RAFFLES BULLETIN OF ZOOLOGY Supplement No. **35**: 88–100
Date of publication: 31 March 2020
http://zoobank.org/urn:lsid:zoobank.org:pub:F7F1A8E4-3CA6-4ECD-9D0D-DE307033F964

A revision of dragon millipedes. V. The new genus *Burmaxytes* for two new species from Myanmar (Diplopoda: Polydesmida: Paradoxosomatidae)

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Abstract. A new genus of dragon millipedes, *Burmaxytes*, is described from Myanmar, based on two new species: *B. mombergi* (type species) from Kayin State, and *B. whitteni* from Mon State. The new genus, constituting a sixth group of dragon millipedes, is discussed, and a distribution map is provided. The two new species were exclusively found living on humid limestone rock walls, and are endemic and restricted to limestone habitats in Myanmar.

Key words. biodiversity, limestone, millipede, Myanmar, new species

INTRODUCTION

This is the fifth paper in a series of articles revising the dragon millipedes, genus *Desmoxytes* Chamberlin, 1923, sensu Golovatch & Enghoff (1994) (*Desmoxytes* sensu lato). Srisonchai et al. (2018a, 2018b, 2018c, 2018d) outlined general information on the dragon millipedes and split *Desmoxytes* sensu lato into five genera based on morphology and an ongoing molecular phylogenetic study, viz., *Desmoxytes* Chamberlin, 1923, *Gigaxytes* Srisonchai, Enghoff & Panha, 2018, *Hylomus* Cook & Loomis, 1924, *Nagaxytes* Srisonchai, Enghoff & Panha, 2018, and *Spinaxytes* Srisonchai, Enghoff & Panha, 2018. These genera constitute the five main groups of dragon millipedes (Srisonchai et al., 2018a), and the present contribution concerns two new species of a hitherto unrecognised sixth group which we here name the "Burmese group", and for which we propose a new genus.

Collecting activities in Myanmar, especially in limestone mountains, were performed with the support of Fauna & Flora International (FFI) in 2015–2017, collaborating with the Animal Systematics Research Unit (ASRU), Chulalongkorn University. These activities took place under the limestone conservation projects, which aim to protect biodiversity in limestone habitats (Fauna & Flora International, 2015; Grismer et al., 2018a, 2018b, 2018c). A considerable amount of material comprising terrestrial snails, earthworms, centipedes and millipedes was collected from these projects, and was found to contain several new species including new dragon millipede species.

Until recently, only three species of dragon millipedes were reported for Myanmar (Pocock, 1895; Likhitrakarn et al., 2017). Subsequently, two new species and one new record were added by Srisonchai et al. (2018a, 2018c, 2018d), totalling six dragon millipede species that exist in Myanmar (four species of *Desmoxytes*, one of *Gigaxytes*, and one of *Spinaxytes*): *Desmoxytes cervina* (Pocock, 1895), *Desmoxytes planata* (Pocock, 1895), *Desmoxytes taurina* (Pocock, 1895), *Desmoxytes waepyanensis* Srisonchai, Enghoff & Panha, 2018, *Gigaxytes fusca* Srisonchai, Enghoff & Panha, 2018, and *Spinaxytes efefi* Srisonchai, Enghoff & Panha, 2018.

In the present study, we describe a new genus with two new species which are narrowly distributed only in Myanmar.

MATERIAL AND METHODS

Specimen collecting and preservation. The material for this article was collected from Myanmar in cooperation with FFI. The main collectors in this work were the staff of FFI Myanmar and members of the ASRU, Department of Biology, Faculty of Science, Chulalongkorn University (ASRU members). All specimens were hand-collected from limestone habitats. Specimens were euthanised based on AVMA guidelines for the euthanasia of animals (Leary et al., 2013), mostly stored in 70% (v/v) ethanol for morphological study, and partly in 95% (v/v) ethanol for molecular analysis. Latitude, longitude, and elevation were recorded using a Garmin GPSMAP 60 CSx, and all

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ISSN 2345-7600 (electronic) | ISSN 021-2445 (print)

coordinates and elevations were checked with Google Earth. All holotypes and paratypes are kept in CUMZ.

Illustrations. Live photos were taken with a Nikon D700 equipped with a AF-S VR Micro-Nikkor 105 mm lens in the field. Specimens for scanning electron microscopy (SEM) were dissected under a stereo microscope, mounted on aluminium stubs, coated with gold, and then studied by SEM (JEOL - JSM-5410 LV) at the Scientific and Technological Research Equipment Centre (STREC), Chulalongkorn University. All plates were composed in Adobe Photoshop CS6. The background of a distribution map was downloaded from Elastic Terrain Map (Willet et al., 2015).

Morphological descriptions. All specimens were carefully examined for non-gonopodal and gonopodal characteristics under a stereo microscope. The morphological terminology used in this study follows that of previous publications (Chamberlin, 1923; Jeekel, 1964, 1980, 2003; Golovatch & Enghoff, 1994; Enghoff et al., 2007; Golovatch et al., 2012; Srisonchai et al., 2016, 2018a, 2018b, 2018c, 2018d). Details of gonopodal terms are shown in the gonopod terminology section below. Positional and directional terms in gonopod descriptions follow Srisonchai et al. (2018a).

Gonopod terms for the genus *Burmaxytes* and their abbreviations.

Cannula (ca): a tube, lever-like, curved and slender; originating from coxa, tip inserted into concavity in prefemur;

Coxa (cx): basal part of the gonopod, rather long, connecting to seventh body ring, attached to apertural rim dorsally; with a distoanterior group of setae;

Femur (fe): longest part of the gonopod, curved; with lateral and mesal sulci distally; accommodates seminal groove (terminology for femorite vs. femur, see Jeekel [2003: 48]);

Mesal sulcus (ms): a distinct sulcus distally on femur, seen obviously in mesal view;

Lamina lateralis (ll): a large and long lobe on distal part of gonopod, apparent in all views;

Lamina medialis (lm): a small and short part distally on the gonopod, apparent in mesodorsal view;

Lateral sulcus (ls): a distinct sulcus distally on femur, seen obviously in lateral view;

Prefemur (pfe, prefemoral part): basal portion of the telopodite, densely setose;

Postfemur (pof, postfemoral part): short part of telopodite, supporting solenophore and solenomere, demarcated from femur by lateral and mesal sulci;

Seminal groove (sg): a conspicuous groove, similar to a tunnel, seen as a transparent line, visible on femur in mesal view;

Solenomere (sl): a long and curved, flagellum-like appendage, originating from base of solenophore;

Solenophore (sph, tibiotarsus): apical part of telopodite, consisting of lamina lateralis and lamina medialis.

Abbreviations. ASRU, Animal Systematics Research Unit, Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok, Thailand; CUMZ, Chulalongkorn University Museum of Zoology, Bangkok, Thailand; FFI, Fauna and Flora International, Myanmar.

SYSTEMATICS

Order Polydesmida Pocock, 1887

Suborder Strongylosomatidea Brölemann, 1916

Family Paradoxosomatidae Daday, 1889

Subfamily Paradoxosomatinae Daday, 1889

Tribe Orthomorphini Brölemann, 1916

Burmaxytes, new genus

Type species. *Burmaxytes whitteni*, new species.

Diagnosis. A genus of dragon millipede characterised by the combination of these characters: (1) small body size (ca. 12 mm); (2) antenna short; (3) metaterga with only two rows of 2+2 tubercles in anterior row and 2+2 spines in posterior row, tubercles in anterior row of some segments poorly developed; (4) paraterga antler-like; (5) sternal lobe between male coxae 4 with one pore; (6) gonopod telopodite a little curved; (7) postfemoral part of gonopod conspicuous; (8) lamina lateralis indistinctly demarcated from lamina medialis; (9) lamina medialis shorter and smaller than lamina lateralis.

Etymology. The name is a combination of Burma, the older name of Myanmar, and *-xytes*, an ending used in the names of other dragon millipede genera: *Desmoxytes*, *Gigaxytes*, *Nagaxytes* and *Spinaxytes* (and its synonym *Pteroxytes*). Gender: feminine.

Included species. *Burmaxytes mombergi* new species, *B. whitteni* new species.

Remarks. *Burmaxytes*, new genus, does not fit into any of the five groups of dragon millipedes defined by Srisonchai et al. (2018a) for *Desmoxytes* sensu Golovatch & Enghoff. Based on the morphological characters, *Burmaxytes* is similar to *Hylomus* in having antler-like paraterga, a curved gonopod telopodite, an indistinct demarcation of lamina lateralis from lamina medialis (*Orthomorpha*-like gonopods), and the latter being shorter and smaller than lamina lateralis. *Burmaxytes* is, however, clearly different from most *Hylomus* in having a small-sized body, metaterga with only two rows of 2+2 tubercles in the anterior row and 2+2 spines in the posterior row, a sternal lobe between male coxae 4 with one pore, and a conspicuous postfemoral part of the gonopod. A preliminary ongoing phylogenetic study based on mitochondrial and nuclear markers also confirmed that the new genus described here is distinct from the other dragon millipede genera and should be regarded as a separate genus. Moreover, the geographical distribution of

Burmaxytes is clearly separated from that of *Hylomus*: whereas *Burmaxytes* occurs only in narrow areas in Myanmar, *Hylomus* inhabits southern China, Vietnam, Laos and northern Thailand.

Description. In order to reduce the redundancy in species descriptions, the general characters of the genus are given here. The description applies to adult males and females, except for the gonopods and when "male" is specified (Figs. 1–5).

Size. Body length ca. 12–14 mm (male) and ca. 12–15 mm (female), width 0.8–1.0 mm (male) and 1.0–1.2 mm (female), females usually a bit larger and longer than males.

Colour (Fig. 1). Most species in life with brown colour, no aposematic.

Antennae (Figs. 2D, 4D). Quite short, covered by delicate setation, reaching backwards to body rings 3–4 (male) and 2–3 (female) when stretched dorsally. Antennomere 2 = 3 = 4 = 5 = 6 > 1 > 7 > 8.

Head (Figs. 2A, D, 4A, D). Delicately setose; vertex bare; labrum and genae sparsely setose; epicranial suture conspicuous as a deep, brown stripe.

Collum (Figs. 2A, 4A). With three regular transverse rows of setiferous setae/tubercles/spines. Paraterga wing-like, quite long, tip sharp, directed caudolaterad, with two conspicuous notches on lateral margin, at base of anterior margin with a long setae.

Tegument. Quite shiny; collum, posterior region of metaterga, paraterga, surface below paraterga of rings 6–19, sterna and epiproct smooth; anterior region of metaterga, surface below paraterga of rings 2–5 and legs microgranulate; prozona finely shagreened. Suture between prozona and metazona quite deep and narrow.

Metaterga (Figs. 2A–C, 4A–C). With one or two regular transverse rows of setiferous tubercles (in anterior row) and spines (in posterior row). Transverse sulcus on metaterga quite deep and wide in body rings 5–18. Mid-dorsal (axial) line missing.

Paraterga (Figs. 2G, H, 4G). Antler-like, long. Callus and shoulder poorly developed, inconspicuous. Anterior margin with two distinct denticles; on body rings 9, 10, 12, 13, 15–19 with a third denticle at lateral margin near tip. Paraterga directed caudolaterad on body rings 2–17, more caudad on body rings 18–19. Degree of elevation of paraterga in male higher than in female. Posterior angle straight. Tip sharp. Ozopore visible from lateral view, round, quite large.

Pleurosternal carinae. Forming a complete, tooth-like crest on ring 2, a short ridge on ring 3, missing on remaining body rings.

Telson (Figs. 2I–M, 4H–L). Epiproct quite short, apically with two pairs of inconspicuous setae (spinnerets) arranged at the corners of a square, not in a depression, anterior pair close to apical tubercles; lateral setiferous tubercles and apical tubercles inconspicuous; tip subtruncate. Paraprocts convex. Hypoproct subsemicircular; caudal margin round, with two inconspicuous setiferous tubercles.

Sterna (Figs. 2N–P, 4M–O). Sparsely setose, cross-impressions shallow. Sternal lobe between male coxae 4 swollen; one pore seen in ventral view.

Legs (Figs. 2Q, R, 4P). Quite long. Relative length of podomeres: femur ≥ tarsus > tibia > postfemur ≥ prefemur ≥ coxa > claw. Male femora modified (*B. mombergi*), or without modification (*B. whitteni*).

Gonopods (Figs. 3, 5). Coxa (cx) shorter than femur. Cannula (ca) quite long. Telopodite curved. Prefemur (pfe) almost half as long as femur. Femur (fe) quite long and curved. Seminal groove running entirely on mesal surface of femur. Mesal (ms) and lateral sulci (ls) conspicuous. Postfemur (pof) conspicuous. Solenophore (sph) long and curved: lamina lateralis (ll) indistinctly demarcated from lamina medialis, larger and longer than lamina medialis; lamina medialis (lm) short, lamella-like. Solenomere (sl) long, slender, supported by sheath-like solenophore.

Distribution and habitat. No sympatry between *B. mombergi* and *B. whitteni* has been found in this study. The two new species were collected exclusively from limestone areas in Kayin and Mon states (Myanmar). Considering their narrow distribution, we regard them as endemic species for Myanmar. Almost all specimens were found on humid limestone rock walls where they mostly blended perfectly with the brown rocks in the field (Fig. 6).

***Burmaxytes mombergi*, new species**

(Figs. 1A, C, 2, 3)

Material examined. Holotype: 1 male (length 12 mm, CUMZ-pxDGT00223), MYANMAR, Hpa-An, Bardai Mountain, 16°59'50"N 97°41'48"E, ca. 27 m asl, coll. FFI staffs and ASRU members, 1 September 2016. Paratypes: 18 males, 19 females (CUMZ-pxDGT00224), same data as for holotype. Additional material (not paratypes): 1 female, MYANMAR, Hpa-An, Bayin Nyi Cave, 16°58'10.1"N 97°29'37.6"E, ca. 23 m asl, coll. FFI staffs and ASRU members, 31 August 2016; 9 males, 10 females, MYANMAR, Hpa-An, near Naung Ka Myaing Village, Kyonkaw Mountain, 17°00'59"N 97°42'13"E, ca. 28 m asl, coll. FFI staffs and ASRU members, 1 September 2016.

Etymology. *Burmaxytes mombergi* is named after Frank Momberg, Asia-Pacific development director for FFI who dedicates himself to protecting wildlife including invertebrates, and always a dear colleague and friend. Our project benefitted enormously from his support in collecting.

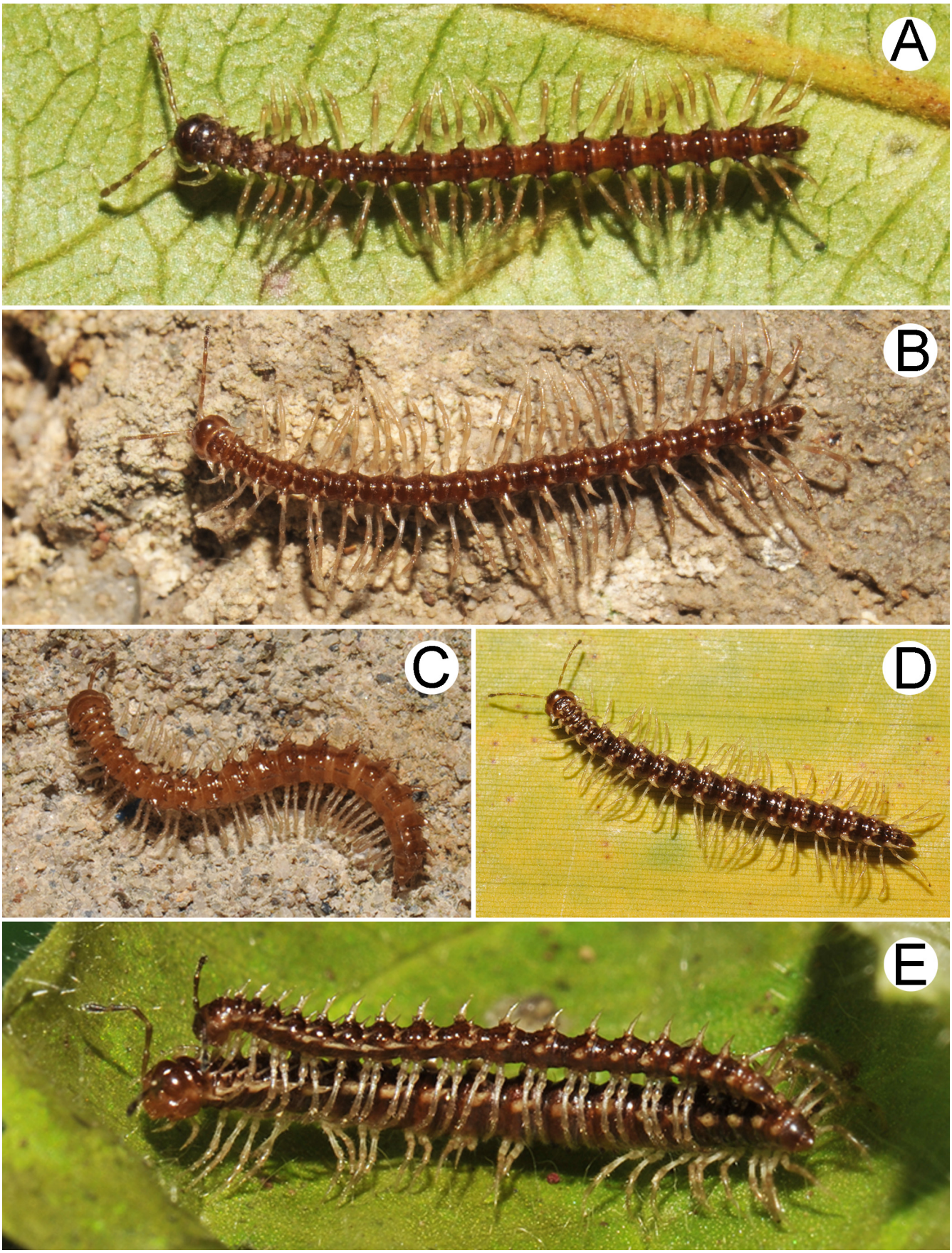

Fig. 1. Live individuals of species of *Burmaxytes*. A, C, *Burmaxytes mombergi*, new species. A, male paratype CUMZ-pxDGT00223; C, female paratype CUMZ-pxDGT00224. B, D, E, *Burmaxytes whitteni*, new species. B, male paratype CUMZ-pxDGT00225; D, female paratype CUMZ-pxDGT00226; E, mating couple.

Diagnosis. Differs from *B. whitteni* by having stout antenna; mesal spines of posterior row on collum very short; legs stout, tegument microgranulate; metaterga on body rings 6–19 with 2+2 spines in posterior row; ozopore located near base of paraterga; sternal lobe between male coxae 4 large, located halfway between anterior and posterior parts of coxae; male femora 4 modified; coxa microgranulate; mesal and lateral sulci shallow; lamina lateralis long, without lobe.

Description. Size. Length 12–13 mm (male), 12–14 mm (female); width of midbody metazona ca. 1.0 mm (male), ca. 1.2 mm (female). Width of rings 2 = 3 < 4 < 5–17 < collum < head (male), 2 = 3 < 4 < 5 < collum < head ≤ 6–17 (female), thereafter body gradually tapering towards telson.

Colour (Fig. 1A, C). Specimens in life brown; paraterga brownish white; head brown to dark brown; antennae (except whitish distal part of antennomeres 7 and 8), collum, metaterga, prozona, paraterga, surface below paraterga and legs brown; sterna pale brown/whitish brown; epiproct pale brown; a few basal podomeres whitish brown.

Antennae (Fig. 2D). Stout, with very long setation.

Collum (Fig. 2A). With 2+2 setae/small tubercles in anterior row, 1+1 setae/small tubercles in intermediate row and 2+2 spines in posterior row; mesal spines of posterior row very short. Paraterga elevated at ca. 20° (male), 30° (female).

Metaterga (Fig. 2A–C). Metaterga 2–5 with 2+2 small setiferous tubercles in anterior row and 2+2 spines in posterior row; metaterga 6–19 with 2+2 spines in posterior row; lateral spines of posterior row longer than mesal ones.

Paraterga (Fig. 2F–H). Elevated at ca. 50°–60° (male) 40°–50° (female). Ozopore located near base of paraterga.

Sterna (Fig. 2N–P). Sternal lobe between male coxae 4 large, located between anterior and posterior parts of coxae 4.

Legs (Fig. 2Q, R). Quite stout, ca. 2 times as long as midbody height, with microgranulation. Male femora 4 modified, with a bean-like swelling.

Gonopods (Fig. 3). Coxa microgranulate. Mesal and lateral sulci very shallow. Lamina lateralis (ll) long, without lobe, tip directed laterad.

Distribution and habitat. *Burmaxytes mombergi* was collected from limestone areas and is currently known only from three locations in Hpa-An, Kayin state (Myanmar), in a narrow area (Fig. 6A, B). We therefore consider this species as endemic to Myanmar. At Bayin Nyi Cave and Kyonkaw Mountain, some parts of the habitat are being destroyed by local people for temple construction, cave tourism and agricultural purposes.

Remarks. We found morphological variation in the tip of paraterga; slightly straight in specimens from the type locality, bent in the others.

***Burmaxytes whitteni*, new species**
(Figs. 1B, D, E, 4, 5)

Material examined. Holotype: 1 male (length 12 mm, CUMZ-pxDGT00225), MYANMAR, Mawlamyine, Pathein Village, Pathein Mountain, 16°13'25"N 97°56'42"E, ca. 26 m asl, coll. FFI staffs and ASRU members, 5 September 2016. Paratypes: 13 males, 20 females (CUMZ-pxDGT00226), same data as for holotype. Additional material (not paratypes): 13 males, 14 females, MYANMAR, Mawlamyine, Pha Puang Cave, 16°17'12"N 97°54'04"E, ca. 41 m asl, coll. FFI staffs and ASRU members, 4 September 2016; 1 female, MYANMAR, Mawlamyine, Kayon Hill (Kha Yone), Farm Cave, 16°31'58"N 97°42'53"E, ca. 51 m asl, coll. FFI staffs and ASRU members, 3 September 2016.

Etymology. *Burmaxytes whitteni* is named after the remarkable conservationist, Dr. Tony Whitten, a senior adviser at FFI (one of the World's oldest conservation organisations), who was devoted to wildlife conservation and played an important role in several conservation projects. Tony Whitten spent countless hours establishing the IUCN specialist group on karst environments, stimulated increasing conservation action for critical and endangered habitats, and was always a dear colleague whose tireless work and passion inspired all who knew him. Our work received huge support from the limestone conservation projects of FFI, and benefitted tremendously from his support in collecting.

Diagnosis. *Burmaxytes whitteni* can be distinguished from *B. mombergi* by a combination of these morphological characters: antenna slender; mesal spines of posterior row on collum long; legs slender, without microgranulation; metaterga on body rings 6–19 with 2+2 setiferous tubercles in anterior row and 2+2 spines in posterior row; ozopore located at halfway on paraterga; sternal lobe between male coxae 4 small, located between anterior parts of coxae; male femora 4 unmodified; coxa without microgranulation; mesal and lateral sulci quite deep; lamina lateralis with digitiform lobe.

Description. Size. Length 11–14 mm (male), 13–15 mm (female); width of midbody metazona ca. 0.8 mm (male), ca. 1.0 mm (female). Width of rings 2 = 3 = 4 < 5–17 = collum < head (male), 2 = 3 < 4 < 5 < collum = head < 6–17 (female), thereafter body gradually tapering towards telson.

Colour (Fig. 1B, D, E). Specimens in life brown/dark brown; head, antennae (except whitish distal part of antennomeres 7 and 8), collum, epiproct and legs brown; paraterga pale brown; metaterga, prozona and surface below paraterga brown/dark brown; sterna and a few basal podomeres pale brown to whitish.

Antennae (Fig. 4D). Slender, with long setation.

Collum (Fig. 4A). With 2+2 setiferous tubercles in anterior row (not including setae at base of paraterga), 1+1 setiferous tubercles in intermediate row and 2+2 spines in posterior row; lateral spines of posterior row longer than mesal ones.

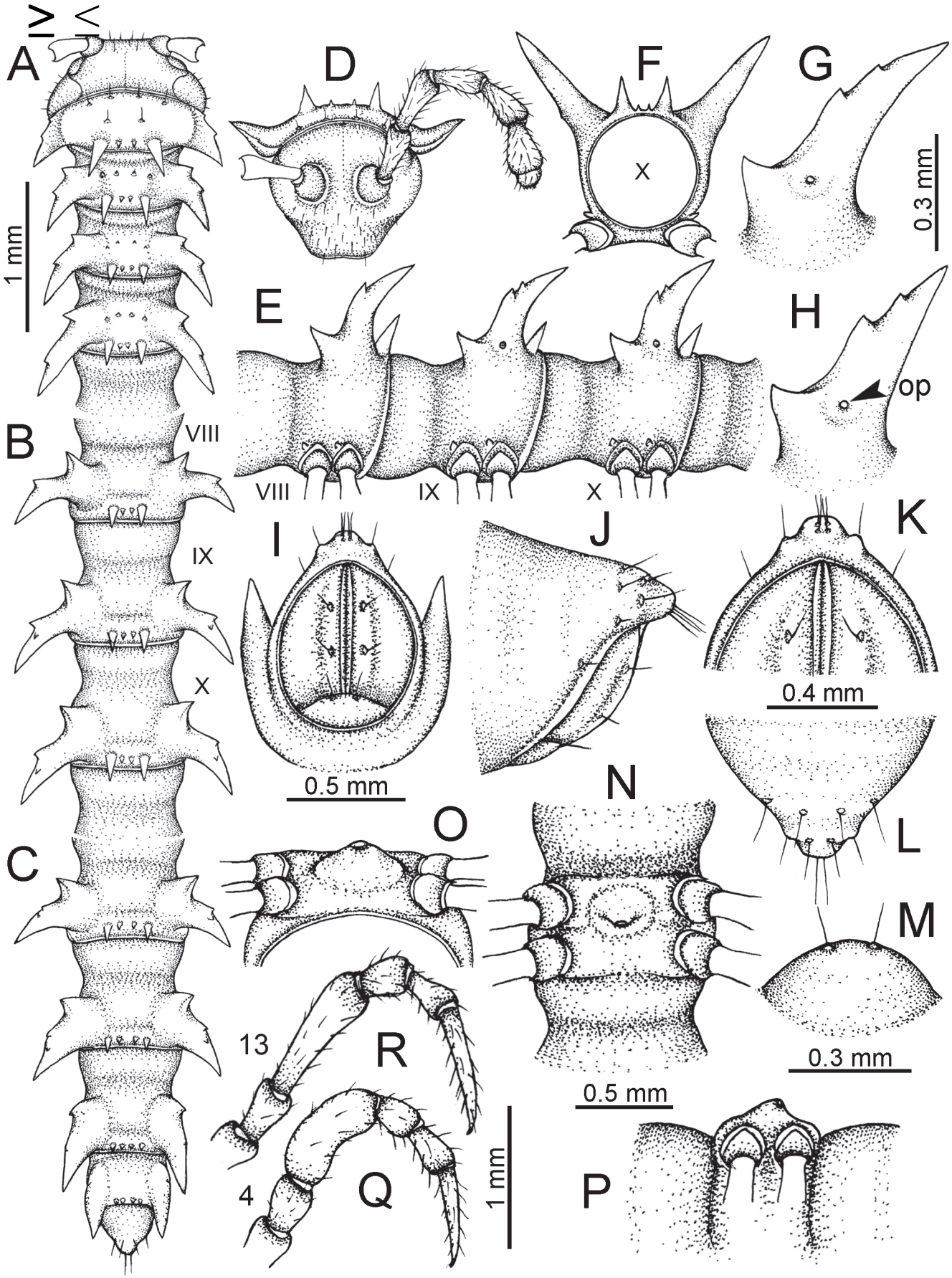

Fig. 2. *Burmaxytes mombergi*, new species, male paratype (CUMZ-pxDGT00224). A, anterior body part; B, body rings 8–10; C, posteriormost body rings and telson; D, head and antenna; E, body rings 8–10; F, midbody ring; G, H, paraterga of ring 10 (G, specimen from Kyonkaow and Bayin Nyi Mountains; H, specimen from Bardai Mountain), arrowhead points to ozopore (op); I, J, last ring and telson; K, L, epiproct; M, hypoproct; N–P, sternal lobe between male coxae 4; Q, male leg 5 (right); R, male leg 6 (right). Scale bars: A–F = 1 mm; G, H = 0.3 mm; I, J = 0.5 mm; K, L = 0.4 mm; M = 0.3 mm; N–P = 0.3 mm; Q, R = 1 mm.

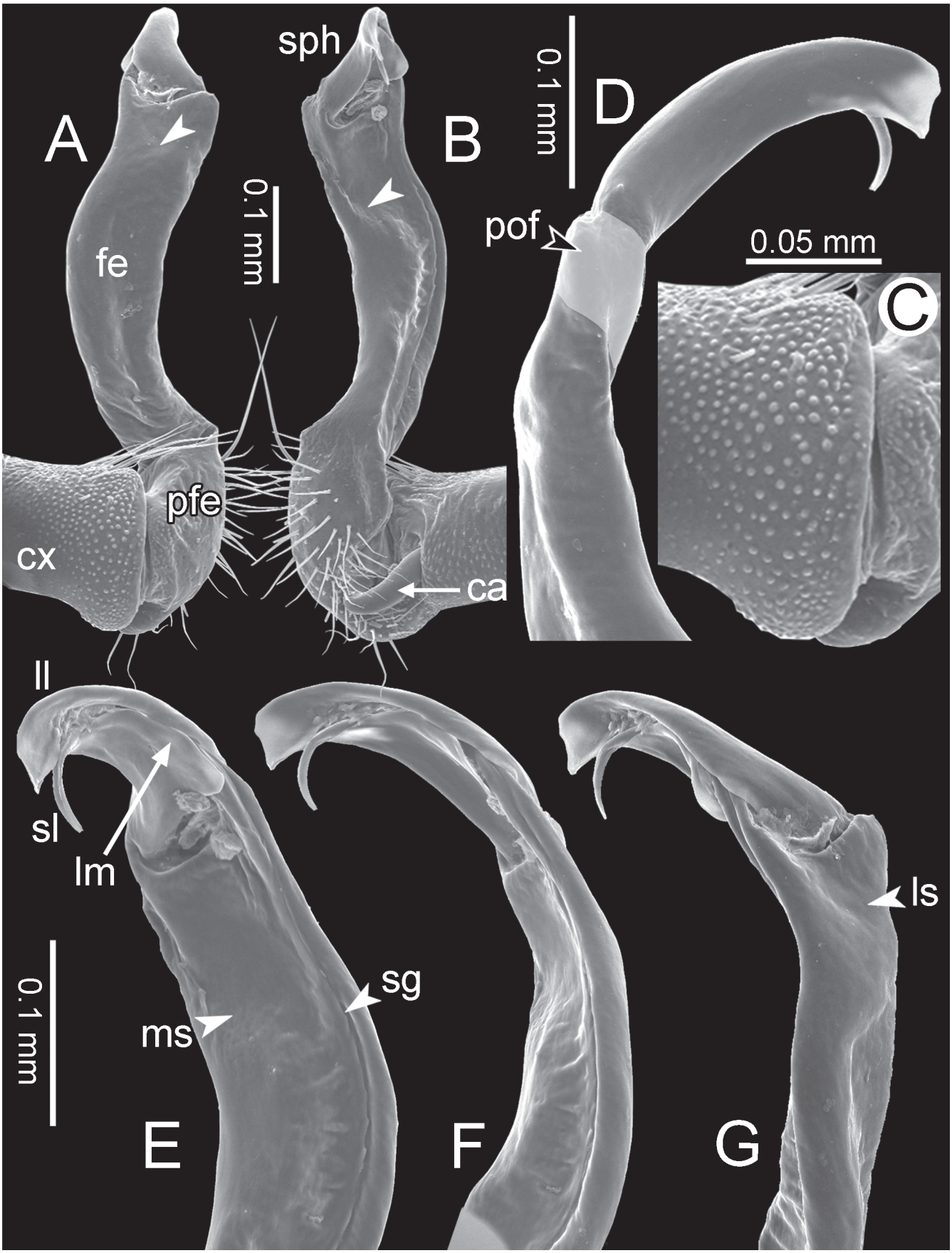

Fig. 3. *Burmaxytes mombergi*, new species, male paratype (CUMZ-pxDGT00224), right gonopod. A, lateral view, arrowhead points to lateral sulcus (ls); B, mesal view, arrowhead points to mesal sulcus (ms); C, coxa microgranulation; D, ventral view; E, mesodorsal view; F, dorsal view; G, laterodorsal view.

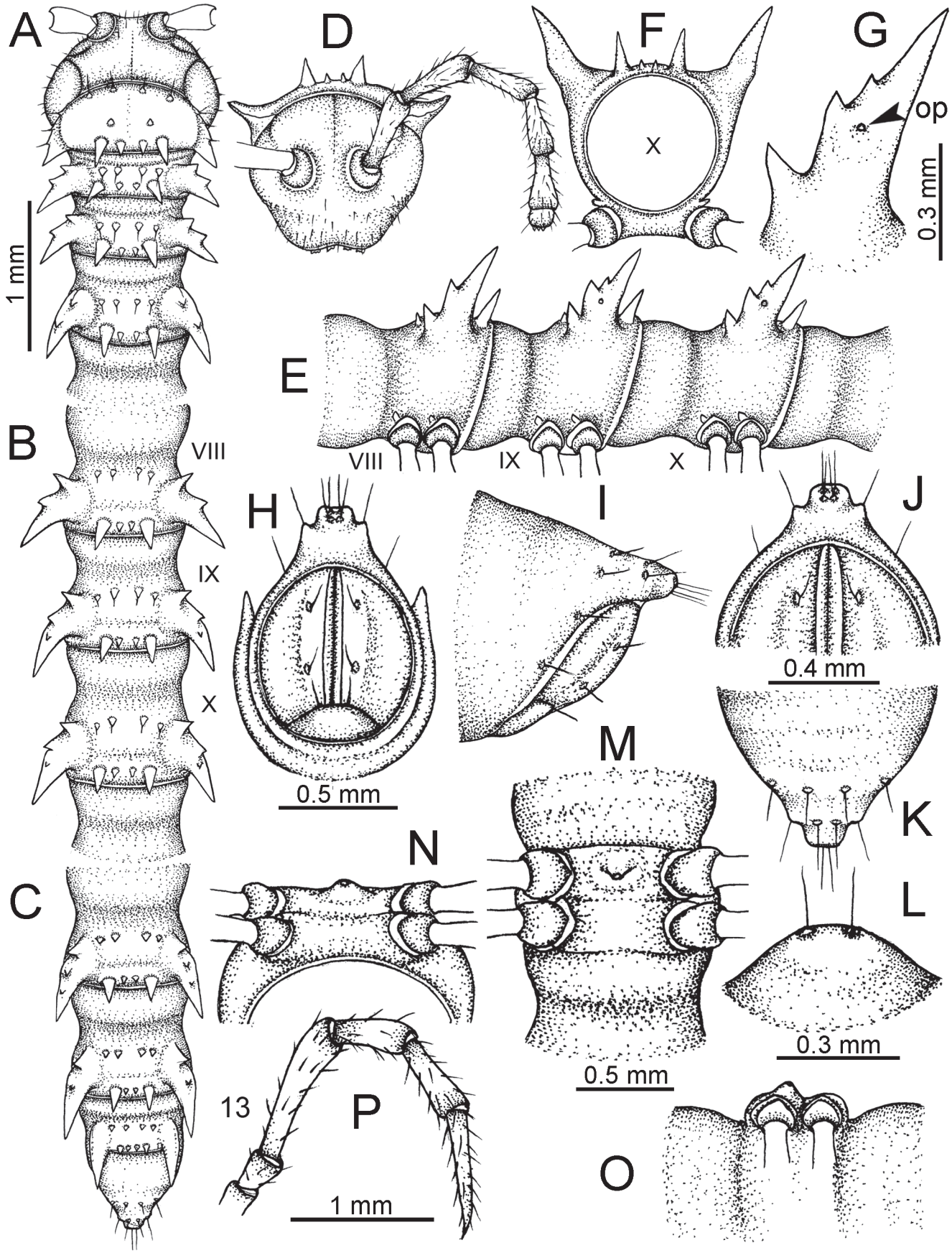

Fig. 4. *Burmaxytes whitteni*, new species, male paratype (CUMZ-pxDGT00226). A, anterior body part; B, body rings 8–10; C, posteriormost body rings and telson; D, head and antenna; E, body rings 8–10; F, midbody ring; G, paraterga of ring 10, arrowhead points to ozopore (op); H, I, last ring and telson; J, K, epiproct; L, hypoproct; M–O, sternal lobe between male coxae 4; P, male leg 5 (right). Scale bars: A–F = 1 mm; G = 0.3 mm; H, I = 0.5 mm; J, K = 0.4 mm; L = 0.3 mm; M–O = 0.3 mm; P = 1 mm.

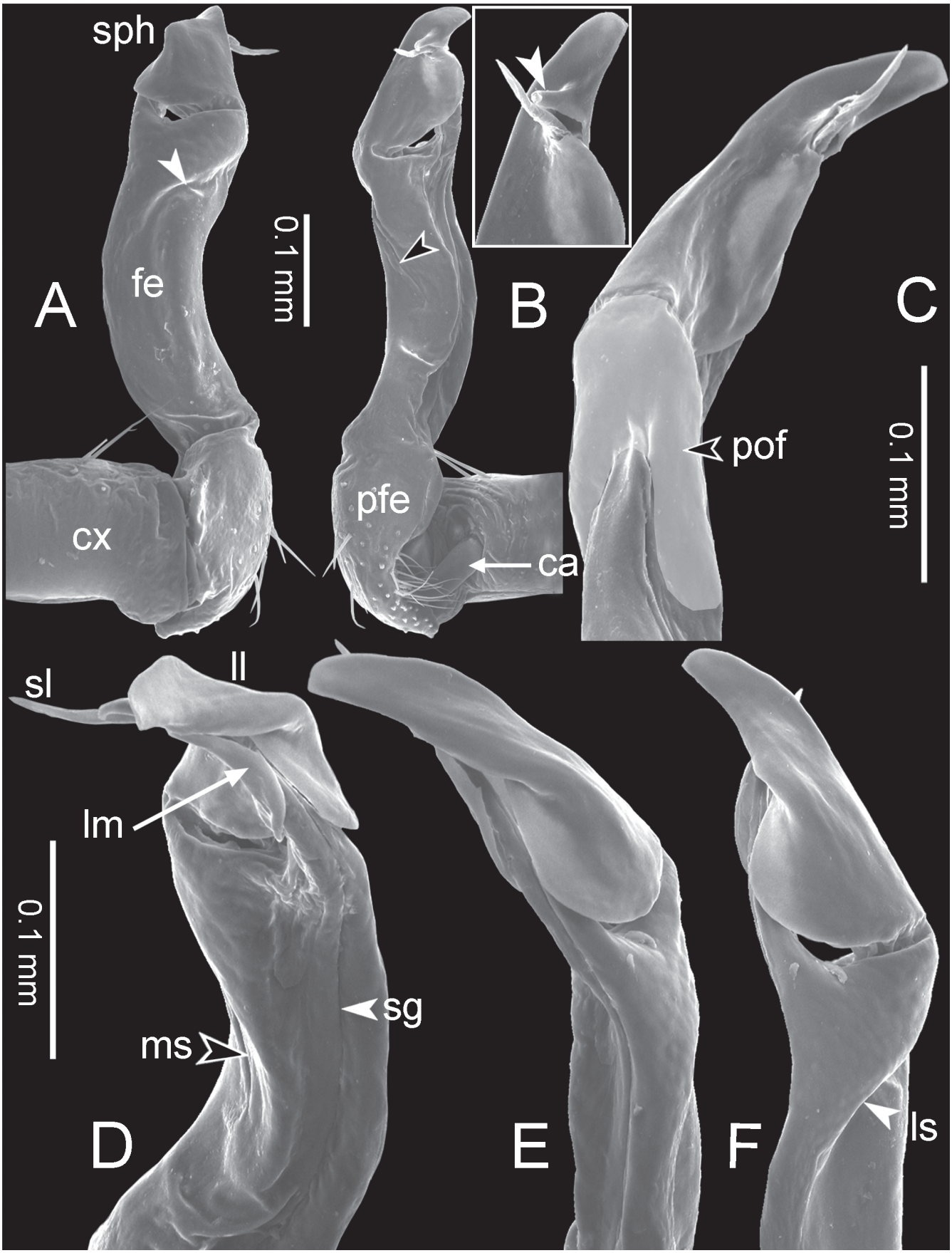

Fig. 5. *Burmaxytes whitteni*, new species, male paratype (CUMZ-pxDGT00226), right gonopod. A, lateral view, arrowhead points to lateral sulcus (ls); B, mesal view, black arrowhead points to mesal sulcus (ms), white arrowhead points to digitiform lobe; C, ventral view; D, mesodorsal view; E, dorsal view; F, laterodorsal view.

Paraterga elevated at ca. 10° (both male and female), anterior margin at base of paraterga with setae.

Metaterga (Fig. 4A–C). Metaterga with 2+2 setiferous tubercles in anterior row and 2+2 spines in posterior row; mesal spines of anterior row shorter than lateral ones; lateral spines of posterior row longer than mesal ones (exception: a female specimen from Farm Cave has metaterga with mesal spines of anterior row longer than lateral ones).

Paraterga (Fig. 4F, G). Elevated at ca. 50° (male) 45° (female). Ozopore located at halfway on paraterga.

Sterna (Fig. 4M–O). Sternal lobe between male coxae 4 small, located between anterior parts of coxae.

Legs (Fig. 4P). Slender, ca. 3 times as long as midbody height, without microgranulation. Male femora unmodified.

Gonopods (Fig. 5). Coxa without microgranulation. Mesal sulcus quite deep; lateral sulcus conspicuous, deep and wide. Lamina lateralis (ll) long, base enlarged, with digitiform lobe near tip (Fig. 5B, arrowhead), tip directed anterolaterad.

Distribution and habitat. *Burmaxytes whitteni* is known only from three localities near Mawlamyine in Mon state, Myanmar, collected only from limestone habitats, exclusively on rock walls, perfectly blending with their environments (Fig. 6A, C). Considering its narrow distribution the new species is here regarded as endemic for Myanmar.

Remarks. No variation has been found for this species. However, one female collected from Farm Cave (Kayon Hill) is here identified as *B. whitteni* due to the similarity to other specimens in almost all morphological characters, especially paratergal shape. The metaterga, however, are markedly different from the others from the type locality and Pha Puang Cave in having larger and longer spines in the anterior row (especially mesal spines). Size of spines on metaterga has long been used to discriminate some species of dragon millipedes, e.g., *Nagaxytes erecta* Srisonchai, Enghoff & Panha, 2018 vs. *N. gracilis* Srisonchai, Enghoff & Panha, 2018, and *Spinaxytes tortioverpa* Srisonchai, Enghoff & Panha, 2018 vs. congeners (Srisonchai et al., 2018b, 2018d). Until male specimens from this locality are been collected and studied we cannot confirm that this female specimen represents another species (and a new species to science). We therefore preliminarily identified and described this female as belonging to *B. mombergi*.

DISCUSSION

The finding of *Burmaxytes*, new genus, from Myanmar highlights the amazing diversity and evolution of the dragon millipedes. Prior to our study, five genera of dragon millipedes were recognised. All five genera have been recorded from Thailand, three from Myanmar, two each from China and Malaysia, and one each from Vietnam and Laos. The genus *Hylomus* is the only genus among the five genera showing very diverse morphological characters in part of the gonopodal solenophore and paratergal shape (Golovatch & Enghoff, 1994; Srisonchai et al., 2018a; Nguyen & Sierwald, 2019). Morphologically, *Burmaxytes* is nearly identical to some species of *Hylomus* with antler-like paraterga and *Orthomorpha*-like gonopods. However, the other morphological characteristics and preliminary molecular phylogenetic results (work in progress) of these two new species differentiate them from most species of *Hylomus* and quite well confirm the validity of the new genus. The geographical distribution also clearly separates *Burmaxytes* from *Hylomus*. The relationships of *Hylomus* itself remain uncertain (Nguyen et al., 2019) and the genus is probably not monophyletic (Nguyen, 2017; Srisonchai, 2019; Nguyen & Sierwald, 2019). Investigation of the relationships of some *Hylomus* specie has been done only in Vietnam by Nguyen et al. (2019), who found that they form a monophyletic group, whereas most of the species of *Hylomus* in China and Laos were excluded. The position of several species of *Hylomus* thus needs to be reconsidered, and *Hylomus* should probably be reorganised into several smaller genera. A taxonomic revision of *Hylomus* should, as mentioned by Nguyen (2017), Srisonchai (2018), and Nguyen & Sierwald (2019), be undertaken with some caution, since the genus as currently defined represents a diverse array of morphological characters and possibly a number of evolutionary lineages. *Burmaxytes* does not fit the definition of other dragon millipede genera, including most species of the genus *Hylomus* which was reinstated to accommodate several diverse morphological species (see Srisonchai et al., 2018a). However, we leave the question open whether some *Hylomus* species and other undescribed specimens from Myanmar perhaps belong to *Burmaxytes*. We hope that further integrative taxonomic studies, which are desirable in order to construct a more robust phylogenetic tree as well as probably contribute to new insights, will lead towards a better understanding of the relationships of *Burmaxytes* with the other dragon millipedes especially with the *Hylomus*.

As mentioned above, the gonopod (solenophore) shape of *Burmaxytes* is particularly similar to that seen in *Hylomus*. Although the structure of the gonopods is basically simple for this genus, it is quite often difficult to identify the various branches due to the small size of gonopods (ca. 0.5 mm). The use of SEM, which has been used previously in several dragon millipede studies, considerably helps, especially because it provides information of more details on the gonopod tip. A search for gonopod microgranulation of dragon millipedes yielded no results whatsoever. To our knowledge, no previous described dragon millipede species shows microgranulation on the gonopod coxa (the surface being always smooth). Thus, out of all the dragon milliped species for which detailed gonopod information is available, *B. mombergi* is the first and only recorded to have microgranulations on the coxa, and this character can be clearly used to distinguish it from *B. whitteni*. A detailed study of the gonopod sculpture and further tegument microstructures on the body rings can certainly help to obtain

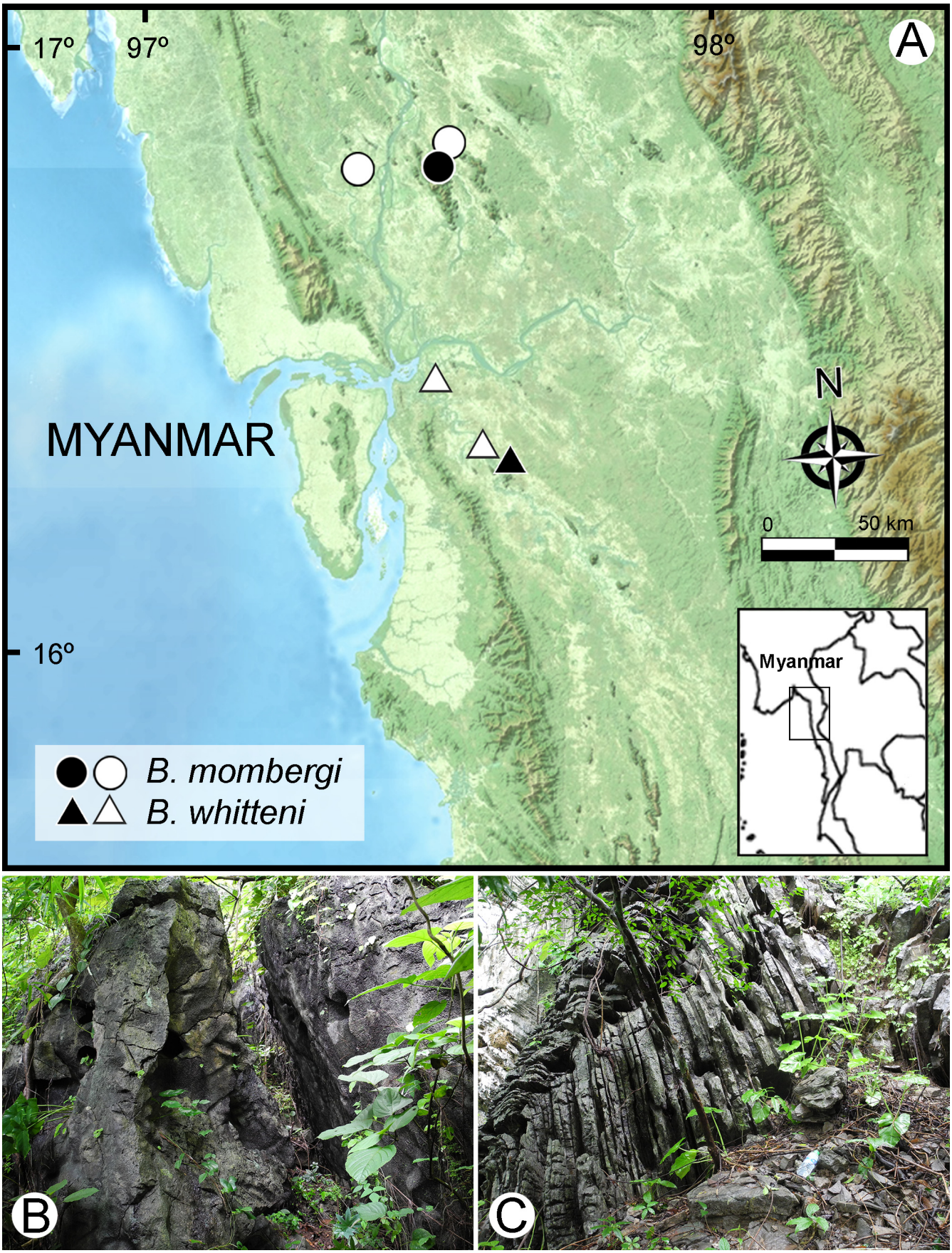

Fig. 6. Known distribution of the two species of *Burmaxytes* and their habitats. A, distribution (black symbols: type locality; white symbols: other locality); B, type locality of *B. mombergi*; C, type locality of *B. whitteni*.

a satisfactory classification, as in the other groups of Polydesmida (Akkari & Enghoff, 2011; Likhitrakarn et al., 2018).

The two new species reported here were only found in Mon and Kayin states of Myanmar, which contain several isolated limestone mountains. Even though they live quite close to each other, no sympatry between the two species or with other dragon millipede genera was found. Their presumed limited dispersal abilities would probably restrict them to small distribution areas. According to our field observations, all specimens of *Burmaxytes* occurred on rock walls, where they almost perfectly blended with the environment (Fig. 6B, C), as reported before for many species of *Desmoxytes*, *Nagaxytes* and *Spinaxytes* (Srisonchai et al., 2018a, 2018b, 2018d). These two new species exclusively inhabit such a narrow distribution that they are viewed as highly endemic species for Myanmar (Fig. 6A). Including the two new species, the known dragon millipede fauna in Myanmar is comprised of eight species in four genera, with the global number of dragon millipedes being 80 species in six genera. However, the number of dragon millipede species in Myanmar still appears low, compared to Thailand, Vietnam and China, each of which have around twice that number of known species (Nguyen et al., 2005, 2019; Golovatch et al., 2010, 2012, 2016; Liu et al., 2014, 2016; Srisonchai et al., 2016, 2018a, 2018b, 2018c, 2018d; Likhitrakarn et al., 2017; Golovatch, 2018; Liu & Wynne, 2019; Srisonchai, 2019). It seems likely that only a small fraction of the existent dragon millipede species have been revealed, with a much greater species diversity remaining to be uncovered. Collection for this study in Myanmar was mainly conducted in Kayin and Mon states, while most of the limestone areas in Myanmar are found in Shan and Kayah states which will require further intensive surveys (Bates, 2005; Clements et al., 2006; Dreybrodt & Steiner, 2015). We strongly believe that additional species of *Burmaxytes* and other dragon millipedes will be found in those still unexplored limestone areas.

ACKNOWLEDGEMENTS

The main funding for this research was from the Center of Excellence on Biodiversity (BDC-PG2-161001), and Fauna & Flora International, Myanmar. This work would not have been possible at all without the impressive help from the FFI (especially Frank Momberg & Tony Whitten) and ASRU members for collecting numerous material studied herein. We would like to thank FFI and Ministry of National Resources & Environmental Conservation Forest Department (MONREC, Myanmar) that granted permits for collecting specimens in Myanmar. The subject editor (Louis Deharveng) and reviewers are sincerely thanked for all constructive comments and advice that helped to improve this paper.

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