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Inventory of the Carabid Beetle Fauna of the Gaoligong Mountains, Western Yunnan Province, China: Species of the Tribe Trechini (Coleoptera: Caraboidea), with Descriptions of Four New Genera, One New Subgenus and 19 New Species.

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Our study of 525 specimens of trechine carabids collected during a ten-year biodiversity inventory project in the Gaoligong Shan region of western Yunnan Province, China, recognized a total of 29 different species representing nine different genera. Four of these genera are described as new: *Minutotrechus* Deuve & Kavanaugh (Type species: *Stevensius minutus* Uéno), *Trechepaphiopsis* Deuve & Kavanaugh (Type species: *T. uniporosa* sp. nov.), *Epaphiotrechus* Deuve & Kavanaugh (Type species *E. fortipesoides* sp. nov.), and *Trechepaphiama* Deuve & Kavanaugh (Type species *T. gaoligong* sp. nov.). *Gaoligongtrechus* Deuve & Kavanaugh is described as a new subgenus of *Queinnectrechus* Deuve (Type species: *Q.* (*G.*) *balli* sp. nov.). In addition, 19 of the 29 species are described as new: *Perileptus pusilloides* Deuve & Liang (type locality: China, Yunnan, Tengchong County, Hehua Township, 5.4 km S of Hehua at Dengman village along Daying Jiang, N24.92346°/E98.38612°, 1105 m), *Agonotrechus fugongensis* Deuve and Liang (type locality: China, Yunnan, Fugong County, Shiyueliang Township, 0 to 2 km W of Shibali on Shibali Road, 2300-2530 m), *A. xiaoheishan* Deuve and Kavanaugh (type locality: China, Yunnan, Longling County, Longjiang Township, Xiaoheishan Forest Reserve, 2067 m), *Queinnectrechus* (*s. str.*) *griswoldi* Deuve & Kavanaugh (type locality: China, Yunnan, Gongshan County, Cikai Township, 0.1 km SE of Heipu Yakou, in valley below tunnel, N27.77437°/E098.44793°, 3270 m), *Q.* (*s. str.*) *gongshanicus* Deuve and Liang (type locality: China, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, on slope NE of Chukuai Lake, N27.98206°/E98.48027°, 3950 m), *Q.* (*Gaoligongtrechus*) *balli* Deuve and Kavanaugh (type locality: China, Yunnan, Gongshan County, Qiqi/Dulong divide area, N27.69655°/E98.45389°, 3300-3680 m), *Trechus shiyueliang* Deuve & Kavanaugh (type locality: China, Yunnan, Fugong County, Shiyueliang Townhip, 10-11 km W of Shibali on Shibali Road, 3200-3280 m), *T. mingguangensis* Deuve and Liang (type locality: China, Yunnan, Tengchong County, Mingguang Township, Eighth Boundary Post Pass, N25.80984°/E98.62084°, 2287 m), *T. qiqiensis* Deuve & Kavanaugh (type locality: China, Yunnan, Gongshan County, Qiqi Trail at No. 12 Camp, N27.71503°/E98.50244°, 2775 m), *T. pseudoqiqiensis* Deuve and Liang (type locality: China, Yunnan, Fugong County, Shiyueliang Township, 11.5 km above Shibali on Yaping Road, N27.20676°/E98.71763°, 3290 m), *T. luzhangensis* Deuve & Liang (type locality: China, Yunnan, Lushui County, Luzhang

Township, Pianma Road at Fengxue Yakou [Pass], N25.97228°/E98.68336°, 3150 m), *T. gongshanensis* Deuve & Liang (type locality: China, Yunnan, Gongshan County, Dongshaofang area, N27.69655°/E98.45389°, 3300–3600 m), *T. shibalicus* Deuve & Kavanaugh (type locality: China, Yunnan, Fugong County, Shiyueliang Township, 8,5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°, 3100 m), *Trechepaphiopsis uniporosa* Deuve & Liang (type locality: China, Yunnan, Lushui County, Pianma Township, 9.3 km ESE of Pianma, N25.99363°/E98.66651°, 2460-2470 m), *T. unisetulosa* Deuve & Kavanaugh (type locality: China, Yunnan, Fugong County, Shiyueliang Township, 0.2 km W of Shibali, N27.16650°/E098.77936°, 2537 m), *T. monochaeta* Deuve & Kavanaugh (type locality: China, Yunnan, Gongshan County, Qiqi Trail at No. 12 Bridge Camp area, 16.3 airkm W of Gongshan, N27.71503°/E98.50244°, 2775 m.), *T. unipilosa* Deuve & Liang (type locality: China, Yunnan, Fugong County, Shiyueliang Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°, 3100 m), *Epaphiotrechus fortipesoides* Deuve & Kavanaugh (type locality: China, Yunnan, Tengchong County, Houqiao Township, 8.5 airkm NNE of Houqiao at Gaoshidong, N25.39858°/ E98.30533°, 2580 m), and *Trechepaphiama gaoligong* Deuve & Kavanaugh (type locality: China, Yunnan, Gaoligong Shan, Lushui County, 9.3 km ESE of Pianma, N25.99363°/E98.66651°, 2460-2470 m.). Lectotypes are designated for *Perileptus imaicus* Jeannel and *P. pusillus* Jeannel. *Agonotrechiotes* Deuve is proposed as a junior synonym of *Eocnides* Jeannel, and *Agonotrechiotes longiantennatus* Deuve as a junior synonym of *Eocnides fragilis* Ueno. We present keys for identification of adults of all species in the study area, first to genus and then to species for each genus, as well as nomenclatural data, diagnoses, illustrations of dorsal habitus and male genitalia, and information about geographical, altitudinal and habitat distributions within the study area and overall geographical distribution for each species. Geographical and altitudinal distributions of the species within the study area are compared, and broader geographical range patterns are characterized, and syntopic among species analyzed. A possible role of the Gaoligong Shan region as one source area for the present-day fauna of the Himalaya and southern edge of the Qinghai-Xizang (Tibetan) Plateau is also discussed.

KEYWORDS: Coleoptera, Caraboidea, Trechini, China, Yunnan, Gaoligong Shan, taxonomy, new genera, new species, distribution, biodiversity hotspot

The Gaoligong Shan (Gaoligong Mountains) of extreme western Yunnan Province, China, form the westernmost range of the Hengduan Mountains system of southeastern Xizang Autonomous Region (Tibet), northern and western Yunnan, and western Sichuan (Fig. 1). They extend north to south for more than 600 km, and, in the central part of the range, their crest forms the border between China and Myanmar. They also separate and form parts of the watersheds of two of Southeast Asia's major rivers, the Irrawaddy and the Salween (known in China as the Nujiang). Elevations within the region range from a low of about 650 m in the south to more than 5000 m in the north. Chaplin (2006) reviewed the physical geography of the region. Because of its geographic isolation and rugged topography, much of this area has remained less disturbed than most other parts of China; and previous biological exploration of the area over the past 150 years has revealed exceptionally high species richness, based almost exclusively on records for vertebrates (e.g., Stattersfield et al. 1998) and vascular plants (Li et al. 2000). Because of these traits, two large nature reserves have been established in the area, and the region has been included in the Three Parallel Rivers of Yunnan World Heritage Site (UNESCO 2003).

In late 1997, the California Academy of Sciences was invited to participate in a joint project with the Kunming Institutes of Botany and Zoology of the Chinese Academy of Sciences to con-

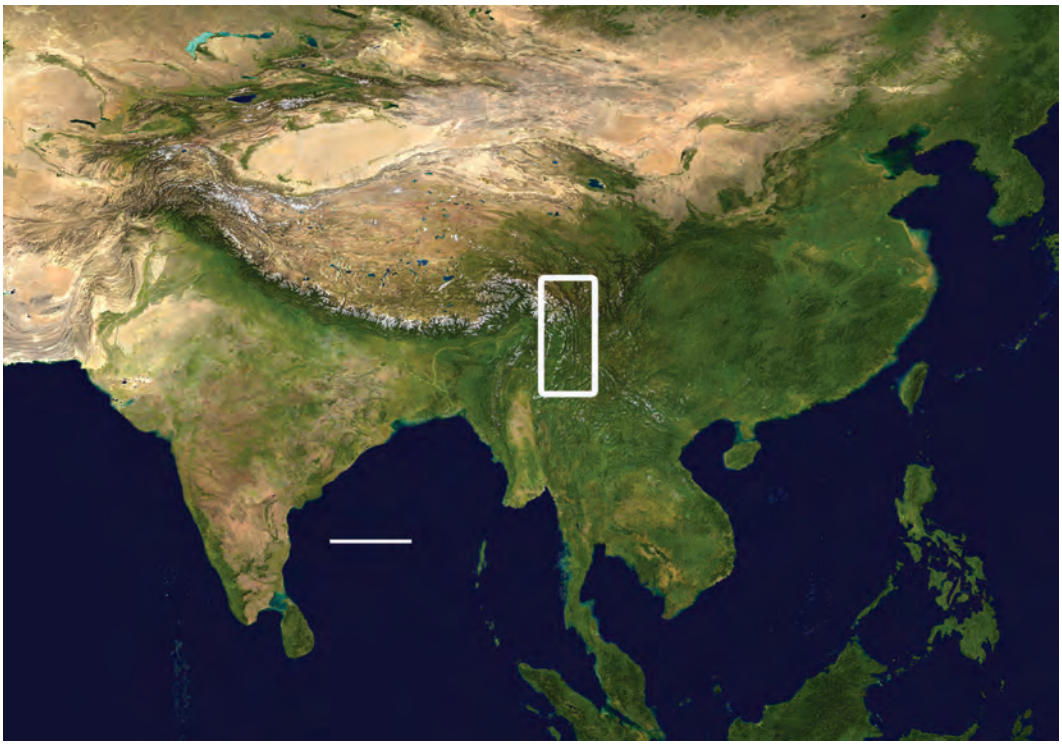


FIGURE 1. Map of Asia with study region outlined; scale line = m 500 km. Modified from Wikimedia Commons, World Atlas of the World, at URL: <*http://upload.wikimedia.org/wikipedia/commons/8/8f/Whole_world_-_land_and_oceans_12000.jpg*> [last accessed 28 September 2016].

duct a biodiversity inventory of the Gaoligong Mountains. Scientists from several additional institutions, including the Institute of Zoology, Beijing, and Royal Botanical Garden (Edinburgh) joined in the collaboration. Principal target groups for the inventory included bryophytes and vascular plants, all vertebrate groups, and arachnids, myriapods, and insects, especially the Neuropteroidea, Mecoptera, and Coleoptera (the Carabidae in particular). Multidisciplinary and multi-institutional teams carried out biotic sampling through more than 25 separate expeditions during the period 1998 to 2007. More than 100 reports on the project have been published to date, including partial results for bryophytes (e.g., Long 2006, Shevock 2005), plants (e.g., Fritsch et al. 2008, Zhou et al. 2006), birds (Dumbacher et al. 2011), amphibians (e.g., Liu et al. 2000), fishes (e.g., Chen et al. 2005), spiders (e.g., Miller et al. 2009, Wang et al. 2010), and carabid beetles (Kavanaugh and Liang 2004 and 2006; Kavanaugh and Long 1999; Liang and Imura 2003; Liang and Kavanaugh 2006 and 2007; Liu et al. 2010 and 2011).

Prior to the start of the project the carabid beetle fauna of the region was very poorly known. The fauna for the entire Hengduan region included only about 50 species (Yu 1992), and most of these were widespread species from low elevation areas. The region in general and the higher elevations in particular were virtually unexplored with respect to the carabid fauna. As a result of our work on this project to date, we now recognize more than 525 species occurring in the Gaoligong Shan, with additional species undoubtedly represented among materials for groups not yet fully studied. For several of the groups currently under study, (e.g., *Leistus* (Nebriini), *Broscosom*a (Broscini), *Amerizus* (*Tiruka*) (Bembidiini) and *Aristochroa* (Pterostichini), species diversity is much higher in this area than is known anywhere else that these taxa occur.

This report, on the tribe Trechini, represents the second of an intended series of treatments on the carabid beetle fauna of the Gaoligong Shan region, each dealing with one or more tribes or genera represented in the fauna. The first report (Kavanaugh et al. 2014) described the zabrine (Caraboidea: Zabrini) fauna of the region. Subsequent reports will appear as taxonomic work on each group is completed and not in any particular taxonomic or phylogenetic order.

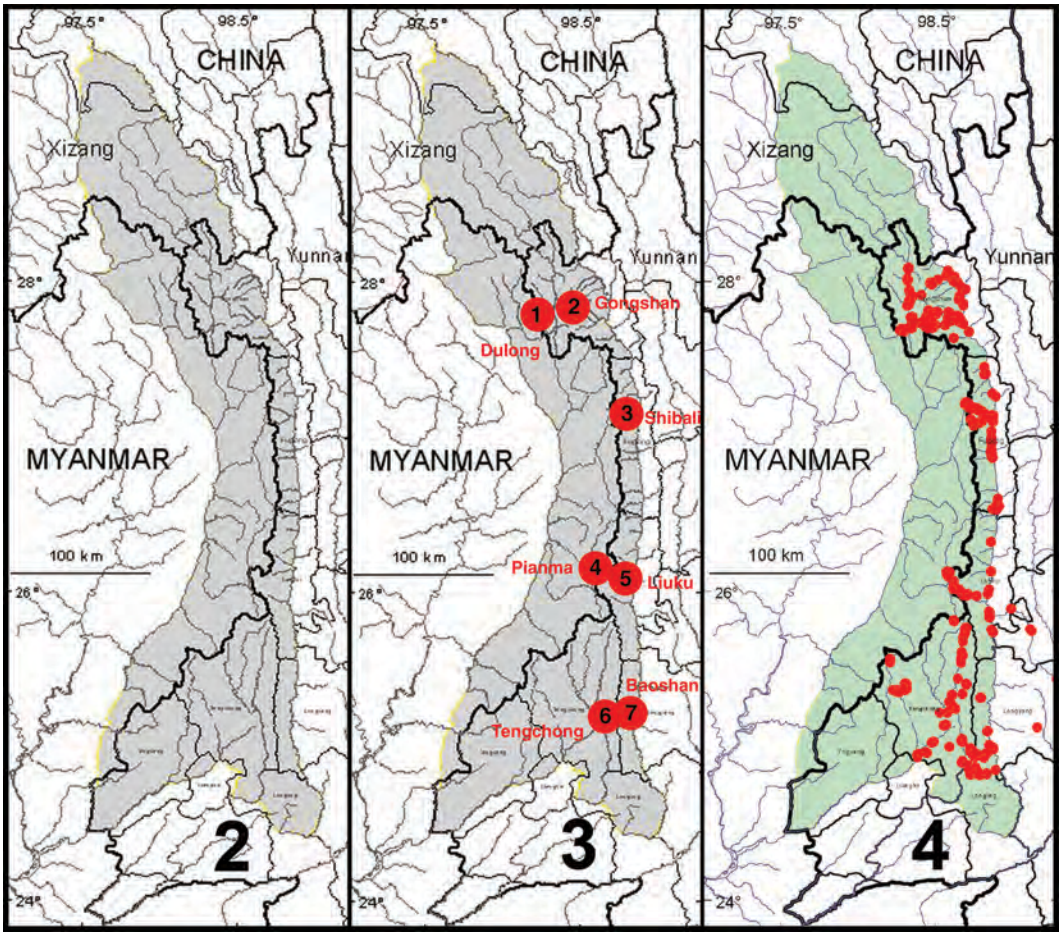
Trechini is a megadiverse taxon, worldwide in distribution, including more than 3,300 described species and subspecies distributed among more than 250 genera and subgenera (Lorenz 2005), and additional new species and genera continue to be described each year, especially from the eastern Palearctic Region. Trechines also occupy a diversity of habitats, from lowland marshes and stream edges to alpine tundra and fellfields; and they are especially diverse in caves, with members of many genera and species morphologically highly specialized for troglobitic life (see a list of the Chinese cavernicolous trechine genera in Tian et al. (2016).

As is the case with most other terrestrial anthropod groups, the trechine fauna of the study area has not been well documented previously. Most of our current knowledge of the Southeast Asian regional fauna is from the works of Belousov and Kabak (2003, 2014a, 2014b, 2016), Deuve (1988, 1992a, 1992b, 1995, 2004, 2005, 2013a); Jeannel (1923, 1928, 1935, 1954), Schmidt (2009) and Uéno (1953, 1962, 1972a, 1972b, 1973, 1977, 1981, 1995, 1996a, 1996b, 1997. 1999a, 1999b), with additional contributions by Andrewes (1936), Casale and Magrini (2009), Deuve et al. (2015), Donabauer (2010), Putzeys (1870), and Uéno and Yin (1993). To date, only five trechine species have been recorded from the Gaoligong Shan region: *Agonotrechus yunnanus* Uéno (1999a), *Stevensius minutus* Uéno (1997), *Trechus asetosus* Uéno (1997), *Trechus unisetiger* Uéno (1997), and *Trechus unisetosus* Deuve (2004). Based on our study of the material collected for the project and additional specimens from the region housed in other collections, we recognize a total of 29 trechine species found to occur in the study area. These species represent nine different genera, four of which are described here as new; and 19 of the 29 species are also described as new.

We present here a key for identification of adults to genus and separate keys for identification to species for each genus. Treatments for each species include nomenclatural data, diagnoses, illustrations of dorsal habitus and male genitalia, and information about geographical and habitat distributions within the study area and overall geographical distribution for each species. We also discuss geographical distributions of the species with respect to the seven core areas and to each other, as well as broader geographical range patterns and the altitudinal ranges of the species.

Materials and Methods

The natural physiographic limits of the study area for the project are as shown in Fig. 2 and include areas in eastern Myanmar and southern Xizang Autonomous Region (Tibet); but we had permission to survey only those parts in Yunnan Province. Specialists for all taxonomic groups concentrated their efforts on seven core areas within the project region (Fig. 3), selected to facilitate comparisons of possible north to south and east to west spatial differences within the regional biota, as well as recognition of areas of local endemism. Other areas were sampled as time and opportunity permitted. The entomological team made a total of 13 expeditions to the Gaoligong region. Our sampling sites within the region are shown in Fig. 4. Habitats included in the study area range from subtropical lowland rainforest to the margin of glaciers and snowfields. In all, more than 35,000 carabid specimens were collected during the project by using a variety of collecting methods, including hand collecting both day and night, beating vegetation, sifting litter with subsequent extraction by hand or by mini-Winkler units, and Malaise flight traps and pitfall traps. All specimens were sorted to morphospecies (i.e., presumptive species units based on features of exter-



FIGURES 2–4. Fig. 2. Map showing natural extent of study area, colored in green (however, sampling was permitted only in those portions in Yunnan Province . Fig. 3. Map showing location of core sampling areas. Fig. 4. Map showing locations of all entomological sampling sites.

nal structure and male and female genitalic traits) and detailed systematic studies of taxonomic groups are ongoing.

The present study is based on the examination of 525 specimens of trechine species from the Gaoligong Shan region. Specimens acquired during the project have been divided among and are deposited in the collections of our home institutions. Codens used throughout this report for collections in which specimens, including primary types, are deposited are as follows:

BMNH	British Museum (Natural History), London, United Kingdom
CAS	California Academy of Sciences, San Francisco, U.S.A.
IOZ	National Zoological Museum of China, Institute of Zoology, Beijing, China
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NSMT	National Science Museum (Natural History), Tokyo, Japan
SCAU	South China Agricultural University, Guangzhou, China

MEASUREMENTS.— The following measurements were recorded: body length (BL), measured longitudinally from the apex of the mandibles to the apex of the elytra; pronotal width (PW), meas-

ured transversely at the widest point on the pronotum; and pronotal length (PL), measured longitudinally between the anterior and posterior pronotal margins along the midline. The means of these measures were combined in the ratio, PW/PL, as an indicator of pronotal shape for each species.

Dissections of male genitalia.— Urite IX (the "ring sclerite") and aedeagus were extracted as a unit manually by using a sharp point to slit the intersegmental membrane between segments VIII and IX. The dissected assemblage was then placed in a dilute solution of KOH at room temperature for 24 hours. After rinsing in water, the dissections were dehydrated using 95% EtOH, then urite IX was separated from the aedeagus by severing the connecting membranes. The parts were then mounted in a Euparal preparation between two small coverslips over a hole in a small card and pinned beneath the specimen.

Illustrations.— Digital images of whole specimens and particular structures were taken using a Leica imaging system including an M165C dissecting microscope, DFC550 video camera, and two KL1500 LCD light sources. Stacked images were captured and combined into single montage images using the Leica Application Suite V4.2.0. Plates of images were created using Adobe Photoshop CS5. Distribution maps for each species were generated from geographical coordinate data maintained in a Biota Version 3.0 database (Colwell 2012) using the ArcMap program in ArcGIS for Desktop Version 10.2 software from Esri.

Geographical Coordinate Data.— All geographical coordinate data are presented in decimal degree format, with the first entry degrees North and the second degrees South, separated by "/". Exceptions to this format include verbatim label data only.

Treatments for new species.— For all new species, label data for all specimens of the type series are quoted verbatim (between quotation marks), with data for multiple labels separated by "/" and any editorial additions included between brackets ("[-]").

Taxonomy

Adult specimens of trechine species represented in the Gaoligong Shan region can be distinguished using the keys provided in this paper. Each key is provided only for distinguishing members of taxa (different genera or species) represented in this region and may not be appropriate for more general use.

Key for Identification of Adults of Trechine Genera of the Gaoligong Shan Region

1. Dorsal surface covered with fairly long pubescence; eyes also pubescent . . . . . *Perileptus* Schaum
1' Dorsal surface glabrous except for isolated fixed setae typical for trechines; eyes also glabrous 2

2(1') Mentum and submentum fused or at least partially fused 3
2' Mentum and submentum not fused, separated by a distinct suture 5

3(2) Body length (BL) less than 3 mm, the protibiae not furrowed . . . ***Minutotrechus* gen. nov.**
3' BL more than 4 mm, the protibiae longitudinally furrowed 4

4(3') Fully winged, elytra with discal striae distinctly impressed. . . . . *Agonotrechus* Jeannel
4' Apterous, elytra with discal striae effaced . . . . . *Queinnectrechus* Deuve

5(2') Form slender and flattened, the pronotum relatively small; antennae long and slender, extended nearly to the apical one-fourth of the elytra . . . . . *Eocnides* Jeannel
5' Form more compact and convex, the pronotum average size; antennae shorter, extended only to the basal one-fourth of the elytra or less 6

6(5') Right mandible with the anterior point of the retinaculum free and displaced distally to form a separate tooth; elytra without or with up to two discal setae, elytral surface with or without iridescence 7

6' Right mandible tridentate, but premolar tooth fused with the retinaculum to form a trifid molar with the anterior point not displaced distally; elytra with two or three discal setae; elytral surface not iridescent . . . . . *Trechus* Clairville

7(6) Tempora pubescent; size small, BL less than 3.8 mm; pronotum with basal angles obtuse and rounded; elytra without (in *T. asetosa*) or with only a single discal seta near stria 3 . . . . . ***Trechepaphiopsis* gen. nov.**

7' Tempora glabrous; size larger, BL more than 4.0 mm; pronotum with basal angles sharp and rectangular; elytra with either two discal setae or none 8

8(7') Elytra with two discal setae near stria 3, elytral disc slightly flattened along the length of the median suture . . . . . ***Epaphiotrechus* gen. nov.**

8' Elytra without discal seta, elytral disc evenly convex . . . . . ***Trechepaphiama* gen. nov.**

Genus *Perileptus* Schaum, 1860

Perileptus Schaum, 1860:663.

Type species.— *Carabus areolatus* Creutzer, 1799.

Diagnosis.— Adults of this genus (Figs. 5a, 6a) can be recognized by the following combination of character states: size small to medium (BL = 2.0 to 3.5 mm), fully winged, dorsal surface covered with more or less long pubescence; eyes large, convex, pubescent; frons flat, frontal furrows wide and deep, attenuated posteriorly; terminal palpomeres slender, attenuated apically; mentum free, not fused with submentum; submentum with 10 or 12 setae; antennal scape distinctly pubescent; pronotum narrowed basally, with base broadly projected posteriorly, median longitudinal furrow deeply and sharply defined; elytra elongate and flattened, recurrent stria indistinct; legs short, protibiae without longitudinal furrows.

Geographical distribution.— *Perileptus* is a moderately diverse genus with about 50 described species arrayed in four subgenera (Lorenz 2005). It is represented in the Palearctic, Oriental, Afrotropical, Australian and Neotropical Regions. The study area is within the previously known range of this genus.

Key for Identification of Adults of *Perileptus* Species of the Gaoligong Shan Region

1. Body size larger (BL = 2.6 to 2.8 mm); body color reddish, apex of the elytra darker; pronotum distinctly convex, with sparse setiferous punctures, basal angles markedly projected laterally; elytra smooth, shiny, microsculture effaced, discal striae coarsely punctuate . . . . . *Perileptus imaicus* Jeannel

   Body size smaller (BL = 2.3 mm), body color pale yellowish brown, elytra concolorous; pronotum less convex, with dense setiferous punctures, basal angles less projected laterally; elytra dull, irregular isodiametric microsculpture evident, discal striae distinctly but finely punctuate . . . . . ***Perileptus pusilloides* sp. nov.**

Perileptus imaicus Jeannel, 1923

(Figs. 5, 35a, 45–48)

Perileptus imaicus Jeannel 1923. Lectotype, here designated, a male, in BMNH, labeled: "Lectotype" [red label];/ "W. Almora, Kumoan U.P., India H.G.C."/ P. imaicus Jeannel det."/ "H.E. Andrewes Coll., B.M.

1945-97."/ "Perileptus imaicus Jeannel, lectotype, Deuve & Kavanaugh des. 2016". Type locality: India, Uttar Pradesh, Kumoan, West Almora. Paralectotypes (a total of 8), labeled same as lectotype, in BMNH and MNHN.

Diagnosis.— Adults of this species (Fig. 5a) can be distinguished from those of all other species in the region by the following combination of character states: size small (BL = 2.6 to 2.8 mm), fully-winged; body color reddish with apical part of elytra darker; microsculpture of elytra effaced; dorsal pubescence sparse and long; pronotum slightly transverse (ratio PW/PL = 1.32), distinctly convex, with lateral margins markedly rounded in anterior half, straightened just anterior to basal angles, the latter acute and sharp and laterally projected, median basal area coarsely punctate; elytra shiny, moderately flattened, with striae coarsely punctate.

Comments.— *Perileptus denticollis* Jeannel (1923), known from the Dali region of Yunnan Province, is probably conspecific with *P. imaicus* because there appear to be no morphological features to distinguish members of these two nominal species. Members of *Perileptus davidsoni* Deuve (1989), described from the Kathmandu area in Nepal, also are externally similar in form and structure to those of *P. imaicus*, but the apex of the median lobe of the aedeagus of males of *P. davidsoni* is more broadly rounded (more narrowly rounded in *P. imaicus* males (Fig. 5b)).

Habitat distribution.— Members of this species have been found in daytime on sandy flats, in gravel and under stones along the open, unshaded banks of small to large streams running through agricultural areas and other disturbed areas at elevations ranging from 680 to 2030 m (Fig. 35a). Most specimens were driven from their hiding places by splashing the banks with water from the stream. At the collecting site in Longyang County (see below), members of this species were found syntopic with members of *Perileptus pusilloides* sp. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 5c. We examined a total of 84 specimens (25 males and 59 females) from the following localities: ***Gongshan County:*** Bingzhongluo Township (Xiao Shangla He at Shuangla Village, N27.97514°/E98.65502°, 1550 m, 9 October 2002, Stop # DHK-2002-043, D.H. Kavanaugh, H.B. Liang, & W.D. Ba collectors [2 males and 30 females; CAS, IOZ, MNHN]). ***Longyang County:*** Bawan Township (Kunhong He at Bingmen, N25.09065°/E98.83721°, 680 m, 22 May 2005, Stop# 2005-019, D.H. Kavanaugh & H.B. Liang collectors [12 males and 14 females; in CAS, IOZ)], 1 June 2005, Stop# 2005-039, D.H. Kavanaugh & H.B. Liang collectors [11 males and 11 females; CAS, IOZ]). ***Tengchong County:*** Jietou Township (0.75 km N of Dahetou Ligganjiao on Longtang He, N25.74622°/E98.69612°, 2030 m, 18 May 2006, Stop # DHK-2006-029, D.H. Kavanaugh, R.L. Brett, & H.B. Liang collectors [3 females; in CAS, IOZ]; stream 0.7 km N of Jietou, N25.43128°/E98.64773°, 1564 m, 22 May 2006, Stop # DHK-2006-036A, D.H. Kavanaugh & R.L. Brett collectors [1 female; CAS]). These localities are at low to middle elevations in Core Areas 2, 6 and 7.

Overall geographical distribution.— Fig. 45. This species currently is known from the Himalayan region of India from Himachal Pradesh to Darjeeling and Sikkim. It has also been reported from Yunnan under the name *P. denticollis* Jeannel (1923) (see Uéno 1996b)

Perileptus pusilloides Deuve and Liang sp. nov.

(Figs. 6, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1039259"/ "CHINA, Yunnan, Tengchong County, Hehua Township, 5.4 km S of Hehua at Dengman village along Daying Jiang, N24.92346°/E98.38612°,"/ "1105 m, 2 June 2006, Stop # DHK-2006-053, D.H. Kavanaugh, R.L. Brett & D.Z. Dong collectors"/ "HOLOTYPE *Perileptus pusilloides* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (a total of 4): 2 males and 1 female (in CAS, IOZ, MNHN)

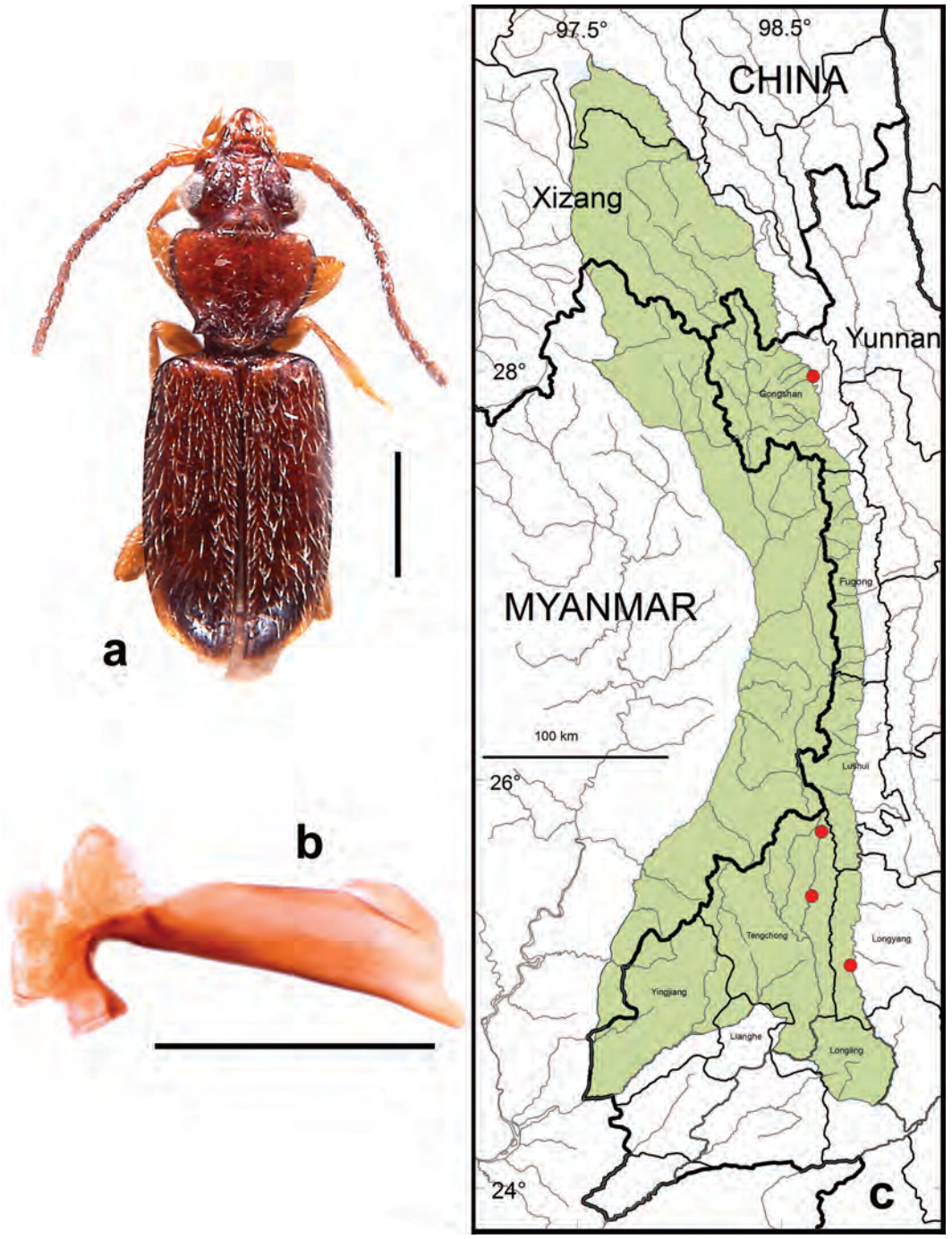


FIGURE 5. *Perileptus imaicus* Jeannel; a. Dorsal habitus (CASENT1036287). b. Median lobe of aedeagus of male (CASENT10363020), left lateral aspect. c. Map of locality records (red circles) for *P. imaicus* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

labeled same as holotype except first label "CASENT 1039257" and "CASENT 1039260" and "CASENT 1039258", respectively; 1 female (in IOZ) labeled: "CASENT 1036294"/ "CHINA, Yunnan, Longyang County, Bawan Township, Kunhong He at Bingmen, N25.09065°/ E98.83721°,"/ "680 m, 1 June 2005, Stop# 2005-039, D.H. Kavanaugh & H.B. Liang collectors". All paratypes also bear the following label: "PARATYPE *Perileptus pusilloides* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Tengchong County, Hehua Township, 5.4 km S of Hehua at Dengman village along Daying Jiang, N24.92346°/E98.38612°, 1105 m.

Etymology.— The species epithet, *pusilloides*, is a combination of the species epithet, *pusillus,* and the Greek suffix, *–ειδής* (transliterated into Latin as *–oides*), meaning resembling, in reference to the similarity of members of this species to those of *T. pusillus* Jeannel (1923).

Diagnosis.— Adults of this species (Fig. 6a) can be distinguished from those of all other species in the region by the following combination of character states: size very small (BL = 2.3 mm), fully-winged; body color light yellowish brown, elytra concolorous throughout; microsculpture of elytra irregularly isodiametric and moderately impressed; dorsal pubescence dense and rather short; pronotum slightly transverse (ratio PW/PL = 1.32) only slightly convex, with lateral margins moderately rounded in anterior half, straightened just anterior to basal angles, the latter acute and sharp but small, median basal area rugulose; elytra alutaceous, distinctly flattened, striae finely punctate.

Description.— Size very small, BL = 2.3 mm. Color of dorsum pale yellowish brown, head and pronotum slightly pale reddish in some specimens, appendages pale yellow, antennomeres 3 to 11 slightly darker yellowish brown; dorsal surface covered with dense but short pubescence.

Head. Relatively large, with eyes large and convex. Tempora very short. Frons flattened, nearly smooth, shiny but finely punctate; frontal furrows arcuate and deeply impressed to posterior margin of tempora; two pairs of supraorbital setae present and distinctly longer than setae of pubescence. Labrum broad with apical margin distinctly emarginate or concave. Mandibles small, slender. Mentum deeply concave, with median tooth broad and truncate. Submentum with a transverse row of ten setae anteriorly. Gula broad. Antennae of moderate length, antennomeres 2 and 3 of equal length.

Pronotum. Slightly transverse (ratio PW/PL = 1.32) and flattened, widest at anterior one-fourth, with lateral margins markedly rounded anteriorly, less so posteriorly, briefly and deeply sinuate just anterior to basal angles, the latter acute and sharp but small; basal margin projected posteriorly as a short, truncate lobe medial to lateral sinuations. Disc moderately punctate, flattened medially and slightly convex laterally; median basal area rugulose, only faintly defined anteriorly; median longitudinal impression distinct throughout, narrow anteriorly, widened toward base. Lateral margination slender throughout, slightly reflexed dorsally. One lateral seta (at anterior one-fifth) and one basolateral seta (on basal angle) present on each side.

Elytra. Alutaceous, moderately elongate, with humeri very distinct, rectangular but broadly rounded; elytral disc flattened, only moderately convex laterally; lateral margination slender and slightly reflexed dorsally; basal margin terminated medially at the origin of stria 5; striae 1 to 4 or 5 dinstinctly impressed and moderately punctate, striae 5 or 6 to 8 effaced. Recurrent stria absent. Umbilicate setal series with setae of humeral group equidistance from each other, those of the median group inserted posterior to middle.

Legs. Short. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Venter. Ventral surface of head and thoracic pleurae, prosternum, metasternum, metepisterna and abdominal ventrites punctate. Pubescence denser on abdominal ventrites than on thoracic venter.

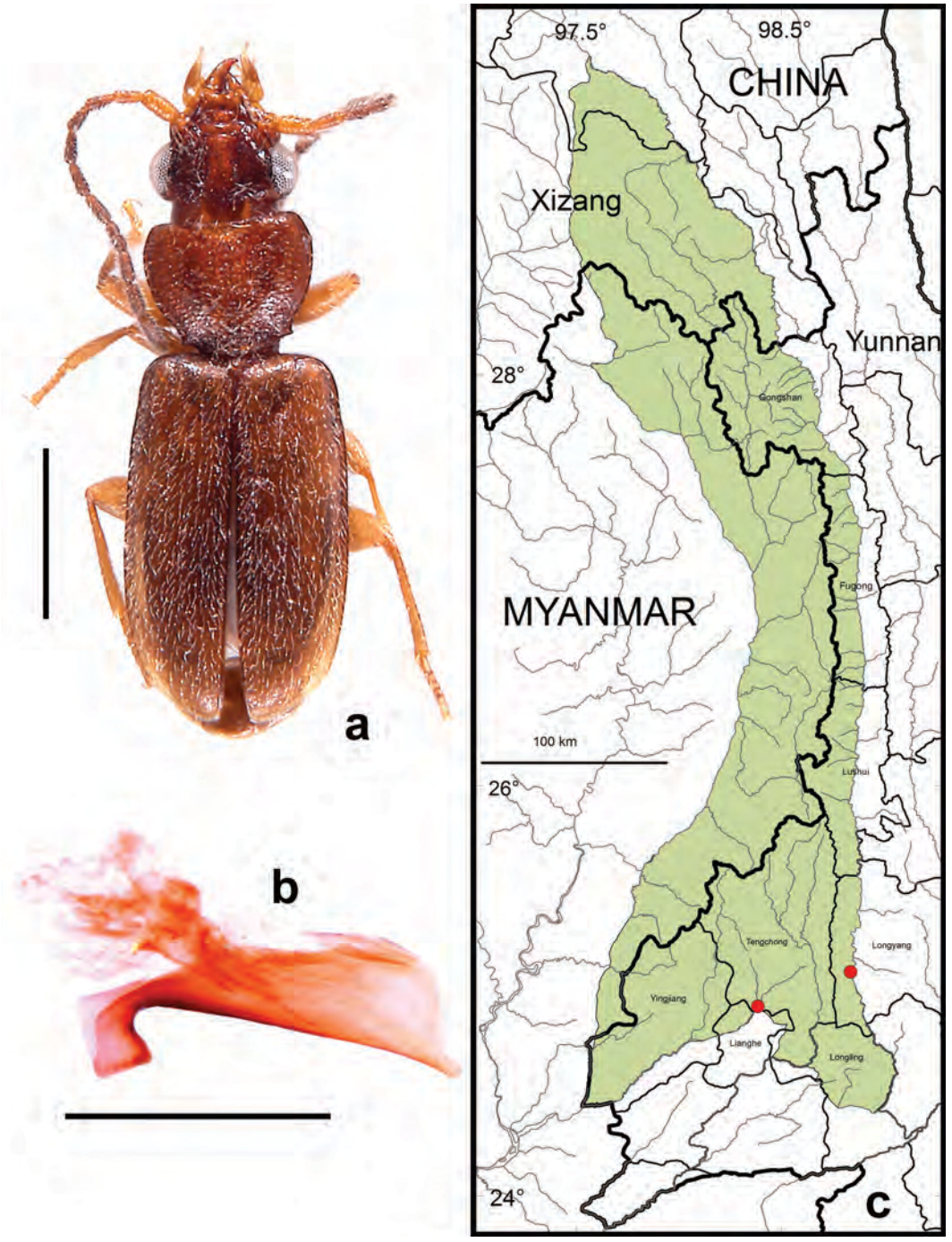


FIGURE 6. *Perileptus pusilloides* sp. nov.; a. Dorsal habitus (CASENT1039260). b. Median lobe of aedeagus of male (CASENT1039259), left lateral aspect. c. Map of locality records (red circles) for *P. pusilloides* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Male aedeagus. Median lobe (Fig. 6b) with apex narrowly lobate, apically rounded.

Comments.— Based on features of form and structure, this species appears to be closely related to *P. pusillus*, described from northern Vietnam. Its members can be distinguished from those of the latter in having their elytra wider, less shiny, more alutaceous, and with more finely punctate striae, and the pronotum relatively larger, with a less smooth surface, and with the greatest pronotal width more anterior. The type series of *P. pusillus* originally consisted of ten syntypes, seven of which are in the Jeannel Collection in MNHN, each with a "Type" label. Among these, six specimens match Jeannel's description of *P. pusillus* very closely. The seventh specimen, a male, instead may be a member of our new species, *P. pusilloides*. Consequently, in order to properly establish the identity to *P. pusillus*, we here designate a lectotype as follows: a male, in MNHN, labeled: "Hoa Binh, Tonkin"/ "*Perileptus pusillus* Jeannel, lectotype, design. 2016, ex coll. R. Jeannel, in coll. MNHN, Paris". The remaining six MNHN syntypes are all paralectotypes of *P. pusillus*, including the lone possible male of *P. pusilloides*, which we are not including in the type series of the latter species.

Habitat distribution.— Members of this species have been found in daytime on sandy flats, in gravel and under stones along the open, unshaded banks of small to large streams running through agricultural areas with subtropical crops at elevations ranging from 680 to 1105 m. Most specimens were driven from their hiding places by splashing the banks with water from the stream. At the collecting site in Longyang County (see below), members of this species were found syntopic with members of *Perileptus imaicus*.

Geographical distribution within the Gaoligong Shan.— Fig. 6c. We examined a total of 5 specimens (3 males and 2 females) from low elevations on both western and eastern slopes of the southern part of the Gaoligong Shan in Tengchong and Longyang Counties, (see Type material above for exact collection data), which are in Core Areas 6 and 7, respectively.

Overall geographical distribution.— This species currently is known only from the southern part of the Gaoligong Shan region in western Yunnan Province, China.

Genus *Agonotrechus* Jeannel, 1923

Agonotrechus Jeannel, 1923:428.
Paragonotrechus Uéno, 1981:2.
Bhutanotrechus Uéno, 1977:188.

Type species.— *Trechus birmanicus* Bates, 1892.

Diagnosis.— Adults of this genus (Figs. 7a–9a) can be recognized by the following combination of character states: size medium to large for a trechine (BL = 4.5 to 7.0 mm) members of most species with full hindwings and large, convex eyes, but those of a few species apterous and with eyes reduced in size and/or convexity, some even microphthalmous or nearly anophthalmous; frons flattened, depressed; dorsolateral margin of mandibular scope with a row of small setae aligned as a sparse comb in some members (Belousov & Kabak 2003); right mandible (Fig. 16a) bidentate, the premolar tooth fused with the retinaculum, from which the anterior tooth is distinctly projected and in a forward position and the posterior tooth is absent or flush; left mandible with only a short, subconical, more or less trifid ridge; clypeus with six setae in most members; labium with anterior margin not or only slightly concave; mentum fused with submentum, incompletely in some members; submentum with six setae in most members, but some with eight setae; pronotum little narrowed basally, with lateral explanation distinctly broadened basally in many members; elytra with discal striae varied, from complete to effaced, punctate in many members, parascutellar striole very long in many members; anterior discal seta present in all members and inserted at the

basal one-fifth or one-sixth of elytra, middle discal seta present or absent, preapical seta present at or near stria 2 in most members, absent from a very few members; legs slender, protibiae furrowed, the basal two protarsomeres dilated and toothed; abdominal ventrites glabrous except for usual paramedial setae; aedeagus with a spoon-shaped copulatory piece.

Taxonomic notes.— Members of the first known *Agonotrechus* species had only the anterior discal seta of the elytron inserted at the basal one-fifth or one-sixth. Consequently, this feature was used by Jeannel (1923) to define his new genus. Members of *Paragonotrechus* Uéno (1981) are very similar and differ only in having a more slender body form and the parascutellar striole very long. Those of *Bhutanotrechus* Uéno (1977), described from Bhutan, were distinguished by having the elytral discal striae effaced and a second elytral discal seta (the middle seta) present. The presence of the middle seta is a plesiotypic feature in Trechini, but species with members having two discal setae sometimes have been grouped together or assigned to genus *Bhutanotrechus* (Deuve 1992b, 1995). Genus *Agonotrechus* is really a homogenous group, despite the differences among its members in impression of the elytral discal striae, length of the parascutellar stiole, number of elytral discal setae and size of the eyes, differences in the last feature being associated with differential flight capability. There appears to be no reason to maintain *Paragonotrechus* and *Bhutanotrechus* as distinct genera.

The bidentate dentition of the right mandible of *Agonotrechus*, with the premolar tooth completely fused with retinaculum, distinguishes this group from members of the *Stevensius* Complex, with which Jeannel (1923, 1928) had grouped it.

Geographical distribution.— This genus, which at present includes 16 species, is known from the southeastern part of the Palearctic Region and northern edge of the Oriental Region, from Nepal eastward to southern Gansu Province in the north and Myanmar, Vietnam, and Hubei and Shaanxi Provinces; and one species has been described from Japan. The study area is within the previously known range of this genus.

Key for Identification of Adults of *Agonotrechus* Species of the Gaoligong Shan Region

1. Eyes less projected, less convex and only about twice as long as the tempora; pronotum only slightly transverse, lateral explanation narrow anteriorly; lateral elytral discal striae deep and markedly punctate, elytral intervals convex . . . . . ***A. xiaoheishan* sp. nov.**
   Eyes large and projected, more convex and more than twice as long as the tempora 2
2. Size smaller, BL less than 5.5 mm. Pronotum smaller, lateral explanation narrow anteriorly; lateral elytral discal striae deep and elytral intervals only slightly convex. *A. yunnanus* Uéno
   Size larger, BL = 5.8 to 6.5 mm. Pronotum larger, lateral explanation wider anteriorly; lateral elytral discal striae more faintly impressed and elytral intervals nearly flat. 3
3. Elytral silhouette subovoid, rather short; pronotum narrower, with lateral explanation narrow, slightly widened basally; elytral recurrent stria abruptly terminated, not connected to apex of discal stria 5. . . . . ***A. fugongensis* sp. nov**.
   Elytral silhouette more subquadrate; pronotum markedly transverse, with lateral explanation wide anteriorly, also widened and slightly explanate basally; elytral recurrent stria continuous anteriorly with discal striae 5 . . . . . *A. wuyipeng* Deuve

Agonotrechus fugongensis Deuve and Liang, sp. nov.

(Figs. 7, 35b, 36a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1019979"/ "CHINA, Yun-

nan, Fugong County, Lishadi Township, 0 to 2 km E of Shibali on Shibali Road, N27.16536°/ E098.78003° to N27.16100°/"/ "E098.79370°, 2300-2530 m, 18 August 2005, Stop# DHK-2005-096, D. Z. Dong collector"/ "HOLOTYPE *Agonotrechus fugongensis* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (only 1): a female (in CAS) labeled: "CASENT 1006974"/ "CHINA, Yunnan, Gaoligong Shan, Nujiang Prefecture, Nujiang State Nature Reserve, Qigi He, 9.9 airkm W of Gongshan,"/ "N27.71542°/ E98.56529°, 2000m, 9-14 July 2000, Stop#00-22A, D.H. Kavanaugh, C.E. Griswold, Liang H.-B., D. Ubick, & Dong D.-Z. collectors"/ "IMAGE" [pale green label]/ "PARATYPE *Agonotrechus fugongensis* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 0 to 2 km W of Shibali on Shibali Road, 2300-2530 m.

Derivation of species name.— The species epithet, *fugongensis*, is derived from the name of the county (Xian) in which the holotype was collected, Fugong, and the Latin suffix, *-ensis*, denoting place.

Diagnosis.— Adults of this species (Fig. 7a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 5.8 to 6.0 mm), fully-winged, dorsum dark piceous to reddish brown, shiny, pronotum and elytra slightly iridescent; eyes convex, moderately projected; clypeus with four setae; mentum and submentum fused, submentum with six setae; pronotum small but transverse, ratio PW/PL = 1.30, median basal area smooth, framed by two deep, oblique furrows, lateral explanation rather narrow, broadened only posteriorly, lateral margins with a short sinuation anterior to the sharp, rectangular or slightly acute basal angles; elytra with all discal striae evident and finely punctate, striae 1 to 4 moderately impressed, striae 5 to 8 more faintly impressed, parascutellar striole rather long, recurrent stria deeply impressed but abruptly terminated anteriorly, not connected with stria 5, intervals slightly convex, two discal seta (anterior and middle setae) present in stria 3, the anterior seta inserted within basal one-sixth of elytra, the middle seta inserted near elytral middle, preapical seta also present; median lobe of aedeagus of male (Fig. 7b) long and slender, endophallus with copulatory piece spoon-shaped.

Description.— Size large, BL = 5.8 to 6.0 mm. Color of dorsum piceous to reddish brown, shiny, pronotum and elytra slightly iridescent, appendages paler, palpi yellowish tan.

Head. Moderate in size, slightly elongate, eyes large, convex, moderately projected, their diameter more than two times length of tempora. Tempora short, only slightly convex and glabrous, joined to neck region at ca. 135° angle. Frons more or less flattened, with two pairs of supraorbital setae, frontal furrows distinct, impressed posterior to or beyond posterior supraorbital setae. Clypeus with four setae. Labrum with six setae, apical margin slightly concave. Mandibles slender; right mandible bidentate, the anterior tooth far forward and long, the basal tooth reduced, obtuse and blunt; left mandible with a very slender trifid process, formed from fusion of the retinaculum with premolar tooth. Palpi with apical palpomeres fusiform. Mentum and submentum fused. Mentum bifossulate, divided into three sectors, a median and two lateral parts, separated by two deep, longitudinal furrows; medial tooth simple, subtriangular with blunt apex, half as long as lateral lobes. Submentum with six setae subapically, gula broad. Genae with a single ventral seta on each side. Antennae of moderate length, with only four antennomeres extended beyond the pronotal base; antennonmeres 3 and 4 virtually the same length and each longer than antennomere 2.

Pronotum. Rather small, moderately narrow posteriorly, ratio PW/PL = 1.30, widest slightly anterior to middle, lateral margins with short sinuation just anterior to sharp, rectangular or slightly acute basal angles; pronotal disc convex, median longitudinal impression very fine and shallow,

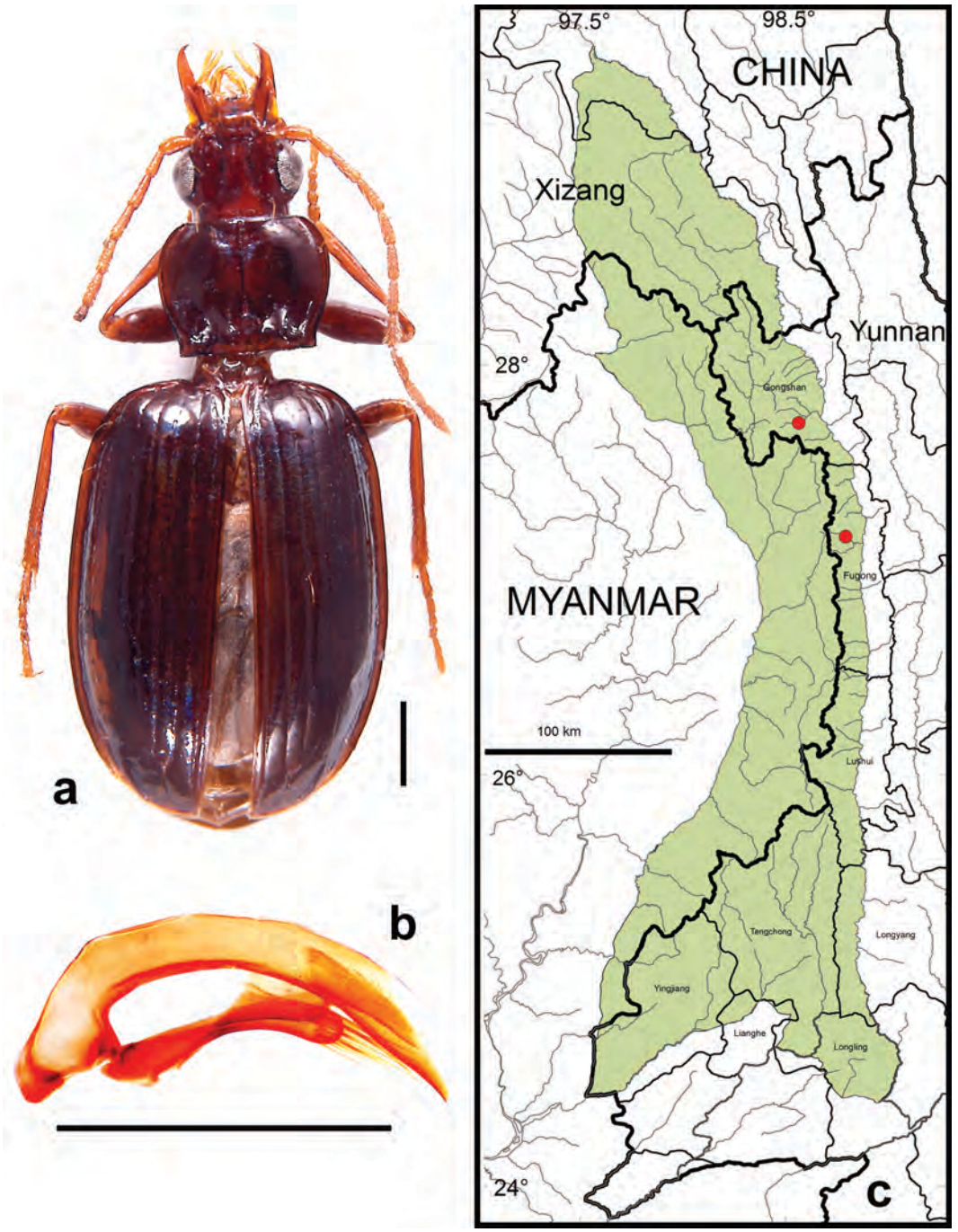


FIGURE 7. *Agonotrechus fugongensis* sp. nov.; a. Dorsal habitus (CASENT1019979). b. Median lobe of aedeagus of male (CASENT1019979), left lateral aspect. c. Map of locality records (red circles) for *A. fugongensis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

extended posteriorly to near basal margin, but not as close anteriorly to apical margin; basal foveae small vaguely delimited; median basal area smooth, delimited laterally by short but deep and oblique furrows; basal margin nearly straight, slightly sinuate. Lateral explanation moderately narrow and slightly reflexed, widened posteriorly but not flattened. Midlateral pair of setae inserted anterior to middle and basolateral pair inserted at hind angles.

Elytra. Moderately wide, elytral silhouette subovoid, humeri distinct but rounded, disc convex. All discal striae evident and finely punctate, striae 1 to 4 moderately impressed, striae 5 to 8 more faintly impressed, partially effaced, parascutellar striole rather long, recurrent stria deeply impressed but abruptly terminated anteriorly, not connected with discal stria 5, intervals slightly convex. Parascutellar setiferous pore present at base at common origin of discal striae 1 and 2. Two discal seta (anterior and middle setae) present in stria 3, the anterior seta inserted within basal one-sixth of elytra, the middle seta inserted near elytral middle. Preapical seta also present, inserted on interval 2 near stria 2, closer to sutural elytral margin than to apex. Umbilicate setal series with setae of humeral group equidistant for each other and those of median group both inserted posterior to middle of elytra.

Legs. Slender, moderately long. Protibiae furrowed, without anteroapical pubescence. Male protarsi with tarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Ventrites each with a pair of paramedial setae, ventrite VII of males with a single pair of paramedial apical setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 7b) long and slender, endophallus with a spoon-shaped sclerite.

Comments.— Males of this species are most similar to those of *A. wuyipeng* in features of the aedeagus; but they are smaller, their pronota distinctly narrower, more slender, and with much narrower lateral margination, and the recurrent stria does not connect anteriorly with stria 5 as it does in *A. wuyipeng* members.

Habitat distribution.— The holotype specimen of this species was found under a stone on moist substrate along a roadcut through an agricultural area formed in a large clearcut in what had been mixed broadleaf evergreen and conifer forest at an elevation somewhere between 2300 and 2530 m (Fig. 36a). The paratype specimen was collected under stones on the shaded bank of the Qiqi River just above the Forestry station at Qiqi at an elevation of 2000 m (Fig. 35b). Members of no other *Agonotrechus* or other trechine species have been found syntopic with those of *A. fugongensis*.

Geographical distribution within the Gaoligong Shan.— Fig. 7c. We examined a total of 2 specimens (1 male and 1 female) from Fugong and Gongshan Counties, respectively (see Type material above for exact collection data).

Specimens of this species were collected only in the northern half of the study area (Core Areas 2 and 3) and only on the eastern side of the mountain range. This distribution pattern may be an artifact of inadequate sampling on the western slope of the mountain range in the north, much of which is in Myanmar. The geographical range of this species overlaps that of *A. wuyipeng*, but members of the latter species appear to occupy slightly higher elevations in the same general areas.

Overall geographical distribution.— This species currently is known only from the northern half of the Gaoligong Shan in western Yunnan Province, China.

Agonotrechus wuyipeng Deuve, 1992

(Figs. 8, 36b, 45–48)

Agonotrechus wuyipeng Deuve, 1992b:172. Holotype, a male, in IOZ. Type locality: China, Sichuan, Wolong, Wuyipeng, 2500 m.

DIAGNOSIS.— Adults of this species (Fig. 8a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 6.5 to 6.7 mm), fully-winged, dorsum piceous to reddish brown and distinctly iridescent; head slender, eyes markedly projected; clypeus with four or six setae; mentum and submentum incompletely fused, submentum with six or eight setae; mandibles with four to six small setae along the dorsolateral margin of the scrobe; pronotum transverse (ratio PW/PL = 1.30), with lateral explanation broader, especially basally, basal angles rectangular and sharp with a small apical tooth projected laterally; elytra broad, with all discal striae evident and finely punctate, striae 1 to 5 moderately impressed, striae 6 to 8 more faintly impressed, parascutellar striole rather long, recurrent stria continuous anteriorly with stria 5, intervals only faintly convex, two discal setae (anterior and middle setae) present, the anterior seta inserted within basal one-sixth of elytra in stria 3, the middle seta near elytral middle in stria 3; median lobe of aedeagus of male (Fig. 8b) long and slender, with apex short, recurved dorsally and bluntly pointed, endophallus with a spoon-shaped sclerite.

COMMENTS.— The polymorphism we observed in the number of setae on both the clypeus (four or six) and submentum (six or eight) among specimens from the Gaoligong Shan populations was surprising. Belousov & Kabak (2003) described *Agonotrechus dubius*, based on a single female from Gansu Province, and noted similarities with *A. wuyipeng*. We have examined a male specimen from Shaanxi Province (Ningshan County, Huoditang Township, 1549 m, collected by Matt Brantley on 9 July 2005) which shares features described for the holotype of *A. dubius*, including six setae on the submentum, which Belousov & Kabak (2003) contrasted with the eight setae reported for *A. wuyipeng* members (Deuve 1992b). Together with other similarities, the polymorphism in this feature found among Gaoligong Shan specimens suggests that these two species may be better treated as conspecific, with *A. dubius* as a distinct subspecies, members of which have smaller size, relatively wider pronota, and more coarsely punctate elytral discal striae but are otherwise similar to members of the nominate form.

HABITAT DISTRIBUTION.— Specimens of this species were collected in daytime from under stones in shaded roadside and trailside areas with scattered grasses at elevations ranging from 2687 to 2770 m (Fig. 36b). Members of no other *Agonotrechus* or other trechine species have been found syntopic with those of *A. wuyipeng*.

GEOGRAPHICAL DISTRIBUTION WITHIN THE GAOLIGONG SHAN.— Fig. 8c. We examined a total of 10 specimens (7 males and 3 females) from the following localities: ***Fugong County:*** Shiyueliang Township (1 km above Shibali on Yaping Road, 2687 m, 1 May 2004, H.B. Liang collector [1 female; MNHN]. ***Gongshan County:*** Qiqi Trail at No 12 Bridge, N27.71500°/ E98.50222°, 2770 m, 2 May 2002, H.B. Liang & W.D. Ba collectors [7 males and 2 females; CAS, IOZ, MNHN].

Specimens of this species were collected only in the northern half of the study area (Core Areas 2 and 3) and only on the eastern side of the mountain range. This distribution pattern may be an artifact of inadequate sampling on the western slope of the mountain range in the north, much of which is in Myanmar. The geographical range of this species overlaps that of *A. fugongensis*, but members of the latter species appear to occupy slightly lower elevations in the same general areas.

OVERALL GEOGRAPHICAL DISTRIBUTION.— Fig. 45. This species currently is known only from the type locality in northcentral Sichuan and the northern half of the Gaoligong Shan in western Yunnan, but it probably occurs in the intervening region as well.

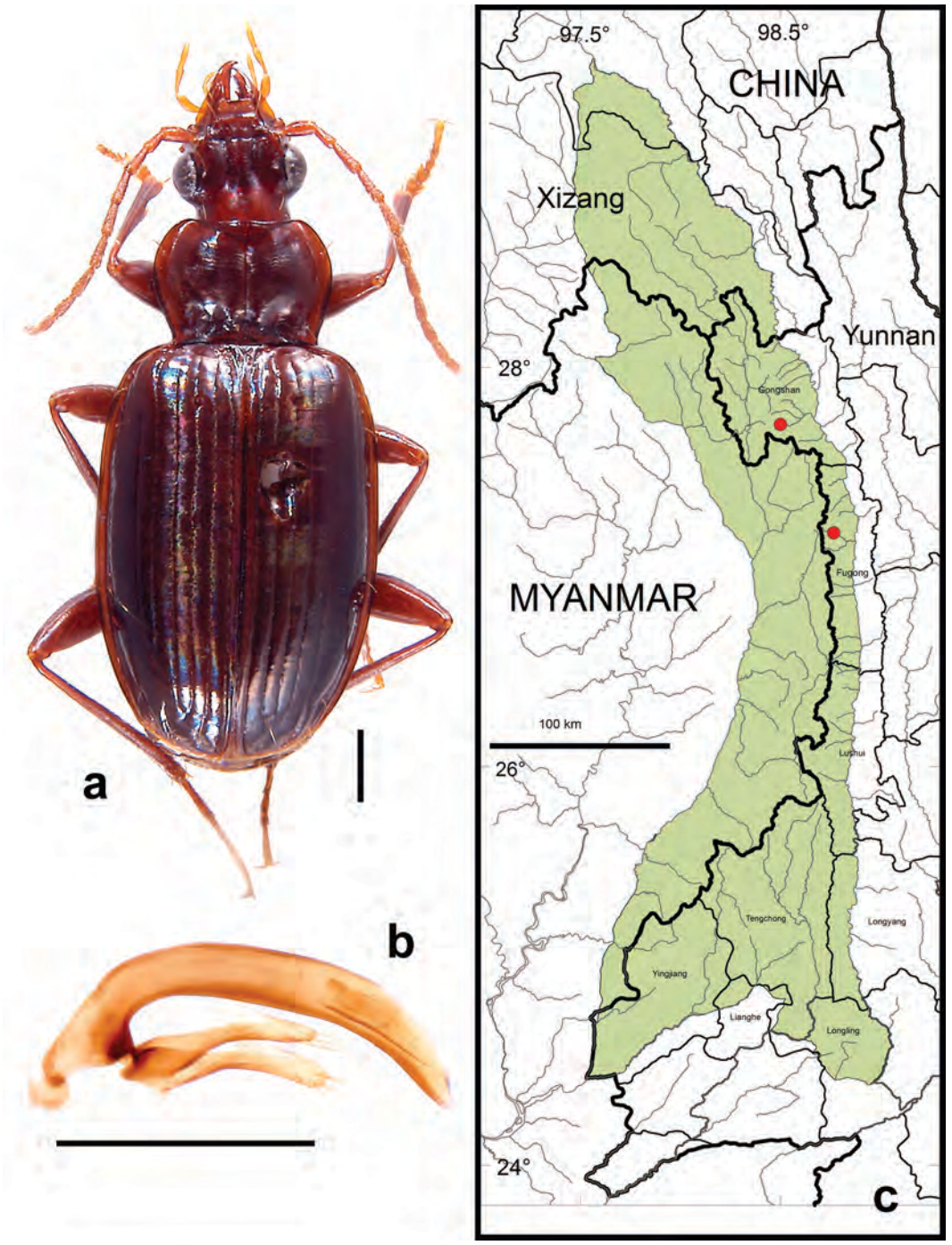


FIGURE 8. *Agonotrechus wuyipeng* Deuve; a. Dorsal habitus (CASENT1010854). b. Median lobe of aedeagus of male (CASENT1010854), left lateral aspect. c. Map of locality records (red circles) for *A. wuyipeng* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Agonotrechus xiaoheishan **Deuve and Kavanaugh, sp. nov.**
(Figs. 9, 16a, 44, 46–48)

TYPE MATERIAL.— Holotype, a male, in IOZ, labeled: "CASENT 1036866"/ "CHINA, Yunnan, Longling County, Longjiang Township, Xiaoheishan Forest Reserve, N24.83671°/ E098.76185°,"/ "2067 m, 28 May 2005, Stop# HBL-05-19, H.B. Liang, H.M. Yan & K.J. Gao collectors"/ "HOLOTYPE *Agonotrechus xiaoheishan* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 13): 2 males and 7 females (in CAS, IOZ, MNHN) labeled same as holotype except first label "CASENT 1036874", "CASENT 1036875", "CASENT 1036867", "CASENT 1036868", "CASENT 1036869", "CASENT 1036870", "CASENT 1036871", "CASENT 1036872" and "CASENT 1036873", respectively; 1 male and 1 female (in CAS) labeled "CASENT 1036863" and "CASENT 1036864", respectively/ "CHINA, Yunnan, Longling County, Longjiang Township, Xiaoheishan Forest Reserve, Guchengshan, 2020 m, N24.82888°/ E098.76001°,"/ "28 May 2005, Stop# 2005-033B, D.H. Kavanaugh, H.B. Liang, D.Z. Dong & J.L. Yang collectors"; 2 females (in CAS) labeled "CASENT 1031915" and "CASENT 1031916", respectively/ "CHINA, Yunnan, Longling County, Longjiang Township, Xiaoheishan Forest Reserve, Guchengshan, 2020 m, N24.82888°/ E098.76001°,"/ "28 May 2005, Stop# 2005-033C, D.H. Kavanaugh, C.E. Griswold, H.B. Liang, D.Z. Dong, H.M. Yan & K.J. Guo collectors". All paratypes also bear the following label: "PARATYPE *Agonotrechus xiaoheishan* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

TYPE LOCALITY.— China, Yunnan, Longling County, Longjiang Township, Xiaoheishan Forest Reserve, N24.83671°/E098.76185°, 2067 m.

DERIVATION OF SPECIES NAME.— The species epithet, *xiaoheishan*, is a noun in apposition, derived from the name of the area in which the holotype was collected.

DIAGNOSIS.— Adults of this species (Fig. 9a) can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 5.3 to 5.7 mm), fully-winged, dorsum piceous to reddish brown and distinctly iridescent; head slender, eyes only moderately projected; clypeus with four setae; mentum and submentum fused, submentum with six setae; mandibles with two or three small setae along the dorsolateral margin of the scrobe; pronotum small and narrow (ratio PW/PL = 1.21), basal angles subrectangular, basal flattened area restricted; midlateral seta inserted at anterior one-fourth, basolateral seta at hind angle; elytra with all discal striae evident, deeply impressed and punctate, however striae 1 to 4 effaced or nearly so near base, parascutellar striole rather long, recurrent stria continuous anteriorly with stria 5, intervals convex, only a single discal seta (anterior seta) present, inserted at basal one-eighth of elytra in stria 3; median lobe of aedeagus of male (Fig. 9b) short, with apex bent ventrally and bluntly pointed, endophallus with a spoon-shaped sclerite.

DESCRIPTION.— Size medium, BL = 5.3 to 5.7 mm. Color of dorsum piceous, shiny, iridescent, femora concolorous, tibiae, tarsi, antennae and mandibles paler reddish tan, palpi yellowish tan.

Head. Relatively slender, eyes only moderately projected, but nonetheless convex and with diameter twice length of tempora. Tempora not or only slightly convex, joined to neck region at ca. 120° angle. Frons slightly flattened, with two pairs of supraorbital setae, frontal furrows linear, distinct between the eyes, but effaced posterior to insertion of second supraorbital seta. Clypeus with four setae. Labrum slightly widened apically, apical margin slightly concave. Mandibles sharp, the right mandible (Fig. 16a) bidentate with the anterior tooth spaced well forward of the posterior tooth and the left mandible with only a small subtriangular process, also with two or three small setae along the dorsolateral margin of the scrobe. Mentum and submentum fused. Mentum with medial tooth rather broad, with the apex either obtuse or truncate, less than one-half as long as lat-

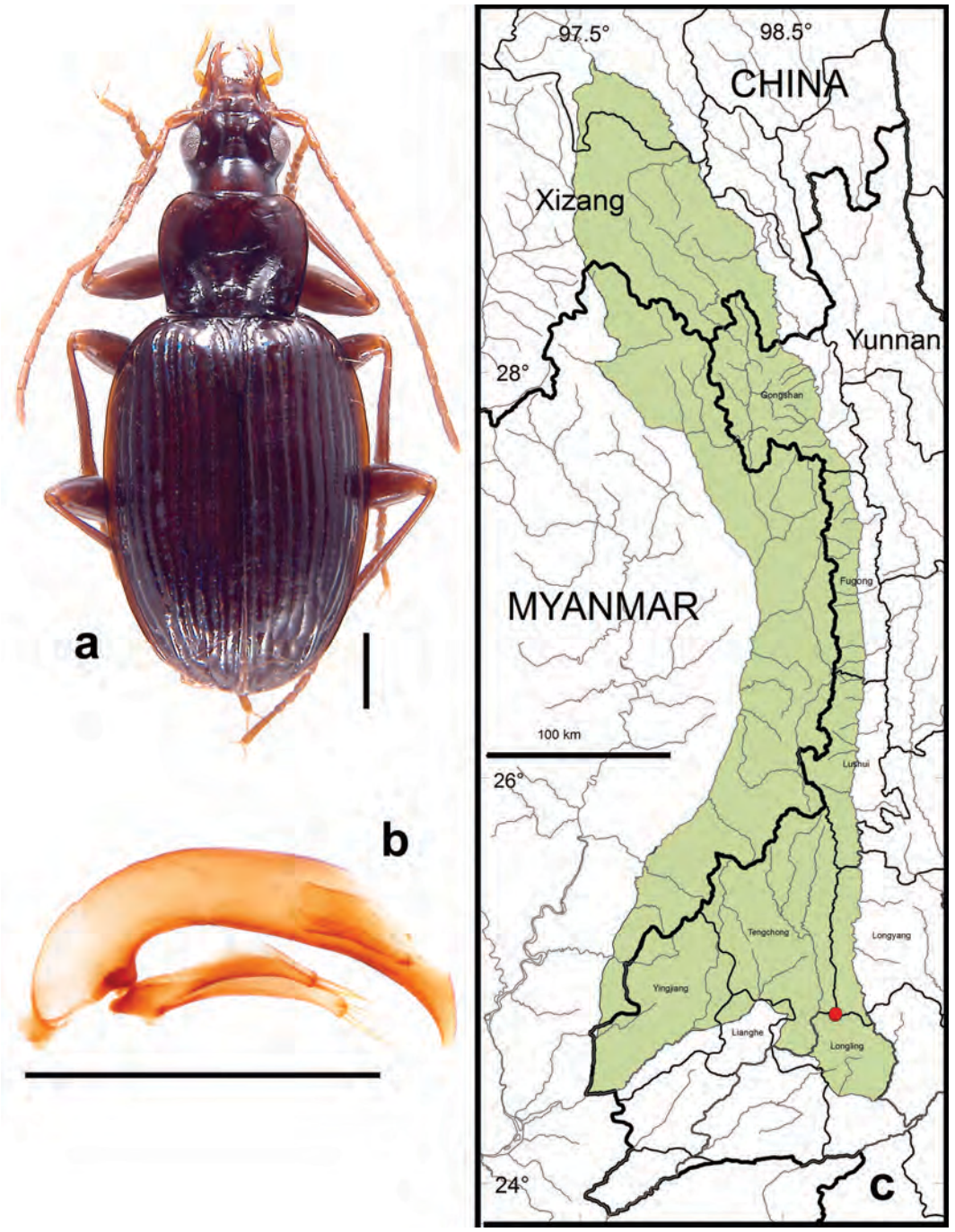


FIGURE 9. *Agonotrechus xiaoheishan* sp. nov.; a. Dorsal habitus (CASENT1036866). b. Median lobe of aedeagus of male (CASENT1036866), left lateral aspect. c. Map of locality records (red circles) for *A. xiaoheishan* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

eral lobes. Submentum with six setae subapically, gula broad. Genae with a single seta ventrally on each side. Antennae long and slender, extended to (in females) or slightly beyond (in males) the middle of the elytra, with five or six antennomeres beyond the pronotal base; antennonmeres 3 and 4 virtually the same length and antennomere 2 slightly shorter.

Pronotum. Relatively small, not or only slightly narrowed basally, only slightly transverse, ratio PW/PL = 1.21, widest at anterior one-third; lateral margins rectilinear in basal half, not sinuate except for a very slight and short inflexion just anterior to the basal angle, which is subrectangular and sharp; pronotal disc smooth, glabrous, moderately convex; median longitudinal impression very fine; basal foveae deep, basal flattened area rather small, delimited laterally by short but deep and oblique furrows. Lateral explanation slender and moderately reflexed in anterior two-thirds, then progressively broader in basal one-third without. Midlateral pair of setae inserted at anterior one-fifth and basolateral pair inserted at hind angles.

Elytra. Convex, large and broad, especially in relation to pronotum, elytral silhouette ovoid, about equally narrowed apically and basally, humeri evident but rounded. All discal striae evident, regular, deeply impressed and punctate, however striae 1 to 4 effaced or nearly so near base, parascutellar striole rather long, recurrent stria continuous anteriorly with discal stria 5, intervals convex, only a single discal seta (anterior seta) present, inserted at basal one-eighth near stria 3. Parascutellar setiferous pore present at base at common origin of discal striae 1 and 2. Anterior discal seta present, inserted at basal one-eighth of elytra in stria 3, which is effaced anterior to that point. Middle discal seta absent. Preapical seta present on interval 3 near stria 2 opposite the anterior edge of the subapical sinuation. Umbilicate setal series with setae of humeral group equidistant for each other and those of median group both inserted posterior to middle of elytra.

Legs. Slender but only moderately long. Protibiae furrowed. Male protarsi with tarsomeres 1 and 2 dilated and apicomedially toothed.

Male aedeagus. Median lobe (Fig. 9b) short, with apex bent ventrally and bluntly pointed, endophallus with a spoon-shaped sclerite.

Comments.— Members of this new species are morphologically similar to those of *Agonotrechus birmanicus* Bates (1892), described from Kachin State in Myanmar, and *Agonotrechus tenuicollis* Uéno (1986), described from eastern Nepal. However, they can be distinguished from members of both of these other species by the following features: pronotum with anterior margin straight, not concave, anterior angles only faintly projected and more broadly rounded, and lateral borders more slender anteriorly and at middle; and apex of the median lobe of the male aedeagus narrower and more curved.

Habitat distribution.— Members of this species have been found in and under rotting logs in dark, closed-canopy broadleaf evergreen forest (Fig. 44) at elevations ranging from 2020 to 2067 m. Although members of no other *Agonotrechus* species have been found syntopic with those of *A. xiaoheishan*, specimens of *Trechus indicus* were collected in the same samples.

Geographical distribution within the Gaoligong Shan.— Fig. 9c. We examined a total of 14 specimens (4 males and 10 females), all from Xiaoheishan Forest Reserve in the southern part of the Gaoligong Shan (see Type material above for exact collection data).

This species was recorded only from near the top of the western slope in the southern part of the study area (Core Area 6). Its known geographical range does not overlap with that of any other *Agonotrechus* species, although *A. yunnanus* has been recorded from the adjacent Core Area 7 on the eastern slope of the Gaoligong Shan, 13.3 km to the north.

Overall geographical distribution.— This species currently is known only from the type area in the southern part of the Gaoligong Shan, in western Yunnan Province, China.

Agonotrechus yunnanus Uéno, 1999

(Figs. 10, 46–48)

Agonotrechus yunnanus Uéno, 1999a:215. Holotype, a male, in NSMT. Type locality: China, Yunnan, Gaoligong Shan, Longyang County, 24.95°/ 98.75°, 2200-2500 m.

Notes on type material.— We have not had an opportunity to study the unique holotype of this species, so features noted below are taken from Uéno's orginal description.

Diagnosis.— Adults of this species (see Uéno 1999a, Fig. 1) can be distinguished from those of all other species in the region by the following combination of character states: size slightly small for the genus (BL = 5.4 mm); eyes large and projected; tempora short; pronotum rather small and only slightly transverse (ratio PW/PL = 1.28), lateral explanation slender anteriorly, slightly widened basally, basal angles subrectangular and sharp; elytra with intervals only slightly convex, discal striae deeply impressed and punctate, two discal setae (anterior and middle) present near stria 3; median lobe of aedeagus of male (see Uéno 1999a, Figs. 2–3) with apex short and broadly rounded.

Habitat distribution.— Although no precise habitat information accompanied the unique holotype specimen, Uéno (1999a:219) suggested it was probably collected near the pass across the crest of the Gaoligong Shan on the route from "Bawan to Shang'ying, which lies near the lower edge of the *Rhododendron* zone." According to Uéno (1999a), specimens of *Trechus indicus* Putzeys (which he recorded as *Trechus macrops* Jeannel) and *Epaphiotrechus fortipes* (Uéno) comb. nov. were also collected in the same area.

Geographical distribution within the Gaoligong Shan.— Fig. 10. ***Longyang County:*** N24.95°/E98.75°, 2200-2500 m, 8-16 May, O. Semala collector [1 male; NSMT]. No specimens of this species were collected during this study.

The type locality for this species is on the eastern slope of the southern part of the

FIGURE 10. *Agonotrechus yunnanus* Uéno; Map of locality record (red circle) in the Gaoligong Shan region. Scale line = 100 km.

Gaoligong Shan in the northern part of Core Area 7. This area is not within the geographical range of any other *Agonotrechus* species, although *A. xiaoheishan* has been recorded from the adjacent Core Area 6 on the western slope of the Gaoligong Shan, 13.3 km to the south.

Overall geographical distribution.— This species currently is known only from the type locality in the southern part of the Gaoligong Shan, in western Yunnan Province, China.

Genus *Minutotrechus* Deuve and Kavanaugh, gen. nov.

Type species.— *Stevensius minutus* Uéno, 1997.

Derivation of genus group name.— The genus group name (masculine) is a combination of the Latin adjective, *minutus*, meaning very small, and the generic name, *Trechus*, in reference to the small size of members of this genus.

Diagnosis.— Adults of this genus (Fig. 11a) can be recognized by the following combination of character states: size small (BL = 2.7 to 2.9 mm), apterous, body color brown to black; head large with small but protruding eyes, their diameter shorter than length of tempora; mandibles short, obtusely bidentate, mentum and submentum at least partial fused, labial suture partially perceptible, mentum with medial tooth truncate; pronotum small, cordate, narrow (ratio PW/PL = 1.25), very convex, globulose, glabrous, basal angles small and subrectangular, slightly obtuse, with basal margin broadly lobate, basal area convex, both midlateral and basolateral setae present; elytra ovoid and markedly convex, with discal striae 2 to 8 striae effaced, stria 1 deeply impressed and punctate, both anterior and middle discal setae present, preapical seta absent, lateral groove abruptly terminated anteriorly at humerus; legs short, protibiae without longitudinal furrows.

Comments.— This new genus is known from only six female specimens that were originally assigned by Uéno (1997) to genus *Stevensius* Jeannel (1923) of the eastern Himalayan region. However, they can be distinguished from members of that genus by their smaller head size, protibiae without longitudinal furrows, pronotum more cordate and with basal angles smaller and basal margin broadly lobate and elytra with the lateral groove abruptly terminated anteriorly at humerus. *Minutotrechus* appears to be more closely related to *Hubeitrechus* Deuve (2005), but its members can be distinguished from those of the latter in having the mentum and submentum at least partial fused, the mandibular teeth short and obtuse, the pronotum with the median basal area more convex and basal margin broadly lobate and without margination, and lateral groove abruptly terminated at the humerus. Because no male specimens of *Minutotrechus* have been collected to date, we do not know if male protarsomeres 1 and 2 are elongate as in males of *Hubeitrechus* or broad as in *Stevensius* males. Members of this new genus can also be compared with those of *Uenoites* Belousov and Kabak (2016), from which they differ in having the right mandible obtusely bifid (tridentate in *Uenoites* members), the protibiae without longitudinal furrows (longitudinal furrows present in *Uenoites* members), the mentum and submentum at least partial fused (not fused in *Uenoites* members), elytra with only two discal setae (three or more discal setae present in *Uenoites* members), the preapical seta absent (present in *Uenoites* members) and the lateral groove abruptly terminated at humerus (gradually narrowed anterior to humerus in *Uenoites* members).

Geographical distribution.— This genus currently is known only from the type species, which is known only from the southern part of the Gaoligong Shan region of western Yunnan Province, China.

Minutotrechus minutus (Uéno, 1997)

(Figs. 11, 46–48)

Stevensius minutus Uéno, 1997:182. Holotype, a female, in NMST. Type locality: China, Yunnan, Gaoligong Shan, Tengchong County, Dabei, 2430 m.

Minutotrechus minutus (Uéno) **New Combination**.

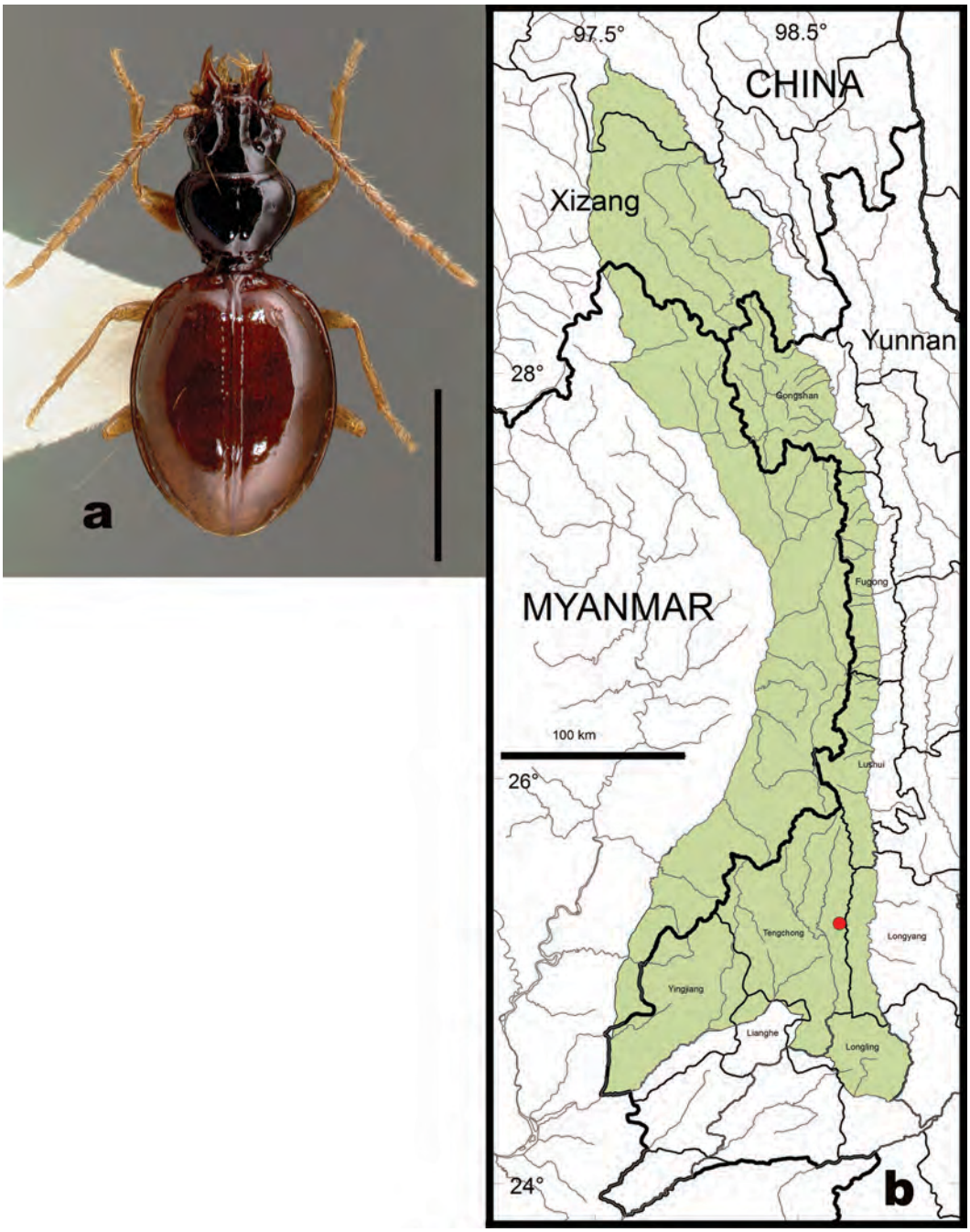


FIGURE 11. *Minutotrechus minutus* (Uéno); a. Dorsal habitus (paratype). scale line = 1.0 mm; b. Map of locality records (red circle) for *M. minutus* in the Gaoligong Shan region. Scale lines a = 0.5mm, b = 100 km.

Notes on type material.— We have not had an opportunity to study the holotype of this species, but we have examined a paratype female deposited in IOZ. Features noted below are based on our examination of that paratype and Uéno's orginal description.

Diagnosis.— Adults of this species (Fig. 11a), the only known species in this new genus, can be distinguished from those of all other species in the region by the combination of character states noted in the generic diagnosis.

Habitat distribution.— According to Uéno (1997) specimens of the type series were collected at an elevation of 2430 m in a dense *Rhododendron* forest by sifting moist leaf litter accumulations on the ground. He also noted that many specimens of "*Trechus asetosus* Uéno" (1997) were also collected in the same litter samples.

Geographical distribution within the Gaoligong Shan.— Fig. 11b. This species is known only from the six female specimens of the type series collected at the type locality, in Tengchong County, high on the western slope of the southern part of the Gaoligong Shan in Core Area 6.

Overall geographical distribution.— This species currently is known only from the type locality in the southern part of the Gaoligong Shan, in western Yunnan Province, China.

Genus *Queinnectrechus* Deuve, 1992

Queinnectrechus Deuve, 1992b:354.

Type species.— *Queinnectrechus excentricus* Deuve, 1992a

Diagnosis.— Adults of this genus (Figs. 12–14) can be recognized by the following combination of character states: size moderate (BL = 3.5 to 4.8 mm), apterous, body dark, reddish brown to piceous, surface micaceous; head with small eyes, mentum and submentum fused; right mandible tridentate, the premolar tooth distinct but joined with the retinaculum (see Deuve 1992b, Fig. 23); pronotum cordiform and markedly convex, lateral margination effaced posteriorly, with two setae (midlateral and basolateral) present on each side; elytra markedly convex, inflated, slightly tear-shaped, humeri effaced, elytral discal striae absent or vestigial, with two (in most members) or three (in a few members) discal setae present, aligned on interval 3 near stria 3, preapical seta absent from most members, in some of these members inserted forward in a subdiscal position, in very few placed in typical trechine position nearer elytral apex and next to stria 2; protibiae furrowed; abdominal ventrites IV to VI glabrous except for a single pair of paramedial setae; endophallus of male aedeagus with two sclerites.

Comments.— Two new genera closely related to *Queinnectrechus* have recently been described. Members of *Dactylotrechus* Belousov and Kabak (2003) are distinguished by the supernumerary setae present on the external margins of the pronotum and on more lateral areas of the elytral disc. Members of *Puertrechus* Belousov and Kabak (2014a) are distinguished by the presence of a single discal setae subbasally on interval 5. Members of both taxa have a preapical seta inserted near stria 2, a plesiomorphic feature among trechines. Taxonomic limits and phylogenetic relationships among the "genera" *Stevensius*, *Kozlovites* Jeannel (1935), *Queinnectrechus*, *Dactylotrechus*, *Puertrechus*, *Sinotrechiama* Uéno (2000), *Uenoite*s Belousov and Kabak (2016) and *Minutotrechus* (describe above) are still poorly resolved. This is why we describe below a new taxon, *Gaoligongtrechus*, provisionally with the rank of subgenus. This assignment can be changed as needed in the future.

Geographical distribution.— This genus, which currently include 13 described species (Belousov and Kabak 2003, Casalle and Magrini 2009, Deuve 1992a, and Uéno 1998a and 1998b) is currently known from the Min Shan region of northern Sichuan Province southwest to western

Yunnan Province. The Gaoligong Shan forms the southwestern limit of the known distributional range of the genus.

Key for Identification of Subgenera of *Queinnectrechus* in the Gaoligong Shan Region

1. Pronotum with basal angles prolonged posteriorly as slender digitiform processes (Figs. 12a, 13a) . . . . . Subgenus *Queinnectrechus* Deuve
1' Pronotum with basal angles simple (Fig. 14a). . . Subgenus ***Gaoligongtrechus* subgen. nov.**

Subgenus *Queinnectrechus* Deuve, 1992

Queinnectrechus Deuve, 1992a:354.

Diagnosis.— Adults of this subgenus (Figs. 12a, 13a) can be recognized by the following combination of character states: size moderate (BL = 3.5 to 4.8 mm), apterous, body dark, reddish brown to piceous, surface micaceous; pronotum with basal angles prolonged posteriorly as slender digitiform processes, with two setae (midlateral and basolateral) present on each side; elytra markedly convex, inflated, slightly tear-shaped, humeri effaced, elytral discal striae effaced, with two (in most members) or three (in a few members) discal setae present, aligned on interval 3 near stria 3, preapical seta absent from most members.

Geographical distribution.— Same as for genus (see above).

Key for Identification of Adults of Subgenus *Queinnectrechus* species of the Gaoligong Shan Region

1. Size larger (BL = 4.3 to 4.8 mm), elytra (Fig. 12a) more elongate; median lobe of male aedeagus broadest at mid-shaft, with apex long and recurved. . . . . ***Q. griswoldi* sp. nov**.
Size smaller (BL = 3.5 to 3.8 mm), elytra (Fig. 13a) shorter, ovoid; median lobe of male aedeagus slender, with apex short and not at all curved. . . . . ***Q. gongshanicus* sp. nov.**

Queinnectrechus (*s. str.*) *griswoldi* Deuve and Kavanaugh, sp. nov.

(Figs. 12, 37b, 38a, 38b, 39b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1026334"/ "CHINA, Yunnan, Gongshan County, Cikai Township, 0.1 km SE of Heipu Yakou in valley below tunnel, N27.76978°/ E98.44681°,"/ "3720 m, 13 August 2006, Stop #DHK-2006-073 D.H. Kavanaugh & J.A. Miller collectors"/ "HOLOTYPE *Queinnectrechus* (*s. str.*) *griswoldi* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 20): 5 males and 3 females (in CAS, IOZ, MNHN) labeled same as holotype except first label "CASENT 1026333", "CASENT 1026335" to "CASENT 1026338" and "CASENT 1026330" to "CASENT 1026332", respectively; 1 female (in IOZ) labeled "CASENT 1010344"/ "CHINA, Yunnan, Gongshan County, Cikai Township, 52.6 km W of Gongshan on Dulong Valley Road, 3360-3380 m,"/ "N27.77032°/ E098.44661°, 1-2 October 2002, Stop #DHK-2002-034, D.H. Kavanaugh & P.E. Marek collectors"; 1 male and 3 females (in CAS, IOZ) labeled "CASENT 1024862" and "CASENT 1024863" to "CASENT 1024865", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, on slope NE of Chukuai Lake, 3950,"/"N27**.**98206°/ E098.48027°, 20 August 2006, Stop #DHK-2006-086 Y. Liu, P. Hu, D.Z. Dong, & J. Wang collectors"; 3 males and 1 female (in CAS, IOZ, MNHN) labeled "CASENT 1026813" to "CASENT 1026815" and "CASENT 1026815", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan at Chukuai Lake, 3720 m,"/ "N27.98121°/ E098.47580°, 18 August 2006 Stop #DHK-2006-079 J.A. Miller, D.Z. Dong, & Y. Liu collectors"; 1 female (in CAS) labeled

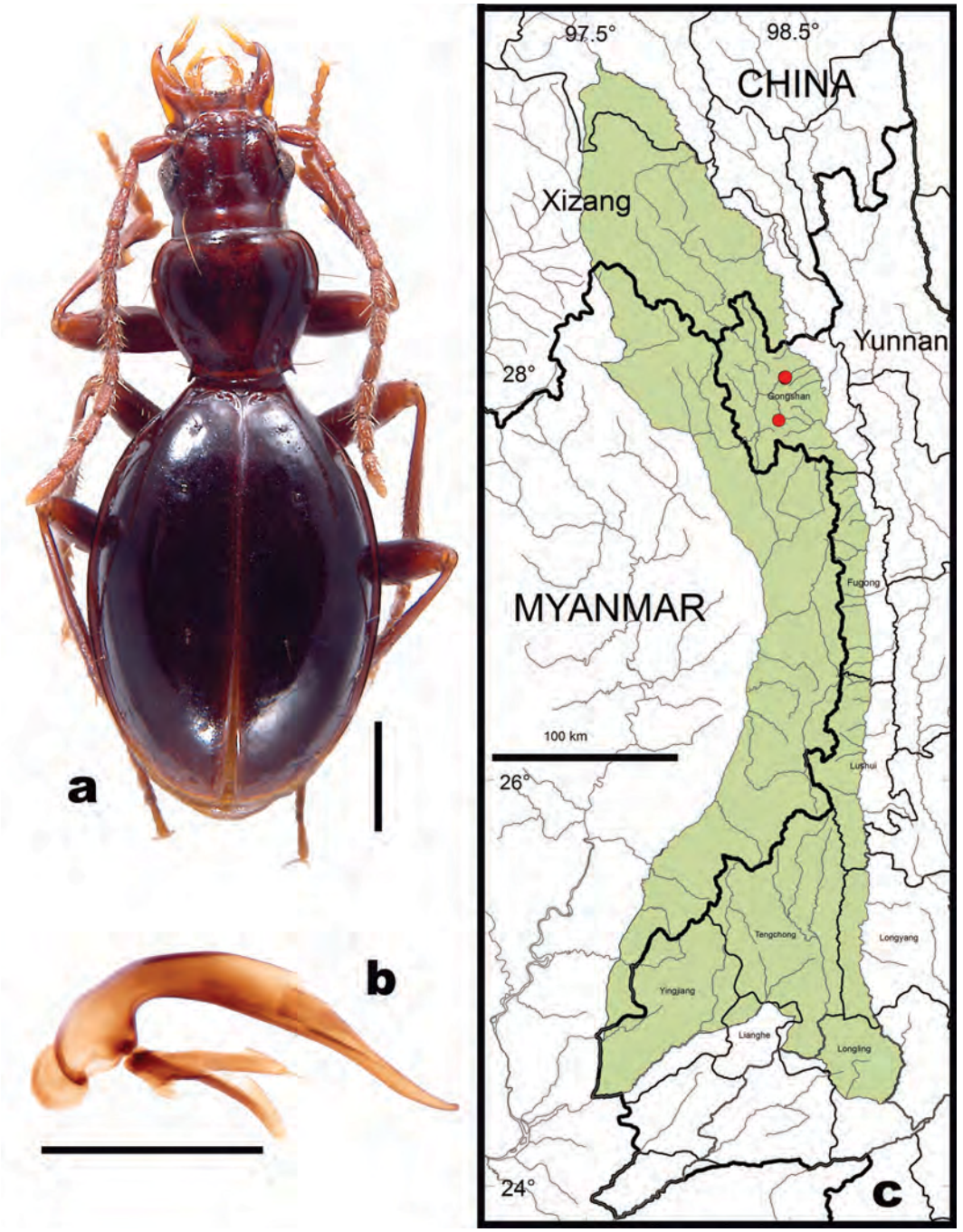


FIGURE 12. *Queinnectrechus* (*s. str.*) *griswoldi* sp. nov.; a. Dorsal habitus (CASENT1026334). b. Median lobe of aedeagus of male (CASENT1026334), left lateral aspect. c. Map of locality records (red circles) for *Q. griswoldi* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

"CASENT 1025813"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan 0.3 km SW of Chukuai Lake at campsite,"/, "N27.97686°/ E098.47799°, 3750 m, 18 August 2006 Stop #DHK-2006-078 D.H. Kavanaugh collector"; 2 females (in IOZ) labeled "CASENT 1025836" and "CASENT 1025837", respectively / "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite,"/ "N27.97686°/ E098.44779°, 3750 m, 19 August 2006, Stop #DHK-2006-082 Y. Liu collector". All paratypes also bear the following label: "PARATYPE *Queinnectrechus* (*s. str.*) *griswoldi* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gongshan County, Cikai Township, 0.1 km SE of Heipu Yakou, in valley below tunnel, N27.77437°/ E098.44793°, 3270 m.

Derivation of species name.— The species epithet, *griswoldi*, is the Latinized form (in the genitive case) of the surname of Charles E. Griswold, now Curator Emeritus and former Schlinger Chair of Arachnology at the California Academy of Sciences, who participated in several of the expeditions to the study area and helped collect many carabid specimens for this project. We are pleased to name this elegant species in his honor.

Diagnosis.— Adults of this species (Fig. 12a) can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 4.3 to 4.8 mm), body dark reddish brown, very shiny; eyes small and convex, tempora slightly convex; pronotum markedly narrowed posteriorly, markedly convex, globulose, narrowly cordate, disc smooth, basal angles with distict digitorm projections, each side with a single midlateral and basolateral seta; elytra markedly convex, tear-shaped, discal striae effaced, with three discal setae in a row along the presumed location of stria 3, preapical seta absent; median lobe of male aedeagus (Fig. 12b) large, elongate, broadest at mid-shaft, with apex long and recurved dorsally, endophallus with internal sclerites acuminate apically.

Description.— Size medium, BL = 4.3 to 4.8 mm. Color of body, antennae and legs dark reddish brown, palpi paler, yellowish tan, body surface very shiny, micaceous, smooth and glabrous.

Head. Moderate in size, eyes small and convex, their convexity greater than and their diameter about as long as tempora, the latter only slightly convex and glabrous. Frons with frontal furrows deep, rounded, and not interrupted posteriorly; two suporaorbital setae present, the anterior inserted opposite midpoint of eye, the posterior inserted in postocular groove. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Right mandible tridentate. Left mandible with a small, minutely tridentate process. Mentum and submentum fused. Mentum with medial tooth wide, bifid or truncate, one half the length of the lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae of moderate length, extended posteriorly almost to or slightly beyond basal one-fourth of elytra, with 3.5 antennomeres in females and 4.5 antennomeres in males extended beyond basal pronotal margin, antennomeres slightly broadened, antennomere 3 slightly longer than antennomeres 2 or 4.

Pronotum. Shape narrowly cordiform, only slightly transverse (ratio PW/PL = 1.1), widest at the anterior one-fourth, markedly narrowed posteriorly, lateral margins distinctly sinuate anterior to basal angles, the latter extended posteriorly as slender, pointed, digitiform processes. Disc markedly convex, globulose, smooth and glabrous, with median longitudinal impression very faintly impressed or effaced, basal fovea small and smooth; median basal area smooth; basal margin slightly convex and rounded. Lateral border of pronotum slender, distinctly defined only in anterior one-third to one-half, effaced in posterior one-half to two –thirds. Single midlateral setae on each side inserted at anterior one-third; single basolateral seta on each side, inserted on basal angle at base of digitform process.

Elytra. Elytral silhouette slightly tear-shaped, with humeri effaced, disc markedly convex, smooth and glabrous. All discal striae effaced except for faintly impressed parascutellar striole and a short, faintly impressed recurrent stria. Basal setiferous pore present. Three discal setae present, aligned along presumed track of stria 3. Preapicale seta absent, one or two apicoangular setules present. Umbilicate setal series with setae of humeral group equidistance from each other, with the first slightly more medially inserted than the others, setae of median group inserted distinctly posterior to middle.

Legs. Moderately long but slender. Protibiae with longitudinal furrow, sparely pubescent apically on anterior surface. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, females with two pairs.

Male aedeagus. Median lobe (Fig. 12b) large, elongate, broadest at mid-shaft, with apex long and recurved dorsally; endophallus with internal sclerites acuminate apically.

Comments.— Based on similarities in the form of the aedeagus of males, this species is closely related to *Queinnectrechus jiuhecola* Deuve & Kavanaugh (Deuve et al. 2015), described from Lijiang County, northwestern Yunnan. However, members of this new species are distinguished from those of the latter by their much smaller size (BL = 5.3 to 5.8 mm in *Q. jiuhecola* members), more elongate body form, more convex elytra, discal striae fully effaced (at least three medial striae evident in *Q. jiuhecola* members) and, most significantly, preapical seta absent (present near stria 2 subapically in *Q. jiuhecola* members).

In a recent paper, Belousov and Kabak (2016) established a new genus, *Uenoites*, in which they placed *Q. jiuhecola*, as well as three other species previously included in *Kozlovites* or *Deuveotrechus* Uéno (1995), based on the presence of a preapical seta, more convex tempora, and the median lobe of the male aedeagus not markedly hooked apically. However, all these features are plesiomorphic among trechines, which is problematic for demonstrating phylogenetic affinity of the included taxa. Clearly, phylogenetic relationships among these groups of species remain unresolved. As noted above, the genitalia of *Q. griswoldi* males are very similar to those of *Q. jiuhecola* males, wherease those of the new species described below, *Queinnectrechus gongshanicus* sp. nov., are of a very different form, although both of the new species described here are members of genus *Queinnectrechus*.

Habitat distribution.— Members of this species have been found in a variety of microhabitats in the alpine zone near the crest of the Gaoligong Shan and the eastern slope, at elevations ranging from 3270 to 3950 m. Specimens were collected under stones in moist meadows and on tundra slopes and ridges with sparse to thick herbaceous vegetation (Figs. 37b, 38a, 38b, 39b), at the edges of small streams and seeps from talus slopes, and at the edges of *Rhododendron* thickets up to 1.5 m tall. Members of this species have been found syntopic with specimens of *Queinnectrechus* (*Gaoligongtrechus*) *balli* sp. nov., *Queinnectrechus* (*s. str.*) *gongshanicus* sp. nov., *Trechus gongshanensis* sp. nov., *Trechus qiqiensis* sp. nov. and *Trechepaphiopsis monochaeta* sp. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 12c. We examined a total of 21 specimens (10 males and 11 females), all from the northern part of the Gaoligong Shan, in Bingzhongluo and Cikai Townships, Gongshan County (see Type material above for exact collection data). These localities are all on the crest or eastern slope of the Gaoligong Shan in Core Area 2.

Overall geographical distribution.— This species currently is known only from the northern part of the Gaoligong Shan, in western Yunnan Province, China.

***Queinnectrechus* (*s. str.*) *gongshanicus* Deuve and Liang, sp. nov.**
(Figs. 13, 39a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1024868"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, on slope NE of Chukuai Lake, 3950 m,"/ "N27**.**98206/ E098.48027°, 20 August 2006, Stop #DHK-2006-086 Y. Liu, P. Hu, D.Z. Dong, & J. Wang collectors"/ "HOLOTYPE *Queinnectrechus* (*s. str.*) *gongshanicus* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (a total of 10): 2 females (in CAS, IOZ) labeled same as holotype except first label "CASENT 1024866" and "CASENT 1024867", respectively; 1 male and 1 female (in IOZ, MNHN) labeled: "CASENT 1025160" and "CASENT 1025161", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.75 km NW of Chukuai Lake,"/ "N27**.**98631°/ E098.47069°, 21 August 2006, Stop #DHK-2006-095 Y. Liu, P. Hu, & J. Wang collectors"; 1 male and 3 females (in CAS, IOZ) labeled "CASENT 1025935" and "CASENT 1025936" to "CASENT 1025938", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite, "N27.97686°/ E098.44779°"/ "3750 m, 19-22 August 2006, Stop #DHK-2006-095C D.H. Kavanaugh, J.A. Miller, D.Z. Dong, Y. Liu, P. Hu, & J. Wang collectors"; 2 males (in CAS, MNHN) labeled "CASENT 1026203" and "CASENT 1026204", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km NNE of Chukuai Lake, "N27.98393°/ E098.47491°"/ "3745 m, 19 August 2006, Stop #DHK-2006-081 D.H. Kavanaugh, J.A. Miller, & D.Z. Dong collectors". All paratypes also bear the following label: "PARATYPE *Queinnectrechus* (*s. str.*) *gongshanicus* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, on slope NE of Chukuai Lake, N27**.**98206/E098.48027°, 3950 m.

Derivation of species name.— The species epithet, *gongshanicus*, is derived from the name of the county (Xian) in which the holotype was collected, Gongshan, and the Latin adjectival suffix, *-icus*, meaning belonging to or pertaining to.

Diagnosis.— Adults of this species (Fig. 13a) can be distinguished from those of all other species in the region by the following combination of character states: same features as members of *Q. griswoldi* except, size smaller (BL = 3.5 to 3.8 mm), body form short, with elytra, in particular, shorter and more oval, less elongate; digitiform projections of pronotal basal angles slightly more divergent laterally; elytral recurrent stria slightly deeper impressed, median lobe of male aedeagus (Fig. 13b) markedly different, with shaft thin and straighter, abruptly bent basally, apex short and rectangular, endophallus with a single apically acuminate internal sclerite.

Description.— Size smaller, BL = 3.5-3.8 mm. Body color dark, reddish-piceous, antennae and legs reddish tan, palpi and tarsi paler, yellowish tan.

Head. Moderate in size; eyes small and convex, their convexity greater than and their diameter about as long as tempora, the latter moderately convex and glabrous. Frons not flattened; frontal furrows deep, rounded, slightly attenuated posterior to the eyes. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mentum and submentum fused. Mentum with medial tooth short, wide, bifid, less than one-half the length of the lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae slightly shorter, with only two antennomeres extended posteriorly beyond basal pronotal margin, antennomeres slightly broadened, antennomere 3 slightly longer than antennomeres 2 or 4.

Pronotum. Cordate (ratio PW/PL = 1.15), markedly narrowed posteriorly, greatest width near anterior one-third, lateral margins rounded anteriorly, then straightened posteriorly just anterior to basal angles, the latter prolonged as slender, slightly divergent digitiform processes. Disc marked-

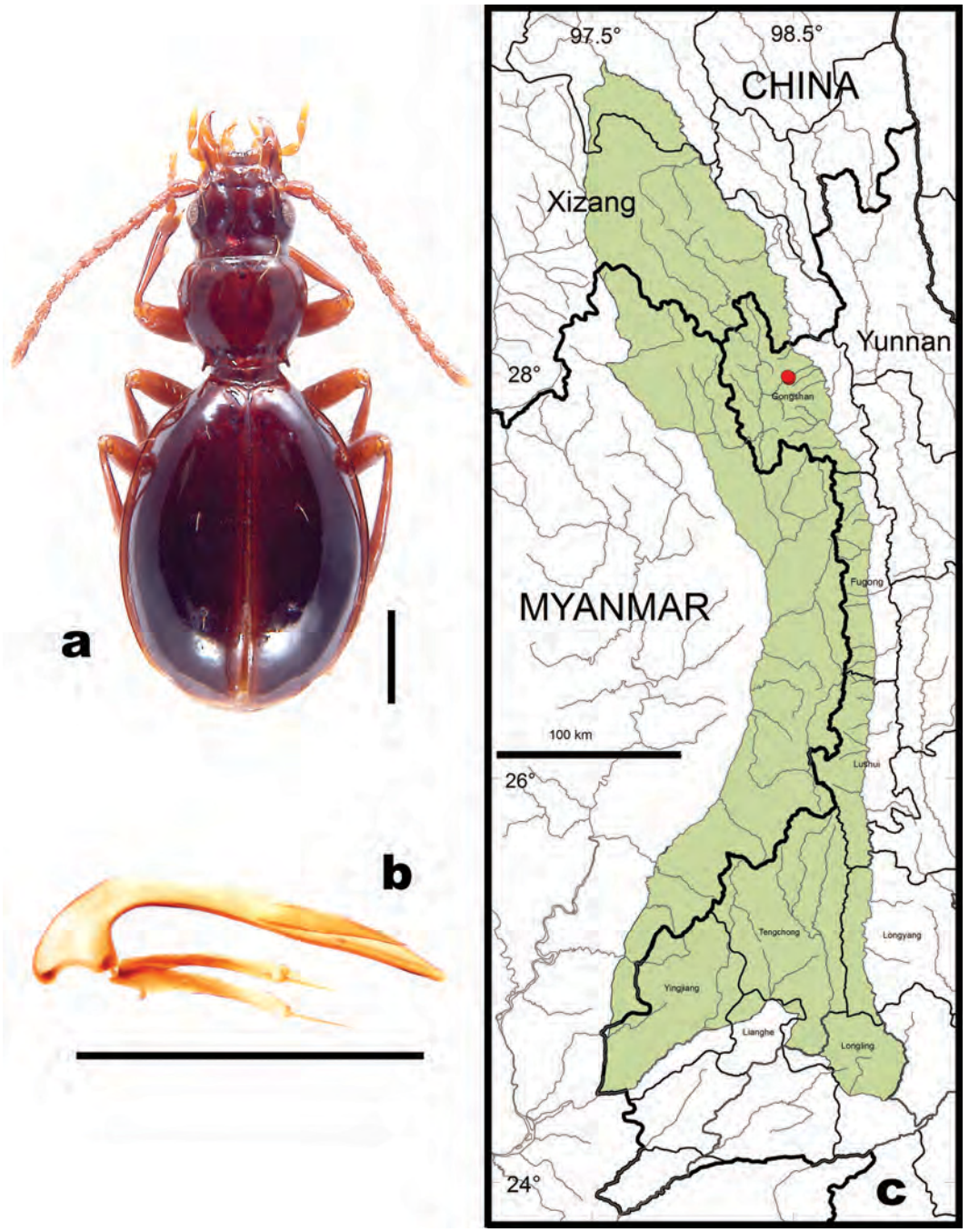


FIGURE 13. *Queinnectrechus* (*s. str.*) *gongshanicus* sp. nov.; a. Dorsal habitus (CASENT1024868). b. Median lobe of aedeagus of male (CASENT1024868), left lateral aspect. c. Map of locality records (red circles) for *Q. gongshanicus* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

ly convex, smooth and glabrous, median longitudinal impression only superficially impressed; basal foveae distinct but small and round; median basal area smooth and markedly transverse, delimited anteriorly by a faint transverse impression; basal margin convex and rounded. Lateral border of pronotum rudimentary, extremely slender, distinctly defined only in anterior one-third to one-half, effaced in posterior one-half to two –thirds. Single midlateral setae on each side inserted at anterior one-third; single basolateral seta on each side, inserted on basal angle at base of digitform process.

Elytra. Short, ovoid, very slightly tear-shaped, narrower anteriorly than posteriorly, humeri effaced. Disc markedly convex and smooth. All discal striae effaced, except for a faintly impressed parascutellar striole and a short and shallow recurrent stria. Basal setiferous pore present. Three discal setae present, aligned along presumed track of stria 3. Preapicale seta absent, two or three apicoangular setules present. Umbilicate setal series with setae of humeral group equidistance from each other, with the first slightly more medially inserted than the others, setae of median group inserted distinctly posterior to middle.

Legs. Slightly short but slender. Protibiae with longitudinal furrow, glabrous or sparely pubescent apically on anterior surface. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 13b) with shaft with shaft thin and straight, abruptly bent basally, apex short and rectangular, endophallus with a single long, apically acuminate internal sclerite.

Habitat distribution.— Members of this species have been found in a variety of microhabitats in the alpine zone on the southwest slope of Kawakarpu Shan, at elevations ranging 3745 to 3950 m. Specimens were collected from under stones in moist meadows, on tundra slopes and ridges with sparse to thick herbaceous vegetation, at the edges of small streams and seeps from talus slopes They were also collected in pitfall traps placed at the edges of *Rhododendron* thickets up to two meters tall. Members of this species have been found syntopic with specimens of *Queinnectrechus* (*Gaoligongtrechus*) *balli* sp. nov., *Queinnectrechus* (*s. str.*) *griswoldi* and *Trechus gongshanensis* sp. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 13c. We examined a total of 11 specimens (4 males and 7 females), all from the southwest slope of Kawakarpu Shan in the northern part of the Gaoligong Shan, in Bingzhongluo Township, Gongshan County (see Type material above for exact collection data). These localities are all in Core Area 2.

Overall geographical distribution.— This species currently is known only from the northern part of the Gaoligong Shan, in western Yunnan Province, China.

Subgenus *Gaoligongtrechus* Deuve and Kavanaugh, subgen. nov.

Type species.— *Queinnectrechus* (*Gaoligongtrechus*) *balli* sp. nov.

Derivation of genus group name.— The genus group name (masculine) is a combination of *Gaoligong*, the name of the mountain range where this taxon was discovered, and the genus name *Trechus*.

Diagnosis.— Adults of this subgenus (Fig. 14a) can be recognized by the following combination of character states: size moderate (BL = 4.3 to 4.8 mm), apterous, body dark and very shiny, micaceous; head slightly elongate, eye small, their diameter less than length of tempora; right mandibles tridentate; mentum and submentum fused; pronotum narrowed posteriorly, narrowly cordate, pronotal disc markedly convex and glabrous, basal angles acute but without digitiform extensions, basal margin roundly convex and fitted to concave elytral base, laterally with two or

three anteromedial setae and a single basal seta on each side; elytral silhouette tear-shaped, widest distinctly posterior to middle, humeri effaced, disc very convex and smooth, without distinct discal striae, except recurrent stria short but distinctly impressed, with four to six discal setae aligned near presumed location of stria 3, preapical seta present; abdominal ventrite IV to VI each with a pair of paramedial setae; male aedeagus with median lobe rather slender, bent basally about 90° to shaft, endophallus with a pair of slender sclerites tapered to points on both ends.

Geographical distribution.— At present this subgenus includes the single species described below, which is known only from the northern part of the Gaoligong Shan in western Yunnan Province, China.

Queinnectrechus (*Gaoligongtrechus*) *balli* Deuve and Kavanaugh, sp. nov.

(Figs. 14, 37b, 39b, 40a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1001935"/ "CHINA, Yunnan Province, Gaoligong Shan, Nujiang Prefecture, Nujiang State Nature Reserve, Dulong/Gongshan Yakou [= Qiqi/Dulong divide] area, 21 airkm W of Gongshan,"/ "N27.69655°/ E98.45389°, 3300-3680m, 16-17 July 2000, Stop#00-24C, D.H. Kavanaugh, C.E. Griswold, Liang H.-B., D. Ubick, & Dong D.-Z. collectors"/ "HOLOTYPE *Queinnectrechus* (*Gaoligongtrechus*) *balli* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 32): 2 males and 12 females (in CAS, IOZ, MNHN) labeled same as holotype except first label "CASENT 1001933" to "CASENT 1001934" and "CASENT 1001936" to "CASENT 1001947", respectively; 1 female (in CAS) labeled "CASENT 1010343"/ "CHINA, Yunnan, Gongshan County, Cikai Township, 52.6 km W of Gongshan on Dulong Valley Road, 3360-3380 m,"/ "N27.77032°/ E098.44661°, 1-2 October 2002, Stop #DHK-2002-034, D.H. Kavanaugh & P.E. Marek collectors"; 1 female (in CAS) labeled "CASENT 1024375"/ "CHINA, Yunnan, Gongshan County, Cikai Township, southeast slope of Heipu Yakou, 3365 m, N27.77032°/ E098.44674°,"/ "11 August 2006, Stop #DHK-2006-069A, D.H. Kavanaugh, J.A. Miller, D.Z. Dong, & Y. Liu collectors"; 3 males and 2 females (in IOZ, MNHN) labeled "CASENT 1025840" to "CASENT 1025842" and "CASENT 1025838" to "CASENT 1025839", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite,"/ "N27.97686°/ E098.44779°, 3750 m, 19 August 2006, Stop #DHK-2006-082 Y. Liu collector"; 1 female (in CAS) labeled "CASENT 1026202"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km NNE of Chukuai Lake, N27.98393°/ E098.47491°,"/ "3745 m, 19 August 2006, Stop #DHK-2006-081 D.H. Kavanaugh, J.A. Miller, & D.Z. Dong collectors"; 5 males and 2 females (in CAS, IOZ) labeled ""CASENT 1026323" to "CASENT 1026327" and "CASENT 1026328" to "CASENT 1026329", respectively/ "CHINA, Yunnan, Gongshan County, Cikai Township, 0.1 km SE of Heipu Yakou in valley below tunnel, N27.76978°/ E98.44681°,"/ "3720 m, 13 August 2006, Stop #DHK-2006-073 D.H. Kavanaugh & J.A. Miller collectors"; 1 male (in CAS) labeled "CASENT 1026707"/ "CHINA, Yunnan, Gongshan County, Dulongjiang Township, NW slope of Heipu Yakou, 3350 m, N27.77437°/ E098.44793°,"/ "13 August 2006, Stop #DHK-2006-075 D.H. Kavanaugh & J.A. Miller collectors"; 2 females (in IOZ) labeled "CASENT 1026817" and "CASENT 1026818", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan at Chukuai Lake, 3720 m,"/ "N27.98121°/ E098.47580°, 18 August 2006 Stop #DHK-2006-079 J.A. Miller, D.Z. Dong, & Y. Liu collectors". All paratypes also bear the following label: "PARATYPE *Queinnectrechus* (*Gaoligongtrechus*) *balli* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gaoligong Shan, Gongshan County, Qiqi/Dulong divide area, N27.69655°/E98.45389°, 3300-3680 m.

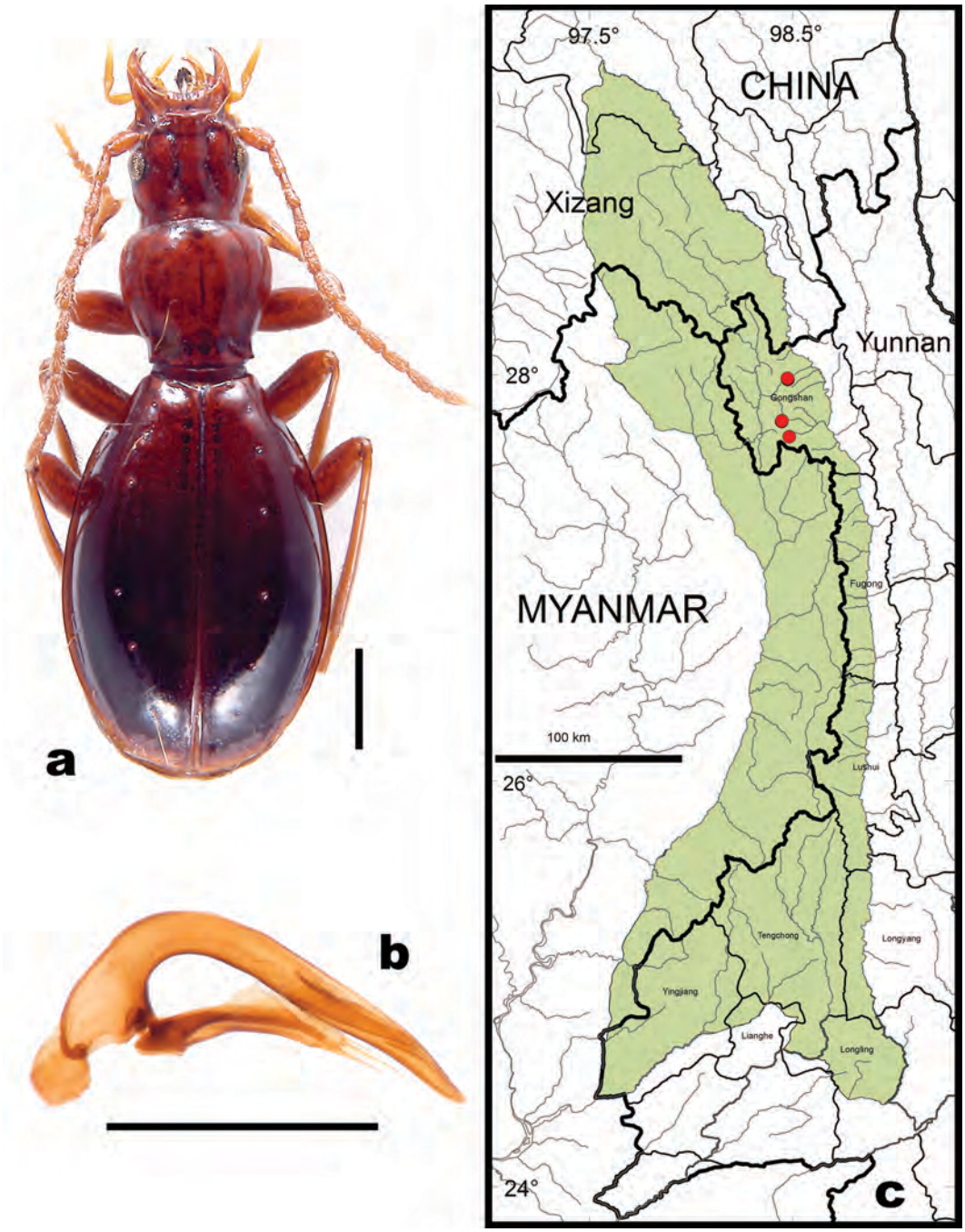


FIGURE 14. *Queinnectrechus* (*Gaoligongtrechus*) *balli* sp. nov.; a. Dorsal habitus (CASENT1001935). b. Median lobe of aedeagus of male (CASENT1001935), left lateral aspect. c. Map of locality records (red circles) for *Q. balli* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Derivation of species name.— The species epithet, *balli*, is the Latinized form (in the genitive case) of the surname of George Eugene Ball, Professor Emeritus at the University of Alberta, Edmonton, Alberta, Canada — our mentor, dear friend, and one of the world's most accomplished and inspirational systematists. We are pleased to name this extraordinary species in his honor.

Diagnosis.— Adults of this species (Fig. 14a) can be distinguished from those of all other trechine species in the region by the combination of character states noted in the diagnosis for this genus.

Description.— Size moderate, BL = 4.3 to 4.8 mm. Color of dorsum dark, forebody dark reddish brown, elytra piceous to black, antennae and legs reddish brown, palpi slightly paler, reddish tan; surface smooth and markedly shiny.

Head. Slightly elongate, with eyes small but convex, their diameter less than length of tempora. Tempora not or only slightly convex, glabrous, and joined to neck region at a markedly obtuse (ca. 150°) angle. Frons with deep frontal furrow that delimit three (two lateral and medial) very convex areas, however furrows abruptly interrupted or less impressed posteriorly; two pairs of supraorbital seta present, the anterior pair inserted near middle of eyes, the posterior pair inserted dorsally on the tempora near the postocular furrow. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Right mandible tridentate, with the middle tooth reduced, obtuse, left mandible with premolar tooth fused with retinaculum to form a small caniniform process with a sharp tip. Mentum and submentum fused. Mentum with medial tooth broad, truncate, about half as long as lateral lobes, the latter apically pointed. Submentum with six setae anteriorly. Genae with a single ventral seta on each side. Antennae pubescent from apical half of scape distally, extended posteriorly to basal one-third of elytra, with four antennomeres posterior to the pronotal base, antennomere 3 slightly longer than antennomere 4.

Pronotum. Narrowly cordate, not transverse, about as long as wide (PW/PL = 1.0), markedly narrowed posteriorly, the lateral margins distinctly sinuate anterior to basal angles, the latter acute, projected, but without digitiform extensions. Disc markedly convex, globose, glabrous; median longitudinal impression faintly impressed; basal foveae formed as small, deep, circular pits, median basal area smooth, faintly delimited, basal margin dilated medially as a broad, round projection. Lateral margination narrow, evident only in anterior one-third, effaced in posterior two-thirds. Two or three anteromedial setae and a single basal seta present on each side, the latter inserted slightly but distinctly anterior to basal angle.

Elytra. Elytral silhouette tear-shaped, narrower anteriorly than posteriorly, widest distinctly posterior to middle, humeri effaced, basal part of lateral explanation not visible from above. Disc markedly convex and smooth, with basal part abruptly and truncate, concave, fitted to convex base of pronotum, without distinct discal striae, except recurrent stria short but evidently impressed. Parascutellar setiferous pore present. Four to six discal setae present and aligned near presumed location of stria 3. Preapical seta present, inserted slightly more medially than the row of discal setae. Umbilicate setal series with setae of humeral group aggregated with distance between first and second setae less than between second and third and third and fourth, setae of median group distinctly posterior to middle.

Legs. Moderately long but slender; protibiae with longitudinal furrow, sparely pubescent apically on anterior surface. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side and ventrite VII of females with two setae on each side.

Male aedeagus. Median lobe (Fig. 14b) slender, bent basally about 90° to shaft, basal bulb with a large sagittal aileron, apex short and slightly narrowed, blunt; endophallus with a pair of slender sclerites tapered to points on both ends.

Comments.— Members of this new genus exhibit practically the same chaetotaxic pattern as those of genus *Kozlovites* Jeannel (1935), with a row of four to six discal setae apparently aligned on interval 3 in or near stria 3 and a preapical seta apparently inserted on interval 3 near stria 2 but in a position forward of the level of the anterior tip of the recurrent stria. However, *Gaoligongtrechus* members are distinguished from those of *Kozlovites* (and of *Uenoites* Belousov and Kabak 2016) by the extreme convexity of both the pronotum and elytra, which are of similar form to that seen in members of *Queinnectrechus* (*s. str.*), and by the posterior projection of the pronotal basal area and margin and its fit with the modified elytral base. Additional distinguishing features include the lateral marginations, each of which bears one or two anteromedial setae and is effaced in the posterior two-thirds, the effaced elytral discal striae, the medial tooth of the mentum truncate rather than bifid, the abdominal ventrites each with only a single pair of paramedial setae, except for the female ventrite VII which has two pairs of subapical paramedial setae, as is typical among Trechini. In addition, Belousov and Kabak (2016) considered the apex of the male median lobe formed as a large apical hook as a synapomorphy for *Kozlovites* species. The apex of the median lobe of *Q.* (*G.*) *balli* males (Fig. 14b) has no trace of a hook; and the slender shaft and abruptly bent (at a 90° angle) basal region are unlike that seen in males of any described *Kozlovites* or *Uenoites* species.

Members of subgenus *Gaoligongtrechus* differ from those of subgenus *Queinnectrechus* Deuve and *Dactylotrechus* Belousov and Kabak, (2003), in having the basal pronotal angles simple, without the digitiform extensions seen in members of these two genera. Like *Dactylotrechus* members, those of our new subgenus have anterolateral setae in the pronotal margins and a preapical seta apparently inserted near stia 2; however, this seta is inserted farther forward, in a subdiscal position, in *Q.* (*G.*) *balli* members.

Habitat distribution.— Members of this species have been found under stones on moist, organic substrate in alpine meadows, slopes and ridges with low, dense to sparse herbaceous vegetation, at elevations ranging from 3300 to 3750 m (Fig. 37b, 39b, 40a). One specimen was collected at night, found walking on the barren slope of a roadcut at 3350 m elevation. Members of this species have been found together (syntopic) repeatedly with specimens of *Queinnectrechus gongshanicus*, *Queinnectrechus griswoldi*, *Trechus gongshanensis* sp. nov., and *Trechus qiqiensis* sp. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 14c. We examined a total of 33 specimens (12 males and 21 females), all from the northern part of the Gaoligong Shan, in Bingzhongluo, Cikai and Dulongjiang Townships in Gongshan County (see Type material above for exact collection data). These localities are in Core Areas 1 and 2.

Overall geographical distribution.— This species currently is known only from the northern part of the Gaoligong Shan, in western Yunnan Province, China.

Genus *Eocnides* Jeannel, 1954

Eocnides Jeannel, 1954:10.
Agonotrechiotes Deuve 2010:17. **New Synonymy**

Type species.— *Eocnides assamensis* Jeannel, 1954

Diagnosis.— Adults of this genus (Fig. 15a) can be recognized by the following combination of character states: size large (BL = 4.8 to 5.2 mm); body form long and slender, fully-winged; eyes moderately large; frontal furrows deep; mentum and submentum fused or not; antennae long and slender; pronotum small, elytra long and flattened, discal striae partially effaced basally and laterally, with two discal setae present inserted in stria 3, umbilicate setae aggregated into humeral and

median groups; legs slender; protibiae longitudinally furrowed; abdominal ventrites with long, very sparse pubescence medially in addition to two or more apical paramedial setae; median lobe of male aedeagus slender, the apex slightly recurved ventrally, endophallus with internal sclerite very long and tapered.

Comments.— This genus was described by Jeannel (1954) based on a single female specimen, which he considered as close to genus *Cnides* Motschulsky (1862), based on overall form and features of elytral sculpture. However, the discovery of a second species and two males allowed Uéno (1989) to find that the median lobe of the male aedeagus was formed as a closed tube, not at all open on its ventral face. He concluded that it should be considered as a taxon in subtribe Trechina and placed near the "*Trechoblemus*" and "*Trechus*" Complexes. We here recognize for the first time *Agonotrechiotes* Deuve (2010) as a junior synonym of *Eocnides* Jeannel (1954).

Geographical distribution.— This genus currently is known from only two species with a combined disjunct distribution including Assam (northeastern India) and Sichuan Province, China. The discovery of members of this genus in the study area in western Yunnan Province partially fills a gap in the distribution of the genus.

Eocnides fragilis Uéno, 1989

(Figs. 15, 45–48)

Eocnides fragilis Uéno, 1989:14. Holotype, a male, in NMST. Type locality: China, Sichuan, Nanping County, Jiuzhaigou, Xiajijie Hai, ca. 2600 m.

Agonotrechiotes longiantennatus Deuve 2010:17. **New Synonymy**

Diagnosis.— Adults of this species (Fig. 15a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 4.8 to 5.2 mm), fully-winged; body color pale, brownish-tan; head with eyes only moderate in size; frontal furrows attenuated; anterior pair of supraorbital setae not foveate; pronotum slightly transverse (ratio PW/PL= 1.48), median longitudinal impression distinctly impressed, especially basally, least so at middle; basal foveae prolonged anteriorly parallel to lateral margin in basal one-half; elytra with discal stria 2 partially effaced near base, striae 5 and 6 faintly but distinctly impressed; median lobe of male aedeagus (Fig. 15b) slender, apex slightly recurved ventrally.

Habitat distribution.— Members of this species were found by splashing gravel bars at the edges of a small, lowland stream adjacent to disturbed, agricultural areas, at elevations ranging from 1610 to 1630 m. This microhabitat is similar to that described by Uéno (1999b) for specimens collected at Munigou He, 2670 m, in Songpan County, northern Sichuan. No other trechines were collected at these sites.

Geographical distribution within the Gaoligong Shan.— Fig. 15c. We examined a total of 2 specimens (1 male and 1 female) from the following localities: ***Gongshan County:*** Bingzhongluo Township (Niwaluo He, just below Nu Jiang Road, 1630 m, N28.05140°/E98.59319°, 8 October 2002, D.H. Kavanaugh, P.E. Marek and D.Z. Dong collectors [1 male; CAS]; Bingzhongluo Township (Yimaluo He, just below Nu Jiang Road, 1610 m, N28.02499°/E98.62564°, 8 October 2002, D.H. Kavanaugh, P.E. Marek and H.B. Liang collectors [1 female; IOZ]. Both of these localities are in Core Area 2.

Overall geographical distribution.— Fig. 45. This species has been recorded previously from five localities in northern Sichuan Province, in Jiuzhaigou and Songpan Counties (Uéno 1989, 1999b) and in Luding County (Deuve 2010). We report here the following new record for Sichuan: ***Wenchuan County***: Qionglai Shan, Sanjiang Township (Sanjiang Nature Reserve, river at gate to reserve, 1300 m, N30.94697°/E103.31217°, 9 September 2007, D.H. Kavanaugh collec-

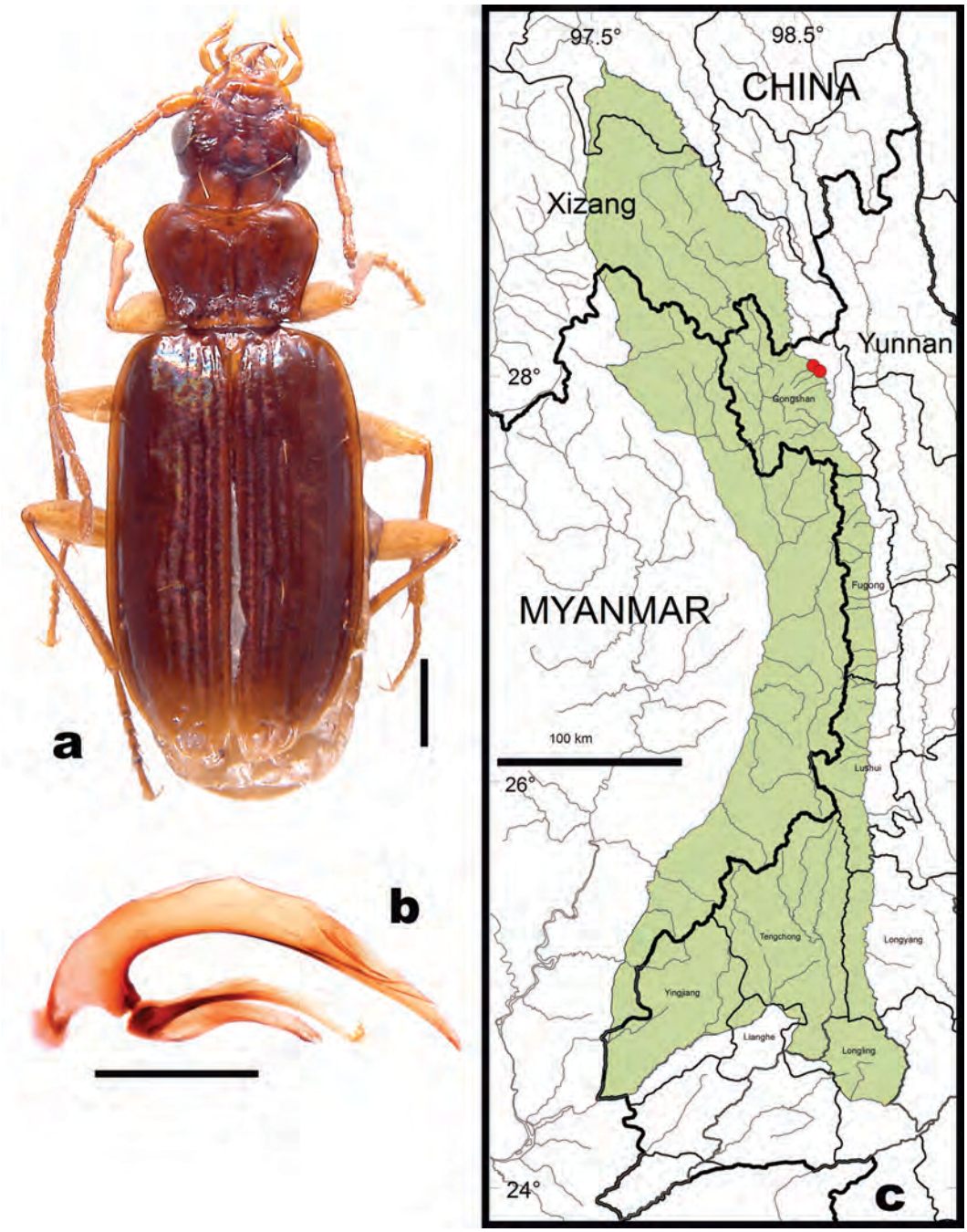


FIGURE 15. *Eocnides fragilis* Uéno; a. Dorsal habitus (CASENT1029485). b. Median lobe of aedeagus of male (CASENT1029485), left lateral aspect. c. Map of locality records (red circles) for *E. fragilis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

tor [1 female; CAS]. This record extends the range of *E. fragilis* in Sichuan. The discovery of *E. fragilis* in the northern Gaoligong Shan region, in western Yunnan Province, extends its known range an additional 260 km SW.

Genus *Trechus* Clairville, 1806

Trechus Clairville, 1806:22.

Type species.— *Carabus rubens*, Clairville, 1806 [nec Fabricius, 1801] (= *Carabus quadristriatus* Schrank, 1781), designated by Blanchard (in Audouin et al. 1841, plate 25). See also comments on type species by Bousquet (2012: 505).

Diagnosis.— Adults of this genus (Fig. 17-25) can be recognized by the following combination of character states: size very small to small for family (BL = 2.5 to 7.0 mm), fully-winged or apterous, eyes large and projected or reduced, with some members eyeless; body color varied, from pale yellowish-tan to black; body form varied, compact and convex in most members, more slender and depressed in some members; labrum with anterior margin concave; right mandible bidentate or tridentate, but with the premolar fused with the retinaculum; submentum free, not fused with mentum, with six setae anteriorly in most members; pronotum with disc glabrous, two pairs of setae lateral present, one each side near middle and near basal angle; elytra with discal striae distinctly impressed and complete or more or less effaced, recurrent stria distinct, discal setae only on interval 3, near or in stria 3 in most members, two setae present in most members, but with more, one or none present in a few members; preapical seta present near discal stria 2 or absent, in a few members present and inserted more anteriorly in a discal position on interval 3 near stria 2 or 3; umbilicate setae of the humeral group equally spaced; protibiae longitudinally furrowed or not.

Comments.— As can be inferred from the above diagnosis, the large genus *Trechus* is markedly heterogeneous and probably polyphyletic. This hypothesis of polyphyletism has been corroborated by early results of analyzes of nucleic acid sequences data (Faille et al. 2010, 2013a).

Among morphological features commonly used in comparative systematic studies of genus *Trechus*, two deserve special attention because they have allowed us to distinguish three new genera, described below, among species occuring in the Gaoligong Shan Mountains. These features include (1) the presence and position or the absence of a preapical elytral seta, and (2) the dentition of the mandibles.

1) *Presence and position of preapical seta*: The primary elytral discal setae of carabid beetles are located on the odd intervals: 3, 5, 7 and 9 (Jeannel 1941). Jeannel named the setae of interval 9 the "*série ombiliquée*", the umbilicate series.

In members of subtribe Trechina, the umbilicate series includes a group of four consecutive humeral setae, a middle group of two consecutive setae, and two more isolated posterior setae; discal setae are absent from interval 7; they occur on interval 5 in some members (eg., in *Trechiama* Jeannel (1927) and *Epaphiopsis* Uéno (1953)). In most members, there are three setae on interval 3, inserted subbasally, near the middle and preapically, respectively. Although this can be considered the basic number for members of the subtribe, but this number is varied, more or less.

In members of genus *Trechus*, there are typically three discal setae in interval 3, the first two inserted in or against stria 3, the third in prepical position inserted against stria 2. In some species (eg., *Trechus perissus* Andrewes (1936), described from Sikkim (see Uéno 1972a), or *Trechus setitemporalis* Deuve (2005), described from southern Xizang Autonomous Region), an additional discal seta is present, inserted next to stria 3, between the middle and preapical setae. In a few species, it is the preapical seta itself, typically inserted preapically against stria 2 that is advanced anteriorly to a discal position on the 3rd interval and inserted either in the center of the interval or

even against stria 3. In the latter case, it is difficult to know if it is actually the preapical seta shifted forward or a supernumerary discal seta with the preapical seta absent. Forward displacement of the preapical seta has been observed in other Trechina as well, such as in members of *Epaphiopsis* subgenus *Pseudepaphius* Uéno (1962), occuring in subtropical China.

Among the representatives of the genus *Trechus* occuring in the Gaoligong Shan, we have identified a particular group of species that we call the "*Trechus qiqiensis* Group", members of which share this forward displacement of the preapical seta. We suggest that this is a synapomorphy for this group. Moreover, with the exception of *T. shiyueliang* sp. nov., members of this group share another synapomorphy: the recurrent stria is continuous anteriorly with stria 7, which is unusual in genus *Trechus*, although previously observed in *Trechus yasudai* Ueno (1973) from eastern Nepal. Based on these two unusual features, this group of species appears to represent a natural, monophyletic group.

Members of the *Trechus qiqiensis* group may be related to some Himalayan species, such as *Trechus himalayanus* Ueno (1972b), in which the preapical seta is displaced forward (Deuve 1988) but the recurrent stria is not in line anteriorly with stria 7. Forward displacement of the preapical seta has long been known to occur also in members of genus *Epaphius* Samouelle (1819).

2) *Dentition of the mandibles*: Jeannel (1926, 1941) separated the Trechini into two groups: (1) the "Tridentati", with a premolar tooth on the mandibles, which grouped what he called the "more primitive" lineages; and (2) the "Bidentati', "without a premolar tooth", which corresponded to the Trechina, including genus *Trechus*. This fundamental dichotomy was accepted by most authors, who, as seemed appropriate, described the mandibles as either "tridentate" or "bidentate". However, this was actually a source of confusion because assigned to the Bidentati were some members with a cleft retinaculum that appeared trifid. The mandibles of those Bidentati with a trifid retinaculum were thus often called "tridentate" in species descriptions. However, Jeannel defined the distinction between the Bidentati of Tridentati precisely, with the criterion being the presence or absence of the premolar tooth.

The mandibles are naturally asymmetrical in order to allow meshing of the teeth when closed. It is the right mandible which serves as the benchmark because it best shows the components: molar, premolar and retinacular blade [For a good understanding of this classic nomenclature, see Acorn and Ball (1991)].

Study of cave Trechina of China recently has revealed that, within the genus *Guizhaphaenops* Vigna Taglianti (1997), members of some species had the right mandible tridentate while in those of other species it was bidentate. The explanation given was that the premolar tooth was merged with the retinaculum to form a trifid ("tridentate") process, and that in the species with the "bidentate" mandible, the median point of this process had been lost subsequently, resulting in a bidentate process, formed in reality of the merged premolar tooth and the retinaculum retaining only its anterior tooth (Deuve and Queinnec 2014). It appears that what was described by Jeannel as disappearance of the premolar tooth was actually the result of a merger of the latter with the retinaculum.

The combination of the unifid premolar with the bifid retinaculum to form a trifid process is evident in genus *Queinnectrechus*, for which the right mandible has been described and illustrated by Deuve (1992a, 1992b), then by Belousov and Kabak (2003), and in which the two teeth, premolar and retinacular, are not yet fully merged.

Among *Trechus* members, the right mandible has been considered as of the "bidentate" type, but with both bidentate and tridentate retinacula represented (Jeannel 1941). In fact, in both cases the premolar tooth is present but fused with the retinaculum. This is the case among all the true

Trechus we have examined from the Gaoligong Shan, which all show a trifid state (Fig. 16b-d). However, in members of a very specific and homogeneous group of species in the study area, the right mandible has dentition of another type: the premolar tooth is incompletely fused with rétinacle (a relatively symplesiomorphic condition) and the anterior tooth of the retinaculum is located forward (a synapomorphy), a greater distance from the posterior tooth (Fig. 16f). Members of this group of species also present two additional remarkable features. First, there is only one or no discal setae on elytral interval 3; and second, the tempora are sparsely pubescent, whereas they are glabrous in all other "*Trechus*" of the Gaoligong Shan region. Members of some species in Tibet, such as *Trechus setitemporalis* Deuve (2005), or those of the "*Trechus dacatraianus* Group" (Schmidt 2009), also have pubescent tempora. However, it is the combination of the three states mentioned above, especially the mandibular structure, which leads us to exclude these species from *Trechus* and consider them as representing a distinct genus within the *Epaphiopsis* Complex of genera. Descriptions of this genus and the included species are provided below. A related species, but one in which members have the tempora glabrous and the premolar and retinaculum of the right mandible (Fig. 16h) more fully fused, is also excluded from *Trechus* and described as a separate genus. Finally, we also exclude two additional species from the southern part of the Gaoligong Shan from *Trechus*. In members of these species, the right mandible (Fig. 16g) is very similar to a bidentate type, but the premolar tooth is not fused with the retinaculum. We consider these also as representing a new and distinct genus described below.

Geographical distribution.— Genus *Trechus* is a megadiverse taxon with more than 900 described species and subspecies arrayed in eight subgenera (Lorenz 2005); and about 95% of these species-group taxa are currently classified in the nominate subgenus. The genus is predominately Holarctic in distribution and widespread in that Region (Jeannel 1927, Casale & Laneyrie 1982), with a few species also recorded from the Afrotropical and Oriental Regions. Several species from subtropical or tropical parts of Southeast Asia have been described in genus *Trechus.* Examples of such species include *Trechus thai* Deuve (1995) from Thailand, *Trechus myanmarensis* Deuve (2005) and *Trechus natmataungensis* Donabauer (2010) from Myanmar and *Trechus vietnamicus* Uéno (1995) from Vietnam. However, the genus is not known from tropical or subtropical parts of China, where it appears to be replaced by species representing the *Epaphiopsis* Complex of genera.

Key for Identification of Adults of *Trechus* Species of the Gaoligong Shan Region

1. Size larger (BL = 4.2 to 5.0 mm), fully-winged; elytra elongate, recurrent stria terminated abruptly on interval 6; preapical seta absent or vestigial and inserted near elytral apex, also without a third discal seta in apical one-fouth of elytra . . . . . *T. indicus* Putzeys
   Size varied, but generally smaller (BL = 3.3 to 4.7 mm), elytra short, recurrent stria continuous anteriorly with stria 5 or 7, preapical seta present and inserted near stria 2 in a subdiscal position or as third discal seta near stria 3 in apical one-fourth of elytra (*Trechus qiqiensis* Group) 2

***Trechus qiqiensis* Group**:

2. Elytra with recurrent stria in line anteriorly with stria 5, preapical seta inserted near stria 2; size moderately large for group (BL = 4.0 to 4.2 mm) (*Fugong County*). . ***T. shiyueliang* sp. nov.**
   Elytra with recurrent stria in line anteriorly with stria 7, preapical seta inserted in interval 3, either near stria 2 or stria 3; size varied. 3

3. Size larger, BL at least 4.0 mm 4
   Size smaller, BL less than 4.0 mm. 6

4. Size larger (BL = 4.5-4.7 mm); pronotum less transverse (ratio PW/PL = 1.40), with anterior transverse impression indistinct; elytra broad, disc slightly flattened (*Tengchong County*) . . . . . ***T. mingguangensis* sp. nov.**
   Size smaller (BL = 4.0 to 4.2 mm); pronotum more transverse (ratio PW/PL = 1.44 to 1.46), with anterior transverse impression distinct; elytra ovoid, disc convex, not at all flattened . 5

5. Elytra with discal striae very distinctly punctate and slight attenuated toward elytral apex; pronotum with basal foveae deep, distinct (*Gongshan County*) . . . . . ***T. qiqiensis* sp. nov.**
   Elytra with discal striae only faintly punctate and not attenuated toward elytral apex; pronotum with basal foveae shallow, less well defined (*Fugong County*) . . . . . ***T. pseudoqiqiensis* sp. nov.**

6. Size larger (BL = 3.7-3.8 mm), elytra with lateral discal striae more shallowly impressed but still clearly evident (*Lushui County*) . . . . . ***T. luzhangensis* sp. nov.**
   Size smaller (BL = 3.3-3.5 mm); elytra with discal striae 6 and 7 effaced, faintly or not at all evident 7

7. Tempora only slightly convex (*Gongshan County*) (Fig. 23a) . . . . ***T. gongshanensis* sp. nov.**
   Tempora markedly convex (*Fugong County*) (Fig. 24a) . . . . . ***T. shibalicus* sp. nov**.

Trechus (*Trechus*) *indicus* Putzeys, 1870

(Figs. 16b, 17, 41a, 44, 45–48)

Trechus indicus Putzeys, 1870:175. Holotype, lost (see Jeannel 1923, footnote p. 416). Type locality: eastern India.

Trechus (*s. str.*) *indicus* Putzeys: Jeannel, 1927:157, 158 (in part)

Trechus (*s. str.*) *macrops* Jeannel, 1927:157, 160 (in part). Type locality: China, Yunnan. Synonymized by Jeannel (1935: 275).

Trechus macrops Jeannel: Andrewes, 1935 63, 67.

Trechus indicus Putzeys: Jeannel, 1935:275.

Trechus indicus Putzeys: Deuve, 1988:80.

Trechus (*s. str.*) *indicus* Putzeys: Uéno 1977:181.

Trechus (*s. str.*) *macrops* Jeannel: Uéno & Yin, 1993:354. These authors considered *T. macrops* as a distinct species.

Diagnosis.— Adults of this species (Fig. 17a) can be distinguished from those of all other species in the region by the following combination of character states: size large for genus (BL = 4.2 to 5.0 mm); fully-winged; eyes markedly large, tempora very short, joined to neck region at nearly a right angle; frontal furrows angulate at midlength; right mandible as in Fig. 16b; mentum and submentum not fused; mentum with medial tooth simple, triangular; antennae with antennomeres 3 and 4 subequal in length, antennomere 2 slightly shorter; pronotum transverse (ratio PW/PL = 1.43), with lateral margins not sinuate posteriorly, straight just anterior to basal angles, the latter small and rectangular, lateral explanation very wide basally, basal margin slightly convex medally; elytra oblong, lateral discal striae effaced, only the medial four or five striae distinctly impressed, recurrent stria markedly impressed; preapical seta absent or vestigial, two discal setae present, inserted in stria 3 at anterior one-fifth and at middle, respectively; median lobe of male aedeagus (Fig. 17b) not arcuate, with apex slender, ventrally hooked, endophallus with two elongate, projecting sclerites, one apically tapered, the other apically lobate.

Comments.— Uéno (1977:182) correctly pointed out that this widely distributed species, with members fully-winged, is morphologically varied across its range. In particular, the preapical seta

tends to be absent from members of eastern populations. The many specimens we examined from localities in the study area confirm his observation. Among them, the prepical seta is absent from most specimens. If present, the seta is very small or vestigial, and only present unilaterally in most such cases. This led Uéno (1999a:215), while reporting the presence of this species in the Gaoligong Shan for the first time, to consider the eastern populations, including those in the study area, as a separate species, *T. macrops* Jeannel.

Habitat distribution.— Members of this species have been found in a variety of microhabitats at elevations ranging from 1230 to 2486 m. They have been collected in daytime from under stones on the shaded and open banks of small to large streams, along roadcuts, and in closed canopy forest. At night, they have been found active on open sandy beaches and floodplain flats of larger streams (Fig. 41a) and on the ground along roadcuts. In almost all of the localities where specimens of *T. indicus* were founded, they were the only trechine collected. However, they were found syntopic with specimens of *Agonotrechus xiaoheishan* at Xiaoheishan Forest Reserve in the southern part of the study area. Uéno (1999a) reported that specimens of this species (which he recorded as *Trechus macrops* Jeannel) were found in the same area as specimens of *Agonotrechus yunnanus* and *Epaphiotrechus fortipes* (Uéno) comb. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 17c. We examined a total of 86 specimens (45 males and 41 females) from the following localities: ***Fugong County*:** Lumadeng Township (Lumadeng, 1230 m, N27.02606°/E98.86269°, 23 April 2004, D.H. Kavanaugh collector [1 female; CAS]). ***Gongshan County*:** Dulongjiang Township (Bapo, 1412 m, N27.73902°/E98.34975°, 3 November 2004, H.B. Liang collector [1 male; IOZ]; Bapo area, Dulong Jiang at Mulangdang, 1355 m, N27.75256°/E98.34745°, 4 November 2004, H.B. Liang collector [1 male; IOZ]; 0.6 km N of Dizhengdang village on Dulong Jiang, 1880 m, N28.084427°/E98.32652°, 29-30 October 2004, D.H. Kavanaugh, D.Z. Dong & G. Tang collectors [9 male and 8 females; CAS, IOZ]; Dulong Jiang at Elideng village, 1640 m, N28.000287°/E98.32145°, 3 November 2004, D.H. Kavanaugh, D.Z. Dong & G. Tang collectors [13 male and 8 females; CAS, IOZ]; Dulong Jiang at Xianjiudang village, 1580 m, N27.94092°/E98.33340°, 4 November 2004, D.H. Kavanaugh, M.A. Dixon, D.Z. Dong & G. Tang collectors [1 male and 7 females; CAS, IOZ]; 0.2 km S of confluence of Dulong Jiang and Muke Wang, 1450 m, N27.84125°/E98.33979°, 7 November 2004, D.H. Kavanaugh, V.F. Lee & D.Z. Dong collectors [1 female; CAS]; 0.5 km N of Kongdang, 1500 m, N27.88111°/E98.34063°, 25 October 2004, D.H. Kavanaugh, H.B. Liang, D.Z. Dong & G. Tang collectors [1 female; CAS]; Moqie Wang at Gongshan-Dulong Road Km 91, 1550 m, N27.89934°/E98.34999°, 6 November 2004, D.H. Kavanaugh & H.B. Liang collectors [2 males and 4 female; CAS, IOZ]). ***Longling County*:** Longjiang Township (small stream 1.2 km SSE of Km 23.5 on Route 23.5, 2020 m, N24.2888°/E98.76001°, 25 May 2005, D.H. Kavanaugh, H.B. Liang & D.Z. Dong collectors [1 male; CAS]; Xiaoheishan Forest Reserve, 2067 m, N24.83671°/E98.76185°, 28 May 2005, H.B. Liang, K.J. Guo & H.M. Yan collectors [3 males; CAS, IOZ]); Zhen'an Township (Bangbie village, 1540 m, N24.81306°/E98.83306°, 30 October 2003, H.B. Liang & X.C. Shi collectors [1 male; IOZ]). ***Longyang County:*** Bawan Township (Baoshan-Tenchong Road Km 24 at Nankang Yakou, 2130 m, N24.82583°/E98.77222°, 26 October 2003, H.B. Liang & X.C. Shi collectors [1 female; IOZ]; Bawan-Tengchong Road at Km 40-41, 2404 m, N24.93750°/E98.75083°, 12 October 2003, H.B. Liang & X.C. Shi collectors [1 male; IOZ]; Bawan-Tengchong Road at Km 41, 2486 m, N24.93750°/E98.75083°, 11 October 2003, H.B. Liang collector [1; female; IOZ]; Bawan-Tengchong Road at Km 42-46, 2290 m, N24.95361°/E98.74222°, 14 October 2003, H.B. Liang & X.C. Shi collectors [1 female; IOZ]; Luoshuidong area at Sancha He, 2300 m, N24.94833°/E98.75667°, 26-31 October 1998, D.H. Kavanaugh & C.E. Griswold collectors [1 female; CAS]). ***Tengchong County:*** Jietou Township

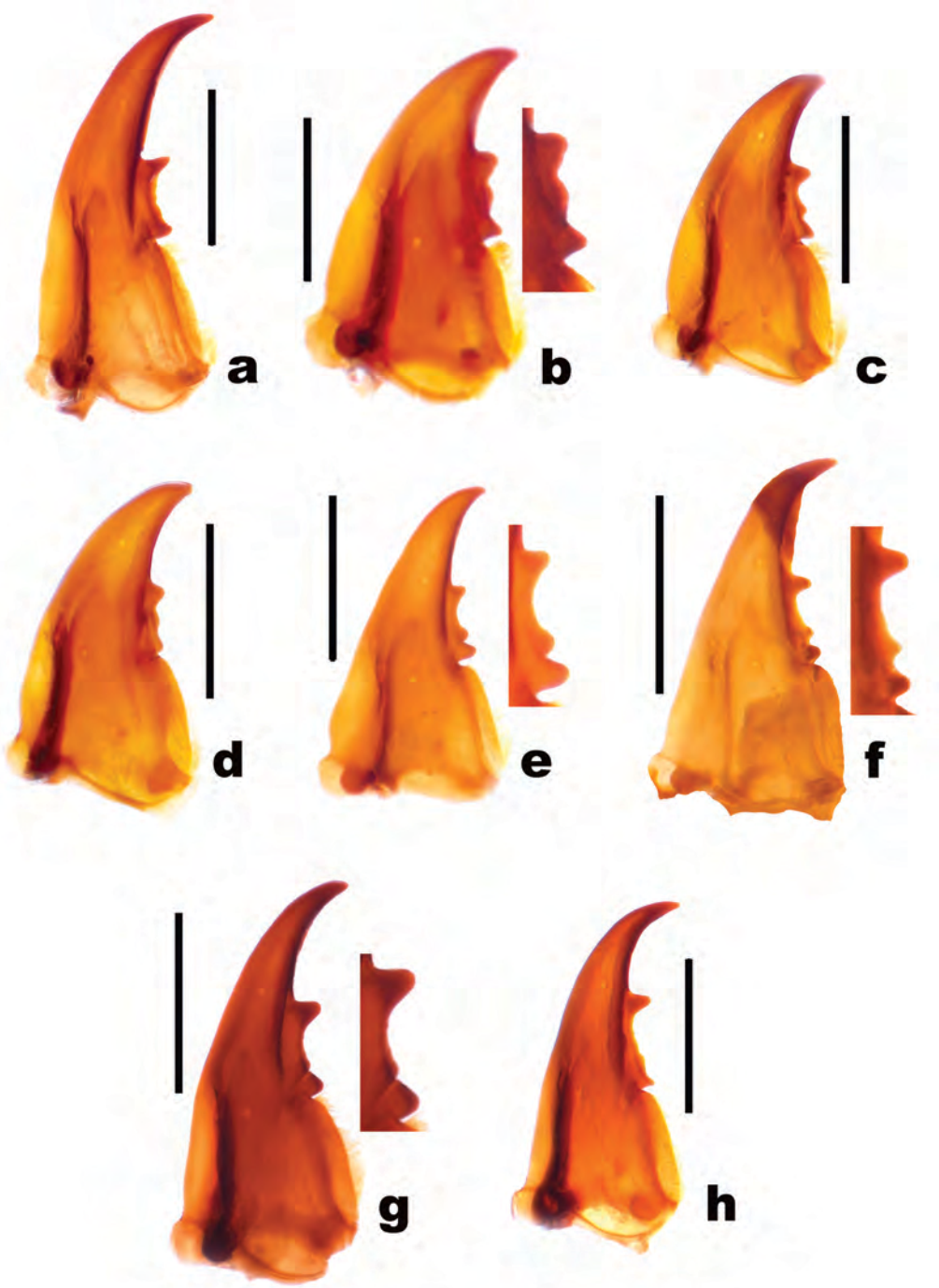


FIGURE 16. Trechine right mandibles, ventral aspect. a. *Agonotrechus xiaoheishan* sp. nov. b. *Trechus indicus* Putzeys with dentition enlarged. c. *Trechus gongshanensis* sp. nov. d. *Trechus shibalicus* sp. nov. e. *Pseudepaphius gonggaicus* Deuve with dentition enlarged (China, Sichuan Province, Moxi Township, NE slope of Gongga Shan). f. *Trechepaphiopsis uniporosa* sp. nov. with dentition enlarged. g. *Epaphiotrechus fortipesoides* sp. nov. with dentition enlarged. h. *Trechepaphiama gaoligong* sp. nov. Scale lines = 0.5 mm.

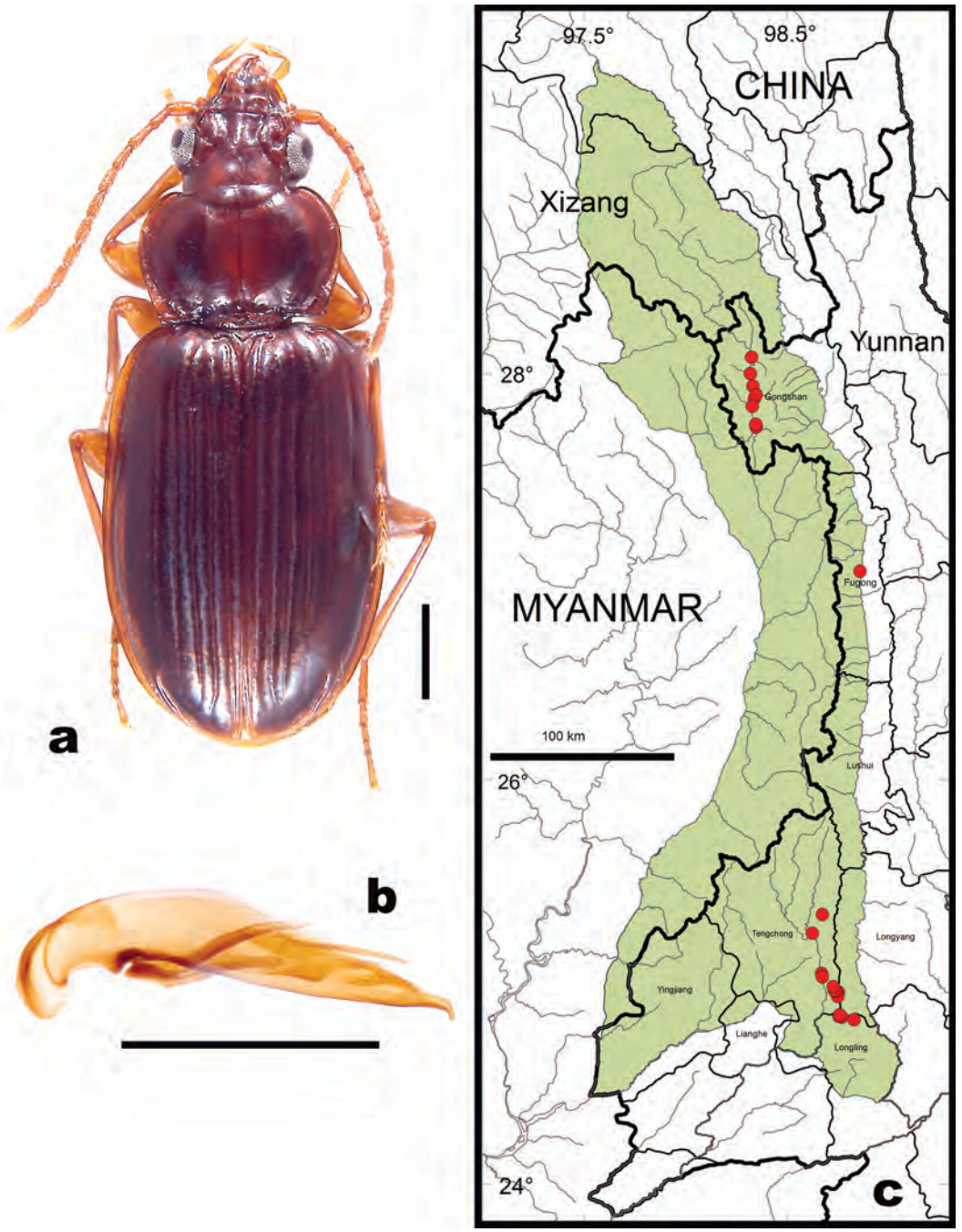


FIGURE 17. *Trechus indicus* Putzeys; a. Dorsal habitus (CASENT1016115). b. Median lobe of aedeagus of male (CASENT1015874), left lateral aspect. c. Map of locality records (red circles) for *T. indicus* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

(Zhoujia-po village, 1740 m, N25.33222°/E98.67611°, 24 October 2003, D.Z. Dong collector [1 male; CAS]); Qushi Township (Longchuan Jiang at Xiaojiangqiao, 1445 nm, N25.23944°/E98.63722°, 21 October 2003, H.B. Liang & X.C. Shi collectors [1 male; IOZ]); Shangying Township (Bawan-Tengchong Road Km 46-51, 2220 m, N24.95722°/E98.73667°, 17 October 2003, H.B. Liang & X.C. Shi collectors [1 male; IOZ]); Bawan-Tengchong Road Km 48-51 at Dahaoping Forest Station, 2014 m, N24.97556°/E98.73000°, 18 October 2003, H.B. Liang collector [6 males and 6 females; CAS, IOZ, MNHN]; Bawan-Tengchong Road Km 65, beside Longchuanjiang, 1335 m, N24.04167°/E98.67306°, 19 October 2003, H.B. Liang & X.C. Shi collectors [1 male and 1 female; CAS IOZ]; Bawan-Tengchong Road Km 65 at Longwenqiao, 1285 m, N25.02396°/E98.67675°, 20 October 2003, H.B. Liang & X.C. Shi collectors [1 male; IOZ]); Wuhe Township (Xiaoheishan Forest Station, 2025 m, N24.82889°/E98.76000°, 29 October 2003, H.B. Liang collector [1 male and 1 female; CAS, IOZ]).

Members of this species have been collected in both northern and southern parts of the study area and on both eastern and western slopes of the Gaoligongshan. We have recorded this species from Core Areas 1, 3, 6, and 7. The absence of records from Core Areas 2, 4 and 5 is likely the result of inadequate sampling.

Overall geographical distribution.— Fig. 45. This species is widely distributed along the southern edge of the Himalayan Mountains and Qinghai-Xizang (Tibetan) Plateau from eastern Afghanistan to Sichuan Province, China. Attainment and maintenance of this broad geographical range is no doubt facilitated by the flight capability of members of this species.

Trechus (*Trechus*) *shiyueliang* Deuve and Kavanaugh, sp. nov.

(Figs. 18, 40b, 42b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1021004"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 10-11 km W of Shibali on Shibali Road, 3200-3280 m, NN27.19980°/E98.71375° to N27.20654°/E98.71772°,"/ 8 August 2005, Stop#DHK-2005-068 D.H. Kavanaugh, H.B. Liang, P. Paquin, & D.Z. Dong collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Trechus shiyueliang* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 8): 1 female (in IOZ) labeled same as holotype, except first label: "CASENT 1021005"; 1 male and 1 female (in IOZ) labeled: "CASENT 1018374" and "CASENT 1018373", respectively/ "CHINA, Yunnan, Fugong County, Lishadi Township, 10 km W of Shibali on Shibali Road, 3221 m,"/ , N27.20055°/E98.71399°, 16 August 2005, Stop #PP-3805 P. Paquin collector"; 1 female (in CAS) labeled: "CASENT 1023759"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°,"/ "3100 m, 7 May 2004 Stop #DHK-2004-038A D.H. Kavanaugh, C.E. Griswold, Liang H.-B., & Zhu B.-X. collectors"; 1 male (in IOZ) labeled: "CASENT 1020019"/ "CHINA, Yunnan, Fugong County, Lumadeng Township, ridge S of Shibali Yakou, N27.20802°/E98.69644°,"/ "3740 m, 12 August 2005, Stop #DHK-2005-092 D. H. Kavanaugh collectors"; 2 males and 1 female (in CAS) labeled: "CASENT 1021323" to "CASENT 1021324" and "CASENT 1021325", respectively/ "CHINA, Yunnan, Fugong County, Lumadeng Township, Lao Shibali Yakou, 3270 m, N27.06429°/E98.75123°, 13 August 2005,"/ "Stop# DHK-2005-079, D.H. Kavanaugh, H.B. Liang, D.Z. Dong, & G. Tang collectors". All paratypes also bear the following label: "PARATYPE *Trechus shiyueliang* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 10-11 km W of Shibali on Shibali Road, 3200-3280 m.

Derivation of species name.— The species epithet, *shiyueliang*, a noun in apposition, is

derived from the name of the township in which the type locality is located, Shiyueliang. This is the current name for the former Lishadi township.

Diagnosis.— Adults of this species (Fig. 18a) can be distinguished from those of all other species in the region by the following combination of character states: size relatively large (BL = 4.0 to 4.2 mm), apterous; body color reddish-brown; head slightly elongate; tempora glabrous; pronotum moderately transverse (ratio PW/PL = 1.42); elytra with striae not or faintly punctate, recurrent stria continuous anteriorly with stria 5, two discal setae present and inserted next to stria 3, preapical seta present and inserted next to stria 2 in forward position near apical one-fourth of elytra; median lobe of male aedeagus with apex thin and faintly reflexed dorsally in lateral view (Fig. 18b), endophallus with only a single, small thin elongate sclerite.

Description.— Size relatively large, BL = 4.0 to 4.2 mm. Body color reddish-brown, shiny, appendages slightly paler. Body surface smooth, head capsule finely alutaceous.

Head. Moderate in size, slightly elongate and thick; eyes small and moderately convex, their diameter about 1.5 times as long as tempora, the latter short, moderately convex and glabrous. Frons slightly flattened; frontal furrows deep, rounded, slightly attenuated posterior to the eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mandibles short; right mandible tridentate with middle tooth closer to basal tooth (premolar) than to distal tooth. Mentum and submentum not fully fused but nearly so, suture between them only faintly impressed. Mentum with medial tooth apically truncate, less than one-half the length of the lateral lobes. Submentum with six setae anteriorly, swollen anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae short, with less than two antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 3 and 4 slightly longer than antennomere 2.

Pronotum. Moderately transverse (ratio PW/PL = 1.42), narrowed posteriorly, greatest width near anterior one-third; lateral margins markedly rounded, straightened only just anterior to small, rectangular and sharp basal angles. Disc convex, smooth and glabrous, median longitudinal impression deeply impressed, interrupted anteriorly a short distance from anterior margin; basal foveae distinct; median basal area with several faint, irregular, punctiform depressions, delimited laterally by oblique furrows. Lateral borders of pronotum moderately slender, regular, slightly reflexed, lateral grooves deeply impressed. Single midlateral setae on each side inserted at anterior one-third; single basolateral seta on each side, inserted slightly anterior to apex of basal angle.

Elytra. Ovoid, humeri distinct but rounded. Disc convex and smooth. Striae not or only faintly punctate, striae 1 to 5 deeply impressed, striae 6 to 8 very faintly impressed but evident. Parascutellar striole present. Recurrent stria continuous anteriorly with stria 5. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted on interval 3 next to stria 2 in forward position near apical one-fourth of elytra.

Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 18b) moderately broad basally with sagittal aileron present and moderate in size; shaft gradually narrowed toward apex; apical lamella short, rectilinear, extremely thin and slightly recurved dorsally in lateral view; endophallus with a single thin and elongate sclerite.

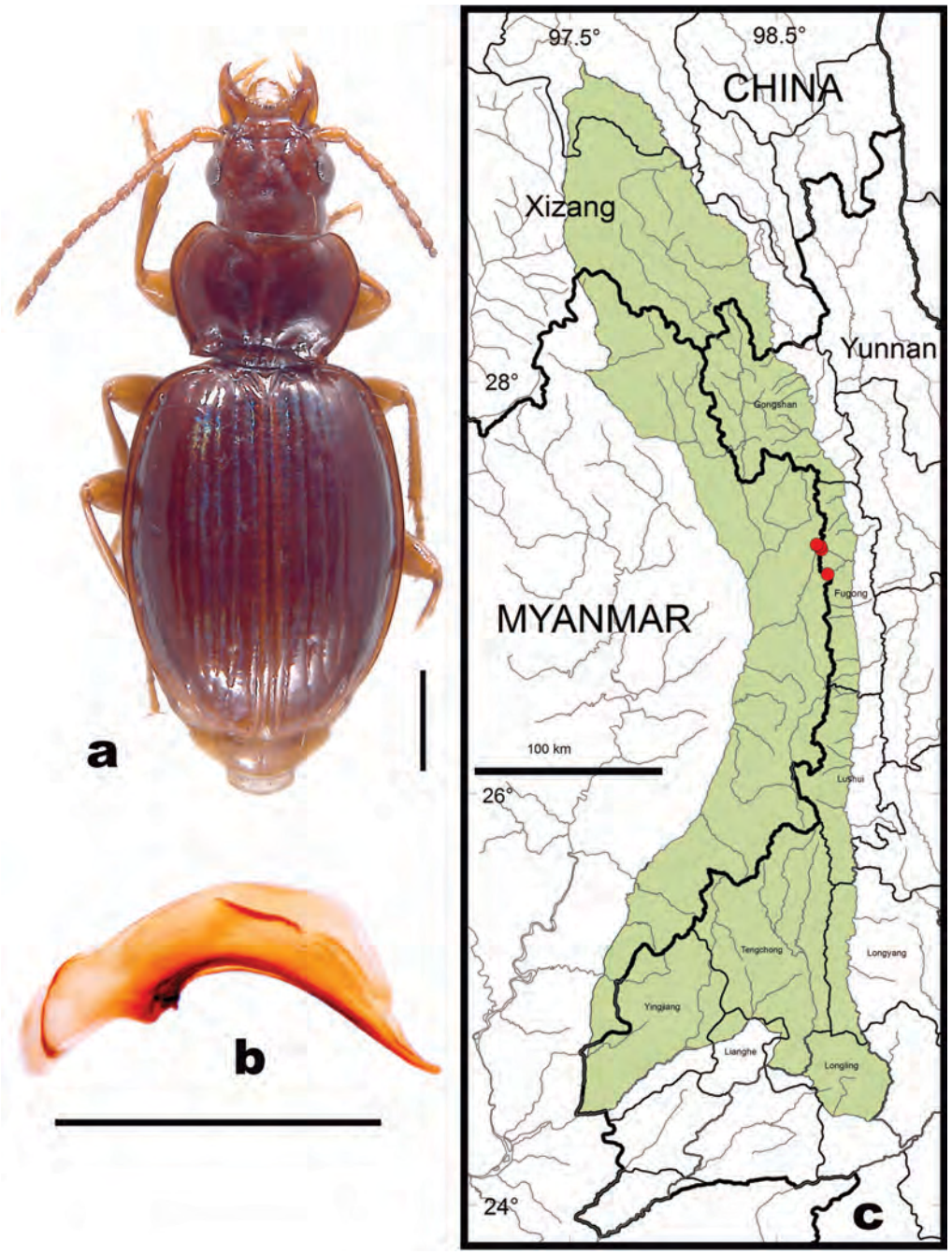


FIGURE 18. *Trechus shiyueliang* sp. nov.; a. Dorsal habitus (CASENT1021004). b. Median lobe of aedeagus of male (CASENT1021004), left lateral aspect. c. Map of locality record s(red circles) for *T. shiyueliang* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Habitat distribution.— Members of this species have been found in a variety of microhabitats at elevations ranging from 3100 to 3740 m. They have been collected in daytime from under stones in thickets of bamboo and *Prunus*, in rocky open areas cleared by snow avalanches (Fig. 40b), in meadows adjacent to bamboo and *Rhododendron* thickets (Fig. 42b) and along roadcuts through such thickets. They have also been collected at night, found walking on the substrate along roadcuts through areas of bamboo with an overstory of scattered *Abies* trees. At higher elevations, they were the only trechine encountered in this area; but they were found syntopic with specimens of *Trechus shibalicus* sp. nov., *Trechepaphiopsis unipilosa* sp. nov. and *Trechepaphiopsis unisetulosa* sp. nov. at the upper limit of the altitudinal range of this last mentioned species (3100 m).

Geographical distribution within the Gaoligong Shan.— Fig. 18c. We examined a total of 9 specimens (5 males and 4 females), all from Fugong County on the eastern slope and crest of the northcentral part of the Gaoligong Shan (see Type material above for exact collection data). These localities are all in Core Area 3.

Overall geographical distribution.— This species currently is known only from the northcentral part of the Gaoligong Shan, in western Yunnan Province, China.

Trechus (*Trechus*) *mingguangensis* Deuve and Liang, sp. nov.

(Figs. 19, 41b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1038692"/ "CHINA, Yunnan, Tengchong County, Mingguang Township, Eighth Boundary Post Pass, N25.80984°/ E98.62084°, 2287 m, 23 May 2006,"/ "Stop # DHK-2006-037A, D.H. Kavanaugh, R.L. Brett, X.P. Wang & D.Z.Dong collectors"/ "HOLOTYPE *Trechus mingguangensis* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (only 1): a female (in CAS) labeled: "CASENT 1038840"/ "CHINA, Yunnan, Tengchong County, Mingguang Township, small stream on SW-facing slope below 7.9 airkm N of Zizhi village, 2200 m,"/ "N25.80314°/E98.62117°, 2200 m, 23 May 2006,"/ "Stop # DHK-2006-038A, D.H. Kavanaugh & D.Z. Dong collectors"/ "PARATYPE *Trechus mingguangensis* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Tengchong County, Mingguang Township, Eighth Boundary Post Pass, N25.80314°/E98.62117°, 2287 m.

Derivation of species name.— The species epithet, *mingguangensis*, is derived from the name of the township in which the type locality is located, Mingguang, and the Latin suffix, *-ensis*, denoting place.

Diagnosis.— Adults of this species (Fig. 19a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 4.5 to 4.8 mm), apterous; body color reddish-brown; tempora glabrous, short and convex; pronotum transverse (ratio PW/PL = 1.40), basal angles acute and sharp; elytra very slightly elongate, striae finely punctate, striae 1 to 4 deeply impressed, stria 5 more faintly impressed, striae 6 to 8 effaced or nearly so, recurrent stria terminated anteriorly at a slight convexity in line with the presumed location of stria 7 apically; two normal discal setae present, inserted next to stria 3, preapical seta present, inserted in a discal position next to stria 3 at apical one-fourth of elytra; median lobe of male aedeagus with a large sagittal aileron, apical lamella long and rectilinear, nearly straight, apex thin, endophallus with copulatory piece poorly defined (Fig. 19b).

Description.— Size large, BL = 4.5 to 4.8 mm. Body color dark reddish-brown, shiny, appendages paler, yellowish- or reddish-tan, palpi pale yellow. Body surface smooth, only head capsule faintly alutaceous.

Head. Moderate in size; eyes slightly reduced, moderately convex, but their diameter less than twice as long as tempora, the latter short, moderately convex and glabrous. Frons moderately flat-

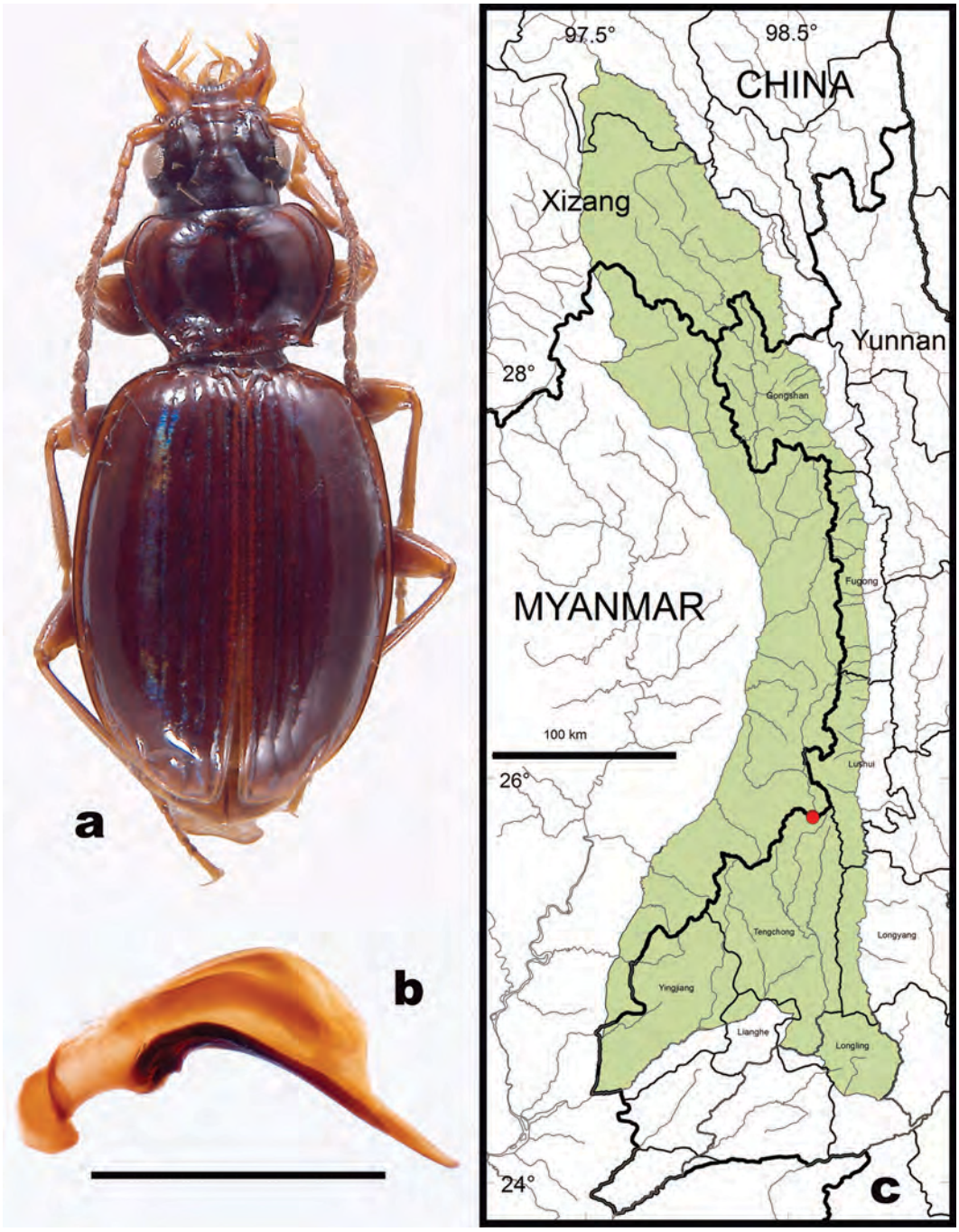


FIGURE 19. *Trechus mingguangensis* sp. nov.; a. Dorsal habitus (CASENT1038692). b. Median lobe of aedeagus of male (CASENT1038692), left lateral aspect. c. Map of locality records (red circles) for *T. mingguangensis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

tened; frontal furrows deep, curved, prolonged and not attenuated posterior to the eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mentum and submentum not fused but suture between them only faintly impressed. Mentum with medial tooth broad and apically truncate, about one-half the length of the lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae short, not quite extended to the basal one-fourth of elytra, male with about 2.5 to 3 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum. Moderately transverse (ratio PW/PL = 1.40), narrowed posteriorly, greatest width anterior to middle; lateral margins widely rounded, straightened only just anterior to basal angles, the latter small, but projected, acute and sharp. Disc convex, smooth and glabrous, median longitudinal impression sharply impressed, not quite extended to anterior margin; basal foveae distinct, subcircular; median basal area with several faint, longitudinal rugulae, delimited laterally by oblique furrows. Basal margin slightly bisinuate, slightly reflexed and oblique laterally, slightly projected medially. Lateral borders of pronotum moderately slender, regular, slightly reflexed, lateral grooves deeply impressed. Single midlateral setae on each side inserted slightly anterior to middle; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid, only very slightly elongate, more narrowed basally than apically, humeri distinct but rounded. Disc convex and smooth. Striae very finely punctate, striae 1 to 4 deeply impressed, stria 5 more faintly impressed, striae 6 to 8 effaced or nearly so. Parascutellar striole present. Recurrent stria terminated anteriorly by a slight convexity at the presumed location of stria 7 apically. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a discal position on interval 3, next to stria 3 in forward position at apical one-fourth of elytra. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Relatively short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with four pairs.

Male aedeagus. Median lobe (Fig. 19b) only slightly enlarged basally but with a large sagittal aileron present; shaft markedly narrowed at middle and broader subapically; apical lamella long, rectilinear, extremely thin in lateral view; endophallus voluminous but without well-defined sclerites.

Habitat distribution.— One specimen of this species was found under stones and debris along a roadcut (Fig. 41b) through slightly disturbed primary forest of *Tsuga*, with small, scattered small bamboo thickets; and the other specimen was found under stones along a small stream crossing the road in the same general area. No other trechines were collected in either of these sites, which range in elevation from 2200 to 2287 m.

Geographical distribution within the Gaoligong Shan.— Fig. 19c. We examined a total of 2 specimens, both from Mingguang Township in Tengchong County on the western slope of the southern part of the Gaoligong Shan (see Type material above for exact collection data). Both of these localities are in Core Area 6.

Overall geographical distribution.— This species currently is known only from the western slope of the southern part of the Gaoligong Shan, in western Yunnan Province, China.

***Trechus* (*Trechus*) *qiqiensis* Deuve and Kavanaugh, sp. nov.**
(Figs. 20, 37b, 42a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1007384"/ "CHINA, Yunnan Province, Gaoligong Shan, Nujiang Prefecture, Nujiang State Nature Reserve, No. 12 Bridge Camp area, 16.3 airkm W of Gongshan,"/ "N27.71503°/E98.50244°, 2775 m, 15-19 July 2000, Stop#00-23A, D.H. Kavanaugh, C.E. Griswold, Liang H.-B., D. Ubick, & Dong D.-Z. collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Trechus qiqiensis* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (at total of 11): 2 males and 4 females (in CAS, IOZ, MNHN) labeled: same as holotype, except first label "CASENT 1007380" to "CASENT 1007381" and "CASENT 1007382" to "CASENT 1007383" and "CASENT 1007385" to "CASENT 1007386", respectively; 1 male and 2 females (in CAS, IOZ) labeled: "CASENT 1010345" and "CASENT 1010346" to "CASENT 1010347"/ "CHINA, Yunnan, Gongshan County, Cikai Township, 52.6 km W of Gongshan on Dulong Valley Road, 3360-3380 m,"/ "N27.77032°/E98.44661°, 1-2 October 2002, Stop #DHK-2002-034, D.H. Kavanaugh & P.A. Marek collectors";1 male (in CAS) labeled: "CASENT 1015626"/ "CHINA, Yunnan, Gongshan County, Cikai Township, 48 km W of Gongshan on Dulong Valley Road, 3330 m,"/ "N27.78075°/E98.47000°, 13 November 2004, Stop # DHK-2004-086, D.H. Kavanaugh collector"; 1 male (in IOZ) labeled: "CASENT 1025832"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite,"/ "N27.97686°/E98.47799°, 3750 m, 19 August 2006, Stop #DHK-2006-082, Y. Liu collector". All paratypes also bear the following label: "PARATYPE *Trechus qiqiensis* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gongshan County, Qiqi Trail at No. 12 Camp, N27.71503°/E98.50244°, 2775 m.

Derivation of species name.— The species epithet, *qiqiensis*, is derived from the name of the ancient trail, Qiqi Trail, passing through the type locality, and the Latin suffix, *-ensis*, denoting place.

Diagnosis.— Adults of this species (Fig. 20a) can be distinguished from those of all other species in the region by the following combination of character states: size relatively large (BL = 4.0 to 4.2 mm), apterous; body color reddish-brown; eyes slightly convex; tempora glabrous, short and convex; pronotum transverse (ratio PW/PL = 1.44), basal angles rectangular and sharp; elytra with striae 1 to 4 deeply impressed on disc but attenuated apically, remaining striae successively less distinct, the outermost effaced or nearly so; recurrent stria terminated anteriorly by a slight convexity in line with stria 7; two discal setae present, inserted on interval 3 next to stria 3; preapical seta present and inserted in a discal position on interval 3, next to either stria 2 or 3 in forward position near apical one-fourth of elytra; median lobe of male aedeagus large and robust, subapically bent ventrally, apical lamella sinuate and reflexed dorsally (Fig. 20b), endophallus with a more heavily sclerotized voluminous lobe or scaly fold.

Description.— Size relatively large, BL = 4.0 to 4.2 mm. Body color reddish-brown, shiny, appendages concolorous but paler, palpi pale yellow. Body surface smooth, only head capsule faintly alutaceous.

Head. Moderate in size; eyes only slightly projected, slightly more convex, their diameter less than twice as long as tempora, the latter short, convex and glabrous. Frons slightly flattened; frontal furrows deep, curved, continuous but attenuated posterior to the eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mandibles short; right mandible distinctly tridentate with middle tooth closer to basal tooth (premolar) than to distal tooth, left mandible with a small slightly bifid process. Mentum and submentum not fused but suture between them only faintly impressed.

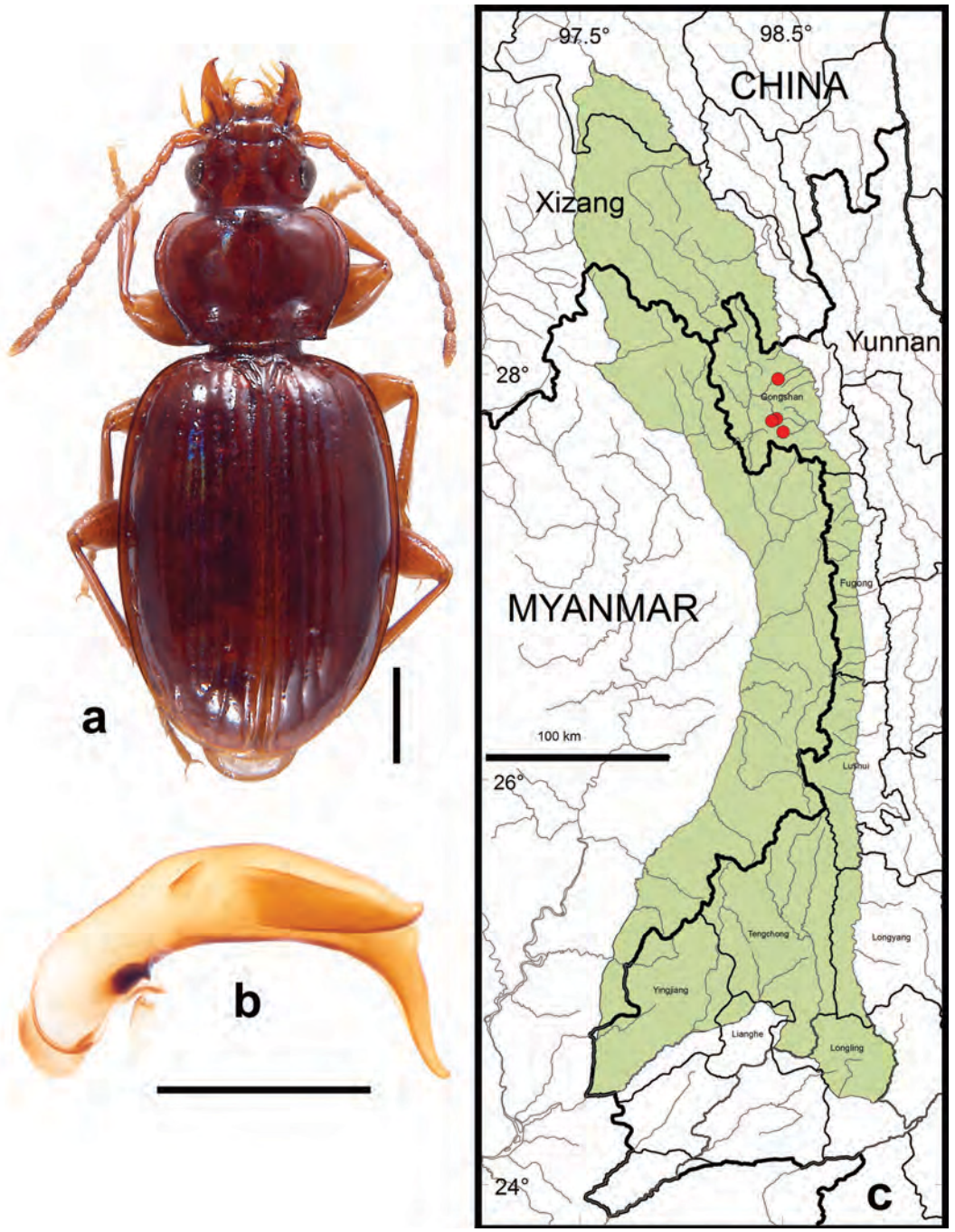


FIGURE 20. *Trechus qiqiensis* sp. nov.; a. Dorsal habitus (CASENT1007384). b. Median lobe of aedeagus of male (CASENT1007384), left lateral aspect. c. Map of locality records (red circles) for *T. qiqiensis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Mentum with medial tooth broad and apically truncate, about one-half the length of the lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae short, extended posteriorly to basal one-sixth of elytra, with about 2 or 3 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum. Transverse (ratio PW/PL = 1.44), narrowed posteriorly, greatest width near anterior one-fourth; lateral margins markedly rounded, with a short sinuation just anterior to basal angles, the latter small, rectangular and sharp. Disc convex, smooth and glabrous, median longitudinal impression finely impressed, but continuous between anterior and posterior margins; basal foveae distinct, circular; median basal area faintly rugulose, delimited laterally by short, oblique furrows. Basal margin nearly rectilinear, slightly projected medially. Lateral borders of pronotum moderately slender, regular, narrowly and regularly reflexed, lateral grooves narrow but distinctly impressed. Single midlateral setae on each side inserted slightly anterior to middle; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid, humeri distinct but rounded. Disc convex and smooth. Striae finely punctate, intervals faintly convex; striae 1 to 4 deeply impressed but attenuated apically, stria 5 more faintly impressed, striae 6 to 8 effaced or nearly so. Parascutellar striole present. Recurrent stria terminated anteriorly by a slight convexity at the presumed location of stria 7 apically. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a discal position on interval 3, next to either stria 2 or 3 in forward position at apical one-fourth of elytra in most specimens; in a few specimens two preapical setae present, one inserted farther forward next to stria 3, as a third discal seta, the second inserted less far forward and next to stria 2. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Medium proportions, slightly short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 20b) large and robust, with a moderate-sized sagittal aileron; shaft subapically bent ventrally; apical lamella sinuate and reflexed dorsally, bluntly pointed apically; endophallus with a more heavily sclerotized voluminous lobe or scaly fold.

Habitat distribution.— Members of this species have been found at elevations ranging from 2775 to 3750 m in a variety of habitats. At the lowest elevation (2775 m), specimens were collected by sifting meager leaf litter and mosses on the forest floor and on rotting logs (Fig. 42a). This area had abundant conifers (*Abies*, *Thuja*, and *Picea* species) that formed a partly open canopy. Litter and mosses were moist and substrate underneath was composed of crumbling granitic sand. Specimens of *Trechepaphiopsis monochaeta* sp. nov. were also collected in the same litter samples at this site. At higher elevations (above 3300 m), specimens were found under stones in meadows, talus slopes, in low *Rhododendron* thickets, and on heath-covered tundra slopes (Fig. 37b). In such areas, *T. qiqiensis* specimens were found syntopic with those of *Queinnectrechus* (*Gaoligongtrechus*) *balli* and *Queinnectrechus* (*s. str.*) *griswoldi,* and at highest elevation (3750 m) also with members of *Trechus gongshanensis* sp. nov.

Geographical distribution within the Gaoligong Shan.— Fig. 20c. We examined a total of 12 specimens (5 males and 7 females), all from Bingzhiongluo and Cikai Townships in Gongshan County on the crest and eastern slope of the northern part of the Gaoligong Shan (see Type material above for exact collection data). These localities are all in Core Area 2.

Overall geographical distribution.— This species currently is known only from Gongshan County on the crest and eastern slope of the northern part of the Gaoligong Shan, in western Yunnan Province, China.

Trechus (*Trechus*) *pseudoqiqiensis* Deuve and Liang, sp. nov.

(Figs. 21, 42b, 46–48)

Type material.— Holotype, a female, in IOZ, labeled: "CASENT 1014205"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 11.5 km above Shibali on Yaping Road, N27.20676°/E98.71763°,"/ "3290 m, 8 May 2004 Stop #DHK-2004-040 D.H. Kavanaugh, C.E. Griswold, Liang H.-B., Li X.-Y., & Zhu B.-X. collectors"/ "HOLOTYPE *Trechus pseudoqiqiensis* Deuve & Liang, sp. nov. designated 2016" [red label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 11.5 km above Shibali on Yaping Road, N27.20676°/E98.71763°, 3290 m.

Derivation of species name.— The species epithet, *pseudoqiqiensis*, is a combination of the Greek prefix, *ψευδής* (translated into Latin as *pseudo-*) meaning false, and the species epithet, *qiqiensis*, in reference to the similarity of the unique holotype female of this species to members of *T. qiqiensis*.

Diagnosis.— Adults of this species (Fig. 21a) can be distinguished from those of all other species in the region by the following combination of character states: similar to *T. qiqiensis* in size (BL = 4.0 mm) and most features, except body color paler, more reddish; elytral striae more faintly punctate, almost impunctate toward elytral apex, more deeply impressed on center of disc and not attenuated near apex, recurrent stria less abruptly interrupted by a convexity and nearly continuous anteriorly with stria 7; preapical seta present and inserted on interval 3 next to stria 2 near apical one-fourth of elytra.

Description.— Size relatively large (BL = 4.0 mm). Body color bright brownish red, shiny, appendages yellowish-tan, palpi pale yellow.

Head. Moderate in size; eyes slightly convex, their diameter about 1.5 times as long as tempora, the latter short, convex and glabrous. Frons not flattened; frontal furrows deep, rounded, not or only slightly attenuated posterior to the eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mentum and submentum not fused. Mentum distinctly concave at middle, with medial tooth broad and apex slightly bifid, about one-half the length of the lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae short, with about 2 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 4 about equal in length, antennomere 3 slightly longer.

Pronotum. Transverse (ratio PW/PL = 1.45), slightly narrowed posteriorly, greatest width near anterior one-third; lateral margins broadly rounded, not sinuate subbasally, straightened only immediately anterior to basal angles, the latter small and rectangular. Disc convex, smooth and glabrous, median longitudinal impression finely impressed, interrupted slightly posterior to anterior margin but extended to basal margin; basal foveae distinct, but shallower and slightly convex at center; median basal area mainly smooth, but with several small foveae anteriorly near the posterior transverse impression. Basal margin rounded and slightly projected medially. Lateral borders of pronotum slender, narrowly reflexed, lateral grooves distinctly impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid and only slightly elongate, humeri not very broad but rounded. Disc convex and smooth. Striae very finely punctate, nearly smooth in apical half, intervals moderately convex;

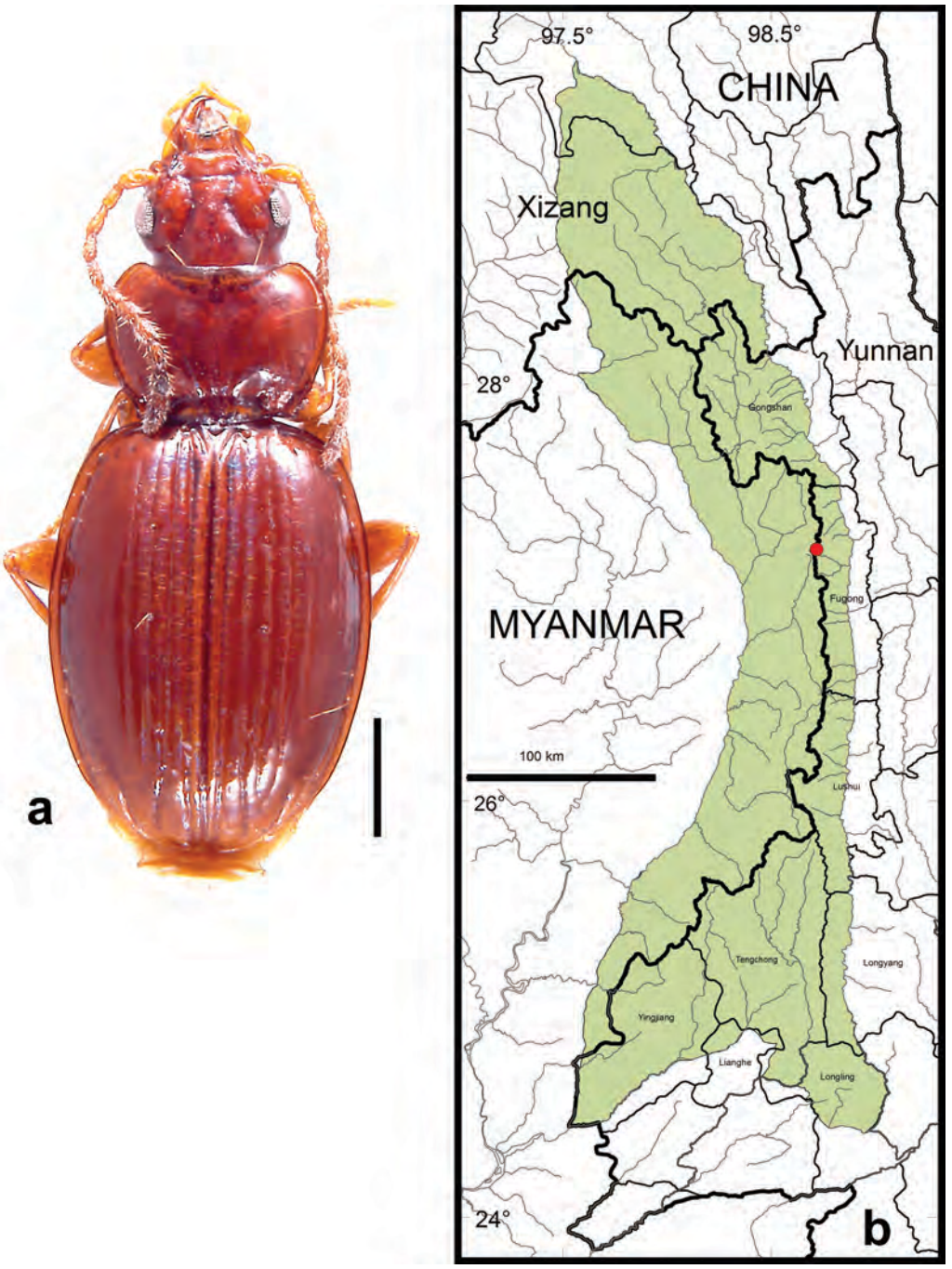


FIGURE 21. *Trechus pseudoqiqiensis* sp. nov.; a. Dorsal habitus (CASENT1014204). b. Map of locality record (red circle) for *T. pseudoqiqiensis* in the Gaoligong Shan region. Scale lines a = 0.5mm, b = 100 km.

striae 1 to 4 deeply impressed and not attenuated apically, stria 5 to 8 successively more faintly impressed by still evident. Parascutellar striole present, short. Recurrent stria less abruptly interrupted by a convexity and nearly continuous anteriorly with stria 7. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a discal position on interval 3 next to stria 2 in forward position at apical one-fourth of elytra. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Slightly short, protibiae with only a faint longitudinal furrow.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of female apically with two pairs of paramedial setae.

Habitat distribution.— The unique holotype female of this species was found under a stone in an open area cleared of forest but surrounded by bamboo thickets and scattered *Abies*, *Rhododendron* and *Prunus* species at an elevation of 3290 m (Fig. 42b). One specimen of *Trechus shibalicus* sp. nov. also was found at the same site.

Geographical distribution within the Gaoligong Shan.— Fig. 21b. This species is known from a single locality in Fugong County, on the eastern slope of the northcentral part of the Gaoligong Shan (see Type material above for exact collection data). This locality is in Core Area 3.

Overall geographical distribution.— This species currently is known only from the type locality on the eastern slope of the northcentral part of the Gaoligong Shan, in western Yunnan Province, China.

Trechus (*Trechus*) *luzhangensis* Deuve and Liang, sp. nov.

(Figs. 22, 43a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1017595"/ "CHINA, Yunnan, Lushui County, Luzhang Township, Piana Road at Fengxue Yakou, N25.97228°/E98.68336°, 3150 m, 11 May 2005,"/ "Stop# 2005-007, D.H. Kavanaugh, H.B. Liang, C.E. Griswold, D.Z. Dong & K.J. Guo collectors"/ "HOLOTYPE *Trechus luzhangensis* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (only 1): a female (in CAS) labeled same as holotype, except first label "CASENT 1017596" and last label "PARATYPE *Trechus luzhangensis* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Lushui County, Luzhang Township, Pianma Road at Fengxue Yakou [Pass], N25.97228°/E98.68336°, 3150 m.

Etymology.— The species epithet, *luzhangensis*, is derived from the name of the township, Luzhang, in which the type locality is found, and the Latin suffix, *-ensis*, denoting place.

Diagnosis.— Adults of this species (Fig. 22a) can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 3.7 to 3.8 mm), apterous; body color dark piceous, shiny, elytra with interval 1, lateral margins and apicomedial area reddish; tempora glabrous, convex, half as long as diameter of eyes; pronotum transverse (ratio PW/PL = 1.46), basal angles rectangular and sharp; elytra ovoid, convex, striae finely impressed, striae 1 to 3 deeply impressed on disc, not attenuated apically, remaining striae successively less distinct, the outermost very faint but still evident; recurrent stria terminated anteriorly at distinct convexity of interval 7; two discal setae present, inserted on interval 3 next to stria 3; preapical seta present and inserted in a discal position on interval 3, near stria 2 in forward position near apical one-fourth of elytra; median lobe of male aedeagus (Fig. 22b) with moderate-sized

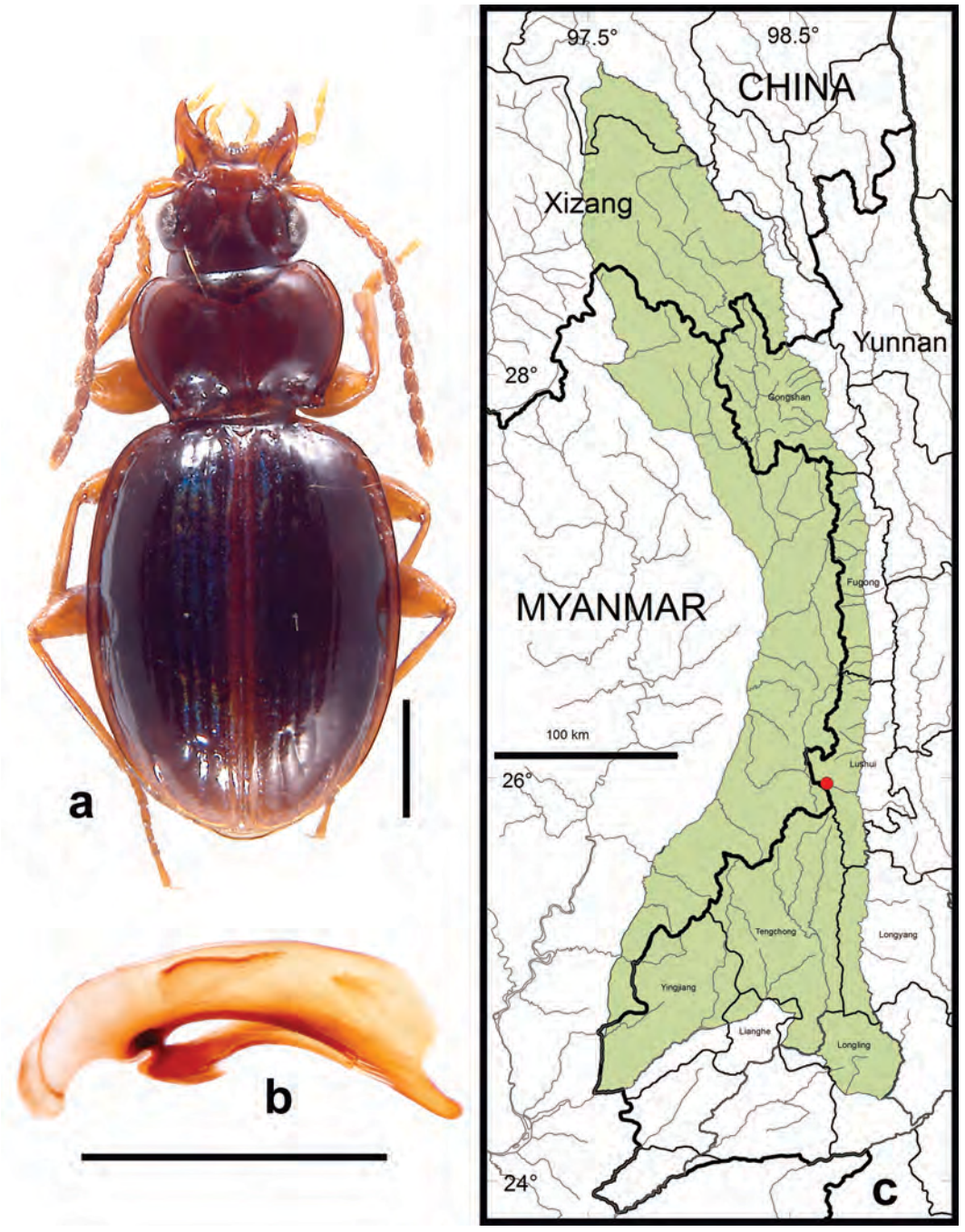


FIGURE 22. *Trechus luzhangensis* sp. nov.; a. Dorsal habitus (CASENT1017595). b. Median lobe of aedeagus of male (CASENT1017595), left lateral aspect. c. Map of locality records (red circles) for *T. luzhangensis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

sagittal aileron, apical lamella short and thick, with apex blunt, endophallus with a sclerotized line and a scaly area.

Description.— Size medium, BL = 3.7 to 3.8 mm. Body color dark piceous, shiny, elytra with interval 1, lateral margins and apicomedial area more or less reddish, appendages paler, yellowish-orange, palpi pale yellow. Body surface smooth, head capsule faintly alutaceous.

Head. Moderate in size; eyes only slightly projected but convex, their diameter twice as long as tempora, the latter short, moderately convex and glabrous. Frons not flattened; frontal furrows deep, rounded, prolonged and not attenuated posterior to the eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Mandibles short; right mandible distinctly tridentate with middle tooth closer to basal tooth (premolar) than to distal tooth. Mentum and submentum not fused but nearly so, suture between them only faintly impressed. Mentum with medial tooth apically truncate, less than half the length of the lateral lobes. Submentum with six setae anteriorly, swollen anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae rather short, with about 2 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum. Transverse (ratio PW/PL = 1.46), moderately narrowed posteriorly, greatest width anterior to middle; lateral margins widely rounded, straightened only just anterior to basal angles, the latter very small, but projected, acute and sharp. Disc convex, smooth and glabrous, median longitudinal impression slender but sharply impressed, extended anteriorly to near anterior margin; basal foveae distinct, subcircular; median basal area faintly, longitudinally rugulose, delimited laterally by obliquely curved furrows. Lateral borders of pronotum moderately slender, narrowly reflexed, lateral grooves deeply impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid, only slightly more narrowed basally than apically, humeri distinct but rounded. Disc convex and smooth. Striae finely impressed, not or only faintly punctate; striae 1 to 3 deeply impressed on disc, not attenuated apically, remaining striae successively less distinct, the outermost very faint but still evident. Parascutellar striole present. Recurrent stria terminated anteriorly at distinct convexity of interval 7. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a prediscal position on interval 3, closer to stria 2 than 3 in forward position at apical one-fourth of elytra. Umbilicate setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Relatively short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 22b) only moderately enlarged basally but with a medium-sized sagittal aileron present; shaft narrow subbasally, progressively thicker toward subapical portion; apical lamella short and thick, with apex blunt, endophallus with a sclerotized line and a scaly area, similar to that seen in males of *T. shiyueliang* sp. nov. (Fig. 18b).

Habitat distribution.— Members of this species have been found under stones on slopes above (Fig. 43a) and below the road and both side of the pass at an elevation of 3150 m. The habitat in this area includes broken scrub vegetation of two to four meter high bamboo and *Rhododendron* thickets on a thin layer of organic substrate, as well as open areas with stones on granitic sand substrate, and small seeps. Both specimens were found at the edges of thickets on organic substrate. No other trechines were found at this site.

Geographical distribution within the Gaoligong Shan. Fig. 22c. We examined a total of 2 specimens (1 male and 1 female), both from the crest of the southcentral part of the Gaoligong Shan in Lushui County (see Type material above for exact collection data). This locality straddles Core Areas 4 and 5.

Overall geographical distribution. This species currently is known only from the type locality on the crest of the southcentral part of the Gaoligong Shan, in western Yunnan Province, China.

Trechus (*Trechus*) *gongshanensis* Deuve and Liang, sp. nov.

(Figs. 16c, 23, 38a, 39a, 39b, 40a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1001929"/ "CHINA, Yunnan Province, Gaoligong Shan, Nujiang Prefecture, Nujiang State Nature Reserve, Dulong/Gongshan Yakou area, 21 airkm W of Gongshan,"/ "N27.69655°/ E98.45389°, 3300-3680 m, 16-17 July 2000, Stop#00-24C, D.H. Kavanaugh, C.E. Griswold, Liang H.-B., D. Ubick, & Dong D.-Z. collectors"/ "HOLOTYPE *Trechus gongshanensis* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (a total of 51): 1 male and 4 females (in CAS, IOZ) labeled: same as holotype, except first label "CASENT 1001928" and "CASENT 1001930" to "CASENT 1001932" and "CASENT 1008148", respectively; 8 males and 4 females (in CAS, IOZ) labeled: "CASENT 1010348" to "CASENT 1010355" and "CASENT 1010356" to "CASENT 1010359", respectively/ "CHINA, Yunnan, Gongshan County, Cikai Township, 52.6 km W of Gongshan on Dulong Valley Road, 3360-3380 m,"/ "N27.77032°/ E98.44661°, 3360-3380 m, 1-2 October 2002, D.H. Kavanaugh & P.E. Marek collectors"; 1 female (in IOZ) labeled: "CASENT 1024869"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, on slope NE of Chukuai Lake, 3950 m,"/ "N27.98206°/ E98.48027°, 20 August 2006 Stop #DHK-2006-086 Y. Liu, P. Hu, D.Z. Dong & J. Wang collectors"; 1 male (in CAS) labeled: "CASENT 1025105"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.4 km NW of Chukuai Lake,"/ "N27.98231°/ E98.47069°, 3808 m, 21 August 2006 Stop #DHK-2006-094 D.Z. Dong collector"/ 2 males and 2 females (in CAS, IOZ) labeled: "CASENT 1025164" to "CASENT 1025165" and "CASENT 1025162" to "CASENT 1025163", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.75 km NW of Chukuai Lake,"/ "N27.98631°/ E98.47069°, 3820 m, 21 August 2006 Stop #DHK-2006-095 Y. Liu, P. Hu, & J. Wang collectors"; 1 male and 2 females (in CAS, IOZ) labeled: "CASENT 1025833" and "CASENT 1025834" to "CASENT 1025835", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite,"/ "N27.98631°/ E98.47069°, 3820 m, 21 August 2006 Stop #DHK-2006-082 Y. Liu collector"; 1 female (in IOZ) labeled: "CASENT 1025920"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan at Chukuai Lake, 3720 m,"/ "N27.98121°/ E98.47580°, 19 August 2006 Stop #DHK-2006-095B D.H. Kavanaugh, J.A. Miller, D.Z. Dong, Y. Liu, P. Hu, & J. Wang collectors"; 1 female (in CAS) labeled: "CASENT 1025939"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km SW of Chukuai Lake at campsite, N27.97686°/ E98.47799°,"/ "3750 m, 19 August 2006 Stop #DHK-2006-095C D.H. Kavanaugh, J.A. Miller, D.Z. Dong, Y. Liu, P. Hu, & J. Wang collectors"; 4 males and 2 females (in CAS, IOZ) labeled: "CASENT 1026196" to "CASENT 1026199" and "CASENT 1026200" to "CASENT 1026201", respectively/ / "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km NNE of Chukuai Lake, N27.98393°/ E98.47491°,"/ "3745 m, 19 August 2006 Stop #DHK-2006-081

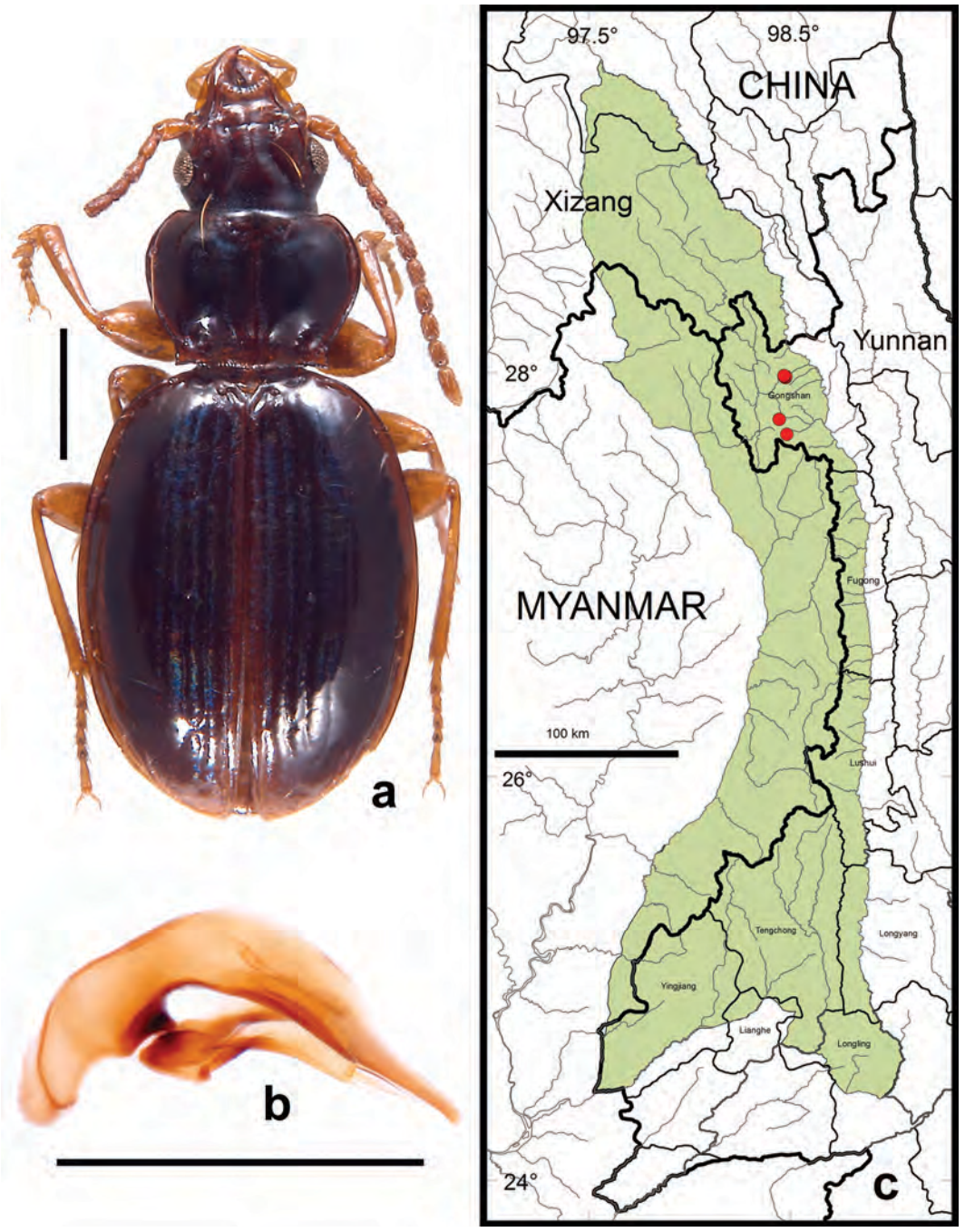


FIGURE 23. *Trechus gongshanensis* sp. nov.; a. Dorsal habitus (CASENT1001929). b. Median lobe of aedeagus of male (CASENT1001929, left lateral aspect. c. Map of locality record s(red circles) for *T. gongshanensis* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

D.H. Kavanaugh, J.A. Miller, & D.Z. Dong collectors"; 3 males (in CAS, IOZ) labeled: "CASENT 1026320" to "CASENT 1026322", respectively/ "CHINA, Yunnan, Gongshan County, Cikai Township, 0.1 km SE of Heipu Yakou in valley below tunnel, N27.76978°/ E98.44681°,"/ "3720 m, 13 August 2006, Stop #DHK-2006-073 D.H. Kavanaugh & J.A. Miller collectors"; 1 male (in CAS) labeled: "CASENT 1026366"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan at Chukuai Lake, 3720 m,"/ "N27.98121°/ E98.47580°, 19 August 2006 Stop #DHK-2006-080 D.H. Kavanaugh & J.A. Miller collectors"; 8 males and 5 females (in CAS, IOZ, MNHN) labeled: "CASENT 10263824" to "CASENT 10263831" and "CASENT 10263819" to "CASENT 10263823", respectively/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan at Chukuai Lake, 3720 m,"/ "N27.98121°/ E98.47580°, 18 August 2006 Stop #DHK-2006-079 D.H. Kavanaugh, J.A. Miller, D.Z. Dong, & Y. Liu collectors". All paratypes also bear the following label: "PARATYPE *Trechus gongshanensis* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gongshan County, Dongshaofang area, N27.69655°/E95.45389°, 3300-3600 m.

Derivation of species name.— The species epithet, *gongshanensis*, is derived from the name of the county, Gongshan, in which all specimens of the type series were collected, and the Latin suffix, *-ensis*, denoting place.

Diagnosis.— Adults of this species (Fig. 23a) can be distinguished from those of all other species in the region by the following combination of character states: size small (BL = 3.3 to 3.5 mm), apterous; body color dark piceous, elytra slightly reddish near sutural and lateral margins; tempora glabrous and only slightly convex; pronotum transverse (ratio PW/PL = 1.45), basal angles acute and sharp; elytra convex, discal striae 1 to 3 or 4 finely impressed, striae 6 to 8 effaced, recurrent stria joined anteriorly with apex of stria 7, two discal setae present on interval 3 next to stria 3, preapical seta present and inserted in a discal, forward position near apical one-fourth of elytra on interval 3, near stria 2 in most individuals, nearer to stria 3 in a few; aedeagus of male with base robust, apical lamella elongate with apex blunt, endophallus with a slightly sclerotized scaly area.

Description.— Size small, BL = 3.3 to 3.5 mm. Body color dark piceous and shiny, elytra slightly reddish near sutural and lateral margins, appendages paler reddish yellow, palpi paler yellow. Body surface smooth, head capsule faintly alutaceous.

Head. Moderate in size, eyes moderately convex, their diameter only slightly longer than length of tempora, the latter glabrous and only slightly convex. Frontal furrows deep, rounded, slightly attenuated posteriorly but prolonged posterior to the eyes. Clypeus with four setae. Labrum with six setae, apical margin distinctly concave. Right mandible as in Fig. 16c. Mentum and submentum not fused but nearly so, suture between them very fine and only faintly impressed. Mentum with medial area concave, median tooth short, apically bifid, less than half as long as lateral lobes. Submentum with six setae anteriorly, swollen anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae short, extended posteriorly to basal one-fifth of elytra, with about 2 antennomeres extended posteriorly beyond basal pronotal margin; antennomere 3 slightly longer than antennomere 2 or 4.

Pronotum. Transverse (ratio PW/PL = 1.45), widest at anterior one-third, narrowed posteriorly, lateral margins rounded, then abruptly sinuate just anterior to basal angles, the latter acute, sharp and slightly projected laterally. Disc convex, smooth, median longitudinal impression finely impressed but prolonged to the basal margin, slightly widened and deepened in the median basal area, the latter also with several faint longitudinal rugulae and delimited anteriorly by an arcuate posterior transverse impression that is partially effaced medially. Basal foveae distinct but smooth.

Basal margin nearly rectilinear. Lateral margination slender throughout and narrowly reflexed, lateral grooves distinctly impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted slightly anterior to apex of basal angle.

Elytra. Ovoid, humeri distinct but rounded. Disc convex, with striae 1 to 3 or 4 finely impressed, the more lateral striae successively more faintly impressed, striae 7 and 8 effaced, striae slightly and irregularly punctate. Parascutellar striole rudimentary. Recurrent stria distinct, moderately deep, terminated at the posterior end of stria 7. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a prediscal position on interval 3, closer to stria 2 than 3 in most specimens (closer to stria 3 in a few) in forward position at apical one-fourth of elytra.

Legs. Relatively short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. (Fig. 23b). Median lobe with basal bulb robust and with a thick sagittal aileron; apical lamella elongate, slightly tapered, with apex blunt. Endophallus nearly unarmed, with only a faintly sclerotized scaly area.

Habitat distribution.— Members of this species have been found in a variety of microhabitats in the alpine zone at elevations ranging from 3360 to 3950 m. Specimens were collected from under stones in moist meadows, on tundra slopes and ridges with sparse to thick herbaceous vegetation (Fig. 38a, 39b, 40a) and at the edges of small streams and seeps from talus slopes (Fig. 39a). They were also collected in pitfall traps placed at the edges of *Rhododendron* thickets up to two meters tall. Members of this species have been found syntopic with specimens of *Queinnectrechus* (*Gaoligongtrechus*) *balli*, *Queinnectrechus* (*s. str.*) *griswoldi*, *Queinnectrechus* (*s. str.*) *gongshanicus*, and *Trechus qiqiensis* at one or more sites.

Geographical distribution within the Gaoligong Shan.— Fig. 23c. We examined a total of 52 specimens (22 males and 30 females), all from Bingzhiongluo and Cikai Townships in Gongshan County on the crest and eastern slope of the northern part of the Gaoligong Shan (see Type material above for exact collection data). These localities are all in Core Area 2.

Overall geographical distribution.— This species currently is known only from Gongshan County in the northern part of the Gaoligong Shan, in western Yunnan Province, China.

Trechus (*Trechus*) *shibalicus* Deuve and Kavanaugh, sp. nov.

(Figs. 24, 16d, 40b, 42b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1017532"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 8.5 km above Shibali on Shibali Road, north bank of North Fork of Yamu He, N27.18416°/ E98.72026°,"/ "3100 m, 8 August 2005 Stop #DHK-2005-067A D.H. Kavanaugh, H.B. Liang, D.Z. Dong, & J.F. Zhang collectors"/ "HOLOTYPE *Trechus shibalicus* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 43): 1 male and 3 females (in IOZ, CAS) labeled: same as holotype, except first label "CASENT 1017531" and "CASENT 1017533" to "CASENT 1017535", respectively; 1 male (in CAS) labeled: "CASENT 1014204"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 11.5 km above Shibali on Yaping Road, N27.20676°/ E98.71763°,"/ "3290 m, 8 May 2004 Stop #DHK-2004-040 D.H. Kavanaugh, C.E. Griswold, Liang H.-B., Li X.-Y., & Zhu B.-X. collectors"; 1 male (in IOZ) labeled: "CASENT 1018365"/ "CHINA, Yunnan, Fugong County, Lishadi Township, headwaters of North Fork Yamu He just E of Shibali Yakou, 3450 m,"/ "N27.21034°/ E98.70141°, 7 August

2005, Stop# LHB-05-52, H.B. Liang & J.F. Zhang collectors"; 1 male (in IOZ) labeled: "CASENT 1018605"/ "CHINA, Yunnan, Fugong County, Lishadi Township, headwaters of North Fork Yamu He just E of Shibali Yakou, 3450 m,"/ "N27.21034°/ E98.70141°, 12 August 2005, Stop# LHB-05-54, H.B. Liang & J.F. Zhang collectors"; 1 male (in CAS) labeled: "CASENT 1018844"/ "CHINA, Yunnan, Fugong County, Lishadi Township, Shibali area, 2535 m, N27.16536°/ E98.78003°, 4-17 August 2005,"/ "Stop# DHK-2005-059 D.H. Kavanaugh, H.B. Liang, P. Paquin, & D.Z. Dong collectors"; 1 female (in CAS) labeled: "CASENT 1020015"/ "CHINA, Yunnan, Fugong County, Lumadeng Township, second cirque S of Shibali Yakou, 3675 m,"/ "N27.20244°/ E98.69526°, 17 August 2005, Stop# DHK-2005-093, D.H. Kavanaugh collector"; 2 males and 2 females (in CAS, IOZ) labeled: "CASENT 1020903" to "CASENT 1020904" and "CASENT 1020905" to "CASENT 1020906", respectively/ "CHINA, Yunnan, Fugong County, Lishadi Township, Shibali Yakou, 3612 m, N27.21231°/ E98.69575°, 7 August 2005,"/ "Stop# DHK-2005-066, D.H. Kavanaugh, H.B. Liang, P. Paquin, & D.Z. Dong collectors"; 1 female (in CAS) labeled: "CASENT 1021290"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 0.5 km NE of Shibali Yakou, N27.21447°/ E98.70064°,"/ "3460 m, 12 August 2005, Stop# DHK-2005-077, D.H. Kavanaugh, P. Paquin, & D.Z. Dong collectors"; 6 males and 5 females (in CAS, IOZ) labeled: "CASENT 1022286" to "CASENT 1022291" and "CASENT 1022292" to "CASENT 1022296", respectively/ "CHINA, Yunnan, Fugong County, Lumadeng Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He,"/ "N27.18416°/ E98.72026°,"/ "3100 m, 5 May 2004, Stop #LHB-04-023 Lian H.-B., Li X.-Y., & Zhu B.-Q. collectors"; 1 female (in CAS) labeled: "CASENT 1023606"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 11.5 km above Shibali on Shibali Road, N27.20676°/ E98.771763°,"/ "3290 m, 6 May 2004 Stop #DHK-2004-036 D.H. Kavanaugh, C.E. Griswold, Liang H.-B., & Zhu B.-X. collectors"; 9 males and 4 females (in CAS, IOZ, MNHN) labeled: "CASENT 1023743" to "CASENT 1023745" and "CASENT 1023747" to "CASENT 1023752" and "CASENT 1023753" to "CASENT 1023756", respectively/ "CHINA, Yunnan, Fugong County, Lishadi Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/ E98.72026°,"/ "3100 m, 7 May 2004 Stop #DHK-2004-038A D.H. Kavanaugh, C.E. Griswold, Liang H.-B., & Zhu B.-X. collectors"; 1 male and 3 females (in CAS, IOZ) labeled: "CASENT 1023775" and "CASENT 1023776" to "CASENT 1023778", respectively/ "CHINA, Yunnan, Fugong County, Lumadeng Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He,"/ " N27.18326°/ E98.72002°, 3100 m, 7 May 2004 Stop #DHK-2004-038B D.H. Kavanaugh collector". All paratypes also bear the following label: "PARATYPE *Trechus shibalicus* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 8,5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°, 3100 m.

Derivation of species name.— The species epithet, *shibalicus*, is derived from the name of settlement, Shibali, at and near which specimens of the type series were collected, and the Latin adjectival suffix, *-icus*, meaning belonging to or pertaining to.

Diagnosis.— Adults of this species (Fig. 24a) can be distinguished from those of all other species in the region by the following combination of character states: size small (BL = 3.3 to 3.5 mm), apterous; body color reddish brown; tempora glabrous, short and distinctly convex; pronotum transverse (ratio PW/PL = 1.44), basal angles rectangular or slightly acute and sharp; elytra with striae finely punctate, lateral striae more or less effaced, recurrent stria abruptly interrupted at slight convexity at posterior end of stria 7, two typical discal setae present, preapical seta present and inserted in a discal, forward position near apical one-fourth of elytra on interval 3 next to stria 2; male aedeagus with sagittal aileron present but reduced, apical lamella slender with blunt apex, endophallus with a distinct scaly area.

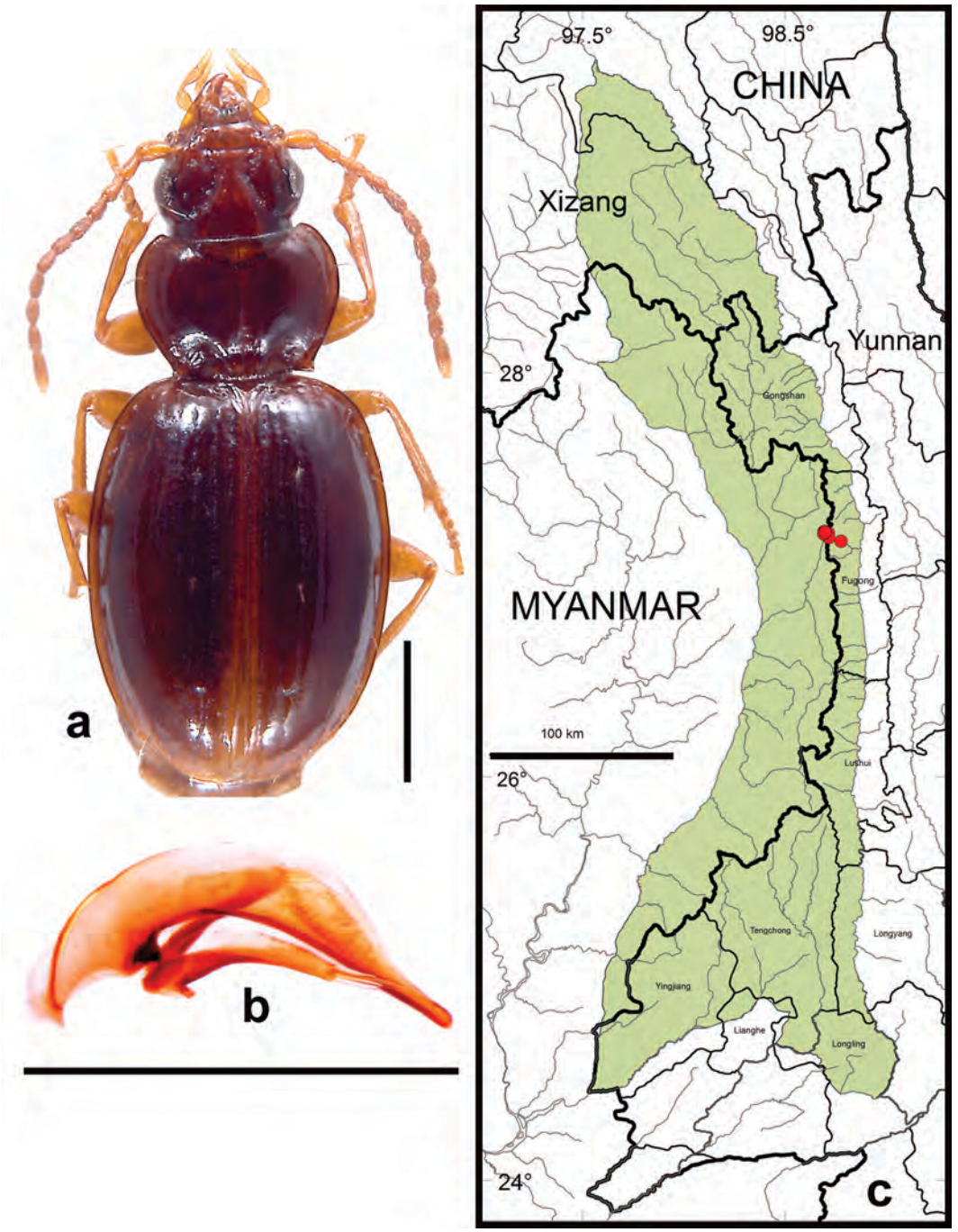


FIGURE 24. *Trechus shibalicus* sp. nov.; a. Dorsal habitus (CASENT1017532). b. Median lobe of aedeagus of male (CASENT1017532), left lateral aspect. c. Map of locality records (red circles) for *T. shibalicus* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Description.— Size small, BL = 3.3 to 3.5 mm. Body color dark brown and shiny, elytra slightly reddish near sutural and lateral margins, appendages paler reddish yellow, palpi paler yellow. Body surface smooth.

Head. Short and thick, eyes slightly convex, their diameter slightly greater than length of tempora, the latter glabrous and distinctly convex. Frons not flattened; frontal furrows deep, broadly rounded, not attenuated posteriorly. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Right mandible as in Fig. 16d. Mentum and submentum not fused. Mentum with median tooth bifid apically, half as long as lateral lobes. Submentum with six setae anteriorly. Gula wide. Genae with a single seta ventrally on each side. Antennae rather short, with about 1.5 to 2 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum transverse (ratio PW/PL = 1.44), greatest width slightly anterior to middle, slightly narrowed posteriorly, lateral margins rounded, abruptly sinuate just anterior to basal angles, the latter rectangular or slightly acute and sharp. Disc convex; median longitudinal impression distinctly impressed, slightly widened and deepened in the median basal area, the latter also with several longitudinal rugulae and delimited laterally by short, oblique furrows. Basal foveae distinct, small and rounded. Lateral margination narrow and slightly widened basally, lateral border slightly reflexed, lateral grooves distinctly impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid, humeri distinct but rounded. Disc convex; striae finely punctate, striae 1 to 4 distinctly impressed, the more lateral striae more or less effaced, stria 6 barely perceptible, stria 7 and 8 indistinct. Scutellar striole short but deeply impressed. Recurrent stria distinct, abruptly interrupted at slight convexity at posterior end of stria 7. Basal setiferous pore present at common origin of striae 1 and 2. Two discal setae present and inserted next to stria 3, one at anterior one-fourth and one near middle of elytra. Preapical seta present and inserted in a prediscal position on interval 3 next to stria 2 in forward position more than twice as far from apex as from sutural margin\.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 24b) with base moderate in size, sagittal aileron present but reduced, shaft moderately thick subbasally, apical lamella narrowed, moderately elongate, with blunt apex; endophallus only faintly sclerotized but with a distinct scaly area.

Habitat distribution.— Members of this species have been found in a variety of microhabitats over a broad elevational range, from 2535 to 3675 m. They have been collected in daytime from under stones in thickets of bamboo (various elevations) (Fig. 42b), in subalpine forests of scattered *Abies* and *Rhodondendron* mixed with bamboo thickets (at 3290 m), in rocky open areas cleared by snow avalanches but shaded by 3 meter high herbaceous cover (3100 m) (Fig. 40b), in meadows adjacent to bamboo and *Rhodondendron* thickets (3400 m) and along roadcuts through such thickets, and on talus and vegtetated slopes in a glacial cirque (3675 m). At the lowest recorded elevation (2535 m), one specimen was collected under a stone along a roadcut on moist, shaded ground. At both highest and lowest elevations, they were the only trechine encountered; but they were found syntopic with specimens of *Trechus shiyueliang*, *Trechus pseudoqiqiensis, Trechepaphiopsis unisetulosa* sp. nov., and *Trechepaphiopsis unipilosa* sp. nov. at one or more mid-elevation (3100 to 3290 m) sites.

Geographical distribution within the Gaoligong Shan.— Fig. 24c. We examined a

total of 44 specimens (23 males and 21 females), all from Fugong County on the eastern slope and crest of the northcentral part of the Gaoligong Shan (see Type material above for exact collection data). These localities are all in Core Area 3.

Overall geographical distribution.— This species currently is known only from Fugong County in the northcentral part of the Gaoligong Shan, in western Yunnan Province, China.

Genus *Trechepaphiopsis* Deuve and Kavanaugh, gen. nov.

Type species.— *Trechepaphiopsis uniporosa*, sp. nov.

Derivation of genus group name.— The genus group name (feminine) is a combination of two other trechine generic names, *Trechus* and *Epaphius*, plus the Greek suffix, οψις (translated into Latin as *-opsis*) meaning having the aspect of, here referring to a similarity with *Epaphius* members.

Diagnosis.— Adults of this genus (Figs. 25–31) can be recognized by the following combination of character states: size small to moderate (BL = 2.8 to 3.7 mm), apterous; body color light to dark brown, reddish-brown, or piceous-brown, most members with dorsum slightly iridescent, dorsal surface glabrous except for isolated fixed setae typical for trechines, eyes also glabrous; head short, with eyes small; tempora convex, swollen in some members, sparsely pubescent; right mandible (Fig. 16e) with premolar tooth not fused with retinaculum and anterior point of the retinaculum free and displaced distally to form a separate tooth; mentum and submentum not fused; mentum with median tooth apical truncate or bifid; submentum with six setae; pronotum transverse, disc glabrous, basal foveae only slightly distinct, median basal area short and very transverse, delimited laterally by short, obliquely curved furrows, basal margin slightly projected posteriorly in most members, basal angles small, obtuse, rounded; elytra distinctly convex, with striae finely impressed, more or less punctate, lateral striae attenuated or effaced, recurrent stria terminated anteriorly with a bend or hook on interval 5 or 6, with a single discal seta on interval 3 next to stria three or without discal setae; preapical seta present, inserted next to stria 2; median lobe of male aedeagus of varied form, but endophallus membraneous, with spiny or scaly areas in some members, more or less sclerotized but without distinct sclerites.

Comments.— In subtropical China, the "Epaphiopsis Complex" of genera is represented mainly by *Pseudepaphius* Uéno (1962), members of which are distinguished from true *Epaphiopsis* members by their smooth pronotum and the presence of a single discal seta on interval 5 next to stria 5 (Deuve 1995). Members of our new genus, *Trechepaphiopsis*, are easily distinguished by their elytra chaetotaxy. Genus *Junnanotrechus* Uéno and Yin (1993) also belongs in this generic complex and is probably closely related to *Pseudepaphius*, based on both morphological (Deuve 2013a) and molecular (A. Faille, unpublished) data. The illustration of the mandibles of *Junnanotrechus elegantulus* Belousov and Kabak (2014b, Fig. 1) confirms this phylogenetic affinity. The right mandible presents the same morphological features shared with *Pseudepaphius* (Fig. 16e) and *Trechepaphiopsis* members (Fig. 16f), namely the unfused premolar and the anterior tip of the retinaculum distinctly displaced anteriorly to form a separate tooth.

Geographical distribution.— This genus currently is known only from the Gaoligong Shan region of western Yunnan Province, China, where it is represented by the seven species treated here. Three were previously described, all in genus *Trechus*, and four are described here as new. Each species apparently occupies only a narrow geographical range within the Gaoligong Shan, but their combined known ranges cover all but the northernmost part of the study area.

As is reflected in the key to species presented below, only male members of most of these species can be reliably distinguished, and that only by extraction and examination of their genitalic structure. To date, only two of these species have been recorded as sympatric and syntopic,

namely *T. unisetosa* (Deuve) and *T. uniporosa* sp. nov. (in Core Area 4). Two species, *T. unisetulosa* sp. nov. and *T. unipilosa* sp. nov. occur in the same general area but apparently have different, non-overlapping altitudinal ranges. So, at least for the present, locality data may aid in tentative identifications of females and undissected males, except for the first two species mentioned above.

Key for Identification of Adults of *Trechepaphiopsis* Species of the Gaoligong Shan Region

1. Elytra without discal setae . . . . . *T. asetosa* (Uéno)
   Elytra with a single discal seta, at or near mid-elytral length, next to stria 3 2
2. Size larger, BL = 3.5 to 3.7 mm; specimen from southeastern part of Gaoligong Shan region (*Baoshan County*) . . . . . *T. unisetigera* (Uéno)
   Size smaller, BL = 2.8 to 3.5 mm; specimen from more northerly part of the Gaoligon Shan region 3
3. Median lobe of male aedeagus (Fig. 27b) with a sinuous form, apical lamella very thin in lateral view, trilobed in apical view (Fig. 27c), endophallus formed as a long sleeve densely covered with long, fine spines; specimen from the southcentral part of the Gaoligong Shan region (*Lushui County*) . . . . . *T. unisetosa* (Deuve)
   Median lobe of male aedeagus (Figs. 28b–31b) with a more simple form, apical lamella thicker in lateral view, monolobate in apical view (Fig. 28c), endophallus with scaly areas but without long spines 4
4. Median lobe of male aedeagus (Fig. 28b) with apical lamella progressively narrowed in lateral view, apex narrow, bluntly rounded and slightly recurved dorsally (*Lushui County*). . . . . ***T. uniporosa* sp. nov.**
   Median lobe of male aedeagus (Figs. 29b–31b) with apex thicker and more broadly rounded in lateral view. 5
5. Size larger, BL = 3.3 to 3.5 mm; median lobe of male aedeagus (Fig. 29b) with shaft thicker subbasally, then moderately narrowed toward apex, apex broadly rounded, slightly lobate (*Fugong County*). . . . . ***T. unisetulosa* sp. nov.**
   Size smaller, BL = 2.7 to 3.1 mm; median lobe of male aedeagus (Figs. 30b–31b) with shaft of more consistent thickness throughout its length, apex short and rounded, not dilated. . . . 6
6. Median lobe of male aedeagus (Fig. 30b) with scaly spoon-shaped area of endophallus only slightly narrowed toward apex (*Gongshan County*) . . . . . ***T. monochaeta* sp. nov.**
   Median lobe of male aedeagus (Fig. 31b) with scaly spoon-shaped area of endophallus markedly narrowed toward apex (*Fugong County*) . . . . . ***T. unipilosa* sp. nov.**

Trechepaphiopsis asetosa (Uéno), 1997

(Figs. 25, 46–48)

Trechus (s. str.) asetosus Uéno, 1997: 185. Holotype, a male, in NMST. Type locality: China, Yunnan, Gaoligong Shan, Tengchong County, Dabei, 2430 m.

Trechepaphiopsis asetosa (Uéno), NEW COMBINATION

NOTES ON TYPE MATERIAL.— We have not had an opportunity to study the holotype or any other specimens of this species. Features noted below are based on Uéno's (1997) original description and illustrations.

DIAGNOSIS.— Adults of this species (see Uéno 1997, Fig. 2) can be distinguished from those of all other species in the region by the following combination of character states: size small to medium (BL= 3.0 to 3.5 mm), apterous; body color dark brown to piceous, dorsum slightly irides-

cent; eyes very small, flattened, not projected laterally beyond tempora ; tempora convex, slightly inflated; pronotum large and transverse (ratio PW/PL = 1.32 to 1.49), widest near anterior two-fifths, lateral margins slightly more curved in apical half than in basal half, basal angles obtuse and rounded; elytra ovoid, relative long and narrow, convex, striae 1 and 2 distinct, nearly complete and finely punctate, striae 3 and 4 faintly evident, stria 5 to 7 effaced, striae 8 evident but interrupted in apical half; recurrent stria terminated anteriorly in presumed location of interval 6; discal setae absent; preapical seta present, inserted next stria 2, inserted closer to sutural than to apical margin; median lobe of male aedeagus (see Uéno 1997, Figs. 3 and 4) with apex short and narrow, faintly recurved dorsally, endophallus without sclerites, but covered with scales.

Habitat distribution.— According to Uéno (1997), members of this species were collected by sifting moist leaf litter accumulations on the ground in the "*Rhododendron* zone" at elevations ranging from 2340 to 2440 m. At one of three sites where specimens of *T. asetosa* were found (at 2340 m), specimens of *Minutotrechus minutus* were also collected in the same litter samples.

Geographical distribution within the Gaoligong Shan.— Fig. 25. We examined a single paratype specimen from the type locality, the only site from which the species has been recorded, in eastern Tengchong County in the southern part of the Gaoligong Shan region. This site is in Core Area 6.

Overall geographical distribution.— This species currently is known only from the type locality, in eastern Tengchong County in the southern part of the Gaoligong Shan, in western Yunnan Province, China.

Trechepaphiopsis unisetigera (Uéno), 1997

(Figs. 26, 46–48)

Trechus (*s. str.*) *unisetiger* Uéno, 1997: 190. Holotype, a female, in NMST. Type locality: China, Yunnan, Gaoligong Shan, Longyang County, Hongxinshu, 2700 m.

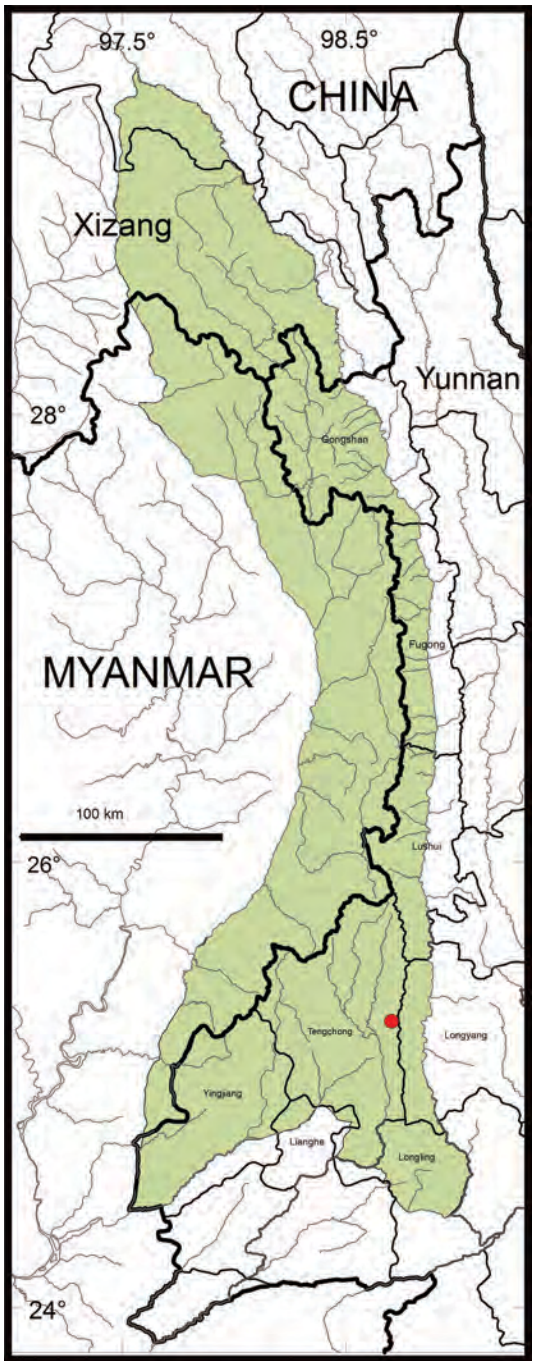


FIGURE 25. *Trechepaphiopsis asetosa* (Uéno); a. Dorsal habitus (paratype). b. Map of locality record (red circle) for *T. asetosa* in the Gaoligong Shan region. Scale line = 100 km.

Trechepaphiopsis unisetigera (Uéno), **New Combination**

Notes on type material.— We have not had an opportunity to study the holotype or any other specimens of this species. Features noted below are based on Uéno's (1997) original description. He did not provide any illustrations for this species.

Diagnosis.— Adults of this species can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 3.3 to 3.7 mm), apterous; body color dark reddish brown, dorsum slightly iridescent; eyes very small; tempora convex; pronotum transverse (ratio PW/PL = 1.34 to 1.40), widest slightly anterior to middle, lateral margins evenly curved throughout,with basal angles obtuse and rounded; elytra broad, relatively short, convex, stria 1 to 3 distinct, punctate, striae 4 to 7 faintly impressed but evident in basal two-thirds, striae 8 evident in apical half; recurrent stria terminated anteriorly in presumed location of interval 6; one discal setae present near apical one-third and inserted next to stria 3; preapical seta present, inserted next stria 2, inserted slightly closer to sutural than to apical margin.

Habitat distribution.— According to Uéno (1997) the two specimens of the type series of this species were "sorted out from soil samples taken in a forest of *Lithocarpus variolosus*" at an elevation of 2700 m. No other trechines have been found syntopic with members of this species.

Geographical distribution within the Gaoligong Shan.— Fig. 26. This species is known only from the type locality in Longyang County in the southern part of the Gaoligong Shan region. This locality is in Core Area 7.

Overall geographical distribution.— This species currently is known only from Longyang County in the southern part of the Gaoligong Shan region, western Yunnan Province, China.

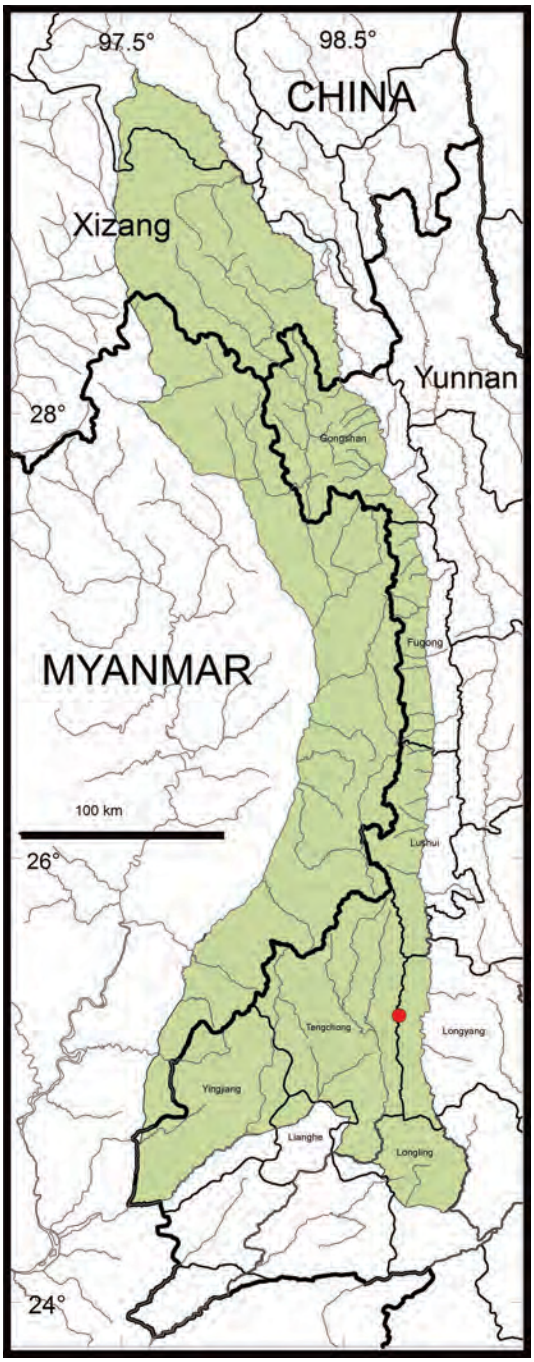


Figure 26. *Trechepaphiopsis unisetigera* (Uéno); Map of locality record (red circle) for *T. unisetigera* in the Gaoligong Shan region. Scale line = 100 km.

***Trechepaphiopsis unisetosa* (Deuve), 2004 (sp. 2)**
(Figs. 27, 37a, 43b, 46–48)

Trechus unisetosus Deuve, 2004: 220. Holotype, a female, in SCAU. Type locality: China, Yunnan, Gaoligong Shan, Lushui County, Fengxue Yakou [Pass], 2600-2700 m.
Trechepaphiopsis unisetosa (Deuve), **NEW COMBINATION**

DIAGNOSIS.— Adults of this species (Fig. 27a) can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 3.1 to 3.5 mm), apterous; body color light brown, dorsum slightly iridescent; eyes small but convex; tempora very convex, sparsely pubescent; pronotum transverse (ratio PW/PL = 1.35), with basal angles obtuse and rounded; elytra convex, with median 2 or 3 striae deeply impressed, lateral striae faintly impressed to effaced; recurrent stria terminated anteriorly in presumed location of interval 6; only one discal setiferous pore present, inserted at anterior one-third next to stria 3; preapical seta present, inserted next to stria 2; median lobe of male aedeagus (Fig. 27b) highly distinctive, with ventral margin of shaft sinuous and apex short and thin in lateral view, with broad apical projects in ventral view; endophallus without sclerites, but with a long tubular sleeve covered with long, slender spines.

COMMENTS.— Among males of all the species of *Trechepaphiopsis*, those of *T. unisetosa* have an endophlallus most like that typical for members of the *Epaphiopsis* complex of genera, especially of certain species of *Epaphius* described from China (Jeannel 1962, Deuve 1992b). These also have a long tubular sleeve covered with long spines, symmetrically arranged in ventral view (Fig. 27c)

HABITAT DISTRIBUTION.— Members of this species have been found in mixed broadleaf evergreen/ deciduous forest at elevations ranging from 2460 to 2470 m and collected using both pitfall traps and sifting of leaf litter from the forest floor (Fig. 37a). Specimens of *Trechepaphiosis uniporosa* sp. nov and *Trechepaphiama goaligong* sp. nov were collected in the same sifted leaf litter samples and are therefore syntopic with *T. unisetosa* at this site. Additional specimens of *T. unisetosa* were collected in pitfall traps set in *Rhododendron* and bamboo thickets on the east flank of the summit ridge just south of the Fengxue Yakou at 3150 m (Fig. 43b), a site slightly above the type locality for the species.

GEOGRAPHICAL DISTRIBUTION WITHIN THE GAOLIGONG SHAN.— Fig. 27d. We examined a total of 25 specimens (10 males and 16 females) from the following localities: ***Lushui County:*** Luzhang Township (100 m S of Fengxue Yakou on east side of pass, 3150 m, N25.97195°/E97.68381°, 11-21 May 2005, D.H. Kavanaugh, C.E. Griswold & K.J. Guo collectors [1 male and 1 female; CAS, IOZ]); Pianma Township (9.3 km ENE of Pianma along road to Lushui at Changyan He, 2460-2470 m, N25.99363°/E97.66651°, 15-18 October 1998, D.H. Kavanaugh, C.E. Griswold, C. Ferraris & C.L. Long collectors [7 males, 12 females; CAS, IOZ, MNHN], 12-21 May 2005, D.H. Kavanaugh, C.E. Griswold & K.J. Guo collectors [2 male and 2 females; CAS, IOZ]).

Members of this species have been collected only in the southcentral part of the study area, on both western and eastern slopes of the Gaoligongshan, which are in Core Areas 4 and 5, respectively.

OVERALL GEOGRAPHICAL DISTRIBUTION.— This species currently is known only from Lushui County in the southcentral part of the Gaoligong Shan region, western Yunnan Province, China.

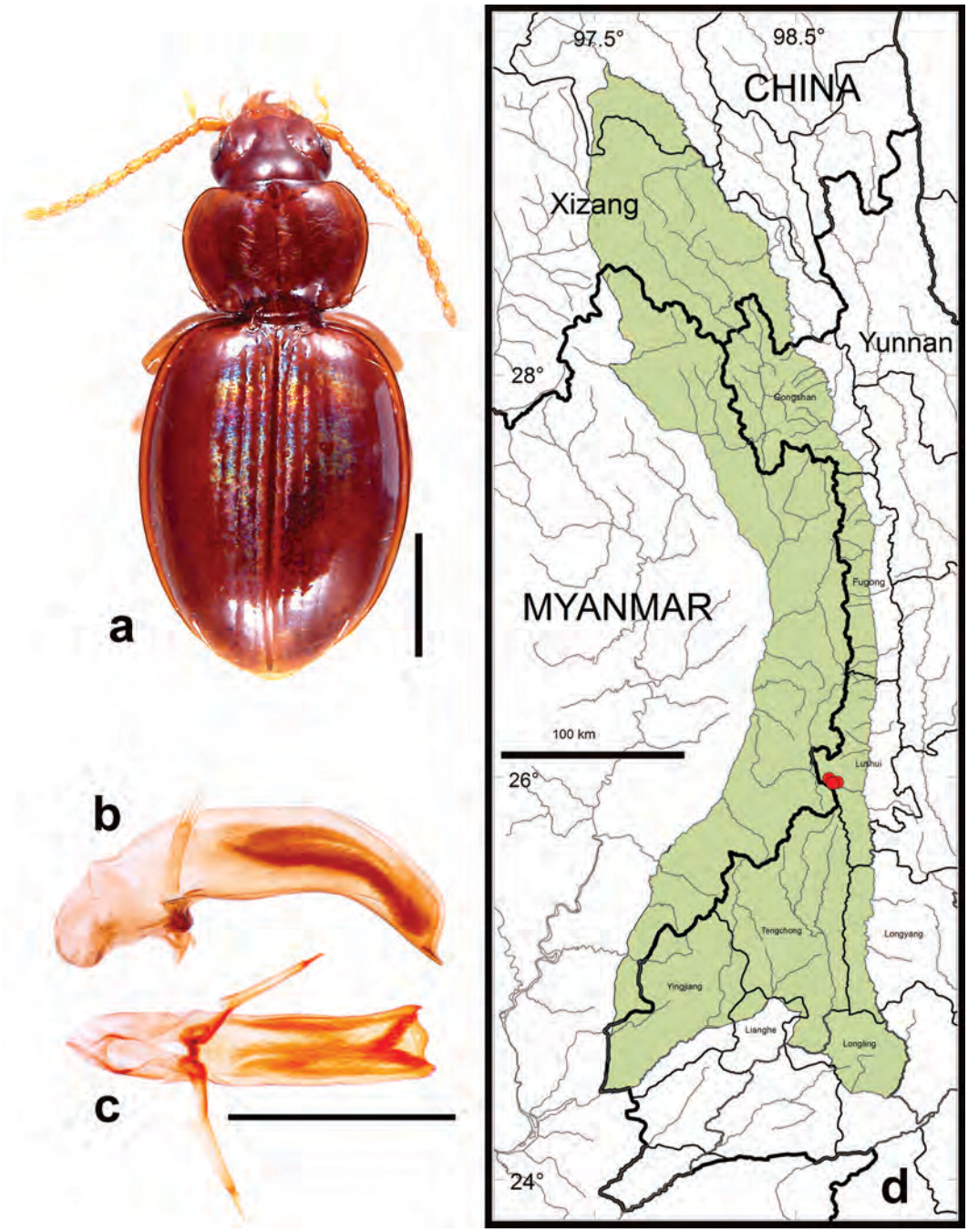


FIGURE 27. *Trechepaphiopsis unisetosa* (Deuve); a. Dorsal habitus (CASENT1024491). b-c. Median lobe of aedeagus of male (CASENT1001903); b. left lateral aspect; c. ventral aspect. d. Map of locality records (red circles) for *T. unisetosa* in the Gaoligong Shan region. Scale lines a-c = 0.5 mm, d = 100 km.

***Trechepaphiopsis uniporosa* Deuve and Liang, sp. nov.**
(Figs. 16f, 28, 37a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1001923"/ "CHINA, Yunnan Province, Gaoligongshan Mountains, Nujiang Prefecture, 9 [actually 9.3] km ESE of Pianma, 25°59.6'N/ 98°37.6'E."/ "2450 [actually 2460-2470] m, 15-18 October 1998, Stop #98-118D D.H. Kavanaugh, C.E. Griswold, C. Ferraris & C.-L. Long collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Trechepaphiopsis uniporosa* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (a total of 5): 3 males and 2 females (in CAS, IOZ, MNHN) labeled: same as holotype, except first label "CASENT 1001920" to "CASENT 1001922" and "CASENT 1001924" to "CASENT 1001925", respectively. All paratypes also bear the following label: "PARATYPE *Trechepaphiopsis uniporosa* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gaoligong Shan, Lushui County, Pianma Township, 9.3 km ESE of Pianma, 25.99363°/ 98.66651°, 2460-2470 m.

Derivation of species name.— The species epithet, *uniporosa*, is an adjective derived from the Latin words, *unus*, meaning one, and *porus*, meaning pore or hole. The name refers to the single discal setiferous pore found on the elytra of members of this species.

Diagnosis.— Adults of this species (Fig. 28a) can be distinguished from those of all other species in the region by the following combination of character states: size medium (BL = 3.3 to 3.5 mm), apterous; body color light brown, slightly iridescent; eyes small; tempora distinctly convex, sparsely pubescent; pronotum transverse (ratio PW/PL = 1.34), with basal angles obtuse and rounded; elytra convex, with stria 1 deeply impressed and finely punctate, other striae more faintly impressed and lateral striae effaced; recurrent stria terminated anteriorly in presumed location of interval 6; only one discal setiferous pore present, inserted at anterior one-third next to stria 3; preapical seta present, inserted next to stria 3; median lobe of male aedeagus (Fig. 28b) with apex slender but bluntly rounded and slightly recurved dorsally, endophallus with a faintly sclerotized scaly area.

Description.— Size medium BL = 3.3 to 3.5 mm. Body color light brown, appendages concolorous, except palpi paler, dorsum shiny, slightly iridescent.

Head. Moderate in size, short; eyes small, not projected, their diameter about equal to length of tempora but their convexity less than that of tempora, the latter markedly convex, inflated and sparsely pubescent. Frontal furrows thin and linear, deeply impressed, arcuate, continuous posteriorly to hind margins of tempora. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave or emarginate. Mandibles short and slender, right mandible as in Fig. 16f. Mentum and submentum not fused. Mentum with medial tooth apically truncate, about one-half the length of the lateral lobes. Submentum with six setae anteriorly. Antennae rather short, not quite extended posteriorly to basal one-fourth of the elytra, only 2.5 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum. Distinctly transverse (ratio PW/PL = 1.34), with greatest width near anterior one-third, only slightly narrowed posteriorly; lateral margins rounded, slightly more so anteriorly, slightly straighten just anterior to basal angles, the latter obtuse and rounded. Disc smooth and convex, median longitudinal impression finely impressed, but continuous between anterior and posterior margins; basal foveae shallow, faintly impressed; median basal area reduced, faintly delimited, slightly punctate in some specimens. Basal margin nearly rectilinear. Lateral pronotal borders moderately slender, regular, narrowly and regularly reflexed, lateral grooves narrow but distinctly impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

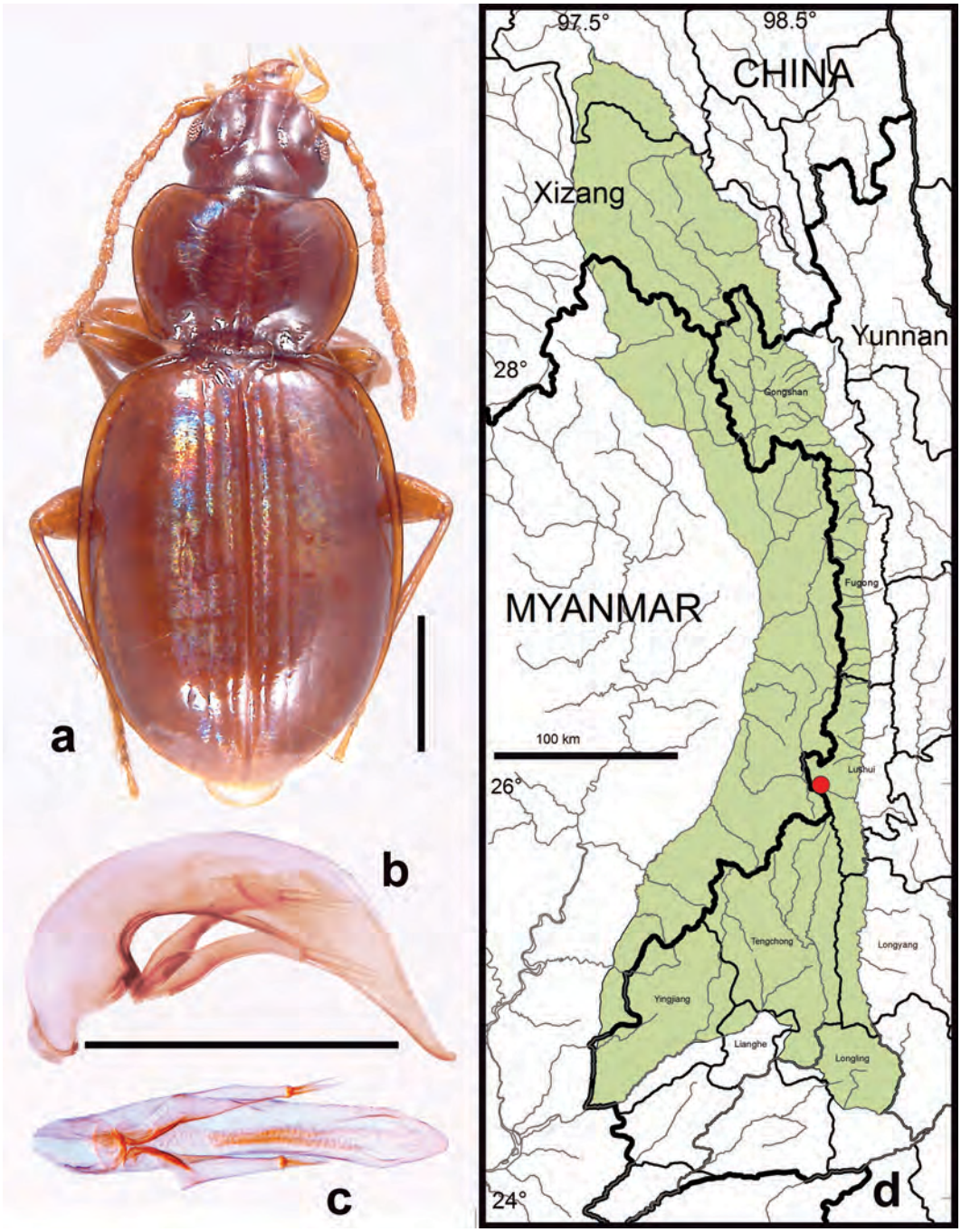


FIGURE 28. *Trechepaphiopsis uniporosa* sp. nov.; a. Dorsal habitus (CASENT1001923). b-c. Median lobe of aedeagus of male (CASENT1001923); b. left lateral aspect; c. ventral aspect. d..Map of locality records (red circles) for *T. uniporosa* in the Gaoligong Shan region. Scale lines a-c = 0.5 mm, d = 100 km.

Elytra. Ovoid, only slightly more narrowed anteriorly than posteriorly, humeri distinct but rounded. Disc convex, striae faintly impressed and finely punctate, the medial three or four striae distinctly impressed, the more lateral striae more or less effaced, but perceptible if only by the presence of fine punctures seen as rows of brown dots visible through the integument. Parascutellar striole present. Recurrent stria abruptly terminated anteriorly in presumed location of interval 6. Parascutellar setiferous pore present at base at common origin of discal striae 1 and 2. Only one discal setiferous pore present, inserted slightly anterior to middle next to stria 3. Preapical seta present on interval 3 near stria 3, closer to elytra apical margin that to sutural margin.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 28b) with sagittal aileron very small, shaft moderately broad basally, expanded near mid-length, then gradually narrowed apically to a thin, bluntly rounded apex, the latter slightly recurved dorsally; endophallus with a small scaly sclerotized area (Fig. 28c).

Habitat distribution.— Members of this species have been found in mixed broadleaf evergreen/ deciduous forest at elevations ranging from 2460 to 2470 m and collected by sifting leaf litter on the forest floor (Fig. 37a). Specimens of *Trechepaphiosis unisetosa* and *Trechepaphiama gaoligong* sp. nov were collected in the same sifted leaf litter samples and are therefore syntopic with *T. uniporosa* at this site.

Geographical distribution within the Gaoligong Shan.— Fig. 28d. We examined a total of 6 specimens (4 males and 2 females) from the type locality on the western slope of the southcentral part of the Gaoligong Shan in Lushui County (see Type material above for exact collection data). This locality is in Core Area 4.

Overall geographical distribution.— This species currently is known only from western Lushui County in the southcentral part of the Gaoligong Shan region, western Yunnan Province, China.

Trechepaphiopsis unisetulosa Deuve and Kavanaugh, sp. nov.

(Figs. 29, 40b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1018407"/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, 0.2 km W of Shibali, 2357 m, N27.16650°/E098.77936°"/ "18 August 2005, in leaf litter, Stop# PP-4405, P. Paquin"/ "IMAGE" [green label]/ "HOLOTYPE *Trechepaphiopsis unisetulosa* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (a total of 26): 1 female (in IOZ) labeled: same as holotype, except first label "CASENT 1018408"; 1 female (in CAS) labeled: "CASENT 1014246"/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, 0.4 km SE of Shibali along North Fork of Yamu He, N27.16337°/E098.78208°, 2475 m, 8-11 May 2004"/ "from mini-Winkler extraction of leaf litter siftate, Stop #CGY37, C. E. Griswold, D. H. Kavanaugh, & Yan H.-M. collectors"; 1 male (in CAS) labeled: "CASENT 1019222"/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, Shibali Road at Shibali, N27.16786°/E098.77741°,"/ " 2560 m, 3 May 2004 Stop #DHK-2004-024, D.H. Kavanaugh & C. E. Griswold. collectors"; 1 female (in IOZ) labeled: "CASENT 1020952"/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, 8.5 km above Shibali on Shibali Road, north bank of North Fork of Yamu He, N27.118416°/E098.72026°"/ "3100 m, 9 August 2005, Stop DHK-2005-067A D.H. Kavanaugh, H.B. Liang, D.Z. Dong, & P. Paquin collectors"; 1 male and 1 female (in CAS) labeled: "CASENT

1021953" and "CASENT 1021952", res/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, 0.3 km above Shibali on Shibali Road, N27.116791°/E098.77655°"/ "2563 m, in pitfall trap, 3-11 May 2004, Stop #CGY21, C. E. Griswold, D. H. Kavanaugh, Liang H.-B., & Yan H.-M. collectors"; 10 males and 10 females (in CAS, IOZ, MNHN) labeled: "CASENT 1023285" to "CASENT 1023294" and "CASENT 1023295" to "CASENT 1023304", respectively/ "CHINA, Yunnan Province, Fugong County, Lishadi Township, 0.3 km above Shibali on Shibali Road, N27.1166361°/E098.77667°"/ "2563 m, in pitfall trap, 4 May 2004, Stop #DHK-2004-026, D. H. Kavanaugh & C. E. Griswold collectors". All paratypes also bear the following label: "PARATYPE *Trechepaphiopsis unisetulosa* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 0.2 km W of Shibali, N27.16650°/E098.77936°, 2537 m,

Derivation of species name.— The species epithet, *unisetulosa*, is an adjective derived from the Latin words, *unus*, meaning one, and *setulosus*, meaning bearing bristles or setae. The name refers to the single discal seta found on the elytra of members of this species.

Diagnosis.— Adults of this species (Fig. 29a) can be distinguished from those of all other species in the region by the following combination of character states: size small to medium (BL = 3.3 to 3.5 mm), apterous; body color dark reddish brown, dorsum shiny, very slightly iridescent; eyes small, only slightly projected laterally; tempora convex and sparsely pubescent; pronotum transverse (ratio PW/PL = 1.40), with basal angles obtuse and rounded; elytra convex, with medial three or four stria distinct, finely punctate, more lateral striae more or less effaced; recurrent stria terminated anteriorly in presumed location of interval 6; only one discal setiferous pore present, inserted near anterior one-third next to stria 3; preapical seta present, inserted next to stria 2; median lobe of male aedeagus (Fig. 29b) with apex lobated and broadly rounded; endophallus with a large, scaly sclerorized area.

Description.— Size small to medium, BL = 3.3 to 3.5 mm. Body color dark reddish brown, interval 1 of elytra slightly paler, reddish, appendages yellowish brown, palpi paler yellow; dorsum smooth, pronotum and elytra shiny, very slightly iridescent, head slightly alutaceous from more deeply impressed isodiametric microsculpture.

Head. Rather broad; eyes small, only slightly projected laterally, their diameter about equal to length of tempora, the latter convex and sparsely pubescent. Frons convex, with frontal furrows evenly rounded and deeply impressed, continuous to posterior margins of tempora. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly emarginate. Mentum and submentum not fused. Mentum with medial tooth broad and apically bifid, less than half the length of the lateral lobes. Submentum with six setae anteriorly. Gula broad. Genae with a single ventral seta one each side. Antennae short, with only about 1.5 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 4 about equal in length, antennomere 3 slightly longer.

Pronotum. Transverse (ratio PW/PL = 1.40), with greatest width near anterior one-third, moderately narrowed posteriorly; lateral margins rounded, slightly more so anteriorly, slightly straighten, but not at all sinuate, just anterior to basal angles, the latter bluntly obtuse. Disc convex, median longitudinal impression finely impressed, continuous from posterior side of apical median swelling to posterior margin; basal foveae shallow, faintly impressed; median basal area well defined but short and transverse. Lateral borders slender and finely relexed dorsally, lateral grooves deeply impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

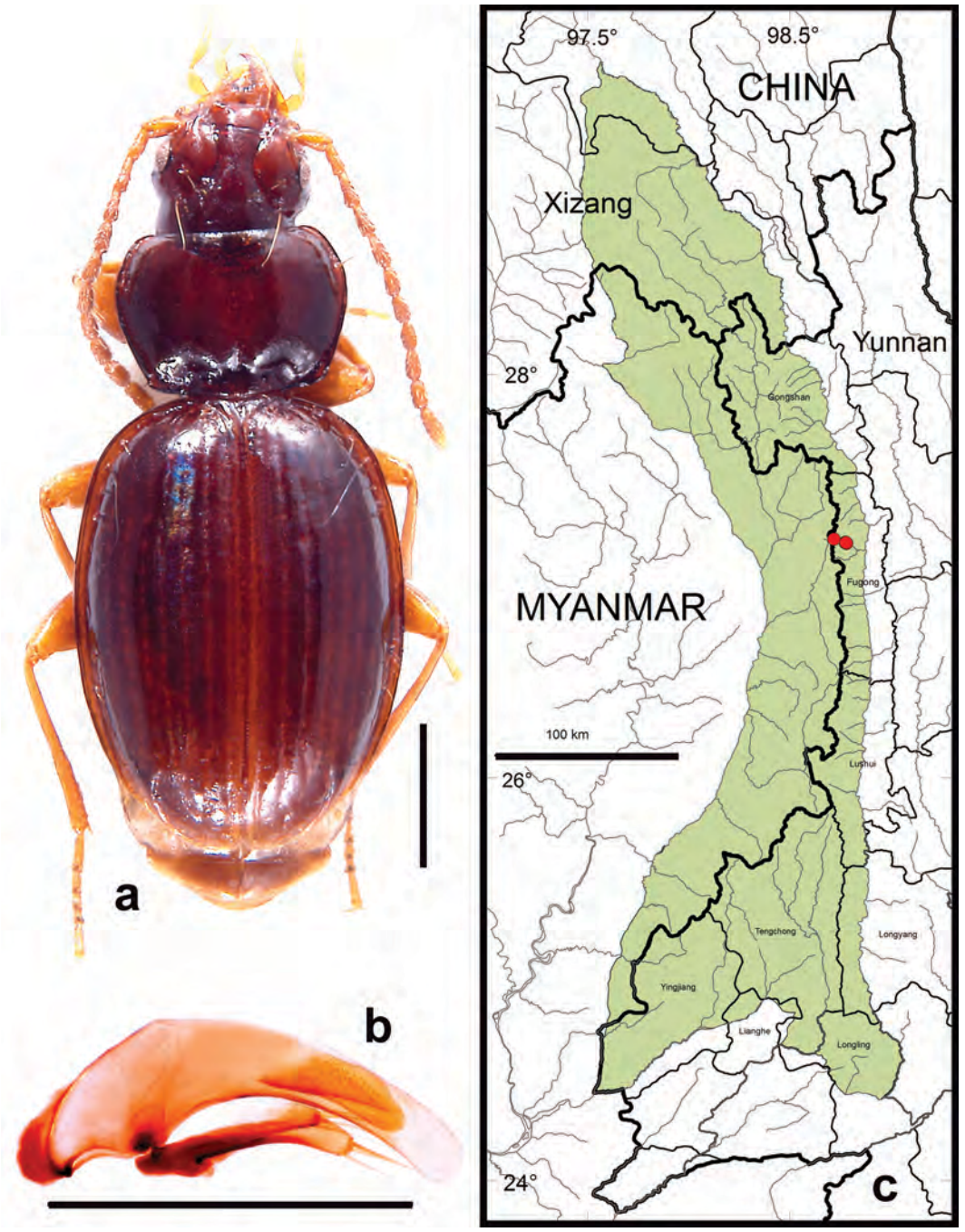


FIGURE 29. *Trechepaphiopsis unisetulosa* sp. nov.; a. Dorsal habitus (CASENT1018407). b. Median lobe of aedeagus of male (CASENT1001903), left lateral aspect. c. Map of locality records (red circles) for *T. unisetulosa* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

Elytra. Ovoid, not or only slightly elongate, about equally narrowed anteriorly and posteriorly, humeri distinct but rounded. Disc convex, striae faintly impressed and finely punctate, the medial three or four striae distinctly impressed, the more lateral striae more or less effaced, bearly perceptible. Parascutellar striole present, longer than average for genus. Recurrent stria abruptly terminated anteriorly in presumed location of posterior end of stria 5. Parascutellar setiferous pore present at base at common origin of discal striae 1 and 2. Only one discal setiferous pore present, inserted at anterior two-fifth of elytral length next to stria 3. Preapical seta present on interval 3 next to stria 2 and about equidistant from apical and sutural elytral margins. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 29b) with sagittal aileron moderate in size, shaft broad basally, then gradually narrowed apically to a broadly rounded apex; endophallus with a large, scaly sclerorized area with two parts or folds.

Habitat distribution.— Members of this species have been collected in pitfall traps set in slightly disturbed broadleaf forest with large trees, dense understory of ferns and other herbs, and a deep leaf litter layer, and also by sifting leaf litter in this same habitat. One specimen was beaten from roadside vegetation with suspended leaf and twig debris in that vegetation in the same area. One specimen was collected at a higher elevation (3100 m) from under stones in a rocky open areas cleared by snow avalanches but shaded by three meter high herbaceous cover (Fig. 40b). Specimens of *Trechus shiyueliang*, *T. shibalicus* and *Trechepaphiopsis unipilosa* sp. nov.were found syntopic with the specimen of *T. unisetulosa* at this last site.

Geographical distribution within the Gaoligong Shan.— Fig. 29c. We examined a total of 27 specimens (13 males and 14 females) from sites on the eastern slope of the northcentral part of the Gaoligong Shan in Fugong County (see Type material above for exact collection data). All of these sites are in Core Area 3.

Overall geographical distribution.— This species currently is known only from Fugong County in the northcentral part of the Gaoligong Shan region, western Yunnan Province, China.

Trechepaphiopsis monochaeta Deuve and Kavanaugh, sp. nov.

(Figs. 30, 38b, 42a, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: labeled: "CASENT 1007387"/ "CHINA, Yunnan Province, Gaoligong Shan, Nujiang Prefecture, Nujiang State Nature Reserve, No. 12 Bridge Camp area, 16.3 airkm W of Gongshan,"/ "N27.71503°/E98.50244°, 2775 m, 15-19 July 2000, Stop#00-23A, D.H. Kavanaugh, C.E. Griswold, Liang H.-B., D. Ubick, & Dong D.-Z. collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Trechepaphiopsis monochaeta* Deuve & Kavanaugh, sp. nov. designated 2016" [red label]. Paratypes (at total of 56): 14 males and 17 females (in CAS, IOZ, MNHN) labeled: same as holotype, except first label "CASENT 1007388" to "CASENT 1007400" and "CASENT 1021923" and "CASENT 1007401" to "CASENT 1007416" and "CASENT 1021924", respectively; 10 males and 14 females (in CAS, IOZ) labeled: "CASENT 1006508" to "CASENT 1006517" and "CASENT 1006518" to "CASENT 1006530" and "CASENT 1021922", respectively/ "CHINA, Yunnan Province, Gaoligong Shan, Nujiang Prefecture, Gongshan County, Dazhu He drainage, 13.5 airkm SW of Gongshan, 2830m"/ "N27.62947°/E98.62010°, 30 June- 5 July 2000, Stop#00-17I, D.H. Kavanaugh, C.E. Griswold,

Liang H.-B., D. Ubick, & Dong D.-Z. collectors"; 1 female (in CAS) labeled: "CASENT 1025812"/ "CHINA, Yunnan, Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan 0.3 km SW of Chukuai Lake at campsite,"/, "N27.97686°/ E098.47799°, 3750 m, 18 August 2006 Stop #DHK-2006-078 D.H. Kavanaugh collector". All paratypes also bear the following label: "PARATYPE *Trechepaphiopsis monochaeta* Deuve & Kavanaugh, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Gaoligong Shan, Gongshan County, Qiqi Trail at No. 12 Bridge Camp area, 16.3 airkm W of Gongshan, N27.71503°/E98.50244°, 2775 m,

Derivation of species name.— The species epithet, *monochaeta*, is an adjective derived from the Greek words, *μόνος* (transliterated into Latin as *mono*), meaning one or single, and *χαίτα* (transliterated into Latin as *chaeta*), meaning hair or bristle. The name refers to the single discal seta found on the elytra of members of this species.

Diagnosis.— Adults of this species (Fig. 30a) can be distinguished from those of all other species in the region by the following combination of character states: size small (BL = 2.8 to 3.0 mm), apterous; body color reddish brown, dorsum shiny, very slightly iridescent; eyes small but convex; tempora convex and sparsely pubescent; pronotum transverse (PW/PL = 1.38), with basal angles obtuse and rounded; elytra convex, medial four or five striae distinctly impressed, more lateral striae more or less effaced; recurrent stria terminated anteriorly in presumed location of interval 6; only one discal setiferous pore present, inserted anterior to and next to stria 3; preapical seta present, inserted next to stria 2; median lobe of male aedeagus (Fig. 30b) with apex moderately broad and apically rounded, slightly deflected ventrally; endophallus with an elongate and scaly sclerotized area not narrowed apically.

Description.— Size small, BL = 2.8 to 3.0 mm. Body color reddish brown, appendages slightly paler, yellowish brown, palpi paler yellow; dorsum shiny, slightly iridescent.

Head. Medium in size; eyes small but moderately convex, their diameter about equal to length of tempora, the latter distinctly convex and sparsely pubescent. Frons convex, with frontal furrows slightly angulate and deeply impressed, continuous to posterior margins of tempora, not or slightly attenuated posterior to margins of eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly emarginate or concave. Mentum and submentum not fused. Mentum with medial tooth broad and apically truncate or faintly bifid, about half the length of the lateral lobes. Submentum with six setae anteriorly. Gula broad. Genae with a single ventral seta one each side. Antennae short, with only about 1.5 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 3 about equal in length, antennomere 4 slightly shorter.

Pronotum. Transverse (ratio PW/PL = 1.38), with greatest width slightly anterior to middle; lateral margins rounded, slightly more so anteriorly, not or only slightly straighten posteriorly just anterior to basal angles, the latter obtuse and bluntly or rounded. Disc convex and smooth, median longitudinal impression finely impressed, continuous from middle of apical median swelling to posterior margin; basal foveae very small and shallow, faintly impressed; median basal area well defined but short and transverse, smooth but with several small longitudinal foveae. Lateral borders slender and finely relexed dorsally, lateral grooves deeply impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid, only slightly narrowed anteriorly and posteriorly, humeri distinct but rounded. Disc convex, striae finely impressed and not or only faintly punctate, the medial three or four striae clearly impressed, the more lateral striae more or less effaced, but still evident. Parascutellar striole present and distinct. Recurrent stria deeply impressed, its anterior recurved end terminated in

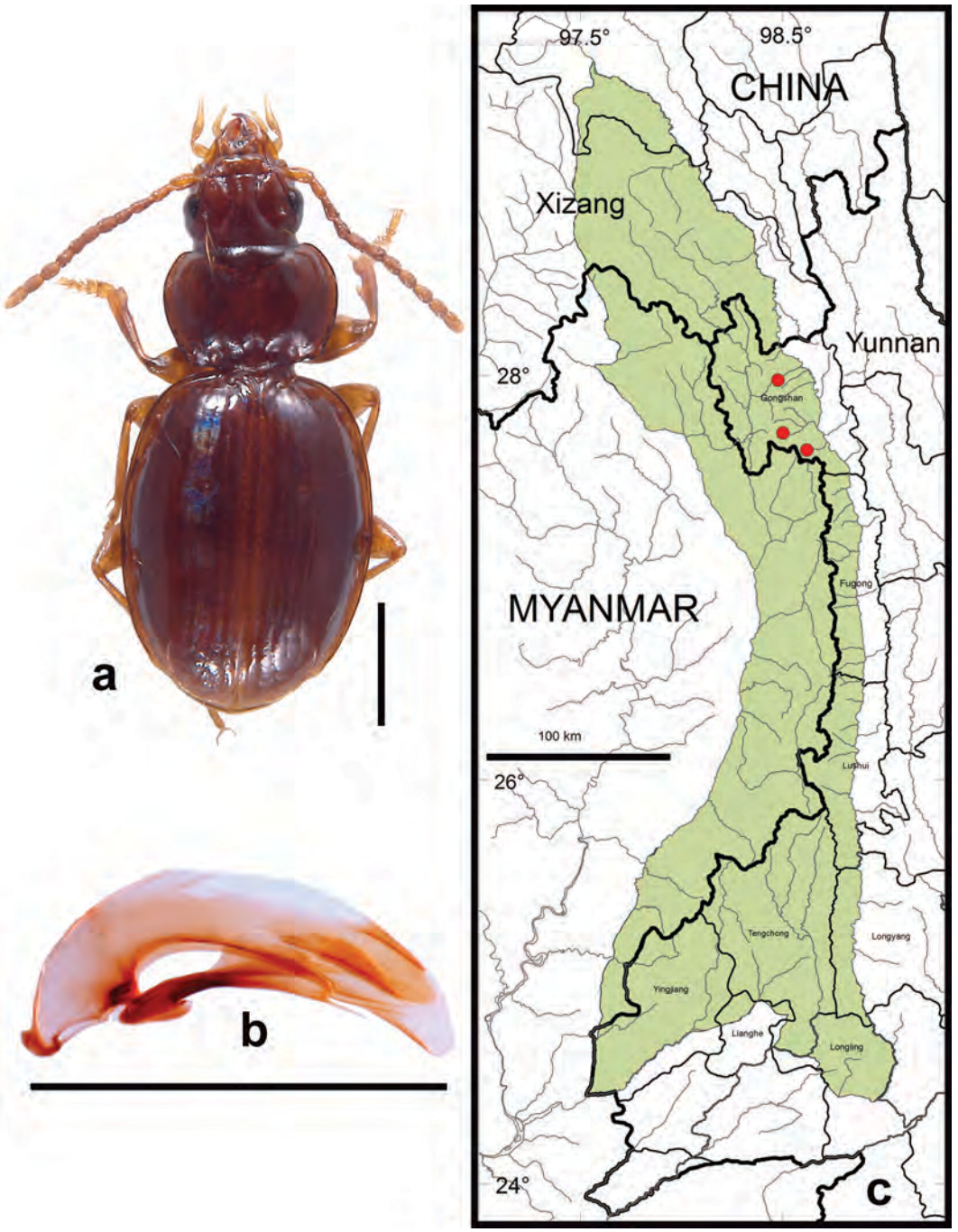


FIGURE 30. *Trechepaphiopsis monochaeta* sp. nov.; a. Dorsal habitus (CASENT1007411). b. Median lobe of aedeagus of male (CASENT1007411), left lateral aspect. c. Map of locality records (red circles) for *T. monochaeta* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

the posterior end of stria 5. Only one discal setiferous pore present, inserted slightly anterior to middle next to stria 3. Preapical seta present, inserted on interval 3 next to stria 2 and about equidistant from apical and sutural elytral margin.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 30b) with sagittal aileron very small, shaft moderately broad basally, then gradually narrowed, with apex moderately broad and apically rounded, slightly deflected ventrally; endophallus with an elongate and scaly sclerotized area not narrowed apically.

Comments.— This species appears to be very closely related (perhaps sister species) to *T. unipilosa* sp. nov., but its male members can be distinguished from those of the latter by having the base of the median lobe of the male aedeagus broader (narrower in *T. unipilosa* members, see Fig. 31b) and the scaly sclerotized area of the endophallus of more equal width throughout and not narrowed distally (as it is in *T. unipilosa* males).

Habitat distribution.— Members of this species have been collected by sifting leaf litter and mosses from the floor of closed canopy forest with an understory of ferns and large-leafed (ca. 60 cm long leaves) *Rhododendron* sp. at elevations ranging from 2775 to 2830 m (Fig. 42a). At the lowest elevation, specimens of *Trechus qiqiensis* were collected in the same litter samples. One specimen was also found under stones or wood chips in a disturbed open meadow area surrounded by one meter high *Rhododendron* thickets at an elevation of 3750 m (Fig. 38b); and specimens of *Queinnectrechus griswoldi* were found in this same area

Geographical distribution within the Gaoligong Shan.— Fig. 30c. We examined a total of 57 specimens (23 males and 34 females) from sites on the crest or eastern slope of the northern part of the Gaoligong Shan in Gongshan County (see Type material above for exact collection data). All of these sites are in Core Area 2.

Overall geographical distribution.— This species currently is known only from Gongshan County in the northern part of the Gaoligong Shan region, western Yunnan Province, China.

Trechepaphiopsis unipilosa Deuve and Liang, sp. nov.

(Figs. 31, 40b, 46–48)

Type material.— Holotype, a male, in IOZ, labeled: "CASENT 1023757"/ "CHINA, Yunnan, Fugong County, Lishadi Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°,"/ "3100 m, 7 May 2004 Stop #DHK-2004-038A D.H. Kavanaugh, C.E. Griswold, Liang H.-B., & Zhu B.-X. collectors"/ "HOLOTYPE *Trechepaphiopsis unipilosa* Deuve & Liang, sp. nov. designated 2016" [red label]. Paratypes (at total of 17): 2 females (in CAS, IOZ) labeled: same as holotype, except first label "CASENT 1023746" and "CASENT 1023758", respectively; 1 male and 2 females (in CAS, IOZ) labeled: "CASENT 1017488" and "CASENT 10174896" to "CASENT 1017490", respectively/ "CHINA, Yunnan, Fugong County, Lumadeng Township, 8.5 km above Shibali on Shibali Road, south bank of North Fork of Yamu He, N27.18326°/ E98.72002°"/ 3100 m, 8 August 2005 Stop #DHK-2005-067B D.H. Kavanaugh, H.B. Liang, D.Z. Dong, & J.F. Zhang collectors"; 7 males and 1 female (in CAS, IOZ, MNHN) labeled: "CASENT 1018375" to "CASENT 1018381" and "CASENT 1018382", respectively/ "CHINA, Yunnan, Fugong County, Lishadi Township, 10 km W of Shibali on Shibali Road, 3250 m,"/ "N27.20055°/E98.71399°, 16 August 2005 Stop #PP-3805 P. Paquin collector"; 1 male (in CAS) labeled: "CASENT 1018392"/ "CHINA, Yunnan, Fugong County, Lishadi Town-

ship, 10.5 km W of Shibali on Shibali Road, 3221 m,"/ "N27.20192°/E98.71329°, 17 August 2005 Stop #PP-4105 P. Paquin collector"; 3 males (in CAS, IOZ) labeled: "CASENT 1023607", "CASENT 1023608" and "CASENT 1023820", respectively/ "CHINA, Yunnan, Fugong County, Lishadi Township, 11.5 km above Shibali on Shibali Road, N27.20676°/E98.71763°,"/ "3290 m, 6 May 2004 Stop #DHK-2004-036 D.H. Kavanaugh, C.E. Griswold, Liang H.-B., & Zhu B.-X. collectors". All paratypes also bear the following label: "PARATYPE *Trechepaphiopsis unipilosa* Deuve & Liang, sp. nov. designated 2016" [yellow label].

Type locality.— China, Yunnan, Fugong County, Shiyueliang Township, 8.5 km above Shibali on Shibali Road, North Fork of Yamu He, N27.18416°/E98.72026°, 3100 m.

Derivation of species name.— The species epithet, *unipilosa*, is an adjective derived from the Latin word, *unus*, meaning one, and the Greek word, *πίλος* (transliterated into Latin as *pilus*), meaning hair. The name refers to the single discal seta found on the elytra of members of this species.

Diagnosis.— Adults of this species (Fig. 31a) can be distinguished from those of all other species in the region by the following combination of character states: size small (BL = 2.7 to 3.1 mm), apterous; body color reddish brown, dorsum shiny, pronotum and elytra slightly iridescent; eyes small but convex; tempora convex and sparsely pubescent; pronotum transverse (ratio PW/PL = 1.42), with basal angles obtuse and rounded; elytra convex, medial striae (1 to 5 or 6) distinct, finely punctate, more lateral striae more or less effaced; recurrent stria terminated anteriorly on interval 6; only one discal setiferous pore present, inserted at anterior one-third next to stria 3; preapical seta present, inserted next to stria 2; median lobe of male aedeagus (Fig. 31b) with apex slender and rounded, endophallus with a faintly sclerotized scaly area distinctly narrowed distally.

Description.— Size small, BL = 2.7 to 3.1 mm. Body color reddish brown, antennmae concolorous, legs slightly paler, yellowish brown, palpi paler yellow; dorsum shiny, pronotum and elytra slightly iridescent, head slightly alutaceous from more deeply impressed, irregularly isodiametric microsculpture.

Head. Broad; eyes small but convex, their diameter about equal to length of tempora, the latter short, distinctly convex and sparsely pubescent Frons convex, frontal furrows sharply impressed and rounded, not attenuated posterior to eyes. Two pairs of supraorbital setae present, the anterior pair inserted in foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly emarginate. Mentum and submentum not fused. Mentum with medial tooth apically bifid, about half the length of the lateral lobes. Submentum with six setae anteriorly. Gula broad. Genae with a single ventral seta one each side. Antennae short, with only about two antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 4 about equal in length, antennomere 3 slightly longer.

Pronotum. Transverse (ratio PW/PL = 1.42), with greatest width at anterior one-third; lateral margins rounded, slightly more so anteriorly, not or only slightly straighten posteriorly just anterior to basal angles, the latter obtuse and blunted. Disc convex and smooth, median longitudinal impression finely impressed, continuous from middle of apical median swelling to posterior margin; basal foveae small and shallow, faintly impressed; median basal area well defined but short and transverse, smooth or with a few small longitudinal foveae. Lateral borders slender and finely relexed dorsally, lateral grooves deeply impressed. Single midlateral setae on each side inserted near anterior one-third; single basolateral seta on each side, inserted at basal angle.

Elytra. Ovoid only slightly elongate, not or only very slightly more narrowed anteriorly than posteriorly, humeri distinct but rounded. Disc convex, striae finely punctate, only medial striae 1 to 3 distinctly impressed, more lateral striae more or less effaced, but still evident in most specimens. Parascutellar striole present, distinct but short. Recurrent stria deeply impressed, its anterior

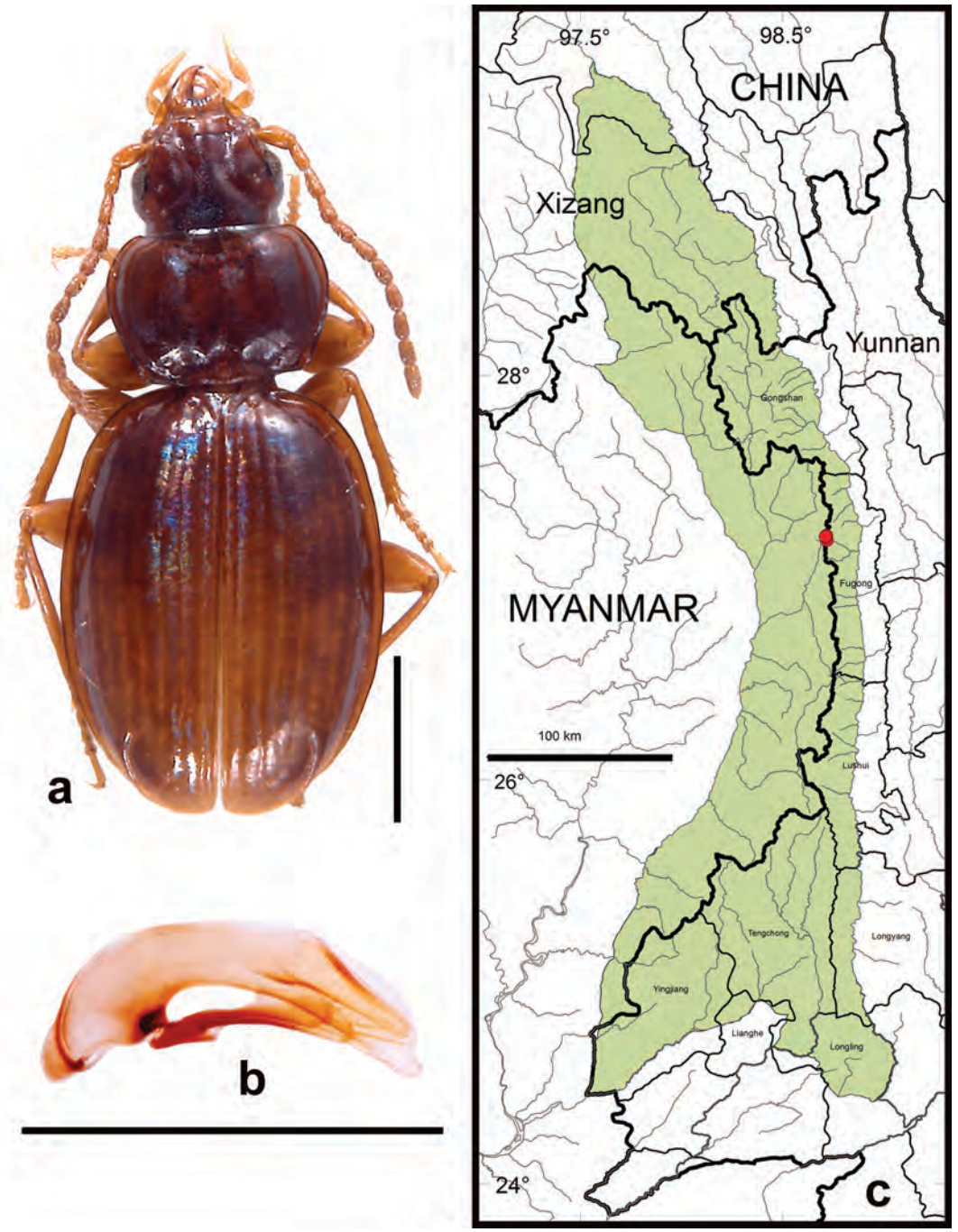


FIGURE 31. *Trechepaphiopsis unipilosa* sp. nov.; a. Dorsal habitus (CASENT1023757). b. Median lobe of aedeagus of male (CASENT1023757), left lateral aspect. c. Map of locality records (red circles) for *T. unipilosa* in the Gaoligong Shan region. Scale lines a, b = 0.5 mm, c = 100 km.

end abruptly terminated in the posterior end of stria 5. Parascutellar setiferous pore present at base at common origin of discal striae 1 and 2. Only one discal setiferous pore present, inserted at anterior two-fifth of elytral length next to stria 3. Only one discal setiferous pore present, inserted slightly anterior to middle next to stria 3. Preapical seta present, inserted on interval 3 next to stria 2 and about equidistant from apical and sutural elytral margin. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Short, protibiae with longitudinal furrow. Male protarsomeres 1 and 2 dilated and apicomedially toothed.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of males apically with one pair of paramedial setae, of females with two pairs.

Male aedeagus. Median lobe (Fig. 31b) with sagittal aileron very small, shaft moderately broad basally, then gradually narrowed apically to a narrowly rounded apex; endophallus with a faintly sclerotized scaly area distinctly elongate and narrowed distally.

Comments.— This species appears to be very closely related (perhaps sister species) to *T. monochaetus*, but its male members can be distinguished from those of the latter by having the base of the median lobe of the male aedeagus narrower (broader in *T. monochaeta* members, see Fig. 30b) and the scaly sclerotized area of the endophallus distinctly narrowed distally (of more equal width throughout in *T. monochaeta* males).

Habitat distribution.— Members of this species have been collected by sifting leaf litter from forests of scattered, large *Abies* sp. trees with a dense understory of bamboo or *Rhododendron* spp. at elevations ranging from 3221 to 3290 m. Specimens of *Trechus shiyueliang and T. shibalicus* were collected in one or more of the same litter samples. Specimens of *T. unipilosa* were also collected at 3100 m elevation under stones at the open edges of a small stream draining a north-facing glacial cirque with a large snowfield in its basin (Fig. 40b). A specimen of *Trechepaphiopsis unisetulosa* sp. nov. was also collected in this area, at the upper limit of the altitudinal range of this last mentioned species.

Geographical distribution within the Gaoligong Shan.— Fig. 31c. We examined a total of 18 specimens (13 males and 5 females) from sites on the eastern slope of the northcentral part of the Gaoligong Shan in Fugong County (see Type material above for exact collection data). All of these sites are in Core Area 3.

Overall geographical distribution.— This species currently is known only from Fugong County in the northcentral part of the Gaoligong Shan region, western Yunnan Province, China.

Genus *Epaphiotrechus* Deuve and Kavanaugh, gen. nov.

Type species.— *Epaphiotrechus fortipesoides* sp. nov.

Derivation of genus group name.— The genus group name (masculine) is a combination of two other trechine generic names, *Epaphius* and *Trechus*.

Diagnosis.— Adults of this genus (Fig. 33a) can be recognized by the following combination of character states: size large (BL = 4.5 to 4.7 mm), apterous; body color dark piceous with elytral interval 1 and lateral areas of pronotum and elytra more or less reddish; dorsum shiny, distinctly iridescent, dorsal surface glabrous except for isolated fixed setae typical for trechines, eyes also glabrous; right mandible (Fig. 16g) with premolar not fused with retinaculum but closely associated with the latter [possibly representative of an intermediate state in the evolution of the "bidentate" mandibular type (see discussion above for genus *Trechus*)], anterior tip of retinaculum enlarged as a distinct tooth and displaced anteriorly (but not quite as far as in members of *Trechepaphiopsis* species); pronotum with basal angles small and rectangular; elytra elongate, oblong,

slightly flattened along the median suture area, striae finely impressed, crenulate or finely punctate, lateral striae partly effaced but striae 6 and 7 still evident; two discal setae present on interval 3 next to stria 3, inserted near the anterior one-sixth and near mid-elytral length, respectively; preapical seta present, inserted next to stria 2.

COMMENTS.— When Uéno (1999) described *Trechus* (*s. str.*) *fortipes*, he noted that it was a "strange species similar to certain *Epaphiopsis*", with the distinct premolar on the right mandible. However, characters of the male aedeagus, particularly the presence of a distinct endophallic sclerite, led him to consider this species as a basal member of genus *Trechus* in which the plesiomorphic right mandibular dentition was retained.

GEOGRAPHICAL DISTRIBUTION. This genus currently is known from only two species, both found only in the southern part of the Gaoligong Shan region of western Yunnan Province, China.

Key for Identification of Adults of *Epaphiotrechus* Species of the Gaoligong Shan Region

1. Median tooth of mentum small and simple, apex not bifid; elytra with stria 5 distinctly deepened at the base, recurrent stria short, terminated anteriorly at a slight convexity at apex of stria 5; preapical seta inserted equidistant from both apical and sutural margins. . . . . *E. fortipes* (Uéno)
   Median tooth of mentum long and wide, apex bifid; elytra with stria 5 not or only faintly deepened at the base, recurrent stria long, terminated anteriorly at a slight convexity at apex of stria 6; preapical seta inserted closer to sutural than to apical margin . . . ***E. fortipesoides* sp. nov.**

Epaphiotrechus fortipes (Uéno), 1999

(Fig. 32, 46-48)

Trechus (*s. str.*) *fortipes* Uéno, 1999a: 219.
Epaphiotrechus fortipes (Uéno), **NEW COMBINATION**

TYPE MATERIAL.— Holotype, a male, in NSMT. Type locality: China, Yunnan, Gaoligong Shan, Baoshan County, N24°57′/ E98°45′, 2200-2500 m

NOTES ON TYPE MATERIAL.— We have not had an opportunity to study the holotype or any other specimens of this species. Features noted below are based on Uéno's (1999a) original description and illustrations.

DIAGNOSIS.— Adults of this species (see Uéno 199a, Fig. 4) can be distinguished from those of all other species in the region by the following combination of character states:

Size large (BL = 4.5 mm), apterous; female holotype with unusually broad protarsomeres; body color dark piceous, slightly paler reddish on elytral interval 1; right mandible tridentate; mentum with median tooth short and simple; pronotum slightly narrowed (ratio PW/PL = 1.26), with basal angles small and rectangular; elytra elongate, slightly flattened medially, striae finely impressed, medial three or four striae distinctly crenulate (due to strial punctures), more lateral striae slightly effaced, but striae 6 and 7 evident, stria 5 deepened at its base; parascutellar striole present, slightly elongate; recurrent stria short, terminated near apex of stria 5; two discal setiferous pores present, inserted at anterior one-sixth and slightly posterior to middle, respectively, on interval 3 near stria 3; preapical seta present, inserted on interval 3 next to stria 2 and about equidistant from apical and sutural elytral margins; median lobe of male aedeagus (see Uéno 1999a, Figs. 5 and 6) with apex, expanded, securiform in lateral view; endophallus with distinct, elongate-triangular sclerite.

HABITAT DISTRIBUTION.— No members of this species were found during field collecting for this project, and no habitat information accompanied the type material. Uéno (1999a) suggested that the type locality was located "near the lower edge of the *Rhododendron* zone. He visited the

area and collected very briefly in "*Rhododendron* and bamboo thickets" there without success. We concur with him that such thickets represent the most likely habitat for members of this species. Uéno (1999a) reported that specimens of this species (which he described as *Trechus fortipes*) were found in the same area as specimens of *Agonotrechus yunnanus* and *Trechus indicus* (which he recorded as *Trechus macrops* Jeannel).

Geographical distribution within the Gaoligong Shan.— Fig. 32. This species is known only from a single male specimen from the type locality in Baoshan County in the southern part of the Gaoligong Shan region. This locality is in Core Area 7.

Overall geographical distribution.— This species currently is known only from Baoshan County in the southern part of the Gaoligong Shan region, western Yunnan Province, China.

Epaphiotrechus fortipesoides Deuve and Kavanaugh, sp. nov.

(Figs. 16g, 33, 46–48)

Type material.— Holotype, a female, in IOZ, labeled: "CASENT 1039089"/ "CHINA, Yunnan, Tengchong County, Houqiao Township, 8.5 airkm NNE of Houqiao at Gaoshidong, 2580 m, N25.39858°/E98.30533°,"/ "27 May 2006, Stop # DHK-2006-043, D.H. Kavanaugh, R.L. Brett, & D.Z. Dong collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Epaphiotrechus fortipesoides* Deuve and Kavanaugh, sp. nov. designated 2016" [red label].

Type locality.— China, Yunnan, Tengchong County, Houqiao Township, 8.5 airkm NNE of Houqiao at Gaoshidong, N25.39858°/E98.30533°, 2580 m.

Derivation of species name.— The species epithet, *fortipesoides*, is a combination of the species epithet, *fortipes*, and the Greek suffix, *–ειδής* (transliterated into Latin as *–oides*), meaning resembling, in reference to the similarity of the unique holotype female of this species to members of *T. fortipes*.

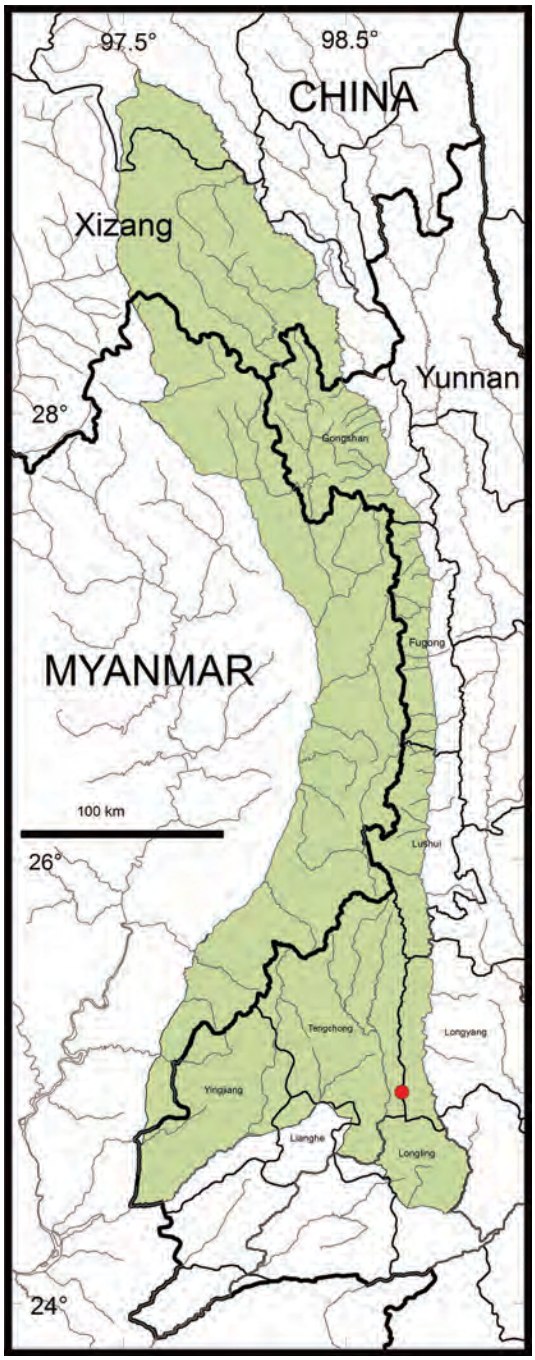


Figure 32. *Epaphiotrechus fortipes* (Uéno); Map of locality record (red circle) in the Gaoligong Shan region. Scale line = 100 km.

Diagnosis.— Adults of this species (Fig. 33a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 4.7 mm), apterous; body color piceous, sutural and lateral elytral margins slightly paler, reddish; tempora glabrous; median tooth of mentum apically truncate, almost bifurcate; antennae long; pronotum slightly narrowed (ratio PW/PL = 1.28), basal angles small, sharp, rectangular; elytra oblong, slightly flattened along median suture, striae finely impressed, finely punctate, striae 1 to 2 or 3 more deeply impressed, more lateral striae more or less effaced but still evident, stria 5 not more deeply impressed at its base; recurrent stria long, deeply impressed, abruptly terminated on interval 7; two discal setiferous pores present, inserted at anterior one-sixth and slightly posterior to middle, respectively, on interval 3 near stria 3; preapical seta present, inserted 1.5 times as far from apical elytral margin as from sutural margin.

Description.— Size large, BL = 4.7 mm. Body color dark piceous, head, basal and lateral pronotal margins, and lateral and sutural margins of elytra more or less reddish, appendages paler reddish brown, palpi yellowish brown, dorsum smooth, shiny with pronotum and elytra moderately iridescent, head faintly alutaceous due to moderately impressed isodiametric microsculpture.

Head. Broad, slightly elongate. Eyes slightly convex, their diameter slightly less than twice length of tempora, the latter short but distinctly convex. Frons convex, with frontal furrows sharply impressed, not attenuated posterior to eyes. Two pairs of supraorbital setae present, the anterior pair inserted in slight foveae. Clypeus with four setae. Labrum with six setae, anterior margin distinctly concave. Right mandible (Fig. 16g) with premolar not fused with retinaculum but closely associated with the latter, anterior tip of retinaculum enlarged as a distinct tooth and displaced anteriorly. Mentum and submentum not fused. Mentum with medial tooth apically truncate, about one-half the length of the lateral lobes. Submentum with six setae anteriorly. Genae with a single ventral seta one each side. Antennae moderate in length, with about 2.5 antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 3 and 4 about equal in length, antennomere 2 slightly shorter.

Pronotum. Slightly narrowed (ratio PW/PL = 1.28), with greatest width anterior to middle, only slightly narrowed posteriorly; lateral margins rounded, straightened for a short distance posteriorly, then slightly sinuate just anterior to basal angles, the latter small, sharp and rectangular; basal margin with median region slightly and convexly projected posteriorly. Disc convex, with median longitudinal impression distinct, markedly deepened in median basal area, not extended anteriorly to apical margin; basal foveae moderate in size and depth; median basal area delimited laterally by a pair of short, oblique furrows, smooth except for a pair of paramedial longitudinal foveae. Single midlateral setae on each side inserted anterior to middle; single basolateral seta on each side, inserted at basal angle.

Elytra. Elongate ovoid, slightly narrowed anteriorly, humeri rounded and only slightly evident. Disc moderately convex, slightly flattened in sutural area; striae finely impressed, finely punctate, striae 1 to 2 or 3 more deeply impressed, more lateral striae more or less effaced but still evident, stria 5 not more deeply impressed at its base. Parascutellar striole present, deeply impressed and long. Recurrent stria long, deeply impressed, abruptly terminated on interval 7 slightly anterior to the insertion point of preapical seta. Two discal setiferous pores present, inserted at anterior one-sixth and near middle, respectively, on interval 3 near stria 3. Preapical seta present, inserted 1.5 times as far from apical elytral margin as from sutural margin on interval 3 next to stria 2.

Legs. Short; protibiae with longitudinal furrow.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of female apically with two pairs of paramedial setae.

Comments.— This species appears to be closely related to *E. fortipes*, but its members can be

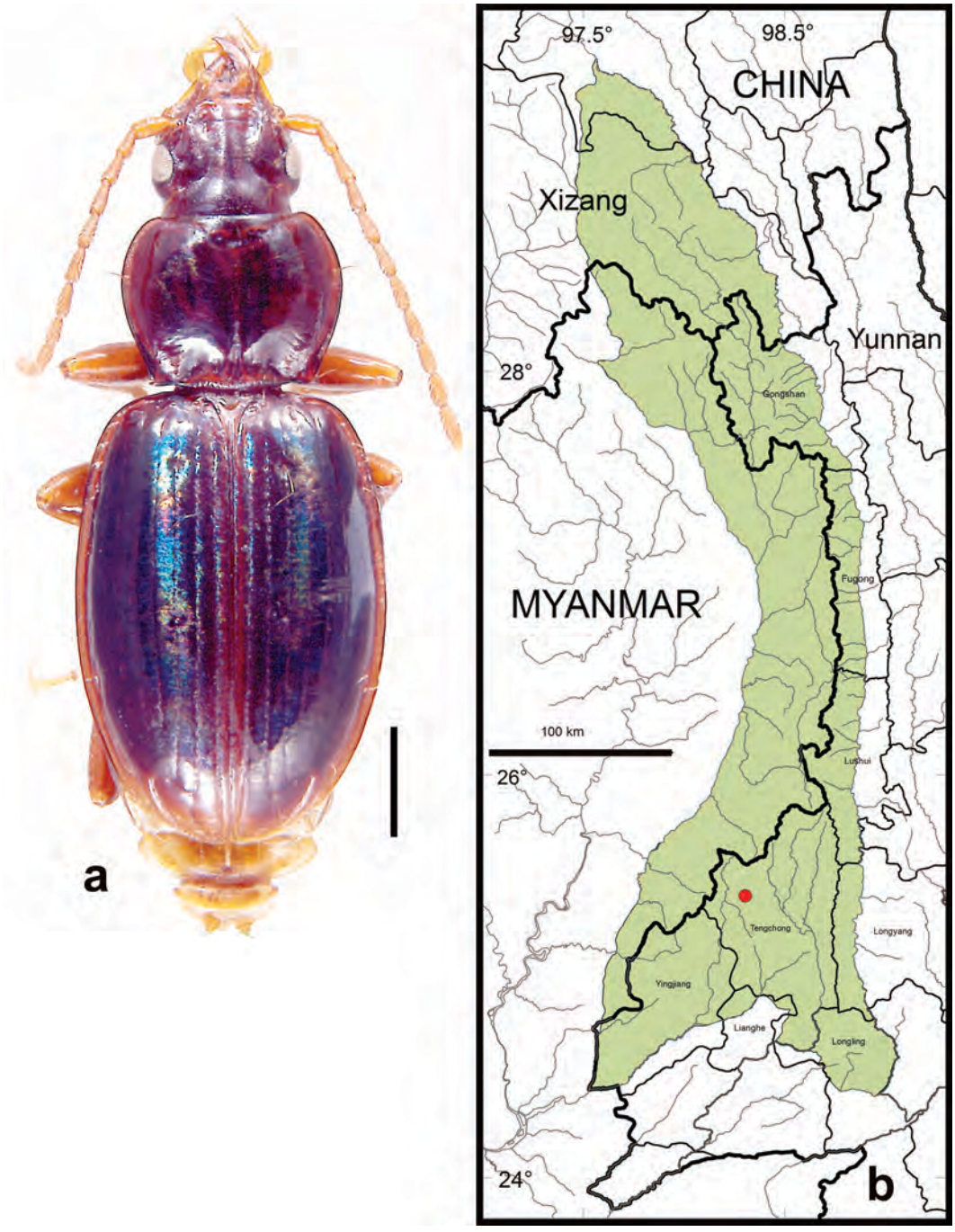


FIGURE 33. *Epaphiotrechus fortipesoides* sp. nov.; a. Dorsal habitus (CASENT1039089). b. Map of locality record (red circle) for *E. fortipesoides* in the Gaoligong Shan region. Scale lines a = 0.5 mm, b = 100 km.

distinguished from those of the latter by the truncate, almost bifurcate, median tooth of the mentum (simple in *E. fortipes* members), elytral stria 5 not more deeply impressed basally (distinctly more deeply impressed in *E. fortipes* members), recurrent stria longer (shorter in *E. fortipes* members) and terminated on interval 7 (terminated on interval 5 in *E. fortipes* members), and the preapical seta inserted 1.5 times as far from apical elytral margin as from sutural margin (inserted about equidistant from apical and sutural margins in *E. fortipes* members).

Habitat distribution.— The unique holotype female of this species was found on the ground under a stone or log in a managed conifer forest along a roadcut at an elevation of 2580 m. No other trechines were found in this area.

Geographical distribution within the Gaoligong Shan.— Fig. 33b. This species is known only from a single female specimen from the type locality in western Tengchong County in the southern part of the Gaoligong Shan region. This locality is in Core Area 6.

Overall geographical distribution.— This species currently is known only from Tengchong County in the southern part of the Gaoligong Shan region, western Yunnan Province, China.

Genus *Trechepaphiama* Deuve and Kavanaugh, gen. nov.

Type species.— *Trechepaphiama gaoligong* sp. nov.

Derivation of genus group name.— The genus group name (masculine) is a combination of two other trechine genus group names, *Trechus* and *Epaphiama*.

Diagnosis.— Adults of this genus (Fig. 34a) can be recognized by the following combination of character states: size large (BL = 4.2 mm), apterous; body color reddish brown, dorsum shiny, slightly iridescent, dorsal surface glabrous except for isolated fixed setae typical for trechines, eyes also glabrous, small, only slightly convex; tempora glabrous; right mandible (Fig. 16h) with premolar tooth fused with retinaculum, anterior tip of retinaculum enlarged to form a distinct tooth and displaced distally, posterior tip of retinaculum reduced, nearly flattened; mentum and submentum not fused; mentum with median tooth simple with apex rounded; submentum [probably] with six setae [only five setae visible in unique female holotype of type species]; pronotum slightly convex, disc glabrous, basal foveae only slightly distinct, median basal area delimited laterally by oblique furrows, basal margin slightly curved medially, slightly sinuate and oblique laterally; elytra broadly rounded, more narrowed apically than basally, humeri broad, disc convex with striae finely impressed, slightly punctate, lateral striae attenuated, recurrent stria deeply impressed, its anterior end straight, almost continuous anteriorly with the apex of stria 5; no discal setae present, preapical seta present, inserted next to stria 2.

Comments.— This genus, known from only a single female specimen, belongs to the "Epaphiopsis Complex" of genera as evidenced by the dentition of the mandibles. Its members can be distinguished from those of other genera of this lineage by the absence of elytral discal setae, which is exceptional among trechines, and by their markedly convex, dorsally inflated elytra, imparting an appearance similar to that of *Epaphiama* Jeannel (1962) members — short and convex. In contrast, *Trechepaphiopsis* members are similar in habitus to small *Epaphiopsis* members while those of *Epaphiotrechus* are more similar in habitus to large *Trechu*s members. A better understanding of phylogenetic affinities of this new genus must await discovery of a male and study of its genital structure and/or comparative molecular study.

Geographical distribution.— This genus currently is known only from the type species, which is known only from the southcentral part of the Gaoligong Shan region of western Yunnan Province, China.

***Trechepaphiama gaoligong* Deuve and Kavanaugh, sp. nov.**
(Figs. 16h, 34, 37a, 46–48)

Type material.— Holotype, a female, in IOZ, labeled: "CASENT 1001926"/ "CHINA, Yunnan Province, Gaoligongshan Mountains, Nujiang Prefecture, 9 [actually 9.3] km ESE of Pianma, 25°59.6'N/ 98°37.6'E."/ "2450 [actually 2460-2470] m, 15-18 October 1998, Stop #98-118D D.H. Kavanaugh, C.E. Griswold, C. Ferraris & C.-L. Long collectors"/ "IMAGE" [green label]/ "HOLOTYPE *Trechepaphiama gaoligong* Deuve & Kavanaugh, sp. nov. designated 2016" [red label].

Type locality.— China, Yunnan, Gaoligong Shan, Lushui County, 9.3 km ESE of Pianma, N25.99363°/ E98.66651°, 2460-2470 m.

Derivation of species name.— The species epithet, *gaoligong*, is a noun in apposition, derived from the name of the mountain range, the Gaoligong Shan, in which the holotype was collected.

Diagnosis.— Adults of this species (Fig. 34a) can be distinguished from those of all other species in the region by the following combination of character states: size large (BL = 4.2 mm), apterous; body color reddish brown, dorsum shiny; eyes reduced, their diameter about equal to length of tempora, the latter distinctly convex and glabrous; pronotum moderately transverse (ratio PW/PL = 1.26), basal angles subrectangular; elytra broad, markedly convex, slightly inflated, humeri broadly rounded, striae 1 to 5 deeply impressed and slightly punctate, more lateral striae more or less effaced, intervals 1 to 4 slightly convex, more lateral intervals flat; recurrent stria anteriorly nearly continuous with posterior end of stria 5; discal setiferous pores absent; preapical seta present, inserted on interval 3 next to stria 2.

Description.— Size large, BL 4.2 mm. Body color reddish brown, appendages concolorous, except palpi yellowish brown, dorsum smooth, shiny, pronotum and elytra very faintly iridescent, head faintly alutaceous due to moderately impressed isodiametric microsculpture

Head. Moderate in size, slightly broad; eyes small, only slightly projected laterally, their diameter about equal to length of tempora, the latter short, convex and glabrous. Frons only slightly convex, with frontal furrows deeply impressed but less so posterior to hind margins of eyes. Two pairs of supraorbital setae present, the anterior pair inserted in distinct foveae. Clypeus with four setae. Labrum with six setae, anterior margin moderately concave. Right mandible (Fig. 16h) with premolar tooth fused with retinaculum, anterior tip of retinaculum enlarged to form a distinct tooth and displaced distally, posterior tip of retinaculum reduced, nearly flattened. Left mandible with only a relatively small, feebly trifid tooth. Mentum and submentum not fused. Mentum with medial tooth broad, apically rounded, about one-half the length of the lateral lobes. Submentum with four setae anteriorly. Gula broad. Genae with a single ventral seta one each side. Antennae rather short, only about two antennomeres extended posteriorly beyond basal pronotal margin; antennomeres 2 and 4 about equal in length, antennomere 3 slightly longer.

Pronotum. Slightly narrow (ratio PW/PL = 1.26), with greatest width anterior to middle, only slightly narrowed posteriorly; lateral margins rounded, straightened for a short distance posteriorly, then very slightly sinuate just anterior to basal angles, the latter blunt and subrectangular, very slightly and bluntly projected laterally; basal margin with median region slightly and convexly projected posteriorly. Disc distinctly convex, with median longitudinal impression very finely impressed, superficial, effaced in the median anterior area but extended to basal margin; basal foveae distinct but shallow; median basal area small, delimited laterally by a pair of oblique furrows, smooth except for several short longitudinal depressions; basal margin slightly bisinuate, slightly convex medially; lateral borders slender, gradually widened posteriorly, faintly reflexed

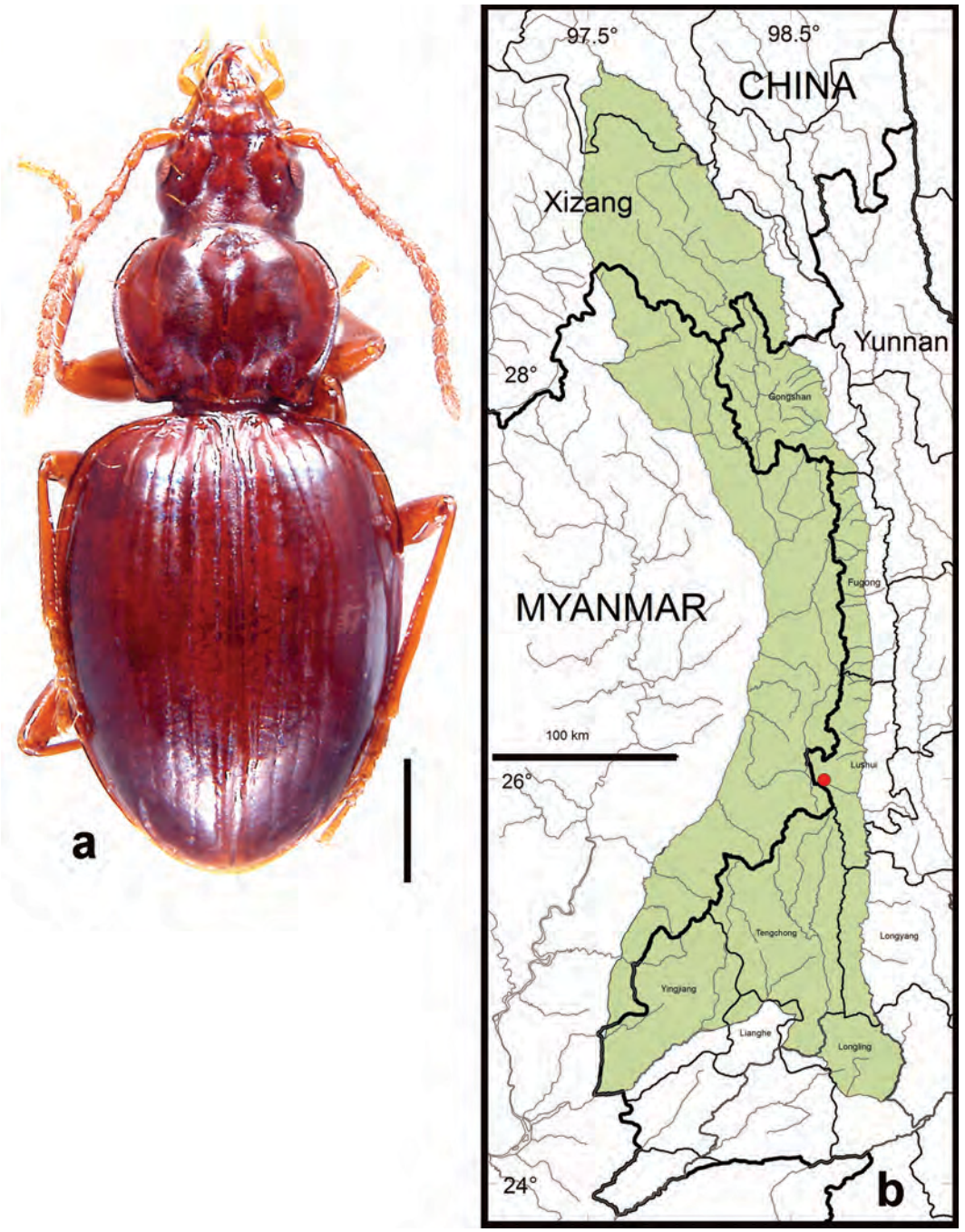


FIGURE 34. *Trechepaphiama gaoligong* sp. nov.; a. Dorsal habitus (CASENT1001926). b. Map of locality record (red circle) for *T. gaoligong* in the Gaoligong Shan region. Scale lines a = 0.5 mm, b = 100 km.

dorsally, lateral grooves widened near base. Single midlateral setae on each side inserted anterior to middle; single basolateral seta on each side, inserted at basal angle.

Elytra. Broad, ovoid, slightly more narrowed posteriorly than anteriorly, markedly convex, slightly inflated; humeri broadly rounded; striae 1 to 5 deeply impressed and slightly punctate, more lateral striae more or less effaced, barely evident; intervals 1 to 4 slightly convex, more lateral intervals flat; basal margination terminated medially at origin of stria 5. Parascutellar striole present, short but distinct. Recurrent stria anteriorly nearly continuous with posterior end of stria 5. Discal setiferous pores absent. Preapical seta present, inserted on interval 3 next to stria 2. Umbilicate setal series with setae of humeral group equidistance from each other and setae of median group inserted slightly posterior to middle.

Legs. Short; protibiae with longitudinal furrow.

Abdomen. Abdominal ventrites glabrous, except for a single paramedial seta on each side, and ventrite VII of female apically with two pairs of paramedial setae.

Habitat distribution.— The unique holotype female of this species was collected by sifting leaf litter taken on sandy substrate on a secondary floodplain covered by a broadleaf forest canopy at an elevation of 2460 m (Fig. 37a). Specimens of *Trechepaphiopsis uniporosa* and *T. unisetosa* were collected in the same sifted litter samples at this site.

Geographical distribution within the Gaoligong Shan.— Fig. 34b. This species is known only from a single female specimen from the type locality in western Lushui County on the western slope of the southcentral part of the Gaoligong Shan region. This locality is in Core Area 4.

Overall geographical distribution.— This species currently is known only from Lushui County in the southcentral part of the Gaoligong Shan region, western Yunnan Province, China.

Discussion

The Gaoligong Shan region is at the very heart of one of the world's biodiversity hotspots (Myers et al. 2000), where faunal elements from the Palearctic and Oriental Regions meet. Adding to this diversity is a distinct regional Chinese element, probably of mixed Palearctic/Oriental origin (Deuve 2013b), which either became isolated and evolved independently within the region or has been replaced elsewhere by present-day Palearctic and/or Oriental elements. Perhaps the most well-known representative of this element is the giant panda, *Ailuropoda melanoleuca* David (1869); but there are also several endemic carabid generic and subgeneric representatives as well (e.g., the nebriine genus *Archastes* Jedličika (1935) and the trechine genus *Eocnides*).

The trechine carabid fauna of the region is hyperdiverse, and the fauna of the Gaoligong Shan region itself is exceptionally species-rich. Of the 29 trechine species recorded from the latter, including the 19 species reported here as new, 25 are known from nowhere else. This pattern contrasts dramatically with that found among the zabrines of the region (Kavanaugh et al. 2014), all 13 of which have been recorded from outside the Gaoligong Shan region and none of which were new to science. In the following sections, we discuss broader geographical distribution patterns of the four trechine species known from outside the region and of the supraspecific taxa of which Gaoligong Shan trechines are members. We also examine geographical and altitudinal distribution patterns and patterns of syntopy (co-occurrence in the same habitat) among species in the regional fauna.

Broad geographical distribution patterns.— The overall geographical ranges of the four trechine species known to occur both inside and outside of the Gaoligong Shan region are graphically approximated, superimposed on one another, in Fig. 45. Among the geographical

ranges of these species, three general range patterns are apparent. The first pattern (1) is shown by one species, *Perileptus imaicus*, with a geographical range that includes only a narrow swath along the southern base of the Himalayan Range from Himachal Pradesh, India in the west to the Gaoligong Shan region, where it reaches its eastern distributional limit. Among the zabrines, *Amara elegantula* Tschitschérine shares this same pattern but in higher elevation habitats (Kavanaugh et al. 2014). The second (2) pattern is shown by two species, *Agonotrechus wuyipeng* and *Eocnides fragilis*, both of which have a geographical range that extends from central or northern Sichuan, respectively, southwest to the northern half of the Gaoligong Shan region, where they reach their western distributional limit. Finally, the fourth species, *Trechus indicus*, shows the third pattern (3), which is a combination of the first two. The range of *T. indicus* extends from eastern Afghanistan eastward along the southern edge of Himalayan range and the Qinghai-Xizang (Tibetan) Plateau to northcentral Sichuan, with its southern limit in the mountains of the Gaoligong Shan region. Several zabrine species, including *Amara sikkimensis* Andrewes, *A. chalciope* (Bates), *A. dissimilis* Tschitschérine, *A. latithorax* Baliani, and *A. birmana* Baliani share this same pattern (Kavanaugh et al. 2014, Fig. 27), although with varied eastern and western extents. Deuve (1997, 2013b) recognized what he called subzones within both the southern Palearctic and northern Oriental Regions based mainly on his biogeographic analysis of the *Carabus* fauna of China and adjacent areas. Our general ranges patterns (1) to (3) correspond well to the southern parts of his Sichuano-Tibetan subzone ("Sous-zone Sichuano-Tibétaine", subzone III in Deuve 2013b, Fig. 13); and pattern (2) is similar to his Yunnan Plateau subregion ("Plateau du Yunnan", subzone IIIa in the same figure).

It is likely no coincidence that all four of the trechine species with known ranges extended beyond the Gaoligong Shan region have adults that are fully-winged. The ability to fly undoubtedly supports the maintenance of larger occupied ranges as well as greater potential for dispersal to new areas. Within the trechine fauna of the study area, four additional species have fully-winged adults: *Perileptus pusilloides*, *Agonotrechus fugongensis*, *A. xiaoheishan*, and *A. yunnanus*. Although all of these species are currently known only from the study area, the discovery of one or more of them in additional, adjacent areas is possible or even likely in the future. However, it would be unexpected to discover populations of any of the remaining 21 species, all of which have flightless adults, outside the Gaoligong Shan region.

With such a large proportion of the trechine fauna of the region known from nowhere else (25 of 29 known species [86%] and four of eight genera [50%, plus one additional subgenus]), a look at the overall distributions of the genera or subgenera to which these trechines belong may provide a broader geographic context for understanding the composition of fauna. *Perileptus* is widely distributed in tropical to temperate portions of all continents in the Eastern Hemisphere and in the Caribbean portion of the Neotropical Region, probably introduced into the latter from Africa with commercial trade. *Agonotrechus* is restricted to the southern portion of the Sichuano-Tibetan subzone and the Subtropical China subzone ("Sous-zone de Chine subtropicale", subzone V in Deuve 2014b, Fig. 13) including Japan. *Eocnides* is restricted to the southcentral portion of the Sichuano-Tibetan subzone and *Queinnectrechus* to the Yunnan Plateau subregion of that subzone. *Trechus*, with its present taxonomic inclusiveness, is Holarctic in distribution, and species in the study area likely have their closest relatives to the north. Three of the remaining genera, *Trechepaphiopsis*, *Epaphiotrechus*, and *Trechepaphiama*, are members of the *Epaphiopsis* complex of genera, which mainly occupy the Subtropical China subzone. The phyletic affinity of *Minutotrechus* remains unclear based on morphological features. As noted above, it is likely related to either *Uenoites*, and therefore has a Sichuano-Tibetan affinity, or to *Hubeitrechus,* and hence has a Subtropical China affinity.

Kavanaugh et al. (2014) suggested that the Gaoligong Shan region may have been an area of differentiation, speciation and origin of montane elements from which, rather than to which, at least some of the species that now range more broadly subsequently spread. This hypothesis was based on meager evidence provided by the zabrine fauna of the Gaoligong Shan, but also on geologic evidence. The Hengduan Mountains date their origins to the late Mesozoic, whereas the uplift of the Himalayan Ranges and Qinghai-Xizang Plateau began later, in the early Cenozoic (Chaplin 2005). Hence the biota of the Gaoligong Shan region probably predates that of these other areas as well. The trechine fauna of the region supports this hypothesis even more strongly. The occurrence of four precinctive genera and one apparently precinctive subgenus of small, flightless beetles, two of which are represented by two and seven species, respectively, suggests differentiation and diversification within the region. The occurrence of another nine likely precinctive species in other genera suggests speciation *in situ*. Finally, even the four species with ranges extended beyond the Gaoligong Shan region all have those ranges either centered on the region of anchored there. As with the zabrines, a better understanding of phylogenetic relationships among the Gaoligong Shan, Eurasian and Oriental *trechine* species and genera is required in order to test this hypothesis, and such an analysis has not yet been undertaken.

Regional geographical and altitudinal distribution patterns.— Within the Gaoligong Shan study area, most of the trechine species represented are narrowly distributed, both geographically and altitudinally. This is not surprising given the high percentage (72%) of species with flightless adults and their preferences for moist, undisturbed habitats. Such areas are restricted within the region mainly to remaining forested areas at low to middle elevations and alpine meadows, moist tundra, stable talus slopes, stream edges and bamboo and *Rhododendron* thickets at higher elevations. Many such areas in the region are separated from each other by deep valleys and, increasingly, by disturbance associated with agriculture and human habitation. While human disturbance is relatively recent, topographic diversity of the region has been developing since the Miocene (Chaplin 2005).

The chart in Fig. 46 summarizes the recorded regional distributions of the species with respect to our project-designated Core Areas (see Fig. 3); and the recorded altitudinal ranges for each species are shown in Fig. 47. These charts clearly demonstrate the relatively narrow geographical and altitudinal ranges of most of the trechine species occurring in the region. This is especially apparent from comparisons with the ranges of zabrine species in the same area (see Kavanaugh et al. 2014, Figs. 28 and 29). Among the 13 zabrine species in the fauna, one is recorded from all 7 Core Areas, one from 6 Core Areas (all except 5) and three from four or five Core areas; and most of these species are likely to occur in all seven Core Areas. In contrast, only one species, *Trechus indicus*, is recorded from as many as four Core Areas (1, 3, 6 and 7) and also has a relatively broad known altitudinal range (1230 to 2486 m). Given that it is recorded from the northernmost and southernmost core areas, as well as from both eastern and western slopes of the Gaoligong Shan, it is likely to be found in additional, if not all, core areas with further sampling. Only one additional species, *Perileptus imaicus*, is recorded from as many as three Core Areas (2, 6 and 7) and also has a broad known altitudinal range (from 680 to 2030 m). Like *T. indicus*, it is recorded from both northernmost and southernmost core areas and from both slopes of the mountain range, so it is likely to be more widespread in the region than is presently known, at low to middle elevations. Five additional species are recorded from as many as two core areas: *Perileptus pusilloides* (Core Areas 6 and 7, known altitudinal range from 680 to 1105 m); *Agonotrechus fugongensis* (Core Areas 2 and 3, known altitudinal range from 2300 to 2530 m); *A. wuyipeng* (core areas 2 and 3, known altitudinal range from 2687 to 2770 m); *Queinnectrechus balli* (Core Areas 1 and 2, known altitudinal range from 3300 to 3750 m); and *Trechepaphiopsis unisetosa* (Core Areas 4 and 5, known altitu-

dinal range from 2460 to 3150 m). For each of these species, Core Areas known to be occupied are immediately adjacent. A sixth species, *Trechus luzhangensis* is recorded only from the pass dividing Core Areas 4 and 5 (at 3150 m) and so has been attributed to both Core Areas. Among these six species, only *P. pusilloid*es, *A. fugonensis* and *A. wuyipeng* have fully-winged adults and are likely to have ranges greater than are presently known. The other three species, *Q. balli*, *T. unisetosa*, and *T. luzhangensis*, have flightless adults and are not likely to have ranges outside their presently known Core Areas. The remaining 21 species are presently known only from a single Core Area and have altitudinal ranges of varied breadth. Among these, only *Agonotrechus xiaoheishan*, *A. yunnanus*, and *Eocnides fragilis* have fully-winged adults and therefore are likely to be significantly more widespread within the region than presently known.

A comparison of recorded diversity for *trechine* species among the seven Core Areas (Fig. 46) shows that all of them are occupied by at least two species, with highest diversity in Core Area 2 (with 10 of the 29 species), second highest in Core Areas 3 and 6 (each with 8 species) and lowest recorded diversity in Core Areas 1 and 5, which are the Core Areas least extensively sampled and perhaps most heavily impacted by human disturbance, respectively. In contrast, the zabrines were found to be most diverse in Core Area 6, second most diverse in Core Area 2, and least diverse in Core Area 4 (Kavanaugh et al. 2014). At present, Core Areas 1 and 2 (West/East versants in the northernmost part of the region) are known to uniquely share only one species, *Queinnectrechus balli*, adults of which are flightless. Further sampling is likely to confirm the occurrence in Core Area 1 of additional species presently known only from Core Area 2, particularly those inhabiting high elevation habitats there. Core Areas 2 and 3 (areas adjacent North/South on the eastern slope of the Gaoligong Shan) share two species uniquely, *Agonotrechus fugongensis* and *A. wuyipeng*, both of which have fully-winged adults. Unfortunately, the China/Myanmar border forms the western limit of Core Area 3 and also of our study area (see Material and Methods section above), so the fauna of the western versant of the Gaoligong Shan in the northcentral part of the range remains unknown. Core Areas 4 and 5 (West/East versants in the southcentral part of the region) uniquely share two species, *Trechus luzhangensis* and *Trechepaphiopsis unisetosa*, both with flightless adults.

Five of the seven Core Areas are inhabited by at least one species recorded from no other Core Area. Six species are uniquely recorded from Core Area 2, the northernmost eastern versant of the region. All of these except *Eocnides fragilis* have flightless adults. Five species are uniquely recorded from Core Areas 3 and 6, respectively; and all of these except *Agonotrechus xiaoheishan* (in Core Area 6) have flightless adults. Three species are uniquely recorded from Core Area 7, the southernmost eastern versant of the region, and two from Core Area 4. Among these, all except *Agonotrechus yunnanus* have flightless adults.

If we ignore the two most widespread species, *Trechus indicus* and *Perileptus imaicus*, it is clear that five different Core Areas or combinations thereof have distinctive trechine assemblages. (1) The northermost part of the Gaoligong Shan region (Core Areas 1 and 2 together) is the most diverse and distinctive region, with seven species (six of which have only flightless adults) unique to it. Only *Agonotrechus fugongensis* and *A. wuyipeng*, both with fully-winged adults, are shared with any other area (adjacent Core Area 3). (2) Core Area 3, the north central part of the region, also has a distinctive trechine fauna, with five species (all with flightless members) unique to it (plus the two species shared with Core Area 2 as just noted). (3) The southcentral portion of the region (Core Areas 4 and 5 together) also has a distinct trechine assemblage of four species, all with flightless members, unique to it. *Trechus indicus*, *Perileptus imaicus* and *P. pusilloides*, all with fully-winged adults, are recorded from Core Areas 6 and 7, but otherwise the trechine assemblages of these areas are distinctive. (4) Four species are unique to Core Area 6, all except *Agonotrechus*

xiaoheishan with flightless adults; and (5) three species are uniquely recorded from Core Area 7, with only *A. yunnanus* having fully-winged adults.

With respect to the distributions of genera within the Gaoligongshan region, a broader picture emerges. Both *Perileptus* and *Agonotrechus* range from Core Area 2 in the northeast to Core Areas 6 and 7 in the south, with gaps in records from the middle part of region. *Minutotrechus* is recorded only from Core Area 6 in the southwestern part of the region and *Eocnides* only from Core Area 2 in the northernmost part. *Queinnectrechus* also appears restricted to Core Areas 1 and 2 in the northernmost part. Although *Trechus indicus* is widespread both within and beyond the region, the remaining species of *Trechus*, which we have informally labeled the "*qiqiensis* group" appear restricted to the northern and central parts of the region (Core Areas 2, 3, 4, and 5). *Trechepaphiopsis* is widely distributed in the region, from northernmost to southernmost Core Areas but most diverse in the northcentral and southcentral areas (Core Areas 3 and 4). *Epaphiotrechus* is recorded only from Core Areas 3 and 7, non-adjacent northcentral and southern parts of the region on the east slope of the Gaoligong Shan, and *Trechepaphiama* is known only from Core Area 4 on the western slope in the southcentral part of the mountain range. In general, genera that have affinities with faunas of the Palearctic Region (e.g., *Trechus* species) and with the Sichuano-Tibetan subzone in particular (e.g., *Queinnectrechus* and *Eocnides*) mainly occupy northern and central parts of the region, whereas genera with affinities with the Oriental Region and with the Subtropical China subzone of the region in particular, mainly occupy the central and southern parts of the region. However, the adaptations of individual species in each of these affinity classes to diverse local topographic differences, which foster geographical and altitudinal isolation in the region, and differences in the respective flight capabilities of their members, which support broader or narrower distributional ranges, serve to partially obscure this overall pattern.

With respect to the altitudinal distribution of the trechine fauna of the study area (Fig. 47), several points can be made. Highest diversity is concentrated in a broad zone between about 2250 m and 3750 m, with 27 of the 29 species occurring within this zone. Only two species, *Perileptus imaicus* and *P. pusilloides* occur below 1000 m in the study area; and only two more, *Eocnides fragilis* and *Trechus indicus*, occur below 2000 m. As noted for each elsewhere above, all of these species have fully-winged adults. Eight species (*Queinnectrechus griswoldi*, *Q. gongshanicus*, *Q. balli*, *Trechus shiyueliang*, *T. qiqiensis*, *T. gongshanensis*, *T. shibalicus*, and *Trechepaphiopsis monochaeta*) occur above 3500 m, but only *Q. gongshanicus* appears to be restricted to that elevation or above. All of these species have flightless adults. Compared with the distributions of zabrines in the region, the trechines occupy relatively restricted altitudinal ranges. The average difference between highest and lowest elevations recorded for each of the 24 trechine species for which more than one elevational record is known is 500 m (range = 20 to 1350 m), whereas the average difference for zabrine species in the region is 1193 m (range = 225 to 2111 m), more than double that for trechine species (Kavanaugh et al. 2014). Also, six of 13 zabrine species occupy greater altitudinal ranges than any trechine species in the same area.

In the preceding discussion, we have repeatedly noted relationships between the extent of geographical and/or altitudinal ranges and flight capability. Why? As Schmidt et al. (2016) noted, "… considering the low dispersal ability of the tiny wingless beetles within their mountainous environment, very small distributional areas can be expected for each of the species and therefore the contemporary existence of a large number of closely related allopatric *Trechus* species." This certainly describes very well the trechine fauna of the Gaoligong Shan region, and also explains how it differs so markedly from the zabrine fauna of the same region.

Syntopy of species in the regional fauna.— Records of the co-occurrence of different trechine species at the same site and in the same habitat (i.e., syntopic) within the study area are sum-

marized in Fig. 48. Syntopy appears to be relatively rare among trechines of the region, especially compared with the zabrines of the region. Four of 13 zabrine species have been recorded syntopic with eight other zabrine species, three other species syntopic with seven other species, and all 13 species syntopic with at least one other species (Kavanaugh et al. 2014). In contrast, seven of the 29 trechine species have not been found syntopic with any other species. Only one trechine species, *Queinnectrechus griswoldi*, has been found syntopic with five other species (*Q. balli*, *Q. gongshanicus*, *Trechus qiqiensis*, *T. gongshanensis*, and *Trechepaphiopsis monochaeta*), but at no single site with more than four of those species. *Queinnectrechus balli* and *T. gongshanensis* have been found syntopic with the same cadre of species except *T. monochaeta*, and *T. qiqiensis* has been found syntopic with all of the above except *Q. gongshanicus*. All the above records of syntopy are from the northernmost part of the study area, in Core Area 2. *Trechus shibalicus* has been found syntopic with four other species (*Trechus shiyueliang*, *T. pseudoqiqiensis*, *Trechepaphiopsis unisetulosa* and *T. unipilosa*) in Core Area 3. *Trechus shiyueliang* has been found syntopic with the same cadre of species except *T. pseudoqiqiensis* in the same area. *Trechus indicus* has also been found syntopic with three other species (with *Agonotrechus xiaoheishan* in Core Area 6 and with *A. yunnanus* and *Epaphiotrechus fortip*es in Core Area 7).

Given the low level of syntopy among the trechines of the area overall, it is perhaps surprising to find it among congeneric species in several genera. The two *Perileptus* species in the fauna are syntopic in Core Areas 6 and 7. All three of the *Queinnectrechus* species are syntopic in Core Area 2. Among *Trechus* species in the region, *T. qiqiensis* and *T. gongshanensis* have been found syntopic in Core Area 2 and *T. pseudoqiqiensis*, *T. shibalicus* and *T. shiyueliang* in Core Area 3. Among the species of *Trechepaphiopsis*, only *T. unisetulosa* and *T. unipilosa* have been found syntopic, also in Core Area 3. For several of these syntopic pairs of congeneric species we have noted evident differences in body size between the pair members. The ranges in size (BL) of *Perileptus imaicus* and *P. pusilloides* adults are 2.6 to 2.8 mm and 2.3 mm, respectively. Those of the two species of *Queinnectrechus (s. str.*), *Q. griswol*di and Q. *gongshanicus*, are 4.3 to 4.8 mm and 3.5 to 3.8 mm, respectively. Those of *Trechus qiqiensis* and *T. gongshanensis* are 4.0 to 4.2 mm and 3.3 to 3.5 mm, respectively; and those of *Trechus pseudoqiqiensis* and *T. shibalicus* are 4.0 mm and 3.3 to 3.5 mm, respectively (*T. shiyueliang* [BL = 4.0 to 4.2] appears to be more distantly related based on key morphological features). Finally, those of *Trechepaphiopsis unisetulosa* and *T. unipilosa* are 3.3 to 35 mm and 2.7 to 3.1 mm, respectively. Sokolov and Kavanaugh (2014) found similar size differences among closely related, small, flightless, litter-dwelling and syntopic anillines of the genus *Geocharidius* in Nuclear Centeral America. Just what role such size differences may play in facilitating syntopy is unclear, but perhaps they allow members of the different species to share slightly different microspaces and/or food (prey) in their shared habitat without or with reduced competition.

Finally, we cannot resist commenting on the *Agonotrechus* fauna of the region. Four species occur there, all with fully-winged adults, and none of them has yet been recorded syntopic with any another, although *A. fugongensis* and *A. wuyipeng* have been collected in adjacent habitats in the southern part of Core Area 2. Unlike members of both *Perileptus* species, which are syntopic in the southern part of the region, those of all the *Agonotrechus* species apparently only occupy habitats above 2000 m in elevation (range = 2000 to 2770 m). Just how, when, or even if these beetles use their wings remains unknown.

FIGURE 35. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, Bingzhongluo Township, Xiao Shangla He at Shuangla Village, elevation 1550 m; habitat in which specimens of *Perileptus imaicus* Jeannel were collected. b. Gongshan County, Qigi He, 9.9 airkm W of Cikai, elevation 2000 m; habitat in which specimens of *Agonotrechus fugongensis* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 36. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Fugong County, Shiyueliang Township, 1 km E of Shibali on Shibali Road, elevation 2400 m; habitat in which specimens of *Agonotrechus fugongensis* sp. nov. were collected. b. Gongshan County, Cikai Township, Qiqi Trail at No. 12 Bridge Camp, elevation 2770 m; habitat in which specimens of *Agonotrechus wuyipeng* Deuve were collected. Photos by David H. Kavanaugh.

FIGURE 37. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Lushui County, Pianma Township ,9.3 km ENE of Pianma along road to Lushui at Changyan He, elevation 2460 m; habitat in which specimens of *Trechepaphiopsis unisetosa* (Deuve), *T. uniporosa* sp. nov., and *Trechepaphiama gaoligong* sp. nov. were collected. b. Gongshan County, Cikai Township, slope S of of Heipu Yakou, elevation 3370 m; habitat in which specimens of *Queinnectrechus griswoldi* sp. nov., *Q. balli* sp. nov., and *Trechus qiqiensis* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 38. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan 0.3 km SW of Chukuai Lake, elevation 3750 m; habitat in which specimens of *Queinnectrechus griswoldi* sp. nov. and *Trechus gongshanicus* sp. nov. were collected. b. same area, but habitat in which specimens of *Queinnectrechus griswoldi* sp. nov. and *Trechepaphiopsis monochaeta* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 39. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan, 0.3 km NNE of Chukuai Lake, elevation 3745 m; habitat in which specimens of *Queinnectrechus gongshanicus* sp. nov., *Q. balli* sp. nov. and *Trechus gongshanensis* sp. nov. were collected. b. Gongshan County, Bingzhongluo Township, SW slope of Kawakarpu Shan on slope NE of Chukuai Lake, elevation 3950 m; habitat in which specimens of *Queinnectrechus griswoldi* sp. nov. and *Trechus gongshanensis* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 40. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, 21 air km W of Cikai on east slope of Qiqi/Dulong divide, elevation 3600 m; habitat in which specimens of *Queinnectrechus balli* sp. nov. and *Trechus gongshanensis* sp. nov. were collected. b. Fugong County, Shiyueliang Township, 8.5 km above Shibali on Shibali Road, elevation 3100 m; habitat in which specimens of *Trechus shiyueliang* sp. nov., *T. shibalicus* sp. nov., *Trechepaphiopsis unisetulosa* sp. nov. and *T. unipilosa* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 41. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, Dulongjiang Township, Dulong Jiang at Elideng village, elevation 1640 m; habitat in which specimens of *Trechus indicus* Putzeys were collected. b. Tengchong County, Mingguang Township, slope SW of Eighth Boundary Post Pass, elevation 2887 m; habitat in which specimens of *Trechus mingguangensis* sp. nov. were collected. Photos by David H. Kavanaugh.

FIGURE 42. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Gongshan County, Cikai Township, Qiqi Trail at No. 12 Bridge Camp area, elevation 2775 m; habitat in which specimens of *Trechus qiqiensis* sp. nov. and *Trechepaphiopsis monochaeta* sp. nov. were collected. b. Fugong County, Shiyueliang Township, 11.5 km above Shibali on Shibali Road, elevation 3290 m; habitat in which the holotype of *Trechus pseudoqiqiensis* sp. nov. was collected. Photos by David H. Kavanaugh.

FIGURE 43. Photographs of habitats for trechine species in the Gaoligong Shan region. a. Lushui County, Luzhang Township, Piana Road 0.1 km E of Fengxue Yakou, elevation 3150 m; habitat in which specimens of *Trechus luzhangensis* sp. nov. were collected. b. Lushui County, Luzhang Township, 100 m S of Fengxue Yakou on east side of pass, elevation 3150 m; habitat in which specimens of *Trechepaphiopsis unisetosa* (Deuve) were collected. Photos by David H. Kavanaugh.

FIGURE 44. Photograph of habitat for trechine species in the Gaoligong Shan region. Longling County, Longjiang Township, Xiaoheishan Forest Reserve, elevation 2020 m; habitat in which specimens of *Agonotrechus xiaoheishan* sp. nov. and *Trechus indicus* Putzeys were collected. Photo by David H. Kavanaugh.

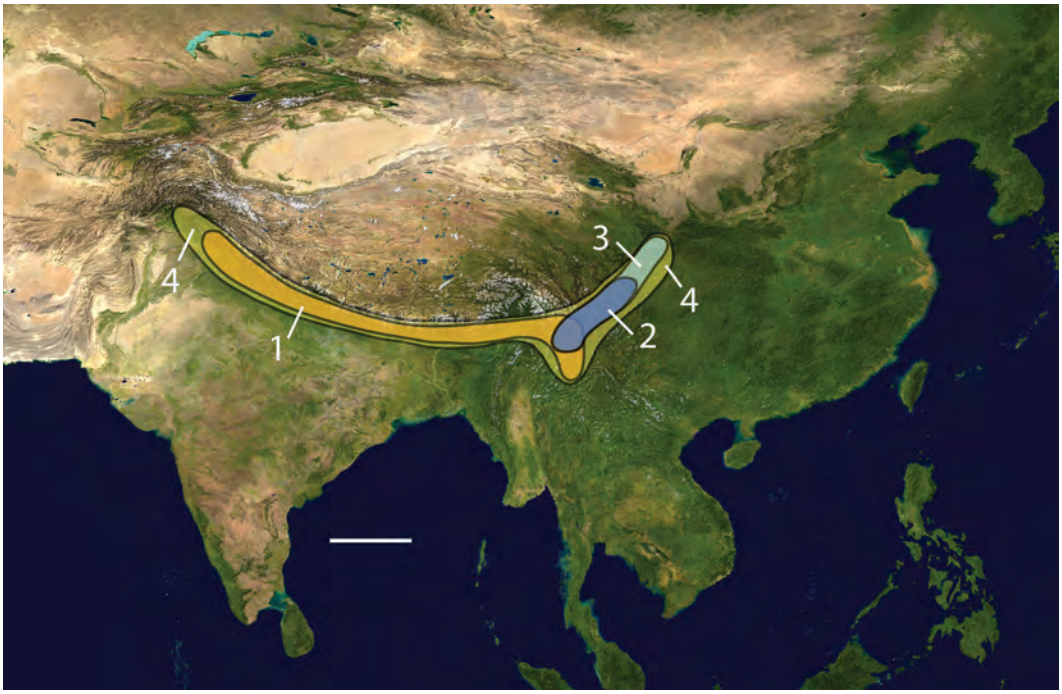


FIGURE 45. Map showing approximate overall known geographical distributions of species occurring in the Gaoligong Shan region as well as outside the region. 1 = *Peripleptus imaicus* Jeannel. 2 = *Agonotrechus wuyipeng* Deuve. 3 = *Eocnides fragilis* Uéno. 4 = *Trechus indicus* Putzeys. Scale line = 500 km.

	Core Area						
species	1	2	3	4	5	6	7
Perileptus imaicus		X				X	X
Perileptus pusilloides						X	X
Agonotrechus fugongensis		X	X				
Agonotrechus wuyipeng		X	X				
Agonotrechus xiaoheishan						X	
Agonotrechus yunnanus							X
Minutotrechus minutus						X	
Queinnectrechus balli	X	X					
Queinnectrechus griswoldi		X					
Queinnectrechus gongshanicus		X					
Eocnides fragilis		X					
Trechus indicus	X		X			X	X
Trechus shiyueliang			X				
Trechus mingguangensis						X	
Trechus qiqiensis		X					
Trechus pseudoqiqiensis			X				
Trechus luzhangensis				X	X		
Trechus gongshanensis		X					
Trechus shibalicus			X				
Trechepaphiopsis asetosa						X	
Trechepaphiopsis unisetigera							X
Trechepaphiopsis unisetosa				X	X		
Trechepaphiopsis uniporosa				X			
Trechepaphiopsis unisetulosa			X				
Trechepaphiopsis monochaeta		X					
Trechepaphiopsis unipilosa			X				
Epaphiotrechus fortipes							X
Epaphiotrechus fortipesoides						X	
Trechepaphiama gaoligong				X			

FIGURE 46. Chart showing the representation of trechine species in project-designated Core Areas (see Fig. 3) in the Gaoligong Shan region.

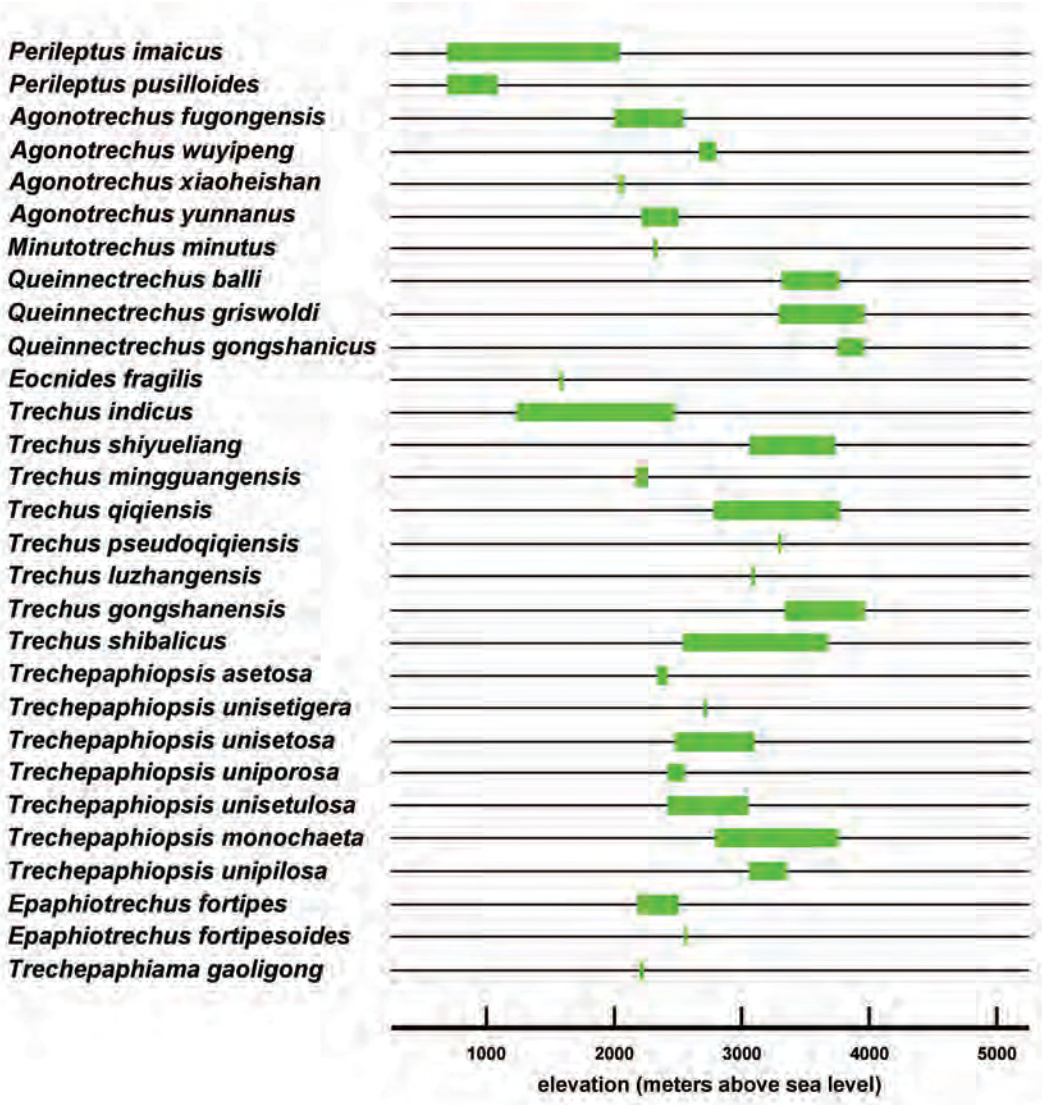


FIGURE 47. Chart illustrating the altitudinal ranges of trechine species represented in the Gaoligong Shan region.

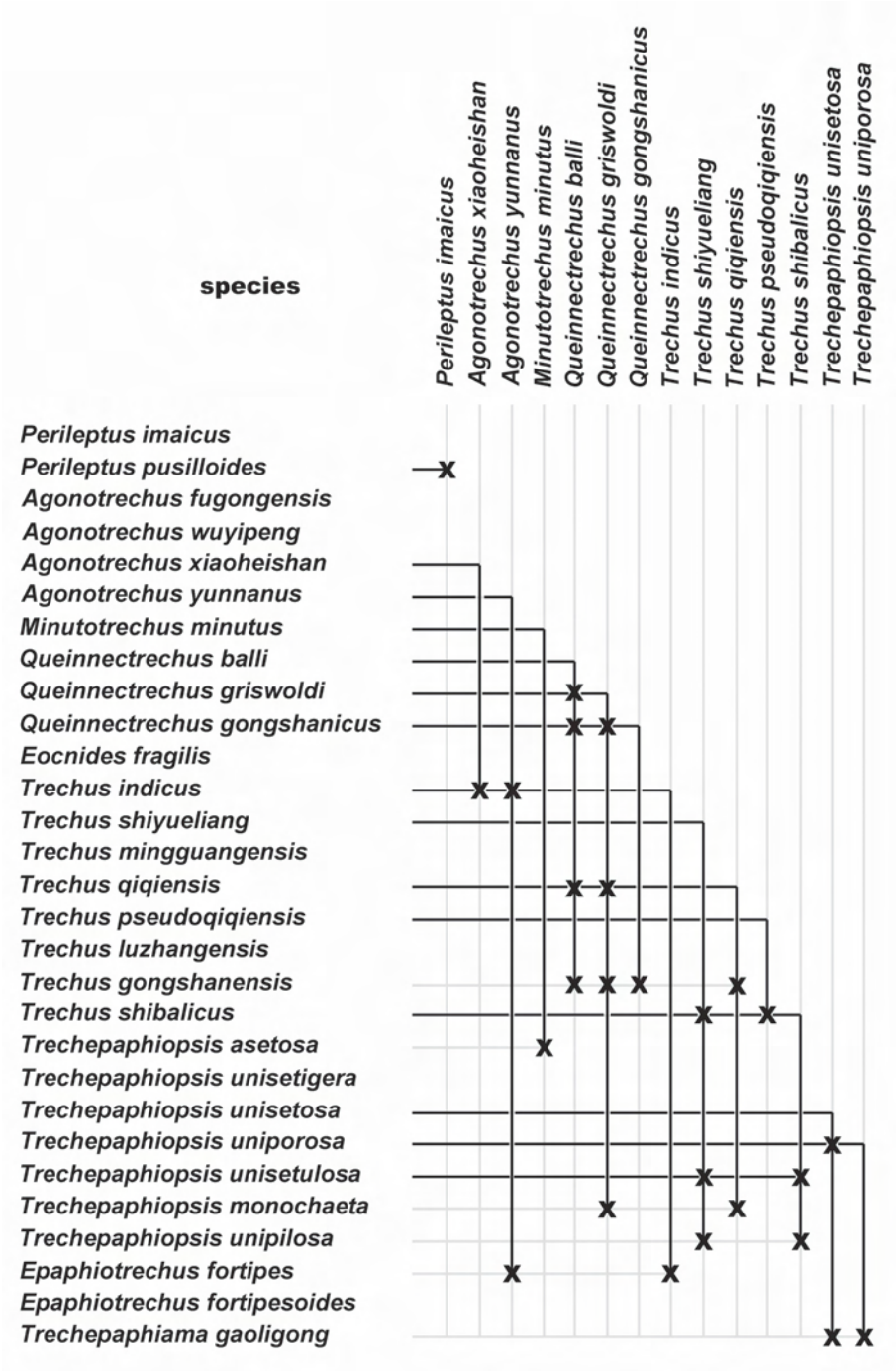


FIGURE. 48. Chart illustrating the co-occurence (syntopy) of trechine species in samples from the same habitats and at the same sites in the Gaoligong Shan region.

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