Amerizus (Tiruka) gaoligongensis sp. n. (Coleoptera: Carabidae): an endogean adapted representative of the genus

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Received 15 December 2014 │ Accepted 10 January 2015 │ Published online 12 January 2015.

Abstract
We describe and illustrate Amerizus (Tiruka) gaoligongensis sp. n. (type locality: cave Wu Shi Shan 1-2-3, near village Kongshuhe, Tengchong County, Yunnan, China). The species possesses a set of real troglomorphic characters, such as depigmentation of tegument, prolongation of the appendages, microphthalmy, roundness of both pronotum and elytra, and brachyptery. These special features, together with three corporal indexes and peculiarities in the structure of the aedeagus, enable a readily distinction of the new species. Otherwise, A. gaoligongensis seems related to species from the queinneci species-group.

Key words: Coleoptera, Carabidae, Bembidiini, Amerizus, new species, China, Yunnan.

Introduction
The genus Amerizus Chaudoir, 1868 contains 50 species arranged in two subgenera and spread in Asia and North America (Sciaky and Toledano 2007; Bousquet 2012). One of the two subgenera, Tiruka Andrewes, 1935, includes 44 species, distributed from northwest India (state Jammu and Kashmir) to the central provinces of China. The species of this subgenus have been distributed into six groups of species (Sciaky and Toledano 2007; Toledano 2011). So far, twenty-two species of Tiruka were reported from China (Deuve 1998; Deuve 2002; Deuve 2004; Sciaky and Toledano 2007; Toledano 2011). It is worth noting that a unique trait has been ascribed to the representatives of Amerizus, which represents modification of the mouthparts in the adult stage. The one segmented galea of the maxilla, formed by fusion of the original two segments into one, is a clear synapomorphy in the congener (Perrault 1985; Belousov and Dudko 2010). As far as we know, this state has not been documented for any other taxon of the Bembidiini.

In contrast with the main evolutionary trend of the most Bembidiini, which have to do with an existence in open habitats on the ground, we face with tendency to a cryptophilous way of living in Amerizus (Belousov and Dudko 2010). This way of life results in the gracilization and prolongation of the appendages, depigmentation of the tegument, reduction of the eyes, and brachyptery. All these traits occur together in A. maquensis Deuve, 2004, A. songpanensis Deuve, 1998, and A. wrzecionkoi Deuve, 1998, though no species of Tiruka was hitherto found in a genuine underground habitat. In spite of all, a case as such presented in this work, is not a surprise, if bearing in mind the above-mentioned peculiar features.

Recently I noticed that a Bulgarian-Chinese speleological expedition has investigated some unmapped cave systems in Yunnan (Guéorguiev 2014). Among the carabids collected by my colleague Boyan Petrov (National Museum of Natural History, Sofia), I found two specimens of a microphthalmic...
species of Bembidiini. At first sight, these samples seemed similar to a member of *Sinechostictus* Motschulsky, 1864. The subsequent work showed that the two specimens are actually representatives of *Tiruka* and belong to a species new for the science.

**Material and Methods**

Specimens were observed using a with an Olympus SZ 60 stereomicroscope and were measured using a stereomicroscope ocular micrometer. Drawings were made with a stereoscopic microscope Carl Zeiss Jena Technival 2. The photo of the habitus was taken by a Zeiss Stemi 2000 microscope equipped with an AxioCam ERC 5s camera and was montaged using CombineZM image stacking software.

The following abbreviations are used in the description: TBL= total body length, measured from the apex of the longer mandible to the apex of the longer elytron; SBL= standardized body length, measured from the front margin of the clypeus to the apex of the elytra; BW= maximum body width, measured across the widest place; AL= antennal length from the base of antennomere 1 to the apex of antennomere 11; HW= maximum head width, the linear distance across the head, including the eyes; PW= maximum pronotal width; PL= pronotal length, measured from the apical margin to the basal margin along the midline; PA= width of pronotal apex, measured between the tips of the fore angles; PB= width of pronotal base, measured between the tips of the hind angles; EW= maximum elytral width, EL= elytral length, measured from an imaginary line connecting the apices of the humeral angles to the apex of the longer elytron.

**Results**

*Amerizus gaoligongensis* sp. n.

(Figs. 1-6)

**Type locality**: China, Yunnan, Baoshan Prefecture, Tengchong County, 2.8 km ENE from village Kongshuhe, cave Wu Shi Shan 1-2-3, N25.73111 E98.66459, altitude ca. 2530-2620m.

**Type series**: Holotype male, “CHINA, Yunnan, Tengchong County, cave Wu Shi Shan 1-2-3, near vil. Kongshuhe, ca. 2580 m, N25.73111 E98.66459, 11.11.2013, B. Petrov leg.” [printed, white label] / “Holotype *Amerizus gaoligongensis* sp. n. B. Guéorguiev des. 2014” [printed, red label]. Paratype: one female, same collecting data as the holotype, labeled as “Paratype *Amerizus gaoligongensis* sp. n. B. Guéorguiev des. 2014” [printed, red label]. The holotype is preserved in the National Museum of Natural History, Sofia, Bulgaria, while the paratype is kept in the private collection of Luca Toledano, Verona, Italy.

**Diagnosis**. A *Tiruka* of the *queinneci* group from Yunnan of large size (TBL: 6.7-6.8 mm), with tegument clearly depigmented, color rufous, antennae elongate (SBL/AL: 1.62-1.68), legs narrow and long, head with elongate mandibles, microphthalmic eyes and tempora one and a half times as long as eyes diameters, pronotum ovate, as wide as long (PW/PL: 0.97-1.0), with sides similarly round towards both the apex and the base, elytra oval, with rounded shoulders and elytral striae faintly punctate, median lobe of aedeagus slightly arcuate in lateral view, with a kernel sclerite provided with a fork-shaped proximal part and a short dorsal process moderately pointed at tip, additional sclerites or pack of scales absent.

**Description**

**Habitus**. Relatively large, oblong and narrow, moderately convex specimens, more or less depigmented, with tegument glabrous, excluding antennomeres 2-11 (Fig. 1).

**Size**. TBL: 6.7-6.8 mm (6.7 mm in holotype); SBL: 6.0-6.05 mm (6.0 mm in holotype); BW: 2.3 mm.

**Color**. Body shiny, light brown to yellowish, unicolored, only antennomeres 4-11 slightly darker.

**Microsculpture**. Isodiametric on head, more distinct on labrum and vertex, less distinct on the other parts, reduced on pronotum and elytra.
Figure 1. *Amerizus gaoligongensis* sp. n., habitus, paratype. Scale bar = 1.5 mm.
Head. Elongate with frontal furrows moderately impressed; disc smooth. Eyes flat, rather small, shape semi-ellipsoid, with longer axis oblique, diameter equal to diameter of base of scapus, each eye with about vestiges of 25-35 depigmented ommatidia (Fig. 2). Tempora about one and a half time as long as eyes diameters at their longitudinal axes. Genae tumid. Labrum subtrapezoid, wider than long, anterior margin nearly straight, with six setiferous punctures bearing setae, lateral two setae nearly twice longer than inner setae. Clypeus subtrapezoid, wider than long, anterior margin straight to slightly emarginate, with two long setae, situated laterally at middle of clypeus; clypeal suture distinct. Mandibles elongate, almost one half as long as length of head, mandibular scrobe with one seta near anterior margin of excavation, situated at middle length of mandible. Maxilla long and fine, lacinia, thin, arcuate and pointed at apex, galea non-segmented, slightly exceeding apex of lacinia; maxillary palpus fairly long, nearly as long as three fourth of head length, segments 2 and 3 of similar length, second segment thin, with proximal part glabrous and distal half moderately pubescent, penultimate segment fusiform at distal half, entirely densely pubescent, ultimate segment almost three times shorter than penultimate segment. Mentum with two labial setae and a sharply pointed medial tooth protruded forward, paralabial pits lack; labial suture indistinct; labial palpomeres with penultimate segment fusiform, glabrous in proximal third, pubescent in distal two-thirds, ultimate segment fine, nearly twice shorter than penultimate segment. Submentum with four prebasilar setae. Antennae relatively elongate (AL: 3.6-3.7 mm, TBL/AL: 1.81-1.89), with segments 2-11 pubescent, second half of antennomere 7 exceeding posterior margin of pronotum, last antennomere exceeding basal third of elytra.

Figure 2. *Amerizus gaoligongensis* sp. n., head and pronotum, holotype (a, maxilla; b, galea). Scale bar = 0.5 mm.
Figure 3. *Amerizus gaoligongensis* sp. n., median lobe of aedeagus, left lateral view, holotype (a, drawing; b, photo). Scale bars = 0.5 mm.

**Pronotum.** Clearly ovate, as wide as long, PW/PL: 0.97-1.0, widest before middle, nearly one quarter wider than head (PW/HW: 1.27); disc slightly convex; midline distinct, not reaching anterior border forward, reaching posterior border backward where it is widened (as in *Pseudolimnaeum*); basal impressions distinct;
basal surface with 8-10 rough punctures from each side of midline. Apex straight, wider than base (PA/PB: 1.12), with anterior angles obtuse, neither salient, nor projecting. Lateral sides convex towards both apex and basis, less constricted anteriorly (PW/PA 1.36-1.43), more constricted behind (PW/PB 1.52-1.60), only slightly concave before posterior angles; margins fine, equally narrow along most length, only at basis significantly widened. Posterior margin medially convex, hardly oblique towards angles; posterior angles slightly projecting laterally.

**Elytra.** Oval, moderately convex, longer than wide, EL/EW: 1.59-1.63, more than twice longer than length of pronotum (EL/PL: 2.53-2.56), significantly wider than pronotum (EW/PW: 1.59-1.63). Sides narrower basally, gradually widened towards middle, widest after middle, then again narrowed to apex; basal margin lacking, lateral borders of elytra reaching level between basal termination of fifth and sixth striae. Shoulders widely rounded, nearly indistinct. Lateral margins equally narrow along most extent, slightly explanate. Striae shallow, punctiform, striae 1-4 less faintly punctate, outer striae more faintly punctate; intervals flat and smooth.

**Hind wings.** Vestigial, scales of wings nearly fully vanished.

**Ventral surface.** Body underneath smooth; metaepisterna one and a half times as long as wide, their surfaces smooth; abdominal sterna 1 and 2 partially fused, as suture between them reduced, sterna 2-4 with pair of medial setae, sternum 5 with two marginal setae in males, with four marginal setae in female. Legs long and slender, first segment of hind tarsi as long as following three segments.

**Male genitalia.** Median lobe of aedeagus moderately sclerotized, elongate (1.25 mm long), widened at basal and medial parts, and constricted at apical third, in lateral view (Fig. 3a-b), with apical orifice long, opened dorsally, and apex wide and feebly curved ventrally; ventral side concave; basal part bilobed, widely opened proximally at large basal orifice; dorsal side convex; median lobe in dorsal view narrow, almost straight, only blade scarcely bent to left. Inner sac consists of a kernel sclerite and a membranous part, surrounding kernel sclerite and extended apically; kernel sclerite formed by one dorsal process well-differentiated, wide and forked at base, and somewhat pointed apically, located at proximal position, and a saddle-like basis, located at distal position (Fig. 3a-b).

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*Figure 4.* Map of the region around village Kongshuhe and cave Wu Shi Shan, yellow pointer indicates the approximate position of the cave.
Figure 5. Scheme of the chasm Wu Shi Shan 2, with photograph of the holotype of *Amerizus gaoligongensis* sp. n., at the depth of -33 m (photo by B. Petrov).
Etymology: The name, treated as an adjective, is from the mountain chain, Gaoligong Mts., where is situated the type locality of the new species.

Notes on the type locality and habitat: Wu Shi Shan 1-2-3 is the name of three explored chasms, which are parts of a joint underground cave system in the Gaoligong Mts. The separate entrances of the cave are situated from 30 to 50 m and between 2530 m and 2620 m above the sea level each other. The spot lies roughly at 2.8 km east-northeast from the village Kongshuhe (Fig. 4). The cave environments and the average air temperatures measured during the visit are almost identical in all surveyed holes: 9.8°C.

The two specimens of the new species were found under stones on the bottoms of chasm 2 (Fig. 5, Boyan Petrov personal communication). The bottom (at 25-30 m depth) of the hole is covered with clay and plenty of rotten logs and litter from the surface. The surrounding terrain above the cave openings consists of semi-degraded sub-tropical wood vegetation characteristic of the humid evergreen broad-leaved forests with well-developed undergrowth (Fig. 6).

Figure 6. Surrounding vegetation at the type locality of *Amerizus gaoligongensis* sp. n. (photo by B. Petrov).

Affinities: *Amerizus gaoligongensis* sp. n. exhibits a peculiar characterization, which enables us an easily distinction from the other species of the genus. We believe that each of the next characters represents a state that is not represented in the rest of the congeners. Except for point 6, these states seem result of a specialization to an underground environment.

1 – Eyes flat and rather small, each eye with vestiges of 25-35 degraded (and probably not functional) ommatidia;
2 – Length of the tempora significantly longer than the diameter of eyes;
3 – Index TBL/AL relatively low (1.81-1.89). *Amerizus schmidtii* Sciaky & Toledano, 2007 possesses a lower index than that in the new species. However, the former has completely different diagnostic characteristics and belongs to a separate group of species (Sciaky and Toledano 2007). *Amerizus puetzi* Sciaky & Toledano,
2007 possess index TBL/AL 1.83–2.03, which is only slightly higher than that in A. gaoligongensis sp. n. The last two species can be surely differentiated each other in a row of other specific features (TBL; ratio PW/PL; ratio EW/PW; shape of the aedeagus; shape and location of the kernel sclerite within the inner sac of the aedeagus; etc.);

4 – Pronotum ovate, as wide as long, its PW/PL: 0.97-1.0. So far, no other congener possesses such low index;

5 – Proportions between the maximal width of elytra and the maximal width of pronotum highest among the congeners (EW/PW: 1.59-1.63). Except for an undescribed taxon from west Sichuan (Sciaky and Toledano 2007: 32), which has ratio EW/PW: 1.53, there is no another congener of the genus with value higher than 1.5;

6 – Median lobe of aedeagus, with kernel sclerite formed by one dorsal process well-differentiated, wide and forked at base, somewhat pointed apically, situated at proximal position, and a saddle-like basis, situated at distal position (Fig. 3a-b). The structure of the kernel sclerite in A. gaoligongensis sp. n. resembles these of two species of the queinneci group. Amerizus davidales Sciaky & Toledano 2007 and A. puetzi Sciaky & Toledano 2007 have similar, but not identical, structure of their kernel sclerites. In both species, the kernel sclerites are situated in a similar position (a dorsomedial or dorsal position in the proximal half of the median lobe) as in the new species, thus their dorsal process are more or less differentiated and slightly pointed apically. However, neither species has dorsal process so clearly forked at the base as it is that of gaoligongensis sp. n. Otherwise, the latter species possesses external characters which separate it easily from its supposedly relatives of the queinneci group.

As a whole, characters of importance put the new species from Gaoligong Mts. most closely to A. davidales and within the queinneci species group (according to Sciaky and Toledano 2007; Toledano 2011). As far as it is known until today, A. davidales is the congener geographically nearest to A. gaoligongensis sp. n., it is not hard to us to believe that the latter is a derivative of a lineage of taxa which include the former species.

The new taxon can be identified by modifying couplet 9 of the key to Amerizus (Sciaky and Toledano 2007):

9 Pronotum ovate, as wide as long, ratio PW/PL 0.97-1.0 (present work, Figs 1-2). Ratio EW/PW more than 1.5. SBL: 6 mm. ................................................................. A. gaoligongensis sp. n.
- Pronotum cordiform, wider than long, ratio PW/PL not less than 1.1. Ratio EW/PW usually less than 1.53 (if larger, then SBL less than 5.9 mm). ............................................................... 9a

9a Sides of elytra markedly parallel; kernel sclerite with dorsal process elongate, narrow and pointed at apex (Sciaky and Toledano 2007, Figs. 10, 27) ......................... A. lama Sciaky & Toledano, 2007
- Elytra more or less oval; kernel sclerite normal................................................................. 10

Acknowledgements
I am very grateful to Boyan Petrov (NMNHS) who provided me with material that is the basis of this article. Tsvetan Parov (Caving Club "Helictit", Sofia) prepared the scheme of Wu Shi Shan 2 used as a basis for Figure 5. The fourth Bulgarian-Chinese speleological expedition held in November 2013 was kindly guided by the Deputy Director of Yunnan Institute of Geography, Mr. Zhang Fan.

I heartily thank also Luca Toledano (Verona, Italy) for the useful discussion and advices, which helped me to improve the quality of the work. He and Riccardo Sciaky (Milano, Italy) reviewed a draft manuscript and both contributed to the final product.

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