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The genus *Chaerilus* Simon, 1877 (Scorpiones: Chaerilidae) in China, with a description of the female of *C. tricostatus* Pocock, 1899

Род *Chaerilus* Simon, 1877 (Scorpiones: Chaerilidae) в Китае с описанием самки *C. tricostatus* Pocock, 1899

Zhi-Yong Di[1], Ying-Liang Wu[1], Zhi-Jian Cao[1], Li-Qing Fan[2] & Wen-Xin Li[1]*
Жи-Юн Ди, Йинь-Лиань Ву, Жи-Джиан Као, Ли-Кинь Фан, Вен-Син Ли

[1]College of Life Sciences, Wuhan University, Wuhan 430072, China.
[2]Institute of Tibetan Plateau Ecology, Tibet Agricultural and Animal Husbandry College, Nyingchi, Xizang, 860000, China.
*Correspondence author: Wen-Xin Li (liwxlab@whu.edu.cn).

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КЛЮЧЕВЫЕ СЛОВА: Chaerilidae, *Chaerilus*, Китай, скорпион, таксономия.

ABSTRACT. A list, a key and distributions of the seven Chinese species of the genus *Chaerilus* Simon, 1877 are provided. The female *C. tricostatus* Pocock, 1899 collected from Xizang is described and figured for the first time.

РЕЗЮМЕ. Представлены список, ключ и данные о распространении семи видов скорпионов рода *Chaerilus* Simon, 1877 встречающихся в Китае. Впервые проиллюстрирована самка *C. Tricostatus* Pocock, 1899, собранная в Тибете.

Introduction

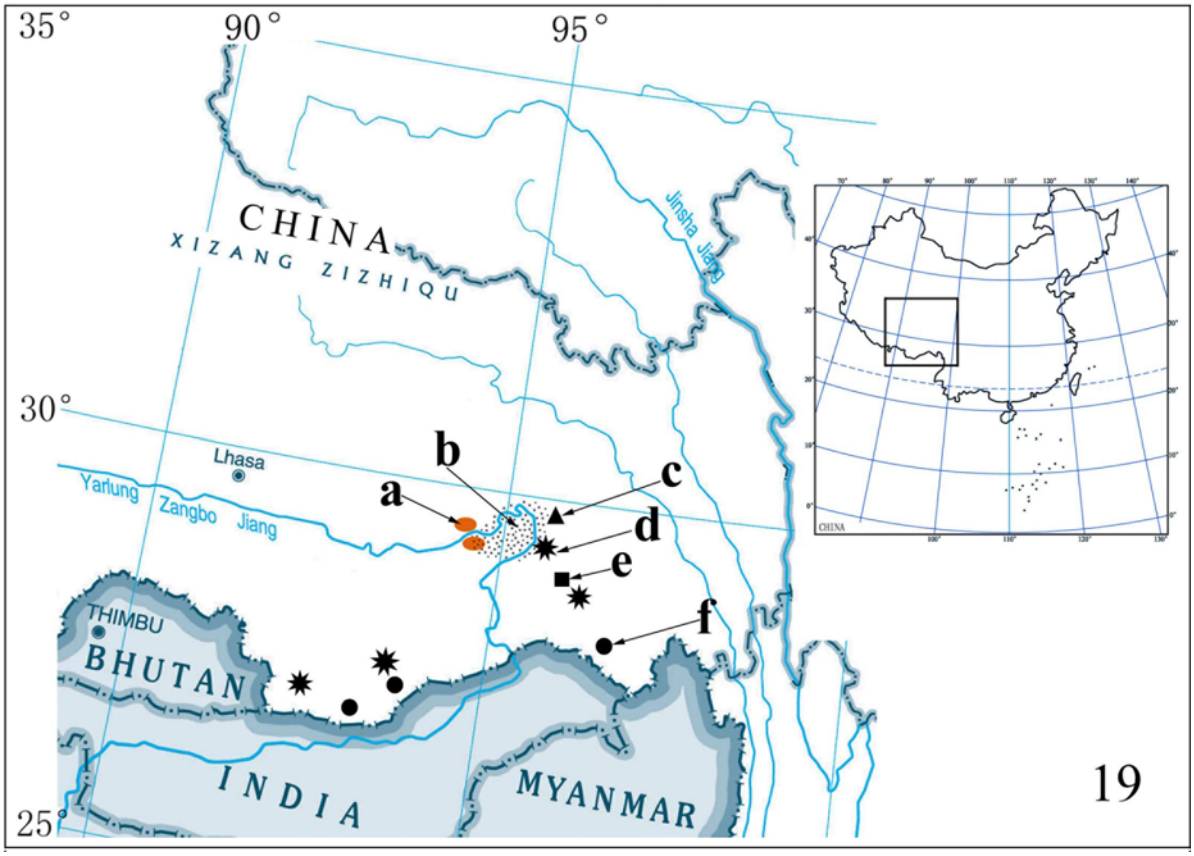
Chaerilidae differs from the other families in Scorpiones in having type B trichobothrial arrangement instead of type A, type C and type D arrangements in other Recent scorpions [Vachon, 1974; Soleglad & Fet, 2001].

According to the Catalog of Scorpions of the World [Fet, 2000], Chaerilidae includes 21 species in the single genus *Chaerilus* Simon, 1877. Kovařík [2000] recognized 18 species in the genus. Recently the taxonomy of *Chaerilus* was discussed by a number of researchers [Fet, 2003; Qi, Zhu & Lourenço, 2005; Lourenço & Zhu, 2008; Lourenço & Ythier, 2008; Zhu et al., 2008; Lourenço, 2009]. As a result, the number of species placed in the genus *Chaerilus* has increased to 28 species as follows: *C. agilis* Pocock, 1899, *C. assamensis* Kraepelin, 1913, *C. cavernicola* Pocock, 1894, *C. celebensis* Pocock, 1894, *C. ceylonensis* Pocock, 1894, *C. chapmani* Vachon & Lourenço, 1985, *C. conchiformus* Zhu, Han & Lourenço, 2008, *C. dibangvalleycus* Bastawade, 2006, *C. insignis* Pocock, 1894, *C. laevimanus* Pocock, 1899, *C. laoticus* Lourenço & Zhu, 2008, *C. lehtrarensis* Khatoon, 1999, *C. ojangureni* Kovařík, 2005, *C. petrzelkai* Kovařík, 2000, *C. philippinus* Lourenço & Ythier, 2008, *C. pictus* (Pocock, 1890), *C. rectimanus* Pocock, 1899, *C. robinsoni* Hirst, 1911, *C. sabinae* Lourenço, 1995, *C. sejnai* Kovaøík, 2005, *C. telnovi* Lourenço, 2009, *C. tessellatus* Qi, Zhu & Lourenço, 2005, *C. tichyi* Kovařík, 2000, *C. tricostatus* Pocock, 1899, *C. truncatus* Karsch, 1879, *C. tryznai* Kovařík, 2000, *C. variegatus* Simon, 1877 and *C. vietnamicus* Lourenço & Zhu, 2008. Among above mentioned species, seven species have so far been recorded from the Xizang region in China: *C. assamensis, C. conchiformus*, *C. dibangvalleycus*, *C. pictus*, *C. tessellatus*, *C. tricostatus,* and *C. tryznai*.

C. tricostatus was originally described by Pocock [1899] (from one male, India, Assam, Sadiya), who then provided a further description [Pocock, 1900]. Tikader & Bastawade [1983] redescribed its male holotype and provided much more detailed information. Kovařík [2000] recorded the female of *C. tricostatus* (from China, Xizang, Abor) for the first time, but did not provide a detailed description in the revision of family Chaerilidae.

Methods

Illustrations and measurements were made using a TTL-II stereomicroscope with an Abbe drawing tube and an ocular micrometer. Measurements follow Sissom [1990] and are in mm. Trichobothrial



Map. 1. Map of China (Tibet and Yunan), showing the localities of the *Chaerilus* species. Map abbreviations: a (ellipse) *C. conchiformus*; b (macula) *C. tessellates*; c (triangle) *C. tryznai*; d (star) *C. tricostatus*; e (square) *C. dibangvalleycus* and f (round) *C. pictus*. *C. assamensis* without a determined locality.

Карта. 1. Карта Китая (Тибет и Юньнань). Показаны места находок видов рода *Chaerilus*: a (овал) *C. conchiformus*; b (точки) *C. tessellates*; c (треугольник) *C. tryznai*; d (звезда) *C. tricostatus*; e (квадрат) *C. dibangvalleycus* and f (кружок) *C. pictus*.

notations follow Vachon [1974] and morphological terminology mostly follows Hjelle [1990]. The terminology of metasomal carination follow Vachon [1952] and the terminology of pedipalp chela carinae follow Prendini [2000] and Soleglad & Sissom [2001]. Research materials have been deposited in the Museum of Wuhan University, Wuhan, China (MWHU).

Taxonomy

Family Chaerilidae Pocock, 1893

Genus *Chaerilus* Simon, 1877

Chaerilus Simon, 1877: 238; Kraepelin, 1899: 157; Pocock, 1900: 53; Vachon, 1974: 912; Fet, 2000: 323; Kovařík, 2000: 38; 2005: 1; Qi, Zhu & Lourenço, 2005: 29; Lourenço & Zhu, 2008: 462.

Type species: *Chelomachus birmanicus* Thorell, 1889 (=*C. variegatus* Simon, 1877).

DIAGNOSIS. All four teeth on the fixed finger of chelicera are distinct (i.e., the median and basal teeth do not form a bicusp): the movable finger has one subdistal and one basal tooth on the external margin; the external distal tooth smaller than the internal one; the internal margin with distinct serration or a row of small teeth. The trichobothrial pattern is Type B. The coxapophyses have broadly expanded anterior lobes. The sternum is subpentagonal. The legs lack tibial spurs, but both prolateral and retrolateral pedal spurs are present. Tarsi bear two rows of ventral setae and a median row of spinules. The telson is without a subaculear tubercle [Qi et al., 2005].

Key to species of the genus *Chaerilus* in China

1. Movable finger of pedipalp with 7–8 rows of granules 2
– Movable finger of pedipalp with 10–14 rows of granules .. 5
2. Anterior margin of carapace straight in both sexes 3
– Anterior margin of carapace of male carapace arched (Fig. 3b in Kraepelin, 1913: 141) ..... *C. assamensis*
3. Chela length to width ratio in adults 1.6–1.8 .... *C. conchiformus*
– Chela length to width ratio in adults greater than 2.0 4
4. Ventral side of seventh mesosomal segment with many granules but without carina ..... *C. tryznai*
– Ventral side of seventh mesosomal segment with 2 pairs of granular carinae, only on posterior portion, posterior

and lateral margins finely granular .... *C. dibangvalleycus*

5.Movable finger of pedipalp with 13–14 rows of granules; telson of male rather long and about 4.7 times longer than wide, with a obvious sexual dimorphism .... *C. pictus*

– Movable finger of pedipalp with 11–12 rows of granules, telson of male and female without sexual dimorphism, manus lacks 1 dorsal carina 6

6.Carapace, tergites nearly smooth in adults, chelicerae dorsal aspect without granules ..... *C. tessellatus*

– Carapace, tergites with many big granules in adults, chelicerae dorsal aspect with granules ..... *C. tricostatus*

List of species of *Chaerilus* from China
(Map. 1)

1. *Chaerilus assamensis* Kraepelin, 1913

Chaerilus assamensis: Kraepelin, 1913: 144 (♂ & ♀); Kovařík, 2000: 42, table 2.

DISTRIBUTION. Southeast Xizang (China), Assam (India).

2. *Chaerilus conchiformus* Zhu, Han & Lourenço, 2008

Chaerilus pictus: Qi, Zhu & Lourenço, 2005: 34–38, Figs126–144 (♀, wrong identification).

Chaerilus conchiformus: Zhu, Han & Lourenço, 2008: 38–44, Figs1–21, table 1 (♂ and ♀).

DISTRIBUTION. Southeast Xizang, Nyingchi County and Mainling County (China).

3. *Chaerilus dibangvalleycus* Bastawade, 2006

C. dibangvalleycus Bastawade, 2006, Figs 1–16 (♂ and ♀).

DISTRIBUTION. Southeast Xizang, Mêdog County (China).

COMMENTS. This species was described by Bastawade [2006] from Dibangvalley District where is a territory belonging to Southeast Xizang (China).

4. *Chaerilus pictus* (Pocock, 1890)

Chaerilus pictus: Pocock, 1900: 59–60 (♂); Tikader & Bastawade, 1983: 332–339, Figs 940–964 (♂ and ♀); Fet *et al*., 2000: 327; Kovařík, 2000: 53-54; Figs 21–22, 39, 42–43, tables 1–2 (♂ and ♀).

Chaerilus gemmifer: Pocock, 1900: 60 (♀); Tikader & Bastawade, 1983: 346, Figs 980–995 (♀).

DISTRIBUTION. Southeast Xizang (China); Assam, (India); Silhet (Bangladesh).

COMMENTS. *C. gemmifer* is a synonym of *C. pictus* [Kovařík, 2000].

5. *Chaerilus tessellatus* Qi, Zhu & Lourenço, 2005

Chaerilus tessellatus: Qi, Zhu & Lourenço, 2005: 30, 34, Figs 109–125 (♀); Zhu, Han & Lourenço, 2008: 44–47, Figs 30–44, table 1 (♀).

DISTRIBUTION. Southeast Xizang, Mêdog County, Bome County, Nyingchi County (China).

6. *Chaerilus tricostatus* Pocock, 1899

Chaerilus tricostatus: Pocock, 1900: 59 (♂); Tikader & Bastawade, 1983: 320–326, Figs 911–924 (♂); Kovařík, 2000: 61–62, Figs 27–28, tables 1–2 (♂ and ♀).

DISTRIBUTION. Southeast Xizang (China); Assam (India).

COMMENTS. This species was rescorded by Kovaøík [2000] from Upper Rotung (Abor District) where is a territory belonging to Southeast Xizang (China).

7. *Chaerilus tryznai* Kovařík, 2000

Chaerilus tryznai: Kovařík, 2000: 65–66, Figs 32–33, tables 1–2 (♂ and ♀).

Chaerilus tryznai: Zhu, Han & Lourenço, 2008: 47–51, Figs 45–60, table 1 (♂).

DISTRIBUTION. Southeast Xizang, Mêdog County, Bome County (China).

Chaerilus tricostatus Pocock, 1899
Figs 1–19.

MATERIAL EXAMINED. female, CHINA: Xizang, Mêdog County, elevation 1146 m, coordinates 29°20' N, 95°20' E; 14.08.2009; Li-Qing Fan leg (Ar.-MWHU-XZMT0901); other material: 2 female adults, 1 female immature and 3 female juveniles, same data as the first (Ar.-MWHU-XZMT0802-04, 05-07) (in MWHU).

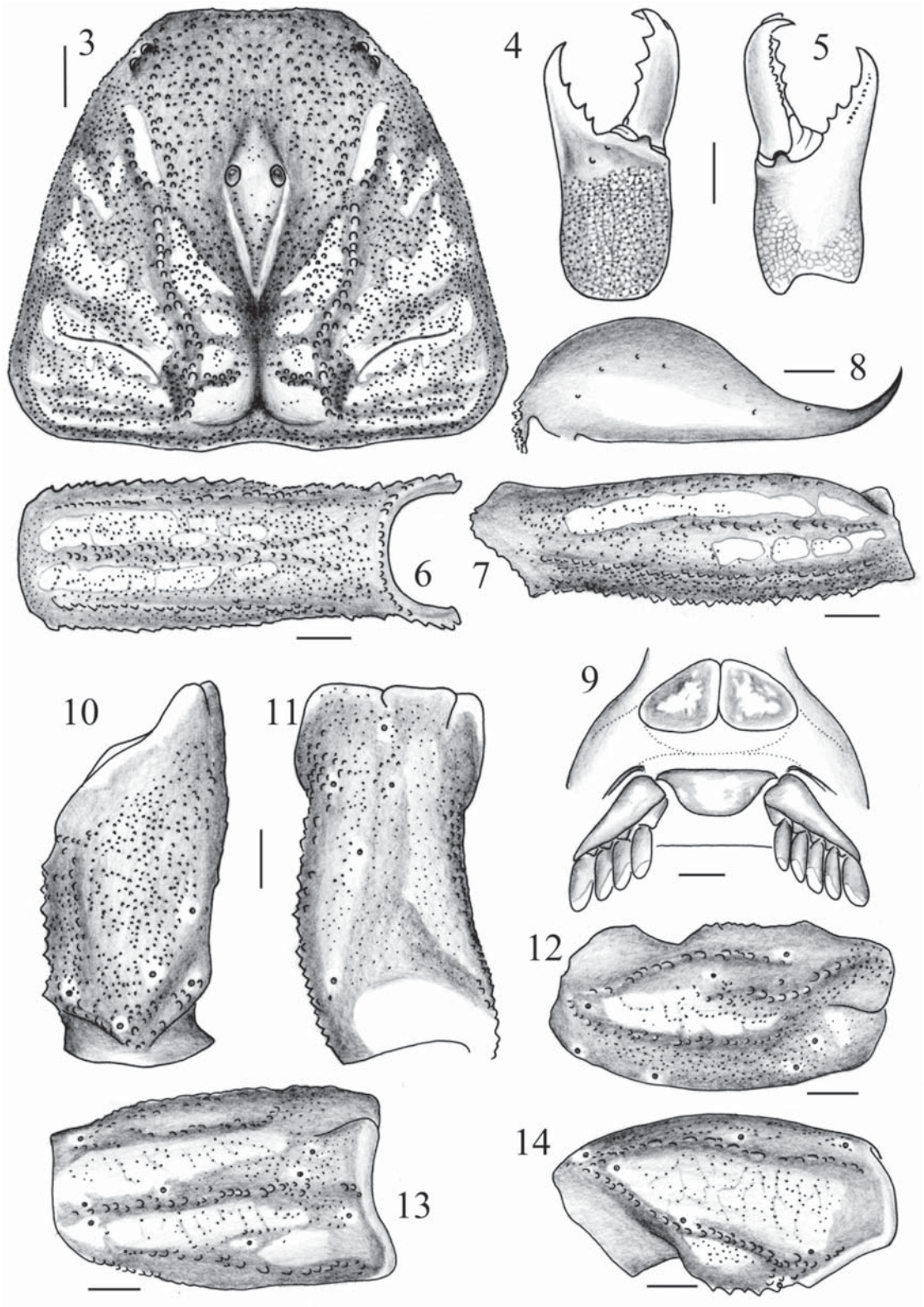
DIAGNOSIS. *Chaerilus tricostatus* differs from other congeners by the following features: (1) good-sized, about 48–60 mm in total length; (2) the chela of pedipalp has 6 keels, dorsal secondary carinae of the chela obsolete as a black stripe without ridges; (3) movable fingers of pedipalp chela with 11–12 rows of granules; (4) the male has the fingers entirely straight and the manus of pedipalp relatively narrower and longer than the female: chela with the ratio between length and width to 3.7 on males and 2.2–2.4 on females; (5) ventral side of seventh mesosomal segment with 2 pairs of granular carinae and tegument with some granules; (6) pectinal teeth number 4–6; (7) chelicerae are granulated dorsally.

DESCRIPTION based on female material (Ar.-MHU-XZMT0901).

Coloration. Basically blackish brown. Carapace blackish brown. Mesosomal tergites reddish brown with yellowish stripes. Metasoma: all segments blackish brown. Telson brown; aculeus light brown at the base and dark brown at the extremity. Chelicerae yellow with dark reticular pattern on dorsal surface; the fingers with darker denticles. Pedipalps: femur, patella and chela dark red-brown with dark carinae. Legs blackish brown and yellowish on distal segments. Sternum, genital operculum and sternites pale red-brown with some light parts. Pectines light yellow.

Morphology. Carapace carinated, with dense granules of nearly equal size; lateral furrow moderately deep; large granules form 2 longitudinal lateral carinae. Median ocular tubercle with granules. Lateral ocular tubercle small with a pair of lateral eyes and some granules. Lateral eyes distinctly smaller than median eyes.

Figs 1–2. Female of *Chaerilus tricostatus*: 1 — dorsal view; 2 — ventral view. Scale bar = 10 mm.
Рис. 1–2. Самка *Chaerilus tricostatus*: 1 — сверху; 2 — снизу. Масштаб 10 мм.



Figs 3–14. Female of *Chaerilus tricostatus*: 3 — carapace, dorsal aspect; 4–5 — chelicera, dorsal and ventral aspects; 6–7 — Metasomal segment V, ventral and lateral aspects; 8 — telson, lateral aspect; 9 — genital operculum and pectines; 10–11 — femur, dorsal and external aspect. 12–14 — patella, dorsal, external and ventral aspects. Scale bars = 1 mm.

Рис. 3–14. Самка *Chaerilus tricostatus*: 3 — карапакс, сверху; 4–5 — хелицера, дорзально и вентрально; 6–7 — сегмент метасомы V, вентрально и латерально; 8 — тельсон, латерально; 9 — генитальные крышки и гребенчатые органы; 10–11 — бедро, дорзо-ретролатерально; 12–14 — колено, дорзально, ретролатерально и вентрально. Масштаб 1 мм.

Figs 15–18. Female of *Chaerilus tricostatus*: 15 — dentate margin of movable finger, showing rows of granules (scale bar =1 mm); 16–18 — chela dorsoexternal, ventral and internal aspects. Scale bars = 2 mm.

Рис. 15–18. Самка *Chaerilus tricostatus*: 15 — зубчатый край подвижного пальца, показаны ряды гранул (масштаб 1 мм); 16–18 — клешня, сверху ретролатерально, вентрально и пролатерально. Масштаб 2 мм.

Mesosoma: Tergites uniform distributing with granules of larger and unequal size; tergites I to III without carinae, each of tergites IV to VI bearing a pairs of obsolete granular carinae on posterior marging, tergite VII bearing two pairs of granular lateral carinae, but middle pair is represented only by ridges without expressed carinae; sternum pentagonal; genital operculum triangular; pectinal teeth count 5/4, with fulcra well developed ; sternites III to VI are smooth, sternite VII with some small granules on posterior portion and with four obsolete carinae.

Metasoma: Length about 4.2 times as long as carapace; segment I always wider than long; segments I to V with 10-8-8-8-7 granular carinae; the ventromedian and ventrolateral carinae of segment V composed of strong, dentated granules, ventromedian carina posteriorly bifurcated as “Y”; all segments with sparse granules. Vesicle is almost smooth; aculeus slightly curved (Fig. 8).

Chelicerae: Tibia dorsal surface with granules; thickly covered with numerous short, silky hairs, extending to ventral aspect of chelicerae and dorsal aspect of fixed fingers; ventral inner edges of movable finger with 9 minute teeth .

Pedipalp: Femur with ventroexternal, external and dorsoexternal, ventrointernal, internal and dorsointeral cuspate granular carinae; external surface without granules, other surfaces covered with sparse granules. Patella with dorsointernal, dorsoexternal, external, ventrointernal, ventroexternal carinae, with smooth granules; internal carina with cuspate granules; internal and ventral surfaces smooth, other surfaces with sparse granules. Chela with moderate length and width, the length/ width ratio about 2.2; dorsointernal, dorsal, dorsoexternal, ventrointernal, ventroexternal carinae with smooth granules; dorsal secondary, external and internal carinae obsolete or vestigial; entire tegument of chela manus densely covered with coarse granules, forming some indistinct reticular pattern; fingers straight, the cutting edge of movable finger with 11 rows of denticles. Trichobothriotaxy of type B; orthobothriotaxic [Vachon, 1974]; femur with nine trichobothria, patella with 14, and chela with 14 trichobothria (Figs10–14, 16–18).

Legs: Tibia without tibial spur. Basitarsus with 2 lateral pedal spurs. Tarsus ventrally with row of spinules and more setae. Claws hook-like.

VARIATION. Coloration and morphology are very similar, but the granules on tegument are different among these materials: very sparse in immature and juveniles. Number of pectinal teeth (left/ right): 1 fe-

Table 1. Measurements (in mm) of *Chaerilus tricostatus* Pocock, 1899. (Ar.-MHU-XZMT0901) and (Ar.-MHU-XZMT0902).
Таблица 1. Промеры (в mm) *Chaerilus tricostatus* Pocock, 1899. (Ar.-MHU-XZMT0901) и (Ar.-MHU-XZMT0902).

	Chaerilus tricostatus	
	Female XZMT0901	Female XZMT0902
Total length	58.8	59.2
Carapace:		
– Length	8.1	8.7
– Anterior width	4.3	4.4
– Posterior width	8.9	9.7
Mesosomal segments		
– Length	15.7	14.2
Metasomal segment I:		
– Length	3.8	3.5
– Width	4.7	4.9
– Depth	3.0	3.6
Metasomal segment II:		
– Length	4.4	4.5
– Width	3.6	4.1
– Depth	2.9	3.3
Metasomal segment III :		
– Length	4.6	4.9
– Width	3.4	3.8
– Depth	2.8	3.1
Metasomal segment IV:		
– Length	5.3	5.3
– Width	3.3	3.4
– Depth	2.7	3.0
Metasomal segment V:		
– Length	8.4	9.0
– Width	3.0	3.0
– Depth	2.5	2.7
Telson		
– Length	8.5	9.1
– Width	2.8	3.0
– Depth	2.7	2.9
Pedipalp femur		
– Length	6.3	6.9
– Width	3.1	3.4
– Depth	3.0	3.4
Pedipalp patella		
– Length	6.6	6.9
– Width	2.8	3.6
– Depth	3.8	4.2
Chela		
– Length	13.7	14.7
– Width (manus)	6.2	6.4
– Depth (manus)	4.9	5.6
Movable finger:		
– Length	8.6	9.4
Pectinal teeth (left/right)	5/4	5/5

male juvenile with 6/5, 2 female juveniles with 5/5. Measurements are in Table 1. Numbers of chelicerae ventral inner edges of movable finger minute teeth (left/ right): XZMT0801 with 9/9 (2 left and 2 right teeth runtish), XZMT0802 with10 /11(1 left and 1 right teeth runtish), XZMT0803 with 9 /9 (3 left and 2 right teeth runtish), XZMT0804 with7 /9 (2 right teeth runtish).

HABITAT. Found under the stones in mixed forest.

DISTRIBUTION AND DEPOSITORY. Type-locality: India, Assam, Sadiya, Khasia Hills; type material, 1 male (holotype), BMNH No. 1897.6.24.2, revised M. Vachon in October 1972 [Kovařík, 2000]. Other locality: China, Upper Rotung, Abor; other material examined by Kovařík [2000]: 1female, 07/1913, Mus. Calcutta, ZMUH. This species is distributing in southeast Xizang (China) and north Assam (India).

COMMENTS. The male *C. tricostatus* with relatively narrower and longer chela than the female is another important dichotocarpism besides male chaerilid with relative length of metasomal segments and telson unusually. Kovařík [2000] recorded the female of *C. tricostatus* for the first time, but he did not provide detailed figures or a description, just described some important information. Our identification is based on Kovařík's paper [2000]. Kovařík [2000] recorded the locality (British India, Abor District) belonging to India by error, in fact, this is a territory of southeast Xizang (China).

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References

Bastawade D.B. 2006. Arachnida: Scorpionida, Uropygi, Schizomida and Oncopodid Opiliones (Chelicerata) // Fauna of Arunachal Pradesh. State Fauna Series. Vol.13. Part 2. Zool. Survey, India. P.449–465.

Fet V. 2000. Family Chaerilidae Pocock, 1893 // Fet V., Sissom W.D., Lowe G., Braunwalder M.E. Catalog of the Scorpions of the World (1758-1998). New York: The New York Entomological Society. P.323–328.

Hjelle J.T. 1990. Anatomy and morphology // Polis G.A. (ed.). The Biology of Scorpions. Stanford: Stanford Univ. Press. P. 9–63.

Kovařík F. 2000. Revision of family Chaerilidae (Scorpiones), with descriptions of three new species // Serket. Vol.7. No.2. P.38–77.

Kovařík F. 2005. Two new species of the genus *Chaerilus* Simon, 1877 from Malaysia (Scorpiones: Chaerilidae) // Euscorpius. No.26. P.1–7.

Kraepelin K. 1899. Lfg. 8 (Arachnoidea). Scorpiones und Pedipalpi // Dahl F. (Hrsg.). Das Tierreich. Berlin: R. Friedländer und Sohn Verlag. 265 S.

Lourenço W.R., Ythier E. 2008. A new species of *Chaerilus* Simon, 1877 from the Philippines // Boletín Sociedad Entomológica Aragonesa. Vol.42. P.27–31.

Lourenço W.R., Zhu M.S. 2008. Description of two new species of the genus *Chaerilus* Simon, 1877 (Scorpiones: Chaerilidae) from Laos and Vietnam // Acta Zootaxonomica Sinica. Vol.33. No.3. P.462–474.

Lourenço W.R. 2009. Eyeless forest litter scorpions; a new species from the island of Halmahera (Moluccas), Indonesia (Scorpiones, Chaerliidae) // Boletín Sociedad Entomológica Aragonesa. No.44. P.93–97.

Pocock R.I. 1900. Arachnida. The Fauna of British India, including Ceylon and Burma. London. 279 pp.

Prendini L. 2000. Phylogeny and classification of the superfamily Scorpionoidea Latreille, 1802 (Chelicerata, Scorpiones): An exemplar approach // Cladistics. No.16. P.1–78.

Qi J.X., Zhu M.S., Lourenço W.R. 2005. Eight new species of the genera *Scorpiops* Peters, *Euscorpiops* Vachon, and *Chaerilus* Simon (Scorpiones: Eucorpiidae, Chaerilidae) from Tibet and Yunnan, China // Euscorpius. No.32. P.1–40.

Sissom W.D., Polis G.A., Wait D.D. 1990. Field and Laboratory Methods // Polis G.A. (ed.). The Biology of Scorpions. Stanford: Stanford Univ. Press. P.445–461.

Soleglad M.E., Fet V. 2001. Evolution of scorpion orthobothriotaxy: A cladistic approach // Euscorpius. No.1. P.1–38.

Stahnke H.L. 1970. Scorpion nomenclature and mensuration // Entomological News. Vol.81. P.297–316.

Tikader B.K., Bastawade D.B. 1983. The Fauna of India. Vol.3. Scorpions (Scorpionida: Arachnida). Calcutta: Zoological Survey of India. 671 p.

Vachon M. 1952. Etudes sur les scorpions. Publications de l'Institut Pasteur d'Algérie, Alger. 482 p.

Vachon M. 1974. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions // Bulletin du Muséum national d'Histoire naturelle, Paris. 3e sér. Vol.140. P.857–958.

Zhu M.S., Han G.X., Lourenço W.R. 2008. The chaerilid scorpions of China (Scorpiones: Chaerilidae) // Zootaxa. Vol.1943. P. 37–52.

Zhu M.S., Qi J.X., Song D.X. 2004. A checklist of scorpions from China (Arachnida: Scorpiones) // Acta Arachnologica Sinica. Vol.13. P.111–118.