

***Parapseudoleptomesochra phayaoensis*, a new species of copepod (Copepoda: Harpacticoida: Ameiridae) from a cave in northern Thailand**

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ABSTRACT: A new species of freshwater harpacticoid copepod, *Parapseudoleptomesochra phayaoensis* sp.n., was found in a sample collected from a cave in northern Thailand. The new species resembles *P. italica* Pesce et Petkovski, 1980; however, it differs from *P. italica* by (1) the armature of baseopod and exopod of the fifth leg in both sexes, (2) the setal formula on P1 Exp-3 and P3–P4 Enp-3 and (3) by having a long inner accessory seta (seta VI) on the caudal rami in the female. To our knowledge, this is the first species of the genus *Parapseudoleptomesochra* Lang, 1965 described in Southeast Asia.

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KEY WORDS: cave-dwelling copepod, freshwater, karstic cave, Southeast Asia, stygobionts.

***Parapseudoleptomesochra phayaoensis*, новый вид копепод (Copepoda: Harpacticoida: Ameiridae) из пещеры в северном Таиланде**

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РЕЗЮМЕ. Новый вид пресноводных гарпактикоидных копепод *Parapseudoleptomesochra phayaoensis* sp.n. обнаружен в пробе из пещеры на севере Таиланда. Новый вид наиболее близок к виду *P. italica* Pesce et Petkovski, 1980 и отличается от него (1) вооружением базоподита и экзоподита пятой ноги у обоих полов, (2) формулой вооружения дистального членика экзоподита первой плавательной ноги и дистального членика эндоподита третьей и четвертой плавательных ног и (3) наличием длинной внутренней добавочной щетинки (щетинка VI) на каудальных ветвях самки. Данное описание — первая находка представителя рода *Parapseudoleptomesochra* Lang, 1965 в Юго-восточной Азии.

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КЛЮЧЕВЫЕ СЛОВА. Пещерные веслоногие ракообразные, пресноводные водоемы, карстовые пещеры, Юго-восточная Азия, стигобионты.

Introduction

The hypogean *Parapseudoleptomesochra* Lang, 1965, is a diverse genus of the family Ameiridae Monard, 1927. Despite being of marine origin, this genus has successfully colonized freshwater and groundwater habitats, such as springs, wells, and caves (Rao, 1972; Kunz, 1975; Pesce, 1981; Dumont, 1984; Rouch, 1986; Boxshall, Halsey, 2004; Karanovic, 2006; Boxshall, Defaye, 2008).

The genus *Parapseudoleptomesochra* was established by Lang (1965) to include the marine species *Ameira trisetosa* Krishnaswamy, 1957 from the coast of Madras. The genus *Parapseudoleptomesochra* differed from other ameirid genera by their 3-segmented endopods on P2–P4; other characters have not been considered (Lang, 1965; Petkovski, 1976). Pesce and Petkovski (1980) emended the generic diagnosis of the genus *Parapseudoleptomesochra* to include information about the segmentation of the swimming legs (P1–P4 with 3-segmented exopod and endopod), the presence or absence of an inner seta on P1 Exp-2, the absence of inner seta in P2–P4 Exp-1, the presence or absence of an inner seta on P2–P4 End-2, and the presence of two outer spines in P2–P4 Exp-3. Mielke (1995) considered that the genus *Parapseudoleptomesochra*, as characterized by Pesce & Petkovski (1980), did not represent a monophyletic taxon and most characters were considered plesiomorphic. He interpreted the absence of inner seta in P2–P4 Exp-1 and the presence of two outer spines in P3–P4 Exp-3 as apomorphies. Moreover, he proposed that specimens of *P. trisetosa* (Krisnaswamy, 1957) from the Caribbean coast of Venezuela were conspecific with those from the type locality of Madras, although his specimens clearly differ from

the original description of *P. trisetosa* by Krisnaswamy (1957). Mielke's specimens differ from *P. trisetosa* (Krisnaswamy, 1957) by having 8 segments of antennule in the female (7 segments in the Indian species), bearing 1-segmented exopod on antenna (2-segmented in the Indian species), the P1 Enp-3 with 3 setae (2 setae in the Indian species), the P3 Enp-3 with 2 setae (only 1 seta in the Indian species), the presence of 4 setae on the female baseoendopod (3 setae in the Indian species), the presence of 2 setae on the male baseoendopod (only 1 seta in the Indian species).

Currently, 28 species and subspecies have been recognized in the genus *Parapseudoleptomesochra* Lang, 1965. These species are widely distributed across Africa, Asia, Australia, Europe, and North America, but information on this genus is lacking from Southeast Asia (Karanovic, 2004, 2006; Wells, 2007). Most of the species of the genus *Parapseudoleptomesochra* can be found in subterranean habitats such as the hyporheic zones, springs, and other types of groundwater environments (Pesce, 2016).

In Southeast Asia, approximately 42 species of groundwater copepods belong to the genera *Asiacaris* Cottarelli, Bruno et Berera, 2010, *Attheyella* Brady, 1880, *Boholina* Fosshagen et Iliff, 1989, *Bryocyclops* Kiefer, 1927, *Elaphoidella* Chappuis, 1929, *Epactophanes* Mrázek, 1893, *Fierscyclops* Karanovic, 2004, *Hadodiaptomus* Brancelj, 2005, *Kinnecaris* Jakobi, 1972, *Nitokra* Boeck, 1865, *Onychocamptus* Daday, 1903, *Parastenocaris* Kessler, 1913, and *Phyllognathopus* Mrázek, 1893. Most of the species are recorded from Thailand, and have been collected from epikarstic habitats (Brancelj *et al.*, 2010, 2013; Watiroyam *et al.*, 2012; Watiroyam *et al.*, 2015a, b, 2017; Watiroyam, Brancelj, 2016; Karanovic *et al.*, 2017,

Boonyanusith *et al.*, 2018; Watiroyam, 2018a, b). However, no representative of the genus *Parapseudoleptomesochra* has been reported from Thailand. During our investigation of cave-dwelling copepods in northern Thailand, the first record of the genus *Parapseudoleptomesochra* is herein presented and a new species of this genus from the Chom Sin cave, Phayao Province, northern Thailand is described.

Materials and methods

Qualitative samples were collected from pools on the floor of Chom Sin cave in Phayao Province, northern Thailand, from July 2015 to June 2016 using a 30 μm mesh hand net. The concentrated samples were directly preserved in 4% formalin. The samples were transferred to pure glycerol and dissected at 100x using an Olympus SZ40 stereomicroscope. For illustrations, the habitus and dissected appendages were drawn at 400x and 1000x with the aid of a drawing tube mounted to an Olympus CH30 compound microscope. The CorelDRAW Graphics Suite 2017 program was employed for the final version of the illustrated figures. Specimens for a scanning electron microscopy (SEM) were dehydrated in graded ethanol concentrations, and then transferred to pure isoamyl acetate. The specimens were placed in a critical-point apparatus for drying. Dried specimens were mounted on stubs and coated with gold. The descriptive terminology follows Huys & Boxshall (1991). Abbreviations used in the text are: End — endopod; Exp — exopod; Exp (End)-1(2, 3) to denote the proximal (middle, distal) segment; ae — aesthetasc; P1–P6 — first to sixth thoracic appendages. The type material is deposited at the Natural History Museum (NHMUK) of London, United Kingdom.

Taxonomic account

Order Harpacticoida Sars, 1903

Family Ameiridae Monard, 1927

Genus *Parapseudoleptomesochra* Lang, 1965

Parapseudoleptomesochra phayaoensis sp.n.

Figs. 1–8.

ETYMOLOGY. The specific name *phayaoensis* is taken after the type locality, Phayao Province. The name is with the Latin suffix “-ensis”, which refers to the type locality.

TYPE LOCALITY. Chom Sin cave, Ban Tham Subdistrict, Dok Kham Tai District, Phayao Province, Northern Thailand (19°04' 52.68" N, 100°04'24.74" E), 443 m above sea level. The cave is about 15 m long, with one single horizontal gallery. Most of the cave is completely dark with little airflow. A pool filled with percolating water about 4 m in diameter, is located in the inner part of the cave, and is not connected to any surface water. On the collecting date (10 June 2016), the following water parameters were measured: temperature 26.6 °C, pH 7.3, a conductivity of 639.3 $\mu\text{S cm}^{-1}$, dissolved oxygen 4.7 mg L^{-1} , nitrate concentration 1.1 mg L^{-1} and orthophosphate concentration 0.56 mg L^{-1} .

MATERIAL EXAMINED. Holotype: one adult female (NHMUK 1009), dissected and mounted in glycerol on one slide; allotype, one adult male (NHMUK 1010), dissected and mounted in glycerol on one slide; paratypes, eleven adult females (NHMUK1011–1021), undissected and preserved in 70% ethanol in a 1.5 mL microtube. All specimens were collected on 10 June 2016 by K. Koopoot.

DESCRIPTION OF FEMALE. Body length (measured from anterior margin of rostrum to posterior of caudal rami, excluding caudal setae), 575–609 μm ($n = 5$; mean = 591 μm), fusiform (Fig. 1A–C). Prosome/urosome ratio 1.8 with largest width along posterior margin of cephalothorax. Naupliar eye not discernible. Rostral tip short and small. Cephalothorax nearly ovoid on lateral view, proportional length/width cephalothorax about 1.0. Integument of cephalic shield bearing several pairs of sensilla on dorsal surface (Fig. 1D, E). Posterior margin of prosomites smooth dorsally (Fig. 1F).

Fifth pedigerous somite, thoracic somite (Fig. 2A) with serrated posterior margin, ornamented with transverse rows of tiny spinules on lateral view. Genital double-somite (Fig. 2A) 0.6 times as long as wide, with short rows of minute spinules laterally on proximal half

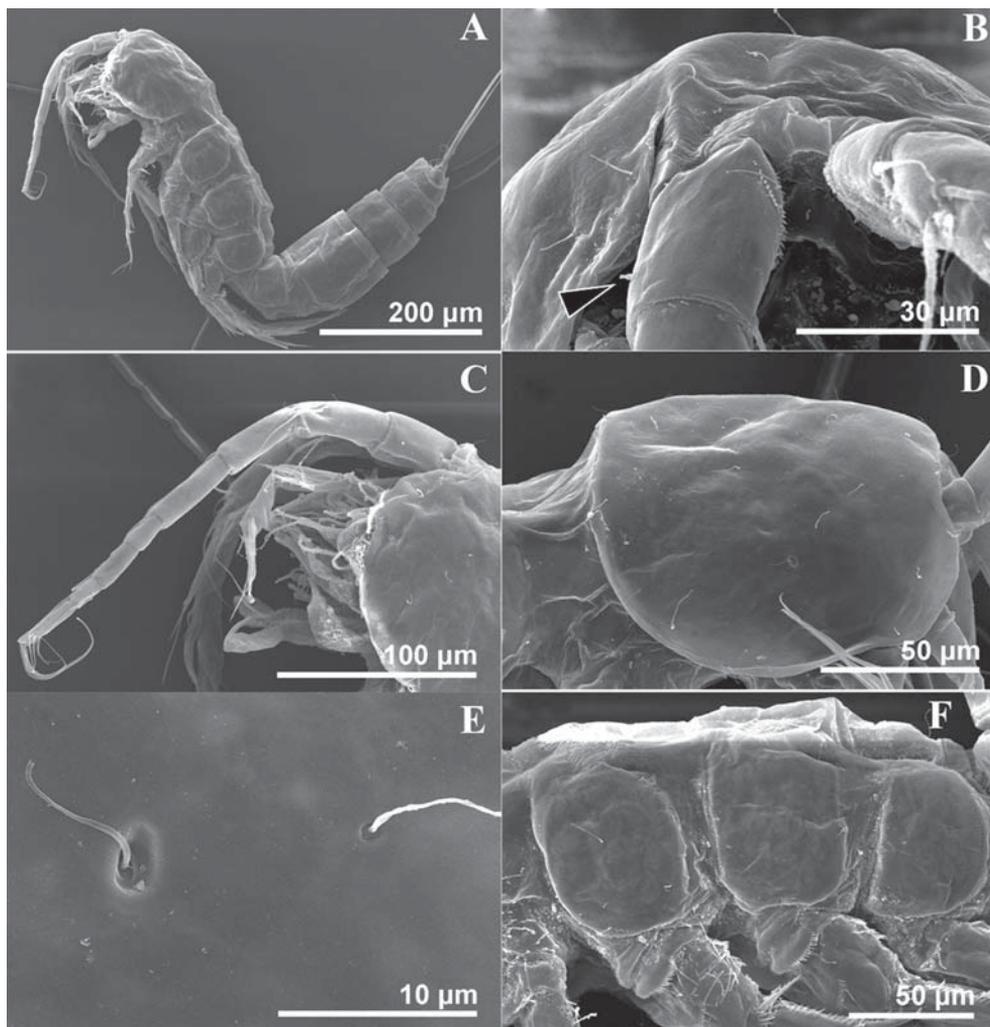


Fig. 1. *Parapseudoleptomesochra phayaoensis* sp.n., SEM photographs, female: A — habitus, lateral view; B — rostral area of cephalothorax, ventroanterior view (arrow indicates a cuticular tube); C — frontal part of cephalothorax with appendages, lateral view; D — cephalothorax, lateral view; E — two sensilla on cephalothorax; F — tergites of free prosomites with coxa and basis of P2–P4.

Рис. 1. *Parapseudoleptomesochra phayaoensis* sp.n., СЭМ, самка: А — вид сбоку; В — рostrальная область головогруди, переднеventрально (стрелка указывает на кутикулярную трубку); С — фронтальная часть головогруди с конечностями, вид сбоку; D — головогpyдь, вид сбоку; E — две сенсиллы на головогpyди; F — тергиты свободных сегментов просомы с коксой и базисом ног 1–4.

and a transverse row above its posterior margin, hyaline fringe serrated on posterior margin. Genital complex with single copulatory pore, seminal receptacles curve and strongly sclerotized. P6 reduced, fused into a small plate on each side of copulatory pore, without armature (Fig. 5A). Urosomites 3–4 with a

continuous row of minute spinules above posterior margins; with serrated hyaline frills on posterior margins (Figs 2B–D, 5A). Anal somite (Figs 2E, F, 5A, B) with short row of spinules on dorsal surface; posterior margin consisting of prominent spinules on dorsal, lateral and ventral views.

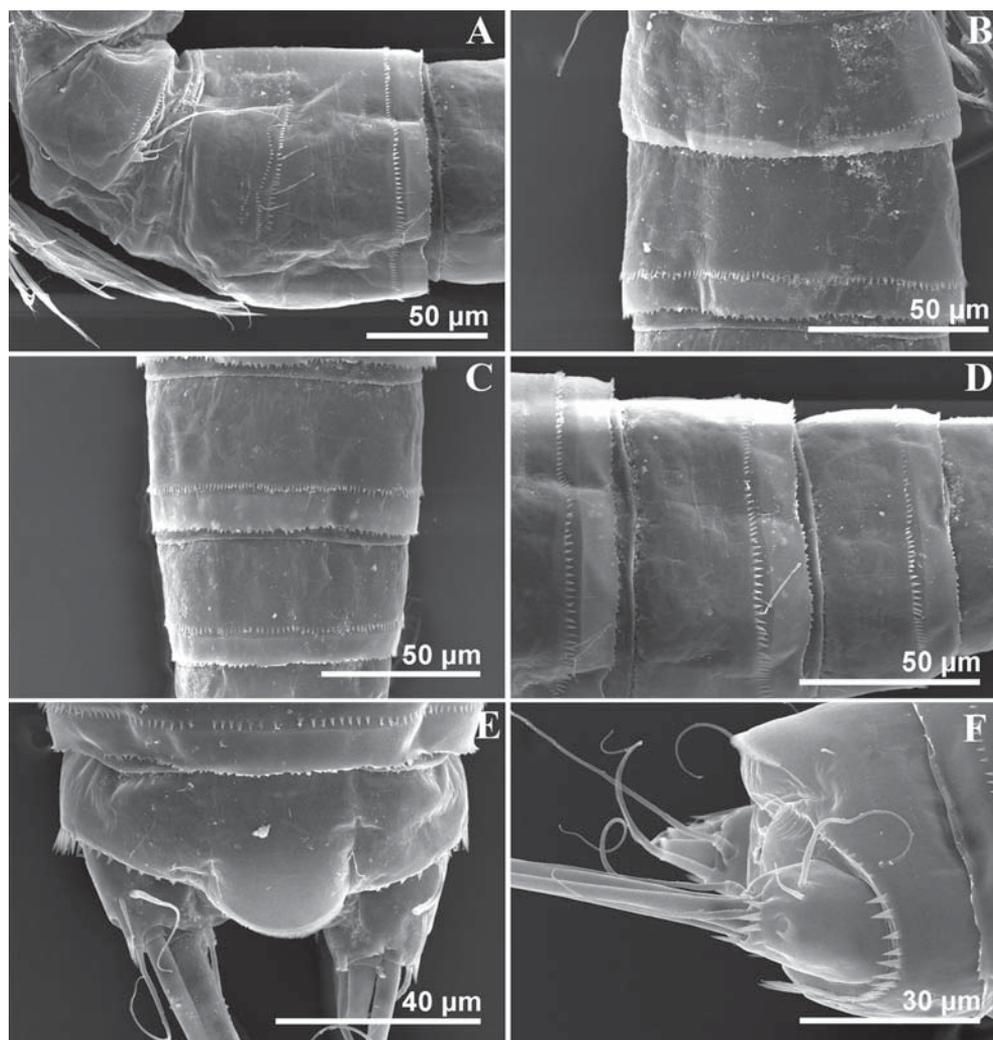


Fig. 2. *Parapseudoleptomesochra phayaoensis* sp.n., SEM photographs, female: A — 5th pedigerous somite and genital double-somite, lateral view; B — 2nd (genital) and 3rd urosomites, dorsal view; C — 4th and 5th urosomites, dorsal view; D — 4th and 5th urosomites, lateral view; E — anal somite and caudal rami, dorsal view; F — anal somite and caudal rami, lateral view.

Рис. 2. *Parapseudoleptomesochra phayaoensis* sp.n., СЭМ, самка: А — сегмент с 5-й парой ног и генитальный двойной сегмент, вид сбоку; В — 2-й (генитальный) и 3-й сегменты уросомы, вид сверху; С — 4-й и 5-й сегменты уросомы, вид сверху; D — 4-й и 5-й сегменты уросомы, вид сбоку; Е — анальный сегмент и каудальные ветви, вид сверху; F — анальный сегмент и каудальные ветви, вид сбоку.

Anal operculum (Figs 2E, F, 5B) convex, reaching beyond somite, with frill on its margin.

Caudal rami (Figs 2E–F, 3A, 5A, B) subconical, about 1.2 times as long as wide, slightly divergent, armed with seven elements. Armature consists of one short anterolateral external

accessory seta (seta I) and a long anterolateral external seta (seta II). Posterolateral seta (seta III) about 1.9 times as long as caudal ramus, with three large spinules at base of distal posterolateral seta. Outer terminal seta (seta IV) without breaking plane, pinnate at distal end,

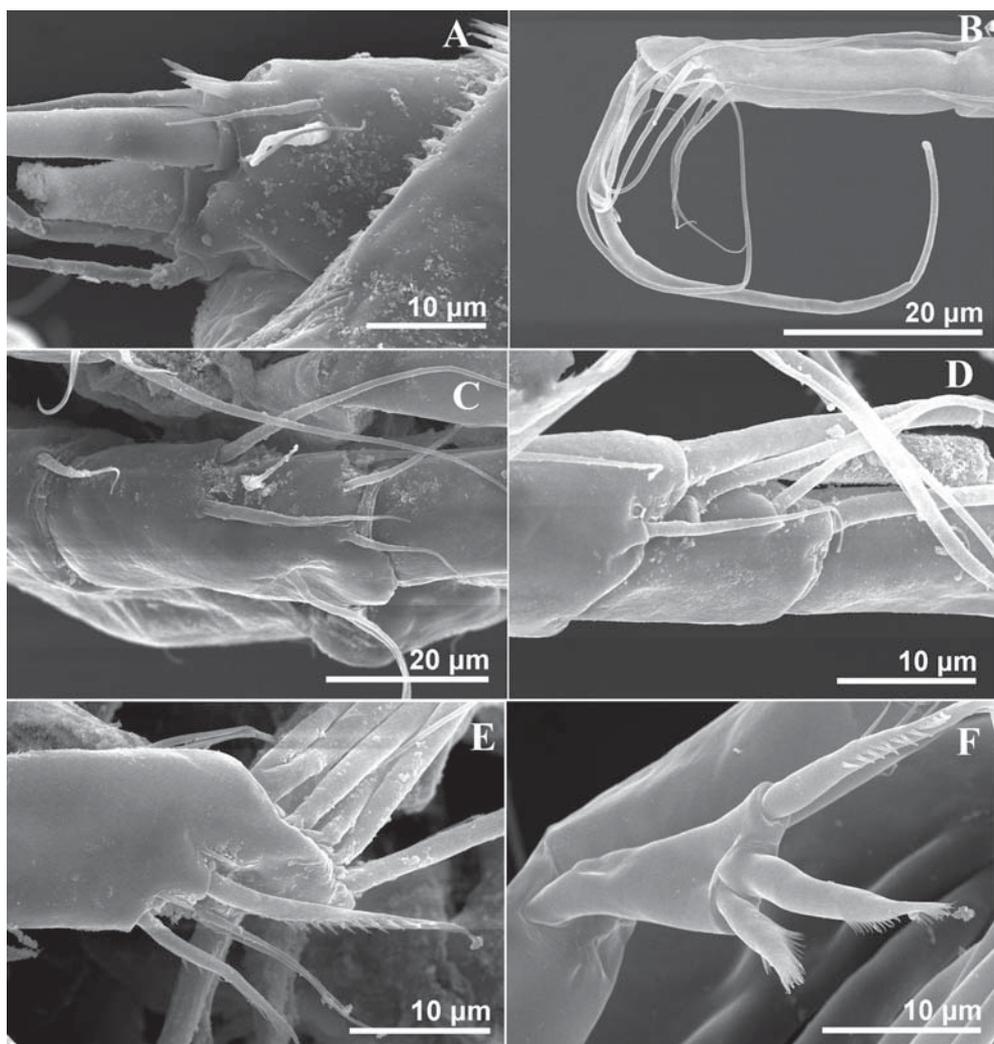


Fig. 3. *Parapseudoleptomesochra phayaoensis* sp.n., SEM photographs, female: A — left caudal ramus, dorsal view; B — last two segments of antennule, lateral view; C — first two segments of antennule, anterior view; D — 4th to 6th segments of antennule, anterior view; E — distal tip of antennal endopod, anterior view; F — Exp of antenna, lateral view.

Рис. 3. *Parapseudoleptomesochra phayaoensis* sp.n., СЭМ, самка: А — левая каудальная ветвь, вид сверху; В — два дистальных членика антеннул, вид сбоку; С — два проксимальных членика антеннул, вид спереди; D — 4–6-й членики антеннул, вид спереди; E — дистальный отдел эндоподита антеннул, вид спереди; F — экзоподит антенны, вид сбоку.

about 3.7 times as long as caudal ramus. Inner terminal seta (seta V) slightly enlarged base and relatively long, without breaking plane, pinnate at distal end, about 20 times as long as caudal ramus. Inner accessory seta (seta VI) smooth, about 2.4 times as long as caudal ramus. Dorsal

seta (seta VII) articulated, arising near posterior inner edge, about 3.7 times as long as caudal ramus.

Antennule (Figs. 3B–D, 6A) eight-segmented and elongate, longer than cephalothorax. Aesthetasc on fourth segment not reaching be-

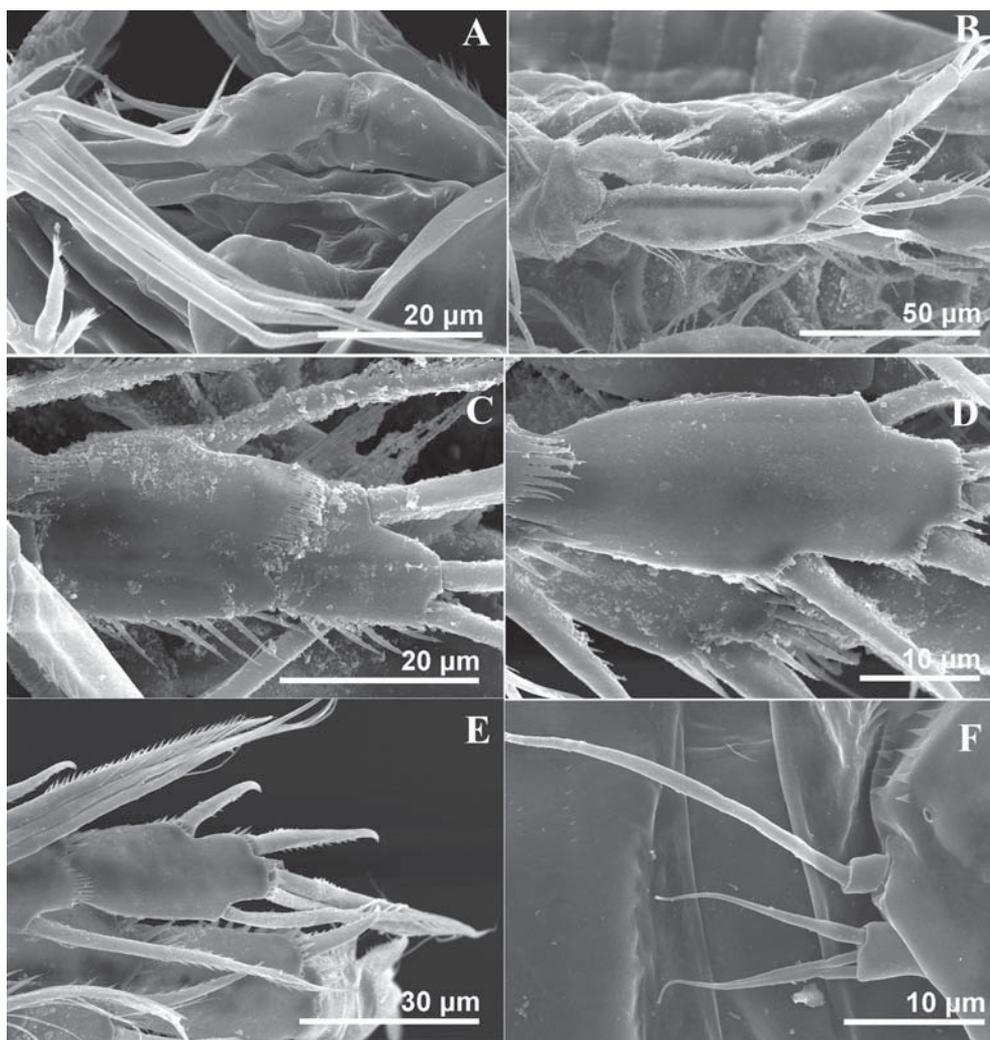


Fig. 4. *Parapseudoleptomesochra phayaoensis* sp.n., SEM photographs, female: A — mouth appendages, lateral view; B — P1, anterior; C — P2 Enp, anterior view; D — P2 Exp-3, anterior view; E — P3 Exp-3, anterior view; F — P5, lateral view.

Рис. 4. *Parapseudoleptomesochra phayaoensis* sp.n., СЭМ, самка: А — околоротовые конечности, вид сбоку; В — нога 1, вид сбоку; С — вид спереди; D — дистальный членок экзоподита 2-й ноги; E — дистальный членок экзоподита 3-й ноги, вид спереди; F — нога 5, вид сбоку.

yond tip of last segment. Setal formula: I (1), II (9), III (5), IV (2, 1+ae), V (4). VI (2), VII (5), VIII (6). Segment 1 with one smooth seta and row of spinules, with cuticular tube on anterior surface (Fig. 1B).

Antenna (Figs 3E, F, 6B) composed allobasis, two-segmented Enp and one-segmented Exp. Allobasis unarmed, about 1.5 times as long as

wide, with row of spinules along outer margin. Enp-1 about 2.8 times as long as wide, unarmed and unornamented. Enp-2 with nine elements: with two surface frills subdistally, armed laterally with two pinnate spines and one slender seta; ornamentation consist of two large spinules distally on anterior surface, apical armature consisting of five geniculate setae, longest one

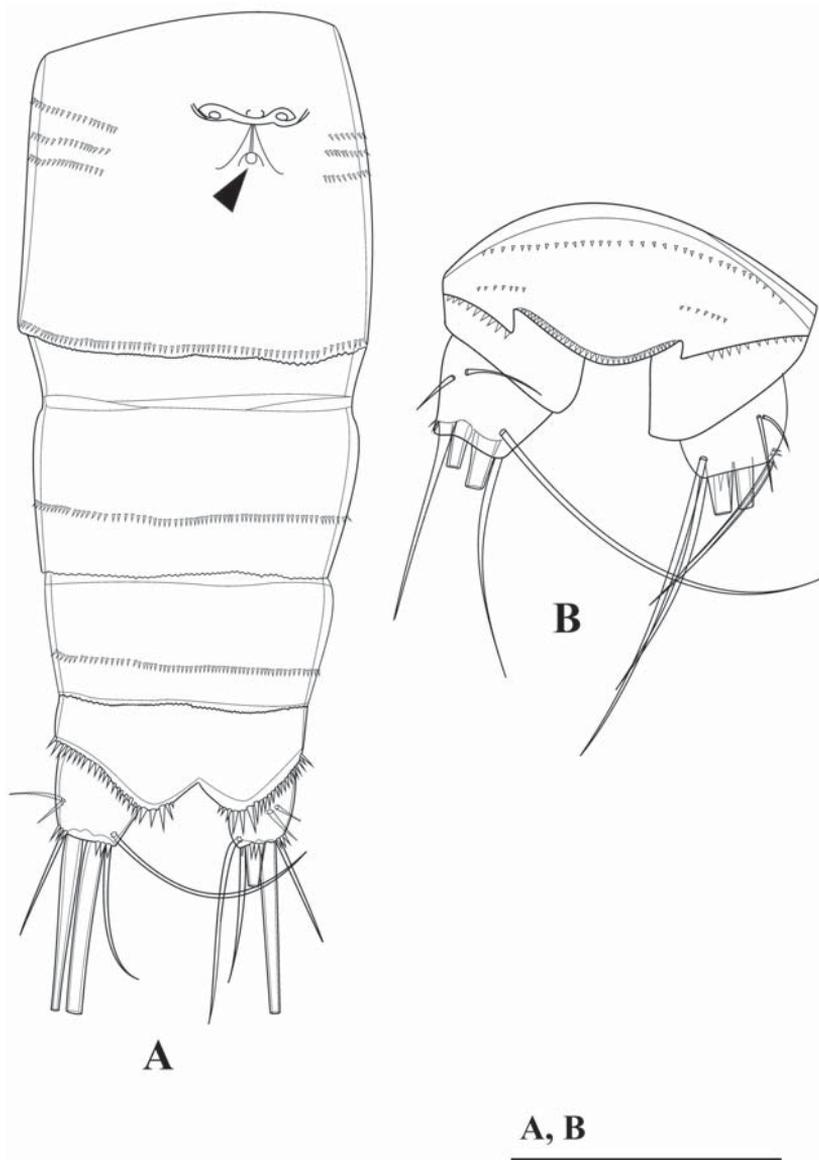
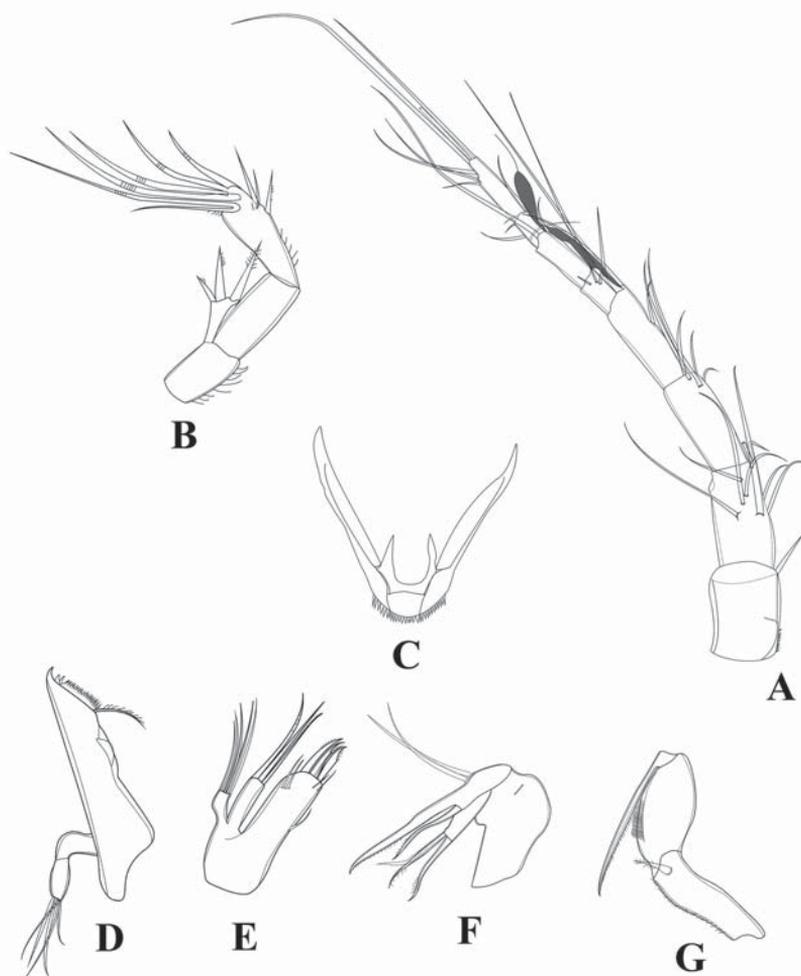


Fig. 5. *Parapseudoleptomesochra phayaoensis* sp.n., female (holotype): A — urosomites 2–5 with caudal rami, ventral view (arrow indicates a copulatory pore); B — caudal rami, dorsal view. Scale bar 0.1 mm.
 Рис. 5. *Parapseudoleptomesochra phayaoensis* sp.n., самка (голотип): А — сегменты уросомы 2–5 с каудальными ветвями, вид снизу (стрелка указывает на копулятивную пору); В — каудальные ветви, вид сверху. Масштаб 0,1 мм.

fused basally to additional smaller and slender seta. Exp with three strong apical setae.

Labrum (Fig. 6C) subtriangular, well-sclerotized, ornamented with a row of teeth on distal margin.

Mandible (Fig. 6D) elongated coxa and wide based. Gnathobase robust, with three slightly curved teeth ventrally and a row of many teeth along distal edge, one unipinnate seta dorsally. Mandibular palp two-segmented, comprising



A, B, C, D, E, F, G

Fig. 6. *Parapseudoleptomesochra phayaoensis* sp.n., female (holotype): A — antennule; B — antenna; C — labrum; D — mandible; E — maxillule; F — maxilla; G — maxilliped. Scale bar 0.1 mm.

Рис. 6. *Parapseudoleptomesochra phayaoensis* sp.n., самка (голотип): А — антеннула; В — антенна; С — лабрум; D — мандибула; E — максиллула; F — максилла; G — максиллипед. Масштаб 0,1 мм.

basis and one-segmented endopod. Basis unarmed and unornamented. Endopod segment slender, with five smooth setae apically.

Maxillule (Fig. 6E) with strong praecoxal arthrite and two long, smooth setae on aboral surface, two smooth setae on inner distal margin, four apical setae (three unipinnate strong

setae and one smooth slender seta) and one seta proximally on oral margin. Coxal endite with three smooth setae. Basis with five smooth setae apically. Exp and Enp absent.

Maxilla (Figs 4A, 6F) composed of syncoxa, basis and one-segmented Enp. Syncoxa with row of spinules on anterior surface, prox-

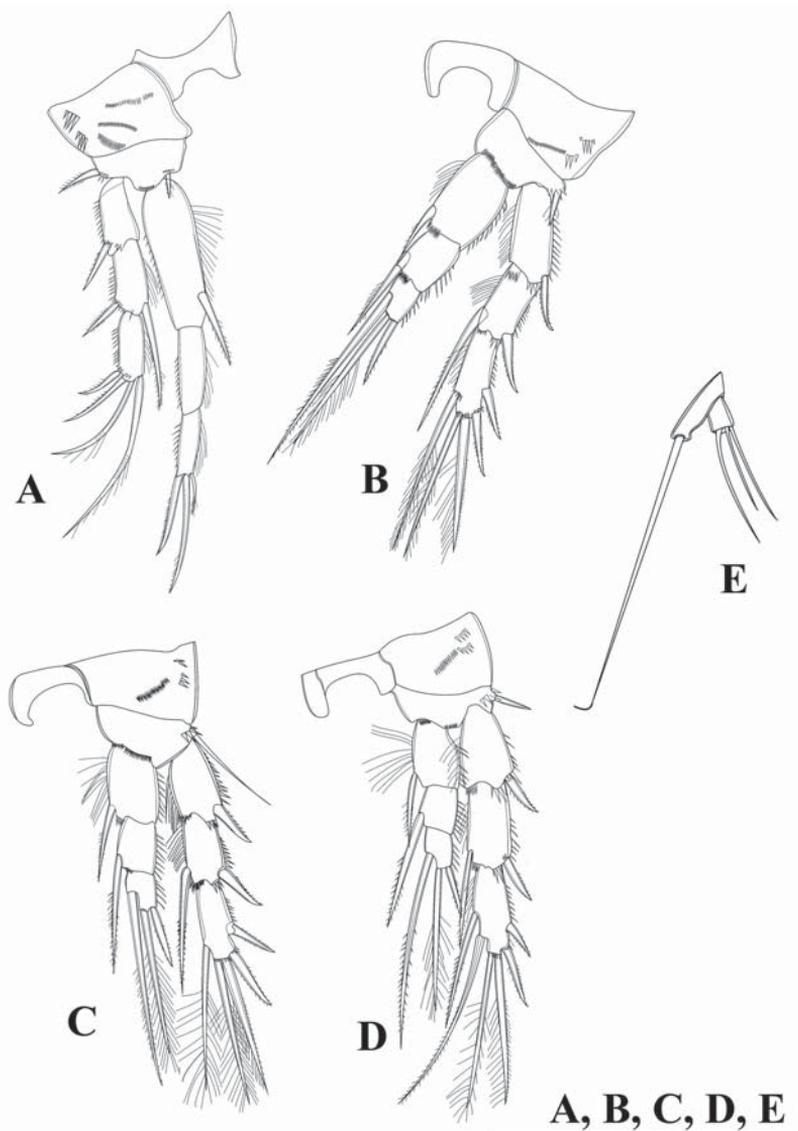


Fig. 7. *Parapseudoleptomesochra phayaoensis* sp.n., female (holotype): A — P1; B — P2; C — P3; D — P4; E — P5. Scale bar 0.1 mm.

Рис. 7. *Parapseudoleptomesochra phayaoensis* sp.n., самка (голотип): А — нога 1; В — нога 2; С — нога 3; D — нога 4; E — нога 5. Масштаб 0,1 мм.

imal endite completely reduced, distal endite armed with two unipinnate spines and one smooth seta. Basis drawn out into robust unipinnate claw and one unipinnate seta. Enp reduced to minute segment, with two smooth setae.

Maxilliped (Fig. 6G) comprising syncoxa, basis and one-segmented Enp. Syncoxa with

row of spinules along inner margin and one pinnate seta. Basis stout, about 1.8 times as long as wide, with a row of spinules along inner median margin. Enp represented by distal unipinnate claw.

P1–P4: (Fig. 7A–D) biramous, with three-segmented Exp and Enp; Exp longer than Enp

on P2–P4, shorter on P1. Armature of P1–P4 as follows (legend: inner/outer spine or seta; inner/terminal/outer; Arabic numerals represent setae; Roman numerals represent spines).

	Exopod			Endopod		
	1	2	3	1	2	3
P1	0/I	1/I	0/2/II	1/0	0/0	1/2/0
P2	0/I	1/I	1/2/II	1/0	1/0	1/2/0
P3	0/I	1/I	1/2/II	1/0	1/0	1/2/0
P4	0/I	1/I	2/2/II	1/0	1/0	1/2/0

P1 (Figs 4B, 7A) coxa; with three rows of spinules on anterior surface and two short rows of spinules on outer margin. Basis with one outer and one inner pinnate spine; row of spinules along outer distal margin, and near base of exopod. Exp-1 with one outer spine on distal margin. Exp-2 with one outer spine on distal margin and one pinnate seta at inner distal margin. Exp-3 with two strong outer spines and two apical geniculate setae. Enp-1 long, about 3 times as long as wide, extending nearly middle half of Exp-3, with one inner pinnate seta distally. Enp-2 unarmed. Enp-3 with two strong apical setae and one thin inner distal seta. All segment of exopod and endopod ornamented with small spinules and hair-like spinules along outer and inner margins, and exopodal segments also with spinules along distal margin.

P2 (Figs. 4C–D 7B) coxa; with one row of spinules on anterior surface and two short rows of spinules on outer margin. Basis with one outer spine; row of spinules along outer distal margin, and near base of endopod. Exp 1–2 with one outer spine on distal margin, Exp-2 with one additional pinnate seta at inner distal margin and an outer bipinnate spine. Exp-3 with two outer spines, two apical pinnate setae (one is spiniform), and inner pinnate seta. Enp-1–2 with inner pinnate seta at distal outer margin. Enp-3 with an inner seta and two apical setae. All segment of exopod ornamented with small spinules and hair-like spinules along outer and inner margins, and exopodal segments also with spinules along distal margin. Enp-1 ornamented with spinules and hair-like spinules along outer and inner margins. Enp-2–3 ornamented with spinules along outer and distal margins.

P3 (Figs 4E, 7C) similar to P2, except basis with slender outer seta. Enp-2 with longer inner seta, reaching to tip of outer apical seta on Enp-3. All segment of exopod and endopod ornamentation similar to P2. Enp-3 with one inner pinnate seta and two apical pinnate setae.

P4 (Fig. 7D) coxa, basis and Exp similar to those in P2, except basis with one outer spine. Exp-3 with two outer spines, two apical pinnate setae (one is spiniform), and two inner pinnate setae. Enp-2 with a long inner seta, reaching to tip of outer apical seta on Enp-3. Enp-3 with one inner pinnate seta and two apical pinnate setae. All segment of exopod and endopod ornamentation similar to P2.

P5 (Figs 4F, 7E): with reduced baseoendopod, with one outer seta. Exp subquadrate, with three smooth setae; inner and outer setae subequal in length, middle seta shortest.

DESCRIPTION OF MALE. (Fig. 8A). Body length 395 μm (measured from anterior margin of rostrum to apex of caudal rami, excluding caudal setae), smaller than female, habitus, general ornamentation of body somites as in female except for typical sexual dimorphism in genital segment, geniculate antennules and P1 basis.

Caudal rami (Fig. 8A) about 1.0 times as long as wide, slightly shorter than those of female. Armature and ornamentation as in female.

Antennule (Fig. 8B) geniculate, ten-segmented, aesthetasc on apical acrothek of segment 5, reaching almost tip of antennule. First segment similar to female. Setal formula as follow: I (1), II (9), III (6), IV (2), V (2+ae), VI (1), VII (1), VIII (1), IX (3), X (8). All setae smooth, except setae on second segment ornamented with one unipinnate and one pinnate and seven smooth setae. Fifth segment ornamented with three spinules on anterior surface.

Antenna, labrum, mandible, maxillule, maxilla, and maxilliped as in female.

P1–P5 (Fig. 8C–D) with same segmentation and majority of ornamentation similar to female but P1 with a modified inner basal spine (Fig. 8C).

P6 (Fig. 8A) completely fused to genital somite, with one smooth seta on each side of posterior margin.

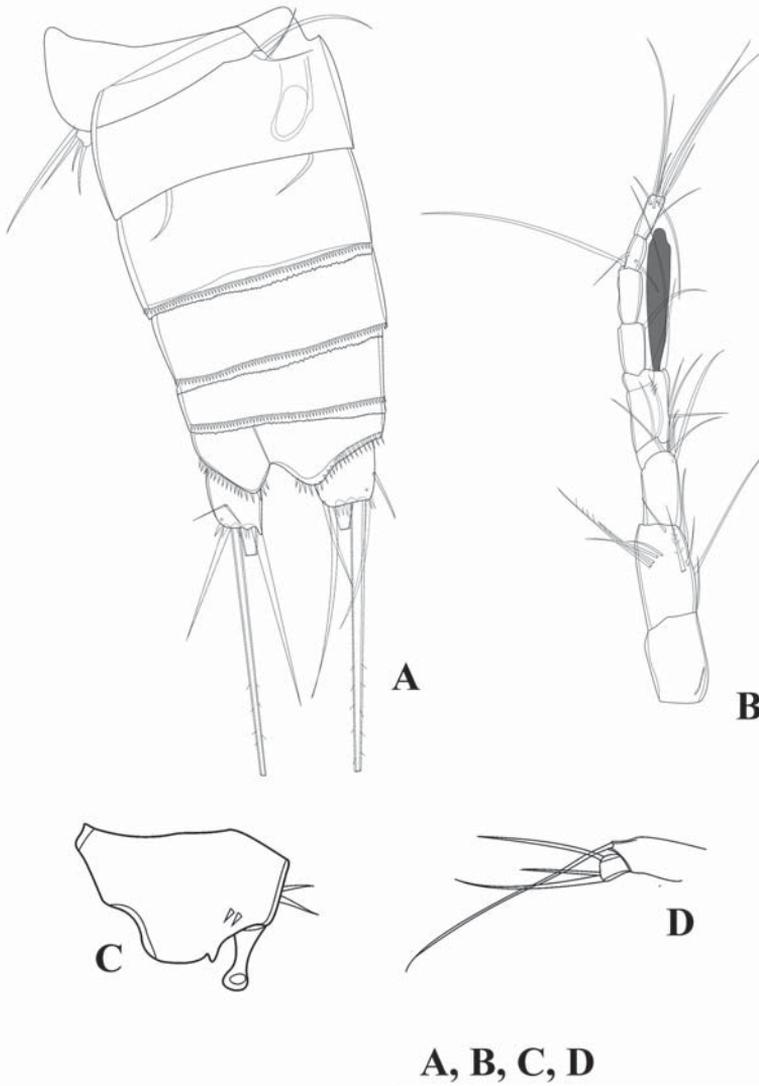


Fig. 8. *Parapseudoleptomesochra phayaoensis* sp.n., male (allotype): A — urosome, P5 and P6; B — antennule; C — a modified spine on basis of P1; D — P5. Scale bar 0.1 mm.

Рис. 8. *Parapseudoleptomesochra phayaoensis* sp.n., самка (аллотип): А — уросома, ноги 5 и 6; В — антеннула; С — измененный шип на базисе ноги 1; D — нога 5. Масштаб 0,1 мм.

Discussion

The genus *Parapseudoleptomesochra* was established by designating the species *Ameira trisetosa* as type species. Walter & Boxshall (2020) placed *P. trisetosa* in the genus *Ameira*, but did not provide any explanations or references. The most recent studies on the genus

Parapseudoleptomesochra agree that the species belonging to this genus share two synapomorphies i.e., there is no inner seta on the P2–P4 Exp-1, and the P3–P4 Exp-3 have two outer spines (Karanovic, 2004; Karanovic, 2006; Wells, 2007). The first character is also presented in some species of *Ameira* such as *A. usitata* Kile, 1950, *A. zahaae* Karanovic et Cho, 2012,

A. kimchi Karanovic et Cho, 2012 (Lang, 1948; Petkovski, 1957; Kunz, 1975; Karanovic, Cho, 2012). It is conceivable that this character is the product of a convergence. The second character does not completely fit to *P. dubia* Kunz, 1975, which has three outer spines on P3 Exp-3. Thus, the presence of the two outer spines on P4 Exp-3 is considered as a synapomorphy for all species of the genus (Pesce, Petkovski, 1980; Pesce, 1981; Dumont, 1984; Rouch, 1986; Mielke, 1995; Karanovic, 2004, 2006; Wells, 2007). This character is also present in *P. trisetosa*, and does not occur in the species belonging to *Ameira*. At present, all species of *Parapseudoleptomesochra* do not share an apomorphy; careful morphological studies are required before a group of species sharing one or more apomorphies can be identified as belonging to *Parapseudoleptomesochra*. Thus, we agree with Lang (1965) to transfer *A. trisetosa* to the genus *Parapseudoleptomesochra*, the type species of the genus *Parapseudoleptomesochra*.

Parapseudoleptomesochra phayaoensis sp.n. shares a number of elements on P2–P3 Exp-3 and P2 Enp-3 with *P. italica* Pesce et Petkovski, 1980 from Italy (Table 1). However, *P. phayaoensis* sp.n. is distinguished from *P. italica* by several morphological features of the female. The chaetotaxy of P1–P4 Enp-3 can separate the females of both species. *P. phayaoensis* sp.n. possesses two apical setae

and two outer spines on the P1 Exp-3, while *P. italica* has two apical setae and three outer spines. The P1 Enp-1 of *P. phayaoensis* sp.n. is approximately 3 times as long as wide, which is longer than the P1 Exp-1–2, while that of *P. italica* is shorter than the P1 Exp-1–2. The inner seta on P1 Exp-2 of *P. phayaoensis* sp.n. is longer than the segment, while that on P1 Exp-2 of *P. italica* is about as long as the segment. The length of P2–P4 Enp-3 in the new species is about two times as long as wide, but for *P. italica* it is more than three times as long as wide. The P4 Enp-3 is armed with one inner pinnate seta and two apical pinnate setae in *P. phayaoensis* sp.n. versus two subapical inner setae and two subapical outer spines in *P. italica*.

The female P5 baseoendopod in *P. phayaoensis* sp.n. is only armed with 1 outer seta (=basal seta) versus five endopodal setae and one basal seta in *P. italica*. The female P5 Exp in *P. phayaoensis* sp.n. bears three setae versus six setae in *P. italica*. Similarly, the male P5 baseoendopod in *P. phayaoensis* sp.n. possesses 1 seta, while that in *P. italica* bears three spines. The male P5 Exp is armed with three setae in *P. phayaoensis* sp.n. versus five setae in *P. italica*. The comparisons of characters between *P. phayaoensis* sp.n. and *P. italica* are presented in Table 1. Furthermore, another feature that distinguishes the new species is the length of the inner accessories seta (seta VI) on

Table 1. Comparisons of morphological characters of *Parapseudoleptomesochra phayaoensis* sp.n. and *P. italica*.

Таблица 1. Сравнение морфологических признаков *Parapseudoleptomesochra phayaoensis* sp.n. и *P. italica*.

Characters (female only)	<i>P. phayaoensis</i> sp.n.	<i>P. italica</i>
Inner seta on Exp-2 P1	Longer than segment	As long as segment
Number of elements on P1 Exp-3	4	5
Number of elements on P2-P3 Exp-3	5	5
Length of Enp-1 P1	Longer than P1 Exp-1-2	Shorter than P1 Exp-1-2
Number of elements on P1 Enp-3	3	3
Number of elements on P2-P3 Enp-3	3 on both	3 on P2 and 4 on P3
Number of elements on P4 Enp-3	3	4
Number of setae or spines on P5 (Exp:endopod)	3:0	6:5

the caudal ramus is less than 1.5 times as long as dorsal seta (seta VII), while the condition in *P. italica* it is less than 3 times as long as the dorsal seta (seta VII).

Additionally, *P. phayaoensis* sp.n. is similar to *P. hellenica* Pesce, 1981 from Greece and *P. attirei* Dumont, 1984 from Sudan by the armature formula of P2–P4 Exp-3 of the females with 5, 5 and 6 elements, respectively.

However, the new species differs from *P. hellenica* in the following features: (1) the P1 Exp-3 of *P. phayaoensis* sp.n. is armed with four elements, while that in *P. hellenica* is armed with five elements, (2) the P4 Exp-3 *P. phayaoensis* sp.n. is armed with three elements, while that in *P. hellenica* is armed with four elements, (3) the length of caudal rami in *P. hellenica* is 1.7–1.9 times as long as wide, while that in *P. phayaoensis* sp.n. is 1.2 times as long as wide ($n = 5$), and (4) the armature of caudal rami in *P. hellenica* is composed of six elements, while that in the new species comprises seven elements.

ECOLOGY AND DISTRIBUTION. *Parapseudoleptomesochra phayaoensis* sp.n. is found only in tiny freshwater pools filled mainly with dripping water from the roof of Chom Sin cave. There are no other subterranean water habitats inside this cave. The cave has one entrance, with a single horizontal gallery, and a permanent absence of light. The new species co-occurs with two cave-dwelling cyclopoid copepods viz., *Thermocyclops thailandensis* Karanovic, Koomput et Sanoamuang, 2017 and *T. parahastatus* Karanovic, Koomput et Sanoamuang, 2017. However, a putative closely related species, *P. italica*, was found in fresh and slightly brackish subterranean waters (anchialine and phreatic habitats) (Pesce, Petkovski, 1980). The family Ameiridae is of marine origin, but some ameirids were reported in both marine and fresh waters, particularly in subterranean environments. Moreover, *P. phayaoensis* sp.n. is considered to be a true stygobiont species by having the following morphological characteristics; the absence of a naupliar eye, a worm-like and cylindrical body, short antennules and antenna, armature reduction on baseopod of P5 (the

new species has only one outer seta but others have 2–7) and a divergent caudal ramus (Pesce, Petkovski, 1980; Pesce, 1981; Dumont, 1984; Rouch, 1986; Mielke, 1995; Karanovic, 2004; Karanovic, 2006). In addition, the new species was collected from an epikarst habitat which is a natural pool filled by dripping water from the cave ceiling, and not connected to any surface water, which also supports the hypothesis of a true stygobiont species.

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