2. Map showing known distribution of the parvorder Iurida in China: *Scorpiops* (solid circle), *Liocheles* (star), "*Tibetiomachus*" (triangle), and *Deccanometrus* (square). *Scorpiops asthenurus* (●), *S. atomatus* (●, one largely covered by *S. asthenurus*), *S. hardwickii* (●), *S. ingens* (●), *S. jendeki* (●), "*S. jingshanensis*" (●), *S. kamengensis* (●), *S. kubani* (●), *S. langxian* (●, largely covered by *S. atomatus* and *S. hardwickii*), *S. leptochirus* (●), *S. lhasa* (●), *S. lii* (●), *S. luridus* (●, largely covered by *S. atomatus*), *S. margerisonae* (●), *S. novaki* (●, one largely covered by *S. asthenurus*), *S. petersii* (●, accurate location unknown), *S. puerensis* (●), *S. shidian* (●), *S. songi* (●), *S. taxkorgan* (●), *S. tibetanus* (●, one largely covered by *S. lhasa* and *S. margerisonae*, and another by *S. langxian*), *S. vachoni* (●, one largely covered by *S. langxian*), *S. validus* (●), *S. wrzecionkoi* (●, largely covered by *S. tibetanus*), *S. xui* (●), *S. yangi* (●), *S. zhangshuyuani* (○); *Liocheles. australasiae* (★); "*Tibetiomachus himalayensis*" (▲);*Deccanometrus bengalensis* (■).

to the nominotypical subgenus: *Alloscorpiops* Vachon, 1980, *Euscorpiops* Vachon, 1980, *Neoscorpiops* Vachon, 1980, *Dasyscorpiops* Vachon, 1974 and *Plethoscorpiops* Lourenço, 2017. However, this revalidation also needs further confirmation. Regarding subgenera (which by now are all but eliminated from scorpion taxonomy), Lourenço & Ythier (2022) quoted Bernardi (1983) who "...insists about the usefulness of retaining this category, when it is well defined, and in particular for genera containing several groups of species forming small evolutionary lineages, which is the case of *Scorpiops* within the Scorpiopidae...". The "small evolutionary lineages" (an undefined term), however, have never been confirmed genetically in the family Scorpiopidae. At the same time, the genus *Scorpiops* sensu lato (Scorpiopidae, excluding *Parascorpiops* Banks, 1928) was already found to be polyphyletic (Šťáhlavský et al., 2020), while Lourenço & Ythier (2022) had neither provided the subgeneric keys at the morphological level or supported their revalidation with DNA analysis. Therefore, the subgenera of *Scorpiops* will not be listed in this paper. The genus *Scorpiops* appears to be more widely distributed than currently known; several new localities have been recorded from the central China (Tang, in prep.).

Genera *Mesobuthus* Vachon, 1950 and *Olivierus* Farzanpay, 1987

Kovařík (2019) divided *Mesobuthus* Vachon, 1950 into three distinct genera based on morphology: *Mesobuthus* Vachon, 1950 *s. str*., *Olivierus* Farzanpay, 1987 and *Aegaeobuthus* Kovařík, 2019; validity of these genera is further supported by the DNA phylogeny of Štundlová et al. (2022). Several recorded Chinese species previously included in *Mesobuthus* were moved to the revalidated *Olivierus*, except for *Mesobuthus mongolicus* (Birula, 1911) and *M. thersites* (C. L. Koch, 1839). More recently, Kovařík et al. (2022) revised the genus *Mesobuthus s. str*., and synonymized *M. mongolicus* with *M. thersites* based on both morphological and molecular support, leaving the latter to be the only species of *Mesobuthus s. str*. that is found in China.

Currently, there are four valid *Olivierus* species in Xinjiang: *O. bolensis* (Sun, Zhu & Lourenço, 2010), *O. karshius* (Sun & Sun, 2011), *O. longichelus* (Sun & Zhu, 2010), and *O. przewalskii* (Birula, 1897), all of which have a generally similar appearance. The records of two more species were already confirmed to be erroneous: *O. caucasicus* (Nordmann, 1840) and *O. intermedius* (Birula, 1897); both the latter and *O. przewalskii* were described as two subspecies of the former,

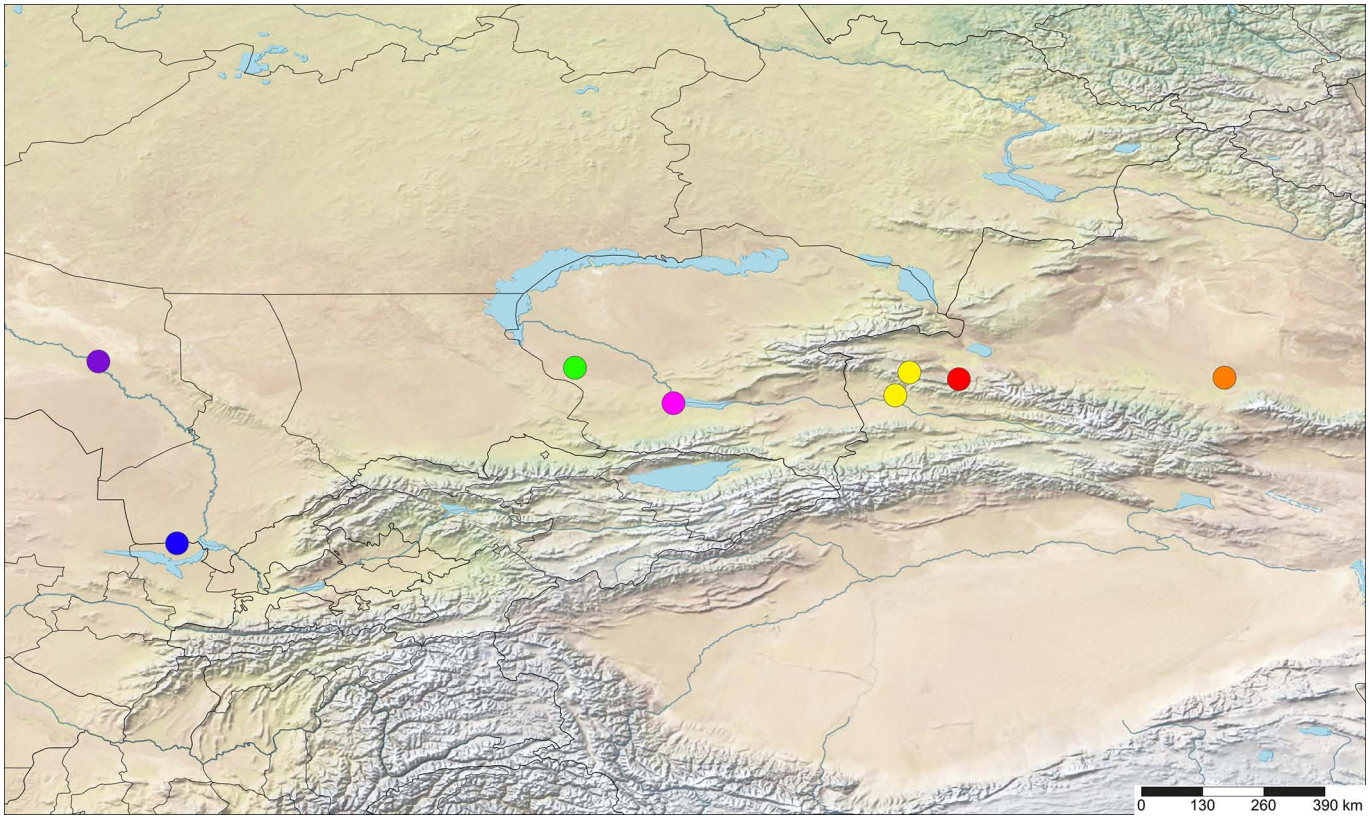

Figure 3. Map showing known localities of some *Olivierus* from China and Kazakhstan: *O. longichelus* (●), *O.* sp. (●), *O. bolensis* (●), "*M. c. intermedius*" from Kurty (●), *O. mikhailovi*/"*M. c. intermedius*" from Chardara (●), *O. tarabaevi* from Kyzylorda (type locality) (●) and *O. tarabaevi* from Kapchagai (●).

all originally in genus *Buthus*, later under *Mesobuthus* (see Fet et al., 2018; Kovařík, 2019). *O. longichelus* can be confidently distinguished from *O. przewalskii* by having a higher PTC (21–23 in female and 27–30 in male vs. 15–19 in female and 19–23 in male of *O. przewalskii*) and more rows of denticles on the pedipalp movable finger (12 in *O. longichelus* vs. 11 in *O. przewalskii*).

Olivierus bolensis, in my preliminary opinion, is very likely a junior synonym of *O. longichelus*. I have examined a series of 14 specimens of different developmental stages of an *Olivierus* sp. collected from Wujiaqu City, Changji Prefecture, Xinjiang Uygur Autonomous Region (44˚34'64.17"N 87˚64'71.69"E) in October 2021 (Figs 4, 6–7). The diagnostic characters of *O. longichelus* provided by the original authors (Sun & Zhu, 2010b: 10; Sun et al., 2010: 36) were found to be unstable. Sun & Zhu (2010b) described *Mesobuthus longichelus* (now *O. longichelus*) based on a holotype female and two juvenile paratypes (male and female). It means essentially that the description of *O. longichelus* was mainly based on a single specimen (since juvenile specimens are usually not useful in the description of scorpion morphology, most buthid species cannot be confidently identified when they are young, except for the PTC which is not influenced by age).

Later the same year, Sun et al. (2010) described another new species from Bole, Xinjiang, as *Mesobuthus bolensis* (now *Olivierus bolensis*), based on two specimens (holotype male and paratype female). The features they applied to distinguish this species from *O. longichelus* were as follows (Sun et al., 2010: 36): (i) larger size (57 mm in male and 71 mm in female of *O. bolensis* vs. 52 mm in female of *O. longichelus*); (ii) metasomal segment V coloration (without black pigment vs. with inconspicuous variegated black pigment); (iii) carapace granulation (denser in *O. bolensis*); (iv) anterior median, central median, and posterior median carinae of carapace and dorsointernal and dorsomedian carinae of patella (granular in *O. bolensis*); (v) dentation of ventrolateral carinae of metasomal segment V (more prominent in *O. longichelus*); (vi) chela length/width ratio (more robust in *O. bolensis*, 2.63 in male and 2.54 in female vs. 2.99 in female of *O. longichelus*). The second diagnostic trait is the most unreliable as the coloration of metasomal segment V can vary from almost the same yellow as in the previous segments to greyish brown (Fig. 6). I have observed this variation in the specimens with several traits consistent with either of the species (e.g., yellow segment V in some specimens that generally fit the description of *O. longichelus*). Color variation in segment V was also observed in other buthids from Xinjiang (*Mesobuthus thersites* and *Olivierus karshius*). As for the carapace granulation, I have observed specimens with an intermediate degree of granulation compared to the original drawing of both species. The pedipalp patellar carinae of all studied specimens were more akin to *O. longichelus*, formed by relatively few granules (according to the illustration comparison given in the original description of *O. bolensis*). Since the pedipalp femur was also compared in the original description of *O. bolensis*, this

Morphometric values	***"M. c. intermedius"*** China, Kazakhstan	***"M. c. intermedius"*** Kazakhstan	***O. longichelus*** China	***O. bolensis*** China
Total length ♂ (mm)	47–60	55–60	*Unknown	57
Total length ♀ (mm)	52–70	66–77	52	71
PTC ♂	21–24	26–30	27–28	28
PTC ♀	17–20	20–25	22–23	22–22
Sources	**Sun (2010)**	**Sun & Zhu (2010b)**	**Sun & Zhu (2010b)**	**Sun et al. (2010)**
Morphometric values	***O. intermedius*** Tajikistan	***O. mikhailovi*** Uzbekistan, Kazakhstan	***O. tarabaevi*** Kazakhstan	***Olivierus* sp.** China
Total length ♂ (mm)	55–70	50–52	48	55–59
Total length ♀ (mm)	55–70	68–75	64–66	56
PTC ♂	21–23	26–28	24–27	27–30
PTC ♀	17–19	21–23	19–22	21–23
Sources	**Fet et al. (2018)**	**Fet et al. (2021)**	**Fet et al. (2021)**	**This study**

Table 1. Comparative morphometric values for some *Olivierus* species.

character was also examined which again yielded a similarity to *O. longichelus*. Many specimens exhibited the pattern of dentition of ventrolateral carinae of metasomal segment V of *O. bolensis*, while most of the other traits (e.g., coloration of segment V, granulation of carapace and carinae) were in accordance with *O. longichelus*. Since some specimens were observed with different degrees of the lobe size on both sides, the relatively reduced lobes may be due to the abrasion against rocks (this species digs burrows). Even in the same individual, these lobes may vary in size and number on both sides. The differences in the total length and chela length/width ratio, used as diagnostic characters in the original description, may result from the probability that the holotype female of *O. longichelus* was juvenile (possibly a second-to-last instar). This also can thus explain its relatively small size and higher chela length/width ratio. No adult specimen was found to fit within the shape of the chela and the degree of development of the basal lobe on the movable finger originally illustrated for *O. longichelus*. Both the shape and development degree are positively correlated with the body size which generally corresponds with the age. The determination of maturity is simple for males as they have a pronounced basal lobe on the pedipalp movable finger. Females do not show a sharp shift in the development of this character; however, they still differ from most of the juveniles. The determination of juveniles, on the other hand, was mainly based on the total length and prominence of the basal lobe. However, the development of the basal lobe may present in the early instar (although relatively weak), which exacerbates the difficulty in distinguishing juveniles and adults.

Additionally, the holotype male of *O. bolensis* had only one side of complete pectines and the PTC of 28 (and 22 in female, on both sides). The PTC for the type specimens of *O. longichelus* is 27–28 for male and 22–23 for female, which overlaps with that of *O. bolensis*. The numbers of the rows of denticles on the pedipalp movable finger were also the same (12). In my opinion, *O. bolensis* and *O. longichelus* are likely to be conspecific due to their largely overlapped morphometric values and intraspecific variation. However, the specimens used for my examination did not originate from the type localities of both species (although within the distribution range of the congeners in Xinjiang; about 418 km for *O. bolensis*, and 372 km for *O. longichelus*). The holotypes of these species are currently unavailable for study. Therefore, no formal synonymization is provided in the present paper, but it is important that the validity of several *Olivierus* species found in China requires a detailed revision (as well as those of *Scorpiops*).

The true identity of the taxon misidentified as "*Mesobuthus caucasicus intermedius*" in China (Xinjiang) (Sun, 2010: 74, figs. 34, 35a–h, 36a–f; Sun & Zhu, 2010b: 3, figs. 2, 11–13; Sun & Sun, 2011: 61, figs 3–4, 10; Di et al., 2014: 7) is unclear. To begin with, in Sun's dissertation (2010: 74), the Chinese "*M. c. intermedius*" were collected in 2006 from Yining City (1 female and 1 male), and in 2007 from Bole City (1 male). He also examined 7 females and 7 males from Kazakhstan (Chardara District and Kurty District). Later, in Sun & Zhu (2010b) where they described *O. longichelus*, they only examined 5 females and 6 males from Kazakhstan, but the PTC data were very different from those of Sun (2010) (see Table 1). However, these materials were part of the Kazakhstan specimens examined by Sun (2010), so the PTC data range in Sun (2010) should have been inclusive rather than smaller than that of Sun & Zhu (2010b). As a result, it is unclear if Sun had properly examined and documented either the Chinese materials, or those from Kazakhstan. In 14 specimens from Xinjiang that I have studied (see above), the PTC range was very close to that given for the "*M. c. intermedius*" from Kazakhstan by Sun & Zhu (2010b) (see Table 1).

Sun & Zhu (2010b: 6) distinguished *O. longichelus* and "*M. c. intermedius*" by the shape of chela, the median lateral

Figure 4. Examined specimens of *Olivierus* sp. (cf. *longichelus*) from Wujiaqu City, Changji Prefecture, Xinjiang Uygur Autonomous Region. **Figure 4a**. Juveniles. **Figure 4b**. Subadults. **Figure 4c**. Adults.

Figure 5. Examined specimens of *Mesobuthus thersites* from Urumqi County, Urumqi Municipality, Xinjiang Uygur Autonomous Region. **Figure 5a**. Typical morph. **Figure 5b**. Dark morph.

carinae (= lateral inframedian carinae) of metasomal segment II and III, and the shape of ventrolateral carinae of metasomal segment V. As discussed above, the holotype female of *O. longichelus* could most possibly be a second-to-last instar individual, which could explain its peculiar chela length/width ratio and comparatively small body size. The lateral inframedian carinae on the metasomal segment II and III were characterized by "...only with sparse granules and covered 1/3

Figure 6. Color variation in *Olivierus* sp. (cf. *longichelus*).

length of segment on II, and obsolete, remaining 1–3 granules at distal end on III..." in "*M. c. intermedius*" and "...only with sparse granules and covered 1/2–2/3 length of segment on II and obsolete, remaining 1–2 granules at distal end on III" in *O. longichelus*. However, based on the current examination, these differences could have resulted from intraspecific variation and thus are not reliable. The final difference, the shape of ventrolateral carinae of metasomal segment V, which could be the size of the lobes/granules according to the original illustration, might also result from intraspecific variation.

Fet et al. (2018) limited *Olivierus intermedius* (Birula, 1897) (as *Mesobuthus intermedius*) to Tajikistan. The localities in Kazakhstan that were mentioned in Chinese works under "*M. c. intermedius*" currently fall into the range of two cryptic species described by Fet et al. (2021), *Olivierus mikhailovi* (type locality in Buxoro Province, Uzbekistan; also found in Chardara, Kazakhstan) and *O. tarabaevi* (type locality in Shieli (Chiili) District, Kyzylorda Province, Kazakhstan; also found in Qonaev (as Kapshagay), Almaty Province). The PTC reported for both species were closer to the data give by Sun & Zhu (2010b) than to those by Sun (2010) (see Table 1). These morphologically similar species probably can only be identified by molecular characters; and their relationship with *O. longichelus* remains to be further studied. All the localities of the relevant specimens are plotted in Figure 3 for distributional information; however, this map excludes the "*M. c. intermedius*" reported from China (Bole and Yining, Xinjiang) as accurate coordinates are unknown.

Sun & Sun (2011) described *Olivierus karshius* (as *Mesobuthus karshius*) from Shache County, Karshi District, Xinjiang, based on a holotype female and 44 paratypes (17 males and 27 females). The total lengths were recorded as 46–62 mm in males and 56–72 mm in females; PTC 19–23 in females and 23–28 in males; dorsal margins of pedipalp movable finger with 12 oblique rows of denticles. The authors only compared this new species in detail with *O. przewalskii* (as *M. caucasicus przewalskii*), "*M. c. intermedius*" and *O. parthorum* (Pocock, 1889) (as *M. c. parthorum*). As limited by Fet et al. (2018), *O. parthorum* is only recorded from Afghanistan, Iran, and Turkmenistan, and will not be discussed here. The examined specimens of "*M. c. intermedius*", which were said to originate from both China (Bole and Yining) and Kazakhstan (Sun & Sun, 2011: 61). They used four characters to distinguish *O. karshius* from the "*M. c. intermedius*": (i) PTC (23–28 in males and 19–23 in females in *O. karshius* vs. 26–30 in males and 20–25 in females of the identified "*M. c. intermedius*"); (ii) irregular net-like dark pigmentation on chela, dorsal surfaces of segments I–V on metasoma and ventral surface of segment V (absence vs. presence); (iii) outer accessory denticles on pedipalp fingers (uniform from base to tip (not becoming smaller) and nearly same as inner accessory denticles on the tip in size vs. becoming markedly smaller from base to tip, and obviously smaller than inner accessory denticles on the tip); (iv) the two longitudinal rows of setae on tarsus of legs (short vs. long). For the PTC data in Sun & Sun (2011), it seems that the data range (a combination of the Chinese and Kazakhstan materials) is the same with that of Sun & Zhu (2010b) (only included part of the Kazakhstan materials), while inconsistent with the range reported by Sun (2010) (also a combination of the materials from both countries). I do not understand the definition of "irregular net-like dark pigmentation", but there are stripes on the mentioned surfaces in the specimens from Xinjiang that I have studied. The other two characters will be discussed in the following paragraph.

For *Olivierus karshius*, Sun & Sun (2011: 67) also noted in their discussion of intraspecific variation "...Several individuals with light brown to brownish-yellow pigmentation on the ventral surfaces of metasoma segment V, and most individuals without...". This is identical with what I have observed in the specimens from Xinjiang, which I identified as *O. longichelus*. However, in the dichotomic keys of Sun & Sun (2011: 73), *O. karshius* was assigned to a group of species *without* brown pigment on the ventral surface of metasomal segment V. As for the potential differences in the ratio of pedipalp chela and metasomal segment V, according

Figure 7. Subadult and adult comparison of *Olivierus* sp. (cf. *longichelus*). **Figure 7a**. Females. **Figure 7b**. Males.

to the original drawing of *O. karshius* (Sun & Sun, 2011: 65, fig 5; 66, fig 6g), it seems that this species has relatively robust pedipalp chelae and metasomal segments, which is close to that of *O. przewalskii* (Sun & Sun, 2011: 64, fig 4g, i). However, after calculating the morphometric values provided in the table of the original paper by Sun & Sun (2011: 62, table 1), I obtained the chela length/width ratio of 3.95 in paratype male and 3.83 in the holotype female of *O. karshius*. This

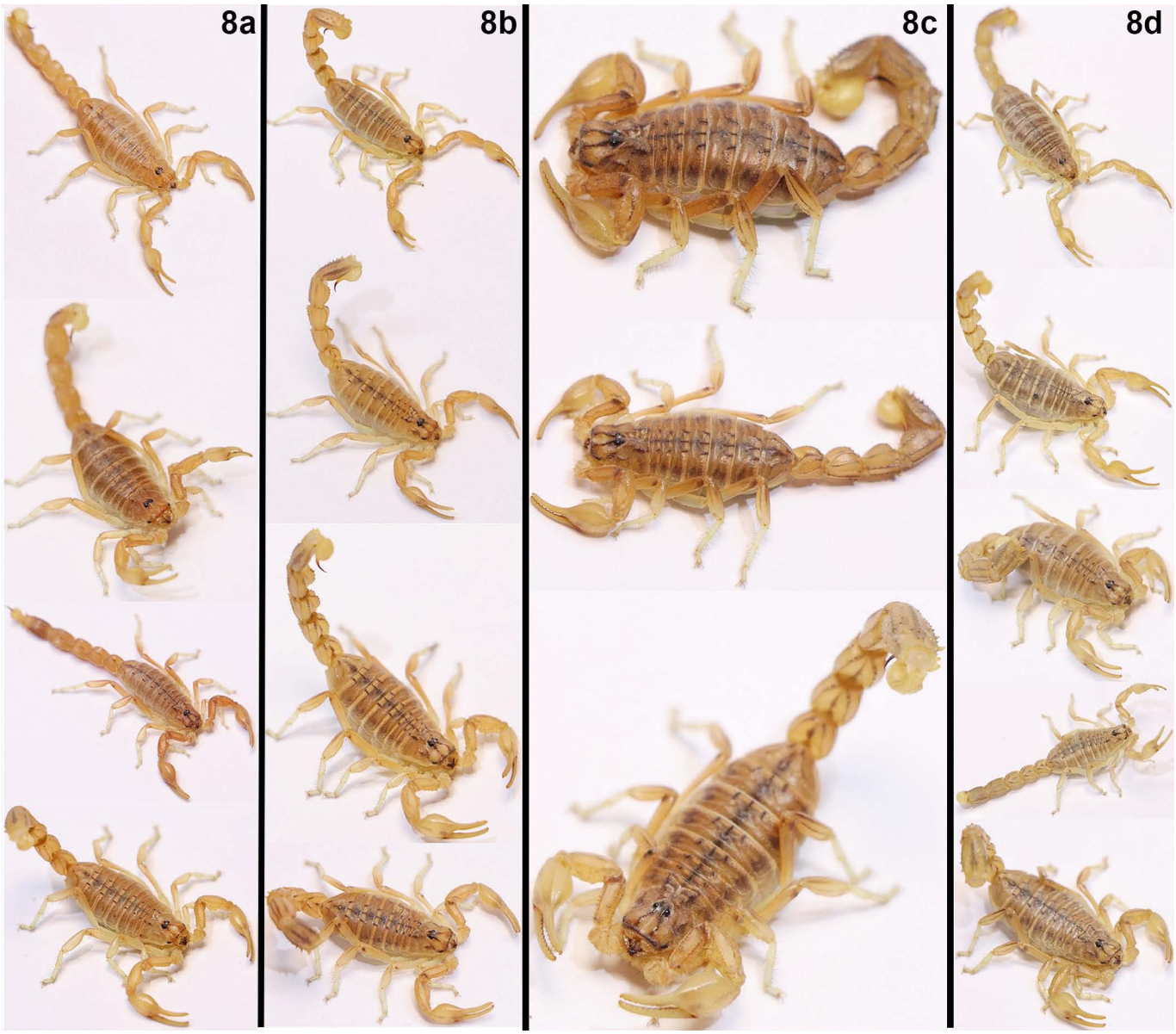

Figure 8. Color variation in the typical morph of *Mesobuthus thersites*. **Figures 8a–8b**. Juveniles. **Figure 8c**. Variegated adults. **Figure 8d**. Normal adults.

means a rather slender chela, even much more slender than the 2.99 ratio calculated for *O. longichelus*—which could be a potential reason for Sun & Sun (2011) not having compared it with their new species. This issue could result from the method they applied for measurement, which can be easily influenced by a tiny angular deviation. I calculated the ratio for "*M. c. intermedius*" from the same table which turns out to be 3.87 in male and 4.40 in female. Therefore, the seemingly robust chelae presented in the original illustration are actually similar to those in the so-called "*M. c. intermedius*" (the length/depth ratio of metasomal segment V yielded an analogous similarity: 2.32 in male and 2.48 in female vs. 2.47 in male and 2.57 in female). Although Sun & Sun (2011) did not compare their new species with *O. longichelus*, two diagnostic characters, inferred from their dichotomic keys (Sun & Sun, 2011: 73) and the original diagnosis for *O. longichelus* (Sun & Zhu, 2010b: 5, 6), can be used (except for the coloration of metasomal segment V): (i) lobes of ventrolateral carinae on metasomal segment V and (ii) two longitudinal rows of setae on tarsus of legs. My observations of the specimens from Xinjiang, however, indicate that both size and shape of lobes of ventrolateral carinae on metasomal segment V can vary within a population. As a result, *O. karshius* may differ from *O. longichelus* based on the following characters: (i) the two longitudinal rows of setae on tarsus of legs (short in *O. karshius* vs. long in *O. longichelus*); (ii) outer accessory denticles on pedipalp fingers (no size difference in *O. karshius* vs. becoming smaller towards the tip in *O. longichelus*); (iii) aculeus length (slightly more than a half of telson length in *O. karshius* vs. markedly more than a half of telson length in *O. longichelus*). The PTC may also serve as an additional character. Although the two species overlap in PTC, the

Figure 9. Color variation in the dark morph of *Mesobuthus thersites*. **Figure 9a–9b**. Juveniles. **Figure 9c**. Darker adults. **Figure 9d**. Lighter adults.

variation range is greater in *O. karshius* (but may still be influenced by the sample size I have examined.

Zhang (2009) described two new buthid species from Xinjiang in his unpublished master's thesis (in Chinese), named "*Mesobuthus beijiangensis*" (from Beijiang, Urumqi County) and "*Mesobuthus nanjiangensis*" (from Nanjiang, Toksun County). These two names are not available according to the ICZN, and do not enter synonymy, since they were never properly published; these populations were not revised thereafter. According to Zhang (2009), "*Mesobuthus nanjiangensis*" was based upon 20 males and 33 females (including a "holotype" female, 5 "paratype" females and 5 "paratype" males; Museum of Hebei University, Baoding; MHBU). The total lengths were 39–57 mm and 40–67 mm, respectively; PTC was 18–24 in males and 16–21 in females. The only species that it differed from according to Zhang (2009), was *Olivierus caucasicus* (which, at that time, included *O. przewalskii*). Only three diagnostic features were used for this "new species": (i) metasomal segment V with dark pigment; (ii) pedipalp patella and manus with black streak; (iii) pedipalp movable finger with 11 rows of denticles. However, (ii) and (iii) fit well with in the redescription of *O. przewalskii* published by Zhang et al. (2020). Additionally, the PTC of both species overlap greatly. The coloration of the metasomal segment V was not described in the redescription of *O. przewalskii*, yet according to the previous papers (Sun & Zhu, 2010b; Sun & Sun, 2011), this species does possess the "irregular net-like dark pigment". The only potential difference would only be the total length (50–61 mm in male and 53–75 mm in female for *O. przewalskii*, in its redescription by Zhang et al., 2020). The total length, however, was not always consistent in the papers as Sun & Zhu (2010b) recorded 50–68 mm in male and 68–78 mm in female. Some of the data of "*M. nanjiangensis*" overlap with that of *O. przewalskii*. The disparity in the lower limit may be due to the possibility that some of the specimens were juvenile. Since most of the diagnostic characters accord with *O. przewalskii*, it is most likely that "*M. nanjiangensis*" belongs to this species.

"*Mesobuthus beijiangensis*" was based upon 27 males and 40 females (including a "holotype" female, 9 "paratype" females and 6 "paratype" males; MHBU). Zhang (2009) associated his "new species" with *Mesobuthus thersites* (then under *M. eupeus*) and distinguished it from the latter by three features: (i) dorsal carinae of metasomal segment II, II, IV obsolete with the granules reduced in quantity; (ii) ventrolateral carinae of metasomal segment V crenulate, granules regularly increasing backwards with 3-5 of them significantly enlarged and lobate; (iii) all surfaces of metasoma with irregularly steady form of black pigment. According to Zhang's description of overall coloration (especially the prosoma, mesosoma and metasoma), this species could most

Figure 10. Color comparison in the typical morph of *Mesobuthus thersites*: a normal adult female vs. an orange juvenile (above); the same normal adult female vs. a variegated adult female (below).

potentially be a dark morph (phenotype) of *M. thersites*. The typical color morph is hereby defined as: basic color yellow, usually with obvious spots or stripes mainly on the mesosoma (Figs 5A, 8, 10); the dark morph is defined as: basic color greyish yellow to greyish brown, without obvious decorations on the mesosoma (Figs 5B, 9). However, I have found no difference between the dark morph and the typical morph in carination and granulation when studying adult specimens from Urumqi County, Urumqi Municipality, Xinjiang Uygur Autonomous Region (43°67'52.61"N 87°35'31.29"E) (n= 33 for typical form, n = 31 for dark form) (Figs 5, 8–10). Even within the same color form, there was a variation in number and prominence of granules, as well as in all the other characters. It is obvious that "*M. beijiangensis*" is conspecific with *M. thersites*.

Finally, *Olivierus hainanensis* (Birula, 1904) (= *Buthus confucius hainanensis* Birula, 1904) is omitted from the list and the map (Fig. 1) as it is likely to be a synonym of *O. martensii* (Karsch, 1879). Birula (1904) studied the specimens labeled "Hainan" and collected by Alfred Otto Herz (St. Petersburg, Russia), and described them as the subspecies of *Buthus confucius* Simon, 1880 (= *Olivierus marternsii*), but did not provide any detailed description or comparisons. Kovařík (2019) published photographs of the syntypes and elevated it to the species rank but did not provide a redescription. According to the study of the distribution pattern of *O. martensii* by Shi et al. (2007), the type locality (Hainan Province) of *O. hainanensis* is almost certainly mislabeled and in fact possibly reflects Henan Province. Since re-examination of Birula's syntypes is warranted, this presumed synonymy is not formally introduced in the present paper.

List of scorpion species currently recorded from China, with their Chinese name equivalents:
(*dubious records, # new localities, ★ species endemic to China)

杀牛蝎小目**Parvorder Buthida Soleglad & Fet, 2003**
杀牛蝎超科**Superfamily Buthoidea C. L. Koch, 1837**
杀牛蝎科**Family Buthidae C. L. Koch, 1837**
霍屯督蝎属**Genus *Hottentotta* Birula, 1908**
宋氏霍屯督蝎*Hottentotta songi* (Lourenço, Qi & Zhu, 2005) [Xizang] ★
等蝎属**Genus *Isometrus* Ehrenberg, 1828**
斑等蝎*Isometrus maculatus* (DeGeer, 1778) [Hainan] (also found in Taiwan)
信使蝎属**Genus *Lychas* C. L. Koch, 1845**
尖刺信使蝎*Lychas mucronatus* (Fabricius, 1798) [Fujian #; Guangxi; Guangzhou #; Hainan; Yunnan]
纤细信使蝎*Lychas scutilus* C. L. Koch, 1845 [Shanghai (extinct)]
中杀牛蝎属**Genus *Mesobuthus* Vachon, 1950**
斗士中杀牛蝎*Mesobuthus thersites* (C. L. Koch, 1839) [Gansu; Inner Mongolia; Ningxia; Xinjiang]
奥氏蝎属**Genus *Olivierus* Farzanpay, 1987**
博乐奥氏蝎*Olivierus bolensis* (Sun, Zhu & Lourenço, 2010) [Xinjiang] ★
喀什奥氏蝎*Olivierus karshius* (Sun & Sun, 2011) [Xinjiang] ★
长螯奥氏蝎*Olivierus longichelus* (Sun & Zhu, 2010) [Xinjiang] ★
马氏奥氏蝎*Olivierus martensii* (Karsch, 1879) [Anhui; Beijing; Fujian; Hebei; Henan; Hubei; Inner Mongolia; Jiangsu; Liaoning; Ningxia #; Qinghai #; Shaanxi #; Shandong; Shanxi; Sichuan; Tianjin #]
普氏奥氏蝎*Olivierus przewalskii* (Birula, 1897) [Gansu; Inner Mongolia; Xinjiang]
拉兹蝎属**Genus *Razianus* Farzanpay, 1987**
新疆拉兹蝎*Razianus xinjianganus* Lourenço, Sun & Zhu, 2010 [Xinjiang] ★
雷氏蝎属**Genus *Reddyanus* Vachon, 1972**
海南雷氏蝎*Reddyanus hainanensis* (Lourenço, Qi & Zhu, 2005) [Hainan] ★
西藏雷氏蝎*Reddyanus tibetanus* (Lourenço & Zhu, 2008) [Xizang] ★
寇里蝎超科**Superfamily Chaeriloidea Pocock, 1893**
寇里蝎科**Family Chaerilidae Pocock, 1893**
寇里蝎属**Genus *Chaerilus* Simon, 1877**
阿萨姆寇里蝎*Chaerilus assamensis* Kraepelin, 1913 [Xizang * (as *C. dibangvalleycus* Bastawade, 2006)]
贝形寇里蝎*Chaerilus conchiformus* Zhu, Han & Lourenço, 2008 [Xizang] ★
米林寇里蝎*Chaerilus mainlingensis* Di & Zhu, 2009 [Xizang] ★
拟贝形寇里蝎*Chaerilus pseudoconchiformus* Yin, Qiu, Pan, Li & Di, 2015 [Xizang] ★
格纹寇里蝎*Chaerilus tessellatus* Qi, Zhu & Lourenço, 2005 [Xizang] ★
三肋寇里蝎*Chaerilus tricostatus* Pocock, 1899 [Xizang]
忒氏寇里蝎*Chaerilus tryznai* Kovařík, 2000 [Xizang]
瑞氏寇里蝎*Chaerilus wrzecionkoi* Kovařík, 2012 [Xizang] ★
拟蛮蝎超科**Superfamily Pseudochactoidea Gromov, 1998**
拟蛮蝎科**Family Pseudochactidae Gromov, 1998**
穴甘蒙蝎亚科**Subfamily Troglokhammouaninae Lourenço, 2007**
钳蝎属**Genus *Qianxie* Tang, 2022**
索氏钳蝎*Qianxie solegladi* Tang, 2022 [Sichuan *; Yunnan] ★
毒尾蝎小目**Parvorder Iurida Soleglad & Fet, 2003**
蛮蝎超科**Superfamily Chactoidea Pocock, 1893**
类蝎科**Family Scorpiopidae Kraepelin, 1905**
类蝎属**Genus *Scorpiops* Peters, 1861**
弱尾类蝎*Scorpiops asthenurus* Pocock, 1900 [Xizang *]
黑斑类蝎*Scorpiops atomatus* Qi, Zhu & Lourenço, 2005 [Xizang] ★
哈氏类蝎*Scorpiops hardwickii* (Gervais, 1843) [Xizang]
硕大类蝎*Scorpiops ingens* Yin, Qiu, Pan, Li & Di, 2015 [Xizang] ★
詹氏类蝎*Scorpiops jendeki* Kovařík, 2000 [Yunnan] ★
卡蒙类蝎*Scorpiops kamengensis* (Bastawade, 2006) [Xizang *]
库氏类蝎*Scorpiops kubani* (Kovařík, 2004) [Yunnan]
朗县类蝎*Scorpiops langxian* Qi, Zhu & Lourenço, 2005 [Xizang] ★
瘦螯类蝎*Scorpiops leptochirus* Pocock, 1893 [Xizang *]

拉萨类蝎*Scorpiops lhasa* Di & Zhu, 2009 [Xizang] ★
李氏类蝎*Scorpiops lii* (Di & Qiao, 2020) [Xizang] ★
浅黄类蝎*Scorpiops luridus* Qi, Zhu & Lourenço, 2005 [Xizang] ★
玛氏类蝎*Scorpiops margerisonae* Kovařík, 2000 [Xizang] ★
诺氏类蝎*Scorpiops novaki* (Kovařík, 2005) [Xizang] ★
佩氏类蝎*Scorpiops petersii* Pocock, 1893 [Sichuan *; Xizang]
普洱类蝎*Scorpiops puerensis* (Di, Wu, Cao, Xiao & Li, 2010) [Yunnan] ★
施甸类蝎*Scorpiops shidian* (Qi, Zhu & Lourenço, 2005) [Yunnan] ★
宋氏类蝎*Scorpiops songi* Di & Qiao, 2020 [Xizang] ★
塔什库尔干类蝎*Scorpiops taxkorgan* Lourenço, 2018 [Xinjiang] ★
西藏类蝎*Scorpiops tibetanus* Hirst, 1911 [Xizang] ★
瓦氏类蝎*Scorpiops vachoni* (Qi, Zhu & Lourenço, 2005) [Xizang *; Yunnan] ★
强壮类蝎*Scorpiops validus* (Di, Cao, Wu & Li, 2010) [Yunnan] ★
瑞氏类蝎*Scorpiops wrzecionkoi* Kovařík, 2020 [Xizang] ★
徐氏类蝎*Scorpiops xui* (Sun & Zhu, 2010) [Yunnan] ★
杨氏类蝎*Scorpiops yangi* (Zhu, Zhang & Lourenço, 2007) [Yunnan] ★
张氏类蝎*Scorpiops zhangshuyuani* (Ythier, 2019) [Yunnan] ★
京山类蝎*Scorpiops* sp. ["*Scorpiops jingshanensis* Li, 2016", *nomen nudum*] [Hubei] ★

蝎超科**Superfamily Scorpionoidea Latreille**, **1802**
链尾蝎科**Family Hormuridae Laurie**, **1896**
藏毒勇蝎属**Genus *Tibetiomachus* Lourenço & Qi**, **2006** (*nomen dubium*)

喜山藏毒勇蝎*Tibetiomachus himalayensis* Lourenço & Qi, 2006 (*nomen dubium*) [Xizang] ★

滑螯蝎属**Genus *Liocheles* Sundevall**, **1833**

南亚滑螯蝎*Liocheles australasiae* (Fabricius, 1775) [Fujian #; Hainan; Hongkong #] (also found in Taiwan #)

蝎科**Family Scorpionidae Latreille**, **1802**
异距蝎亚科**Subfamily Heterometrinae Simon**, **1879**
德干异距蝎属**Genus *Deccanometrus* Prendini & Loria**, **2020**

孟加拉德干异距蝎*Deccanometrus bengalensis* (C. L. Koch, 1841) (as *Heterometrus tibetanus* Lourenço, Qi & Zhu, 2005) [Xizang]

Acknowledgments

I would like to thank Wenxuan Dong (董文萱) for his help in gathering the information on some new localities. My gratitude also goes to František Kovařík, who has been working tirelessly in arranging the journal articles. I also thank Professor Victor Fet for his constant support in my study of scorpiology, and an anonymous reviewer for valuable comments.

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