

Description of *Elaphoidella brancelji* sp. nov. (Crustacea, Copepoda), a New Species from a Cave in Northern Thailand

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ABSTRACT.— A new species of *Elaphoidella* Chappuis, 1929 (Copepoda, Harpacticoida) is described based on material collected from Pratummas Cave, Phitsanulok Province, Northern Thailand. *Elaphoidella brancelji* sp. nov. is the 13th species of *Elaphoidella* recorded from Thailand, and the 9th species originally described from Thailand. The new species belongs to group VIII, and is most similar to *E. surinamensis* (Delachaux, 1924) in the following characters: 1) anal operculum with fine (more than 25) spinules on free margin; 2) anal somite with four ventral spinules at the base of the caudal ramus; 3) first leg with three-segmented exopod and endopod; 4) first endopod of the second to the fourth legs without inner seta; 5) second endopod of the fourth leg with three elements; 6) exopod of the fifth leg in male with three setae; and 7) third endopod of the third leg in male with one apical seta. However, the new species differs from *E. surinamensis* in the following characters: 1) urosomites with serrated free posterior margins; 2) caudal ramus crescent-like shape, twice as long as wide at its base; 3) baseoendopod of the fifth leg in female with second inner seta longest; and 4) second endopod of the fourth leg in male with long and soft apical seta.

KEY WORDS: Canthocamptidae, dripping water, epikarst, karstic caves, Southeast Asia

INTRODUCTION

Representatives of Copepoda (Crustacea) are common components of freshwater and groundwater communities. At least 900 species and subspecies of copepods are known from continental groundwaters (Galassi, 2001). Obligate groundwater-dwelling copepods (= stygobionts) inhabit karstic, fissured, and porous aquifers, as well as surface/subsurface ecotones (Brancelj et al., 2013). More than 250 species and subspecies of harpacticoid copepods of the genus *Elaphoidella* Chappuis, 1929 have been recorded from different habitats globally (Wells, 2007; Brancelj et al., 2010). Among these, 29 species and subspecies have been so far reported from Southeast Asia (SEA) (Watiroyram et al., 2017, 2021). Most of them have been documented in Indonesia (15 species and subspecies) and Thailand (12 species), while

some are found in Vietnam (7 species and subspecies), Malaysia (5 species), and the Philippines (3 species) (Chappuis, 1931; Borutzky, 1967; Pesce and Apostolov, 1985; Dussart and Defaye, 1990; Mamaril, 2001; Apostolov, 2007; Tran and Chang, 2012; Brancelj et al., 2013; Watiroyram et al., 2015, 2017, 2021; Alekseev et al., 2016; Watiroyram and Brancelj, 2016; Boonyanusith et al., 2018; Lopez and Papa, 2020). The 12 species that have thus far been reported from Thailand include *E. bidens decorata* (Daday, 1901); *E. bromeliaecola* (Chappuis, 1928); *E. grandidieri* (Guerne and Richard, 1893); *E. intermedia* Chappuis, 1931; *E. isana* Watiroyram, Sanoamuang and Brancelj; *E. jaesornensis* Watiroyram, Brancelj and Sanoamuang, 2015; *E. ligorae* Watiroyram, Sanoamuang and Brancelj, 2017; *E. margaritae* Pesce and Apostolov, 1985; *E. namnaoensis* Brancelj, Watiroyram and Sanoamuang, 2010; *E. paraaffinis* Watiroyram, Sanoamuang and

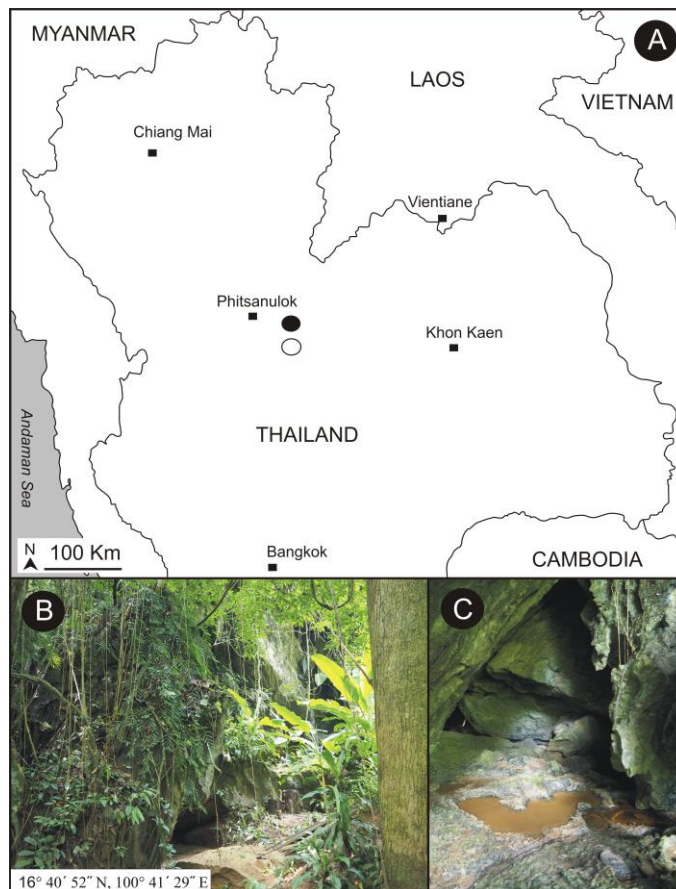


FIGURE 1. The sampling location of *Elaphoidella brancelji* sp. nov. and *E. thailandensis*: A. species distribution, black circle (●) sampling location of *E. brancelji* sp. nov., white circle (○) sampling location of *E. thailandensis*, black square (■) locations of cities; B. the cave entrance; C. the pool with the new species.

Brancelj, 2017; *E. sanoamuangae* Watiroyram and Brancelj, 2016; and, *E. thailandensis* Watiroyram, Brancelj and Sanoamuang, 2015 (Watiroyram et al., 2017, 2021). While examining cave-dwelling copepods from a cave in Northern Thailand, we encountered a hitherto undescribed species of the genus *Elaphoidella*. In this contribution, a description of a new species, hereafter named *E. brancelji* sp. nov., is given.

MATERIALS AND METHODS

Fauna samples from small pools on the floor of Pratummas Cave were collected using

a 3 mL pipette, and then transferred into 60 mL plastic bottles. Samples were preserved on-site in 70% ethanol, and later examined in the laboratory under a stereomicroscope at 40x magnification. Before dissection, specimens were placed in a mixture of glycerol and 70% ethanol (ratio ~ 1:10 v/v), which was replaced within one hour with pure glycerol. Specimens were dissected at 40–100x magnification under an Olympus SZ51 stereo microscope.

Pratummas Cave (Fig. 1, for details see type locality) is located about 800 meters north of the Pratummas Temple. There are two entrances into the cave. The cave is

shallow (about 15 meters long), there is no dark zone, and there is no connection between water bodies inside the cave with water bodies located outside the cave. The cave is relatively dry, although lichens and bryophytes grow on the floor and walls. The site from where the samples were collected is located at the entrance of the cave. During the rainy season, water drips down into the cave from a ground layer consisting of a complex of plant roots, soil, and fractured rock that lies above and outside the cave (= epikarst zone). This dripping water forms four small pools on the rock floor, and each pool contains 10–30 mL of water.

All appendages and body ornamentation were examined at 1,000x magnification. All drawings were made at the same magnification using an Olympus U-DA drawing tube mounted on an Olympus compound microscope (CX31). The final versions of the drawings were made using CorelDraw® 12.0 software. To create semi-permanent slides, all body parts were placed in a drop of glycerol on a microscope slide, covered with a cover slip, and sealed with nail polish.

Specimens to be evaluated by scanning electron microscopy (SEM) were dehydrated for 15 minutes in 50%, 70%, 80%, 90%, 95%, and 100% ethanol. Specimens were dried in a critical point dryer, mounted on stubs, and coated with gold in a sputter-coater. SEM photographs were made using a scanning electron microscope (LEO 1450 VP).

The abbreviations used include: Enp, endopod; Exp, exopod; Exp/Enp-1, proximal segment of exopod/endopod; Exp/Enp-2, middle segment of exopod/endopod; Exp/Enp-3, distal segment of exopod/endopod; P1–P6, swimming legs 1–6; A, aesthetasc. The terminology used to describe the caudal setae (I–VII) follows Huys and Boxshall (1991). Specimens were deposited at the Thailand Natural History Museum, Natural

Science Museum, Thailand (THNHM), and the Applied Taxonomic Research Center, Khon Kaen University, Thailand (KKU).

RESULTS

Order Harpacticoida Sars, 1903

Family Canthocamptidae Brady, 1880

Genus *Elaphoidella* Chappuis, 1929

Elaphoidella brancelji sp. nov.

(Figs. 2–8)

Type locality.— Pratummas Cave, Chomphu Subdistrict, Noen Maprang District, Phitsanulok Province, Northern Thailand; 16° 40' 52" N, 100° 41' 29" E (Fig. 1).

Material examined.— Holotype: adult female (THNHM-Iv-18757) dissected and mounted on one slide. Allotype: adult male (THNHM-Iv-18758) dissected and mounted on one slide. Paratypes: three females and three males preserved in 70% ethanol (THNHM-Iv-18759); and three females and three males preserved in 70% ethanol (KKU-COP-2021-T-02). All materials were collected from Pratummas Cave by Prapatsorn Dabseepai (collector) on 1 December 2017.

Etymology.— The new species is named after Prof. Dr. Anton Brancelj of the National Institute of Biology, Slovenia in recognition of his long-term dedication to the study of cave-dwelling copepods in Thailand and Southeast Asia. It is a noun in the genitive case.

Differential diagnosis.— *Elaphoidella brancelji* sp. nov. has the diagnostic features of the genus *Elaphoidella* in the armature of P5 in female, and of P4–P5 in male. The new species differs from other congeners in the following combination of characters: 1) urosomites with serrate-free posterior margins; 2) anal somite with four ventral spinules at the base of the caudal ramus; 3) anal operculum with more than 25 spinules on the free margin; 4) caudal ramus crescent-like shape; 5) P1 with three-segmented Enp, P2–P4 with two-segmented Enp (except P3 of

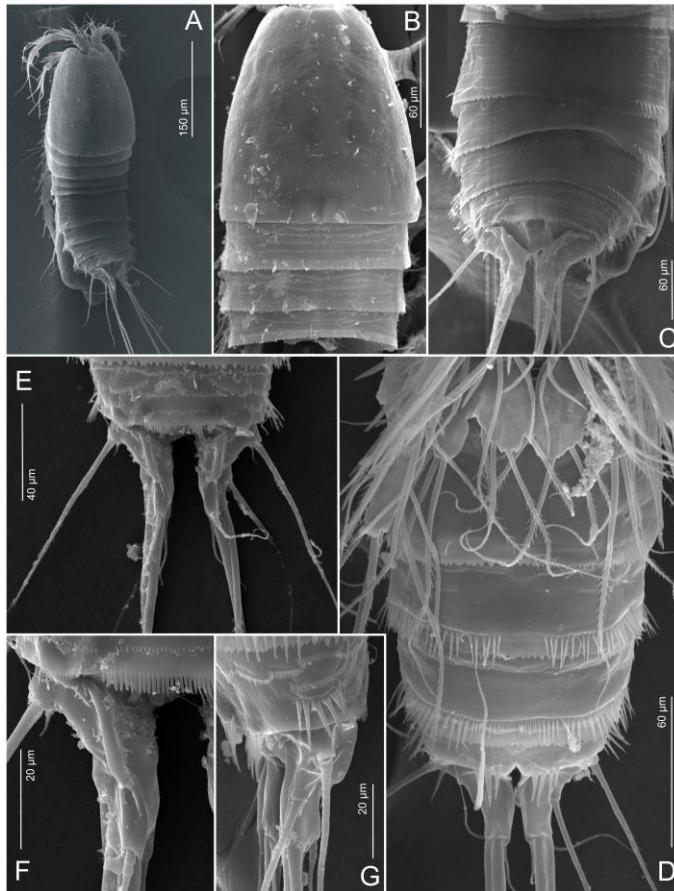


FIGURE 2. SEM photographs of *Elaphoidella brancelji* sp. nov., adult female: A. habitus, dorsal view; B. prosome, dorsal view; C. urosome (without urosomite 1), dorsal view; D. urosome (without urosomite 1), ventral view; E. anal somite and caudal rami, dorsal view; F. caudal ramus, dorsal view; G. anal somite and caudal rami, lateral view.

male); 6) P2–P4 Enp-1 without inner seta; 7) P2–P4 Exp-3 and Enp-2 of the female with armature formula as 5.6.6 and 4.5.3, respectively; 8) P4 Exp-3 of male with one apical transformed spine; 9) female with four exopodal and endopodal setae, but male with only three exopodal setae; and, 10) P6 of female represented by two setae, but unarmed in male.

Description of adult female.— Total body length, measured from anterior margin of rostrum to posterior margin of caudal rami, 650–780 µm (mean = 720 µm, n = 5). Habitus elongated, subcylindrical; greatest width at

cephalothorax; preserved specimens colorless (Fig. 2A). Naupliar eye not discernible. Cephalothorax (Fig. 2B) with several pairs of dorsal sensilla, integumental window saddle-shaped, well discernible. Posterior margins of prosomites and urosomites fine serrated, except for cephalothorax and anal somite with smooth posterior margins. Prosomites 2–5 with 2–4 pairs of dorsal sensilla; ornamented with several transverse rows of very minute spinules (Fig. 2B–C). Genital double-somite completely fused (Figs. 2C–D, 3A–B), about 0.8 times as long as wide, with row of strong spinules on dorso-lateral margin posteriorly;

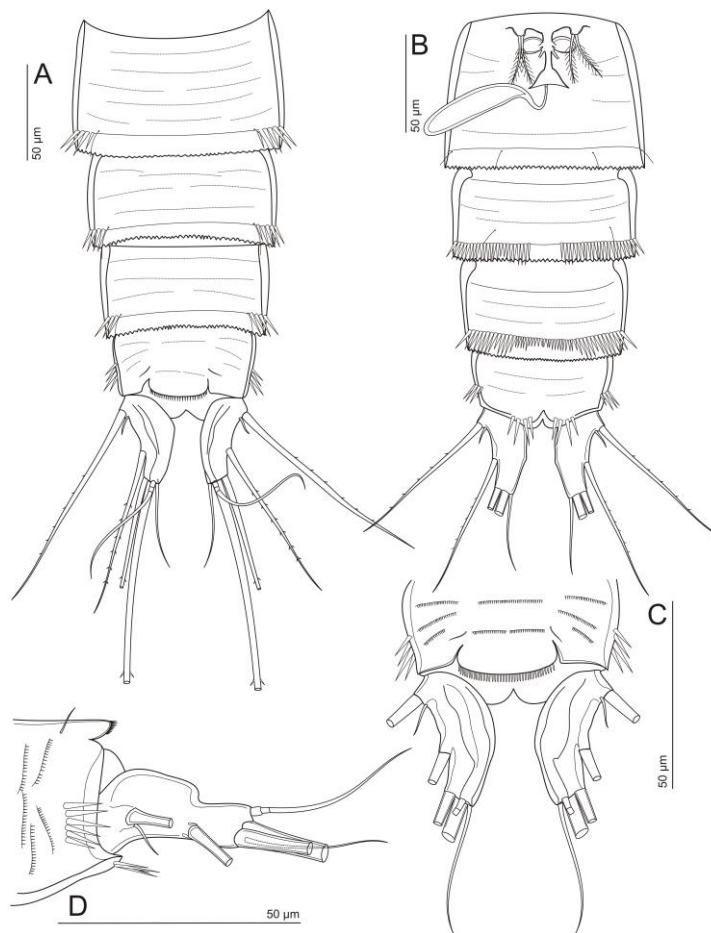


FIGURE 3. *Elaphoidella brancelji* sp. nov., adult female (holotype): A. urosome (without urosomite 1), dorsal view; B. urosome (without urosomite 1), ventral view; C. anal somite and caudal rami, dorsal view; D. anal somite and caudal ramus, lateral view.

with several transverse rows of very minute spinules; with 4–5 pairs of dorsal sensilla. Genital complex (Fig. 3B) with a large, bell-shaped median copulatory pore; seminal receptacles symmetrical, well developed. Urosomites 3 and 4 (Fig. 3B) with row of strong spinules distally along dorsoventral margin, interrupted medially on urosomites 3; with several transverse rows of very minute spinules; with 2–3 pairs of dorsal sensilla. Anal somite (Figs. 2C–E, 3A–D) with one pair of sensilla dorsally at base of anal operculum; with several transverse rows of very minute spinules; with transversal row of

strong spinules laterally; four strong spinules ventrally above insertion of each caudal ramus.

Anal operculum (Figs. 2E–G, 3C–D) short, not reaching to distal margin of anal somite; ornamented with more than 25 strong spinules along free margin.

Caudal ramus (Figs. 2D–G, 3A–D). Crescent, divergent, tapering toward distal end; about two times as long as wide at its base. Dorsal longitudinal keel well-developed, with acute distal inner margin. Anterolateral accessory seta (I) small and smooth, located below anterolateral seta (II). Anterolateral seta (II) strong, very long, spiniform, inserted at

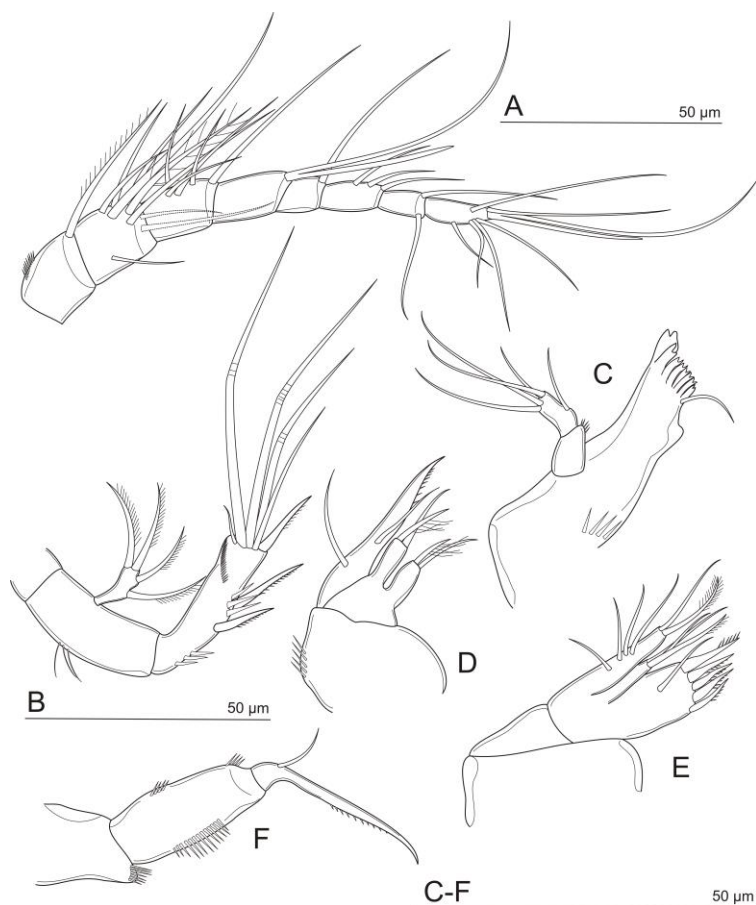


FIGURE 4. *Elaphoidella brancelji* sp. nov., adult female (holotype): A. antennule; B. antenna; C. mandible; D. maxilla; E. maxillule; F. maxilliped.

proximal fifth of caudal ramus length. Posterolateral seta (III) strong, spiniform, below midway of outer margin of ramus, shorter than seta II. Outer apical seta (IV) strong, spiniform, without breaking plane, about four times as long as caudal ramus. Inner apical seta (V) strong, spiniform, without breaking plane, longest. Inner accessory seta (VI) thin, smooth, about as long as caudal ramus. Dorsal seta (VII) thin, smooth, articulated, inserted at distal end of dorsal keel, longer than caudal ramus.

Antennule (Fig. 4A). Eight-segmented, not reaching to posterior extremity of cephalothorax. Segment 1 with row of strong spinules. Aesthetasc on segments 4 and 8

cylindrical, similar in length; proximal aesthetasc extends to base of distal end of distal segment. Both aesthetascs fused with seta at its base (= acrothek). Setal formula: 1, 9, 5, 1+A, 1, 3, 2, 6+(1+A).

Antenna (Fig. 4B). Coxa shorter than wide, unornamented. Allobasis about three times as long as wide, with three spinules on abexopodal margin. Exp with four unipinnate setae: two apical and two inner setae. Enp slightly longer than allobasis, with two inner spines, one apical spine, and five apical setae (three geniculated, two normal setae); several strong spinules along inner margin; transverse row of fine spinules at outer distal margin.

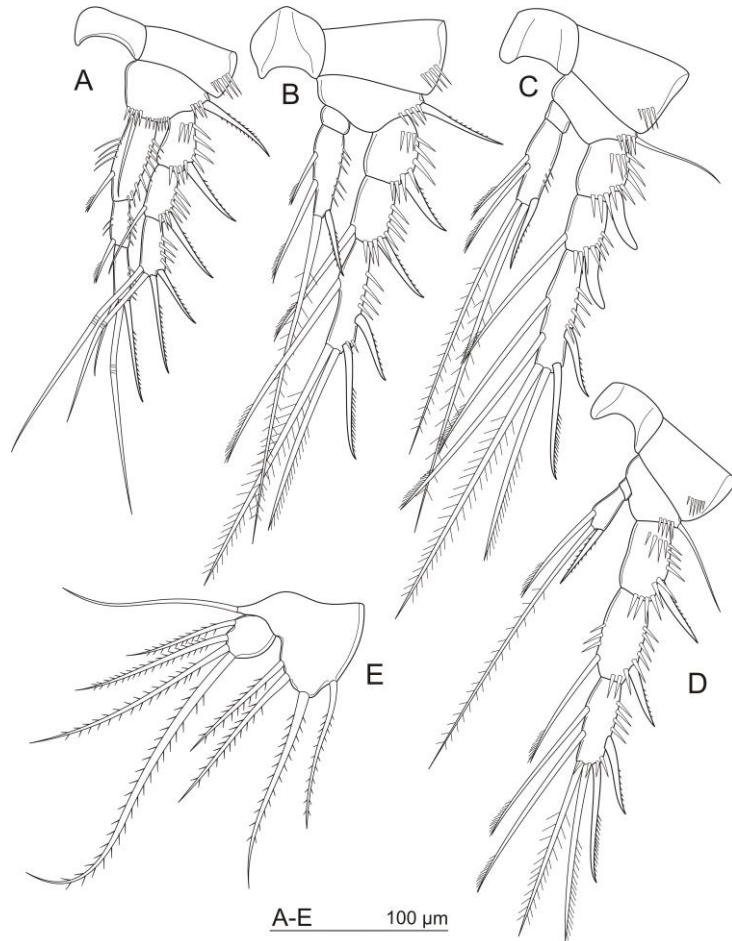


FIGURE 5. *Elaphoidella brancelji* sp. nov. adult female (holotype): A. P1; B. P2; C. P3; D. P4; E. P5.

Mandible (Fig. 4C). Gnathobase with eight strongly chitinized teeth and one smooth, thin seta; dorsal margin with row of spinules proximally, one protrusion distally. Mandibular palp two-segmented: basis unarmed, with tiny spinules on distal corner; Enp with five smooth setae (one lateral, four apical).

Maxilla (Fig. 4D). Praecoxa with row of spinules at outer margin. Syncoxa with two endites, each with two setae. Allobasis drawn out into strong, beak-like spiniform claw, with one accessory seta; Enp represented by one smooth seta.

Maxillule (Fig. 4E). Praecoxal arthrite with five strong spiniform spines distally and one smooth seta on median surface. Coxa endite fused to basis and arthrite at its base; cylindrical, with one unipinnate and two smooth apical setae. Basis with cylindrical endite with one pinnate and one smooth apical seta. Exp and Enp reduced, represented by one and three smooth setae, respectively.

Maxilliped (Fig. 4F). Prehensile; syncoxa unarmed, with spinules at distal inner margin. Basis about two times as long as wide, with longitudinal row of strong spinules along median inner margin; two small spinular groups at outer margin. Enp as long as basis,

TABLE 1. Armature formula of swimming legs (P1 to P4).

Leg	Coxa	Basis	Exp			Enp		
			1	2	3	1	2	3
P1	0-0	1-1	I-0;	I-1;	II,2,0	0-1;	0-1;	0,3,0
P2	0-0	1-0	I-0;	I-1;	II,2,1	0-0;	I,1,2	
P3	0-0	1-0	I-0;	I-1;	II,2,2	0-0;	I,2,2	
P4	0-0	1-0	I-0;	I-1;	II,2,2	0-0;	I,1,1	

(outer-inner seta/spine; outer-apical-inner; Arabic numerals represent setae, Roman numerals represent spines)

modified into spiniform claw, with small seta proximally.

P1–P4 (Fig. 5A–D). P1 with three-segmented Exp and Enp, P2–P4 with three-segmented Exp and two-segmented Enp. Armature formulae for P1–P4 are shown in Table 1.

P1 (Fig. 5A). Coxa unarmed, with row of strong spinules on outer margin. Basis with thin, smooth inner seta and robust, spiniform outer seta; with rows of spinules at insertion of Enp and both setae. Exp shorter than Enp. Exp-1–3 similar in length, with lateral and median spinules. Exp-1 with spiniform outer spine. Exp-2 with spiniform outer spine and thin, smooth inner seta. Exp-3 with spiniform outer and apical spines, one geniculate apical seta and one inner geniculate seta. Enp-1 long, slightly shorter than Exp-1 and Exp-2 combined, with unipinnate-tip inner seta; with lateral spinules: inner spinules thinner than outer spinules. Enp-2 two times as long as wide, with unipinnate-tip inner seta; with spinules as Enp-1. Enp-3 with three apical setae: innermost seta thin, smooth, shortest; middle one geniculated, longest; outermost seta spiniform.

P2 (Fig. 5B). Coxa as in P1. Basis with spiniform outer seta; with spinules near insertion of seta. Exp-1 1.3 times as long as wide, with spiniform outer spine; with lateral and median spinules. Exp-2 as long as Exp-1, with spiniform outer spine, unipinnate-tip inner seta; with lateral spinules. Exp-3 three

times as long as wide, with two spiniform outer spines, unipinnate and bipinnate apical setae, unipinnate-tip inner seta; with lateral spinules. Enp slightly shorter than Exp-1 and Exp-2 combined. Enp-1 small, shorter than wide, unarmed. Enp-2 2.5 times as long as wide, with spiniform outer subapical seta, bipinnate apical seta, two setae along inner margin; with spinules along outer margin.

P3 (Fig. 5C). Coxa and basis ornamented as P2. Basis with thin, smooth outer seta. Exp-1 with smooth, blunt-tip outer spine; with lateral and median spinules. Exp-2 similar to Exp-1, with additional unipinnate-tip inner seta. Exp-3 three times as long as wide, with two spiniform outer spines, unipinnate apical seta, bipinnate apical seta, two unipinnate-tip setae along inner margin; with lateral spinules. Enp two-segmented, shorter than Exp-1 and Exp-2 combined. Enp-1 small, shorter than wide, unarmed. Enp-2 three times as long as wide, with spiniform outer spine, two bipinnate apical setae, two unipinnate-tip inner setae.

P4 (Fig. 5D). Coxa, basis, Exp-1–2 as P3 but outer spines with sharp tips. Exp-3 similar in length to Exp-1–2, about two times as long as wide: with one spiniform outer spine, one spiniform apical spine, unipinnate apical seta, bipinnate apical seta, two unipinnate-tip inner setae; with lateral, apical spinules. Enp shorter than 1/2 of Exp-1. Enp-1 very small, shorter than wide, unarmed. Enp-2 unornamented, with three elements: spiniform apical spine

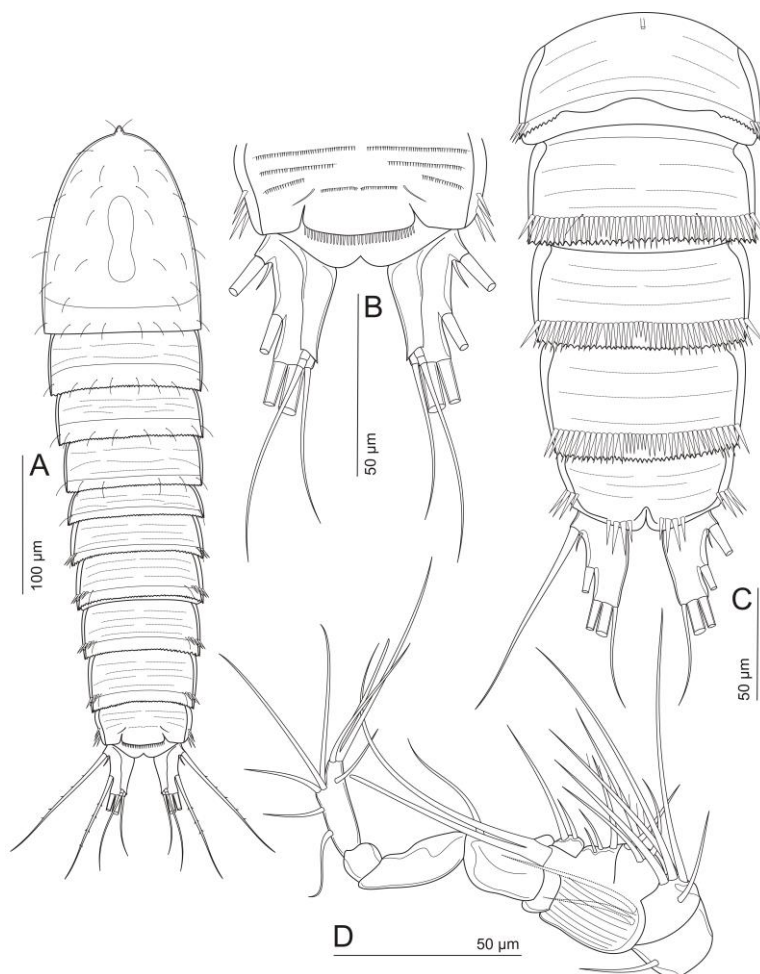


FIGURE 6. *Elaphoidella brancelji* sp. nov., adult male (allotype): A. habitus, dorsal view; B. anal somite and caudal rami, dorsal view; C. urosome (without urosomite 1), ventral view; D. antennule.

shortest, slightly longer than segment; bipinnate apical seta longest, about 4.0 times longer than spine; unipinnate-tip inner seta slightly longer than spine.

P5 (Fig. 5E). Outer basal seta thin, smooth. Exp and baseoendopod separated. Baseoendopod well developed, as long as Exp; with four spiniform setae: second inner seta longest, followed by second outer seta, innermost seta and outermost seta, respectively. Exp small, sub-oval; with four spiniform setae: innermost seta longest; seta length decreasing from inner-most seta to outer-most seta.

P6 (Fig. 3B) fused to genital double-somite, represented by simple plate with two subequal bipinnate setae ventrally on each side of copulatory pore.

Egg sac. One egg sac; each with 9–12 eggs ($n = 5$).

Description of adult male.— Body slightly smaller than female; body length, measured from anterior margin of rostrum to posterior margin of caudal rami, 630–750 μm (mean = 700 μm , $n = 5$) (Fig. 6A). Habitus similar to female; posterior margins of prosomites and urosomites fine serrated, except cephalothorax (Figs. 6A, 6C, 7 A–B). Anal somite ornamented

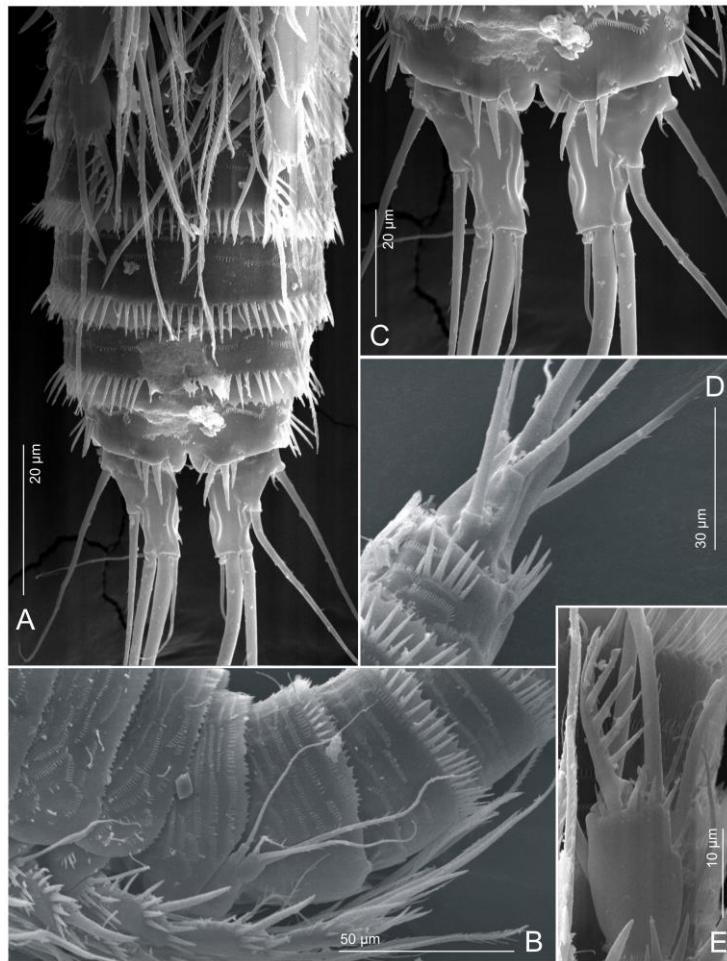


FIGURE 7. SEM photographs of *Elaphoidella brancelji* sp. nov., adult male: A. urosome (without urosomite 1), ventral view; B. prosomites 3–4 and urosomites 1–4, lateral view; C–D. anal somite and caudal rami, ventral and lateral views; E. apical transformed spine on the male P4 Exp-3.

as in female (Figs. 6B–C, 7A, 7C–D). Caudal ramus armed and ornamented similar to female, but slightly tapering distally end (Fig. 6B–C).

Antennule (Fig. 6D). Eight-segmented, geniculated between segment 4–5 and segment 5–6. Aesthetascs cylindrical, rounded-tip, fused basally to seta; first aesthetasc located on segment 2, longer than second one on last segment, not reaching distal end of antennule. Setal formula: 1, 5, 10+A, 2, 1, 0, 0, 8+A.

Antenna, mouthparts and P1 (Fig. 8A) similar to those of female.

P2 (Fig. 8B). Coxa, basis, and Exp same as in female. Enp as long as Exp-1, two-segmented. Enp-1 small, shorter than wide, unarmed. Enp-2 three times longer than wide, with few spinules along outer margin; with three setae: bipinnate apical seta, longest; two inner setae, proximal smooth seta shorter than segment, distal unipinnate-tip seta longer than the segment bearing it.

P3 (Fig. 8C). Coxa, basis and Exp same as in female. Three-segmented Enp, as long as

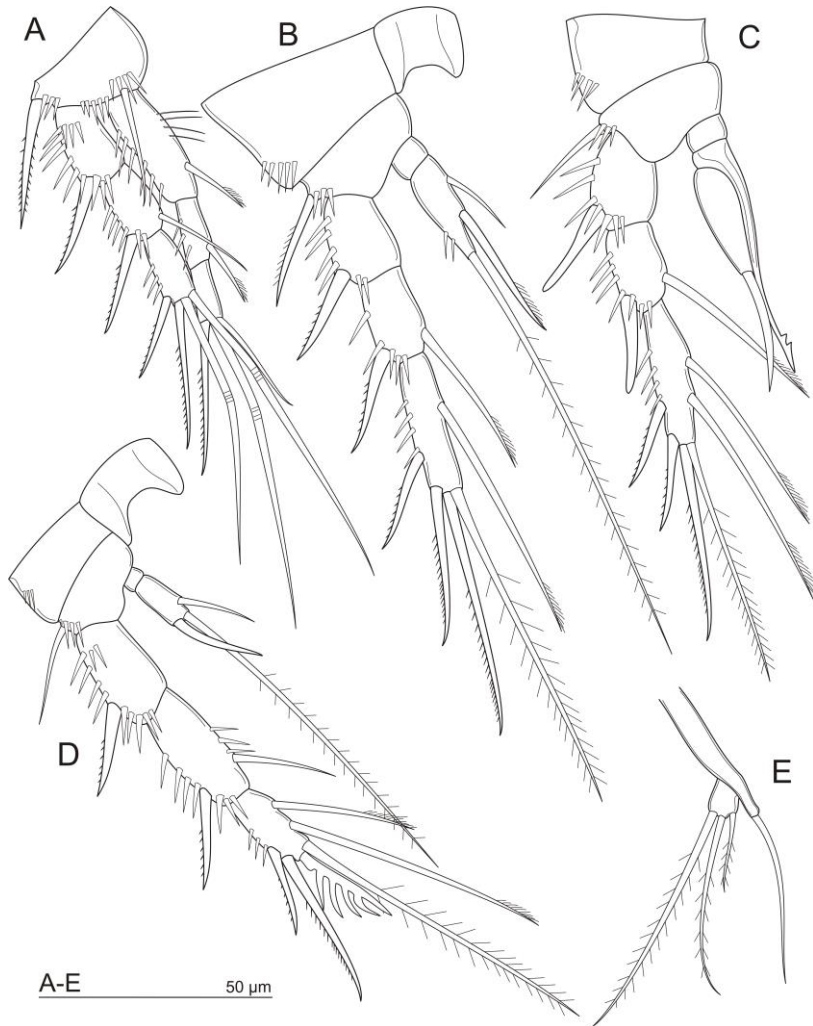


FIGURE 8. *Elaphoidella brancelji* sp. nov., adult male (allotype): A. P1; B. P2; C. P3; D. P4; E. P5.

Exp-1 and Exp-2 combined. Enp-1 shorter than wide, unarmed. Enp-2 with long inner apophysis with harpoon-like tip, not reaching distal end of Exp-3. Enp-3 about 2.2 times as long as wide, with strong, smooth spiniform seta apically.

P4 (Fig. 8D). Coxa with row of spinules on outer margin. Basis with thin, smooth outer seta; with row of spinules at insertion of seta. Exp-1; two times as long as wide; with spiniform outer spine; with lateral and median spinules. Exp-2 similar to Exp-1, with additional smooth inner seta and spinules

along inner margin. Exp-3 shorter than two previous segments, with six elements: two spiniform outer spines; transformed apical spine (Figs. 7E, 8D) and bipinnate apical seta; two unipinnate-tip inner setae. Two-segmented Enp, reaching middle of Exp-1. Enp-1 very small, shorter than wide, unarmed. Enp-2 two times as long as wide, with three elements: apical spine and smooth inner seta slightly longer than segment bearing it; bipinnate apical seta reaching beyond distal end of Exp-3.

P5 (Figs. 7B, 8E). Outer basal seta thin, smooth. Exp and baseoendopod separated. Both baseoendopod fused, less developed, unarmed. Exp small, slightly longer than wide, with three apical bipinnate setae: outermost seta shortest; innermost seta longest, greater than 7.0 times longer than the segment bearing it.

P6 (Fig. 6C). Reduced to simple bilobate plate, unarmed.

Spermatophore (Fig. 3B). Cylindrical, elongated, attached at mid-ventral copulatory pore.

Remarks.— *Elaphoidella brancelji* **sp. nov.** fits group VIII *sensu* Lang (1948) because the female P5 baseoendopod is well developed, as long as Exp, and both segments have four setae. The male P4 Exp-3 has a transformed outer apical spine. Among the members of this group, the new species is most similar to *E. surinamensis* (Delachaux, 1924) from Suriname in the following characters: 1) anal operculum with fine spinules (more than 25) on free margin; 2) anal somite with four ventral spinules at base of caudal rami; 3) P1 with three-segmented Exp and Enp; 4) P2–P4 Enp-1 without inner seta; 5) P4 Enp with three elements; 6) male P5 Exp with three setae; and, 7) male P3 Enp-3 with one apical seta. *Elaphoidella brancelji* **sp. nov.** differs from *E. surinamensis* in the following characters: prosomites and urosomites with serrated free posterior margins (smooth in *E. surinamensis*); urosomite 4 in the female with a continuous row of posterior spinules ventrally, whereas that of *E. surinamensis* has an interruption in the middle of the spinular row; shape and armature of caudal ramus (the caudal ramus of the new species with crescent-like shape, two times as long as wide, whereas that of *E. surinamensis* is conical, about 1.5 times as long as wide); the second inner seta of the female P5 baseoendopod of the new species is the longest, whereas that in *E. surinamensis* the two middlemost are the longest; the male

P4 Enp-2 of the new species with middle seta longer, at least four times longer than the segment bearing it, whereas it is about 1.5 times as long as wide in *E. surinamensis*.

Compared to four species of group VIII in Southeast Asia (SEA) [i.e., *E. malayica* (Chappuis, 1928) from Indonesia, *E. sewelli* (Chappuis, 1928) s. str. from the Philippines, *E. thailandensis* Watiroyram, Brancelj and Sanoamuang, 2015 from Thailand, and *E. vietnamica* Borutzky, 1967 from Vietnam], *E. brancelji* **sp. nov.** is most similar to *E. malayica* in characters, as follows: 1) anal operculum with fine (>18) spinules on distal free margin; 2) P1 with three-segmented Exp and Enp; and, 3) armature of P1, P2, P4, and P5. The new species differs from *E. malayica* in characters, as follows: 1) urosomites with serrated posterior margin (smooth in *E. malayica*); 2) anal somite with four spinules at base of caudal ramus insertion (with six spinules in *E. malayica*); 3) caudal ramus crescent, about two times as long as wide (rectangular, <1.5 times in *E. malayica*); 4) P3 Enp-1 unarmed (with inner seta in *E. malayica*); 5) male P2 Enp-2 with normal segment and normal pinnate apical seta (*E. malayica* with acute blade-like segment and very thin and smooth apical seta). In addition, P4 Enp-2 of both sexes in the new species has a long apical seta, over four times longer than the segment bearing it compared to those in *E. malayica*, which are never longer than two times the length of the segment bearing it.

Elaphoidella brancelji **sp. nov.** can be differentiated from *E. sewelli* and *E. vietnamica* by the following features: 1) urosomal posterior margin serrated (smooth in *E. sewelli* and *E. vietnamica*); 2) four spinules ventrally at each base of caudal ramus (five in *E. sewelli*, three in *E. vietnamica*); 3) a different shape and length/width ratio of caudal ramus (1.2–1.5 times as long as wide, conical in *E. sewelli* and *E. vietnamica*); 4) without an inner seta on P2–P3 Enp-1 (similar

Key to the species of *Elaphoidella* from Thailand**Female:**

1. P5 Exp with two setae *E. margaritae*
1. P5 Exp with four or five setae 2
2. Urosomites with smooth free posterior margins 3
2. Urosomites with serrated free posterior margins 4
3. P5 Exp with four setae *E. sanoamuangae*
3. P5 Exp with five setae *E. jaesornensis*
4. P5 Exp with four setae 5
4. P5 Exp with five setae 10
5. P4 Enp present 6
5. P4 Enp absent *E. thailandensis*
6. P3 Enp-1 with inner seta 7
6. P3 Enp-1 without inner seta 8
7. P3 Enp-2 with three spines and setae *E. bromeliaecola*
7. P3 Enp-2 with six spines and setae *E. namnaoensis*
8. P2 Enp-1 with inner seta *E. ligorae*
8. P2 Enp-1 without inner seta 9
9. P4 Enp-2 with three spines and setae *E. brancelji* sp. nov.
9. P4 Enp-2 with four spines and setae *E. paraaffinis*
10. Posterior margin of urosomites finely serrated 8
10. Posterior margin of urosomites coarsely serrated *E. bidens decorata*
11. Caudal ramus without spinules at distal inner margin *E. intermedia*
11. Caudal ramus with spinules at distal inner margin *E. isana*

Male (unknown for *E. bidens decorata*, *E. isana*, *E. jaesornensis*, and *E. namnaoensis*):

1. P5 Exp with two setae *E. margaritae*
1. P5 Exp with four setae 2
2. Urosomites with smooth free posterior margins *E. sanoamuangae*
2. Urosomites with serrated free posterior margins 3
3. P4 Enp present 4
3. P4 Enp absent *E. thailandensis*
4. P2 Enp-1 without inner seta 5
4. P2 Enp-1 with inner seta 6
5. P2 Enp-2 with three spines and setae *E. brancelji* sp. nov.
5. P2 Enp-2 with four spines and setae *E. paraaffinis*
6. P4 Exp-3 with transformed spine 7
6. P4 Exp-3 without transformed spine *E. ligorae*
7. Transformed spine of P4 Exp-3 presented with reduced spine *E. intermedia*
7. Transformed spine of P4 Exp-3 presented with antler-like spine *E. bromeliaecola*

to *E. vietnamica*, but present in *E. sewelli*); 5) female P3 Enp-2 with five spines and setae, but four in *E. sewelli* and *E. vietnamica*; 6) the female P6 is represented by two setae (one seta in *E. vietnamica*, but not known in *E.*

sewelli); and, 7) male P4 Exp-3 with one apical transformed spine (similar to *E. vietnamica*, but two transformed apical spines in *E. sewelli*).

Elaphoidella thailandensis, as a representative of group VIII, exhibits distinctive characteristics observed in other representatives of the group (including *E. brancelji* **sp. nov.**), as follows: 1) anal operculum with spinose (10–12) spinules on distal free margin; 2) P1 with two-segmented Enp; 3) P4 Enp absent (=autapomorphy); 4) armature formula on P2–P4 Exp-3 as 4.5.6 (5.6.6 in the other species); and, 5) the female P5 Exp with a second inner seta shortest (outermost seta shortest in the other species).

DISCUSSION

The serration on ‘hyaline frills’ or ‘posterior margins’ of body somites is used to distinguish the species of the genus *Elaphoidella*, but this indistinct serration is usually overlooked when observed under a light microscope. Dorsal hyaline frills of all urosomites, except the anal somite, are frequently more serrated than prosomites, and can be easily observed on specimens without dissection. The dorsal hyaline frills show different degrees of serration among species, which were classified into three levels by Wells (2007), as follows: 1) smooth hyaline frill — distal edge without serration or denticles; 2) weak — distal edge with weak serration, low pitch, or wavelength-like; and, 3) serrate — distal edge with strongly irregular or regular serration. Amongst the 13 *Elaphoidella* species collected from Thailand, the serrations on the dorsal hyaline frills of *E. namnaoensis* remain obscure (smooth or weakly serrated). Different populations of *E. namnaoensis* were collected from across Thailand for resolve this confusion. After examination of specimens, and re-examination of its paratype at the Science Museum of Khon Kaen University, Thailand (KKU), the weak serration on the dorsal hyaline frills was confirmed. *Elaphoidella brancelji* **sp. nov.** is similar to *E. namnaoensis*

relative to having weakly serrated hyaline frills that are unclearly observed under a light microscope. SEM photographs can resolve this problem, so SEM photographs are recommended for species with dorsal hyaline frills that are weakly serrated. Most early-described species were incompletely described – most notably details specific to the legs, antennule, antenna, mouthparts, and ornamentation on the body surface, including hyaline frills. Therefore, the serration on the hyaline frills of the early-described species should be reexamined to clarify the identity of these species.

The presence and shape of the male P6 is almost unknown for the species of *Elaphoidella*, and little information is available for the female. This leg varies in number and size of armature in both sexes: 1) the female and male P6 unarmed in *E. karamani* Chappuis, 1936, *E. millennii* Brancelj, 2009, *E. negroensis* Kiefer, 1967, *E. nuragica* Pesce and Galassi, 1986, and *E. tarmani* Brancelj, 2009; 2) the female P6 possesses one seta and is unarmed in the male of *E. montenegrina* Karanovic, 1997, *E. moreae* Pesce, 1981, and *E. paramuna* Gavia and Defaye, 2015; 3) the female P6 possesses two setae, but is unarmed in the male of *E. brancelji* **sp. nov.**, *E. margaritae*, *E. namnaoensis* (male unknown), *E. paraaffinis*, *E. ligorae*, *E. sanoamuangae*, and *E. silverii* Pesce, 1985 (male unknown); 4) the female P6 possesses two setae, but only one seta is present in the male of *E. nepalensis* Ishida, 1994; and, 5) the P6 of both the female and the male possesses two setae in *E. humphreysi* Karanovic, 2006, and *E. thailandensis* (the male with two tiny spinules). The other two species originally described from Thailand, *E. isana* and *E. jaesornensis*, have two setae on the female P6, but details about the males remain unknown. A comparison of the female P6 among the members of group VIII from SEA [including

a closely related species (*E. surinamensis*) revealed that *E. brancelji* sp. nov. has two setae on the simple plate versus the presence of one seta in *E. thailandensis* and *E. vietnamica* (unknown for *E. sewelli* and *E. malayica*), and the absence of seta in *E. surinamensis*. A detailed description of the male P6 is known in only two species from Thailand – unarmed in *E. brancelji* sp. nov. and two-minute spinules in *E. thailandensis*.

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