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## SUPPLEMENTARY ONLINE MATERIAL FOR

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### **Miocene cyclopoid copepod from a saline paleolake in Mojave, California**

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#### **Supplementary Online Material**

**SOM 1.** Comparison of the antennule setation in the female and male copepodid V instars of *Mesocyclops acanthoramus* Hołyńska and Brown, 2003.

**SOM 2.** Coding of the setal elements in distal half of the antennule in male of Cyclopidae.

**SOM 3.** Material examined.

**SOM 4.** *Apocyclops californicus* sp. nov. Additional SEM micrographs of the adult female (habitus, legs 2–5, caudal rami) and male (leg 5 and genital segment).

**SOM 5.** *Apocyclops californicus* sp. nov. Additional SEM micrographs of the male (antennule and leg 5) and copepodid V instar (habitus, urosome with spermatophores, caudal rami).

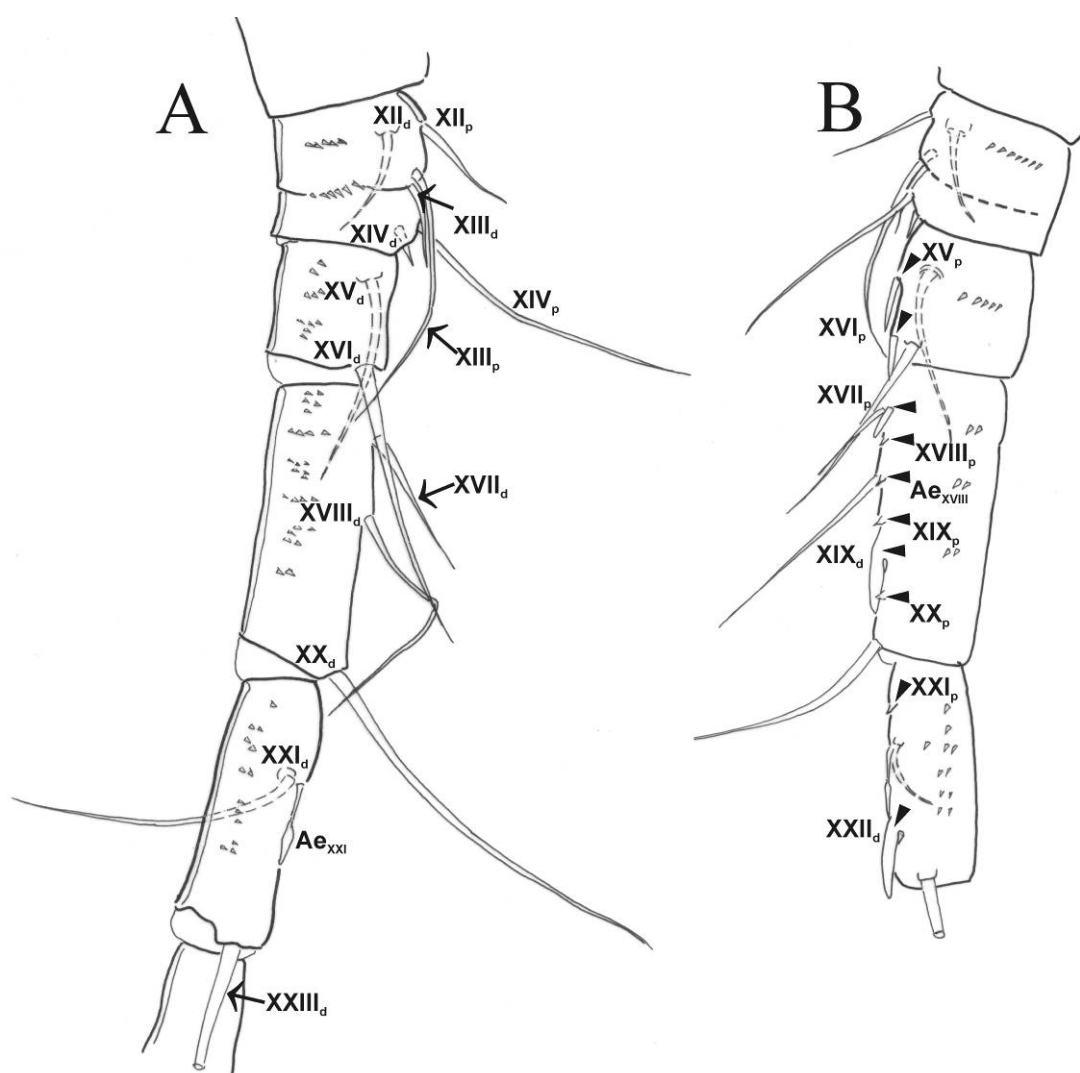
**SOM 6.** *Apocyclops californicus* sp. nov. Additional SEM micrographs of copepodid V male (antennule and antenna), copepodid IV (caudal rami, setation) and copepodid III (urosome) instars.

#### **References**

Hołyńska, M., Leggitt, L., and Kotov, A.A. 2016. Miocene cyclopoid copepod from a saline paleolake in Mojave, California. *Acta Palaeontologica Polonica* 61(2): 345-361.

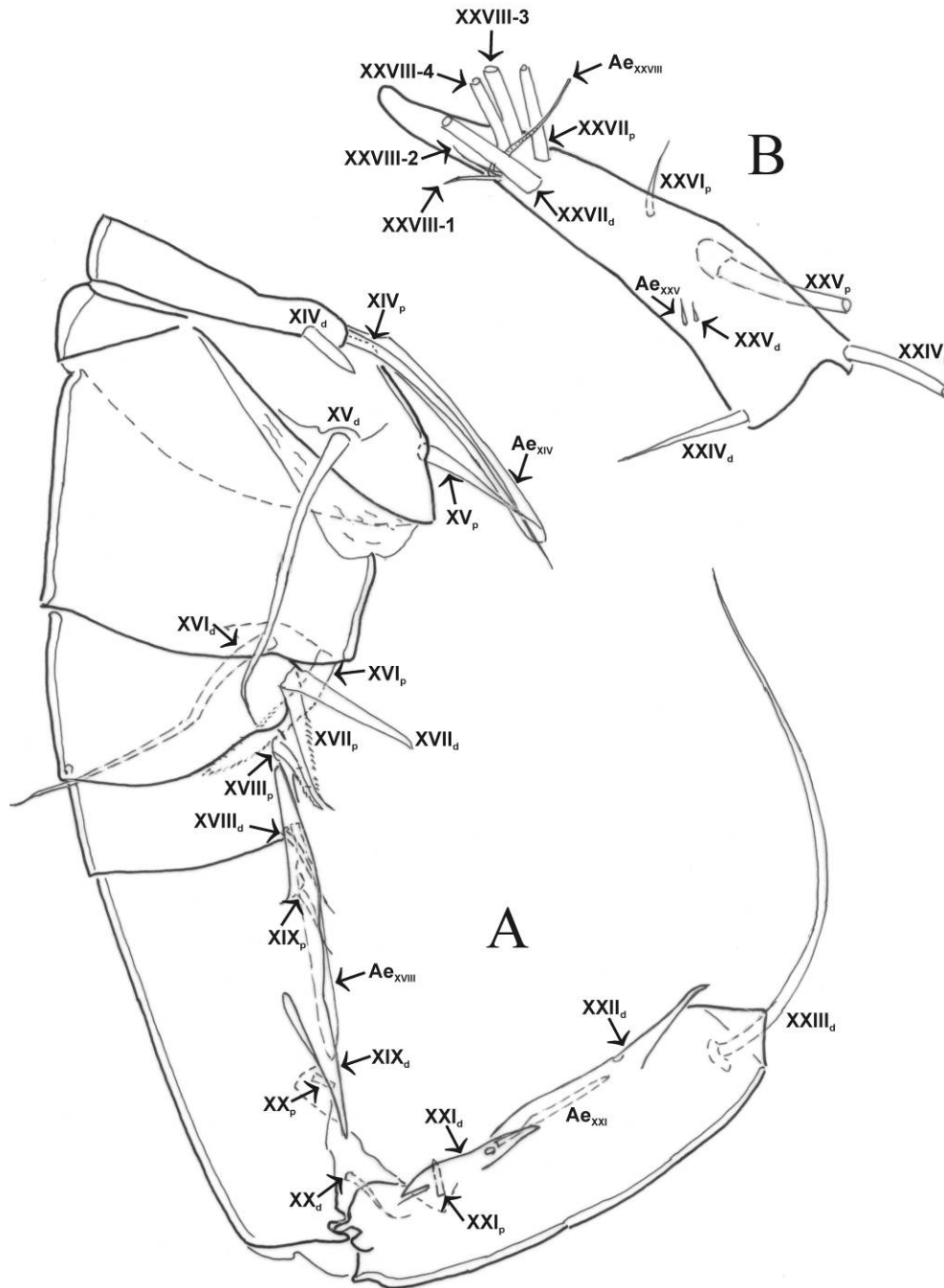
## SOM 1

Comparison of the antennule setation in the female (**A**, MIZ 2/2015/14) and male (**B**, MIZ 2/2015/15) copepodid V instars of *Mesocyclops acanthoramus* Hołyńska and Brown, 2003 helped to set homologies of the modified setal elements in the distal half (ancestral segments XV–XXIII, homologous to segments 4–8 in copepodid V) of the male antennule. Both A and B show ventral aspect. Coding of the antennular setae as in Hołyńska et al. 2016: Fig. 1. Codes on the male antennule (B) denote elements that are present in the male but absent in the female, arrowheads point to the insertion sites.



## SOM 2

Coding of the setal elements in distal half of the antennule in male of Cyclopidae (cf. SOM 1 and Hołyńska et al. 2016: Fig. 1). **A.** Segments 9–15 (XIV–XXIII), dorsal view [*Mesocyclops acanthoramus* Hołyńska and Brown, 2003 (MIZ 2/2015/13)]. **B.** segment 16 (XXIV–XXVIII), dorsal view [*Apocyclops panamensis* (Marsh, 1913) (MIZ 2/2015/3)].



### SOM 3

MATERIAL EXAMINED: Paratypes: UMNH IP 4852, adult female, dorsal aspect showing nine body segments and caudal rami, intact caudal setae III–VI, (II and VII are partly injured), posterolateral lobe of pediger 4, spinule ornamentation on free segment of P5, and spinule ornamentation of pediger 5 next to P5, surface ornamentation of caudal rami; OUMNH NT.233, adult female, ventral aspect showing cephalothoracic appendages (antennule, antenna with allobasis, maxilla and P1); UMNH IP 4829, adult female, ventral aspect showing nine body segments and caudal rami, caudal setae II–VI (none intact), antennule, maxilla, P1–P5; UMNH IP 4860, adult female with one egg sac, ventral aspect showing nine body segments and caudal rami, caudal setae II–V (none intact), antennule, maxilla, P1–P4; UMNH IP 4833, adult female, ventral aspect showing nine body segments and caudal rami, caudal setae III–V (none intact), two pairs of spermatophores on genital double-somite, antennule, maxilla, P1–P5; UMNH IP 4834, adult female, dorsal aspect showing nine body segments and caudal rami, caudal setae II–VII (setae II, III, VI intact), antennule, spinule ornamentation on free segment of P5 and spinule ornamentation of pediger 5 next to P5; UMNH IP 4826, adult female, ventral aspect showing antennule, antenna (enp1–3), P1–P4, caudal setae II–V (none intact); UMNH IP 4853, adult female, lateroventral aspect showing nine body segments and caudal rami, caudal setae IV and V (none intact), antennule, maxillary basipodite and endopodite, P2–P5, spinule ornamentation on free segment of P5 and spinule ornamentation on pediger 5 next to P5; UMNH IP 4836, adult female, lateral aspect showing nine body segments and caudal rami, antennule, P2–P5, spinule ornamentation on free segment of P5 and spinule ornamentation on pediger 5 next to P5; UMNH IP 4843, adult female, dorsal aspect showing nine body segments and caudal rami, caudal setae III–VII (only seta III intact), spinule ornamentation of caudal rami, spinule ornamentation on free segment of P5 and spinule ornamentation on pediger 5 next to P5, long egg sac reaching beyond posterior end of caudal ramus; UMNH IP 4844, adult female, lateroventral aspect showing nine body segments and caudal rami, caudal setae III–V, antennule, antenna, maxilla, P2–P4; UMNH IP 4845, adult female, ventral aspect showing antennule, antenna, maxillule, maxilla, P1–P4, spinule ornamentation on caudal surface of intercoxal sclerite and protopodite of P4, urosome surface is contaminated with detritus; UMNH IP 4846, adult female dorsal aspect showing nine body segments and caudal rami, caudal setae (IV, V), antennule, free segment of P5 with spinules, and spinules next to P5 on pediger 5; UMNH IP 4827, adult female, ventral aspect showing nine body segments and caudal rami, caudal setae III–V, antennule, swimming legs; UMNH IP 4839, adult female, dorsal aspect showing 10(!) body segments (genital segment and first abdominal segment fail to fuse) and caudal rami, caudal setae II–VII (II, III, VI intact), 11-segmented straight antennule, medial spine of P5 short.

UMNH IP 4850, adult male, ventral aspect showing prosome and urosomites 1–4 (urosomites 5–6 and caudal rami are contaminated with detritus), antennule setation, antenna, P2–P4, spinule ornamentation on caudal surface of intercoxal sclerite and protopodite of P4, P5, spinule ornamentation of pediger 5 and P6 flap; UMNH IP 4856, adult male dorsal aspect showing 10 body segments and caudal rami, caudal setae II–V, VII (none intact), terminal exopodal segments of P1–P3, P4 (exp1–2), P5–P6; UMNH IP 4828, adult male, lateral aspect showing 10 body segments and caudal rami, caudal setae IV and V thick, antennule, P2–P6;

UMNH IP 4858, adult male, lateroventral aspect showing 10 body segments and caudal rami, caudal setae III–V, antennule, maxilla and maxilliped, P1 (with medial spine on basipodite), P2, P3, and P5; OUMNH NT.234, adult male, lateral aspect showing 10 body segments, and caudal rami, caudal setae II–VII, P2–P6; UMNH IP 4830, adult male, lateroventral aspect showing 10 body segments and caudal rami, caudal setae III–VI, antennule, maxilla, P1–P6; UMNH IP 4831, adult male, lateral aspect showing 10 body segments and caudal rami, proximal antennular segments, maxilla, P1–P4; UMNH IP 4855, adult male dorso-ventrally compressed, dorsal aspect showing 10 body segments and caudal rami, caudal setae III–V, and VII, terminal exopodite segments of P3–P4; digeniculate antennules; UMNH IP 4840, adult male lateral aspect showing 10 body segments and caudal rami, caudal setae IV–V (none intact), antennule, antenna, P2–P4; UMNH IP 4842, adult male ventral aspect showing 10 body segments and caudal rami, distal geniculation of antennule, two-segmented exopodite of P1–P2.

UMNH IP 4857, CV larva (female), lateral aspect showing nine body segments and caudal rami, 11-segmented antennule, antenna (enp2–3), maxilla, P1–P5, P6 with three elements on laterodorsal surface; UMNH IP 4832 CV larva, lateral aspect showing nine body segments and caudal rami, caudal setae III–VII, 11-segmented antennule, mandibular palp setae, maxillule (proximalmost part of praecoxal arthrite), maxilla, P1–P4, medial spine on P1 basipodite, P5; UMNH IP 4854, CV larva dorsoventrally compressed, ventral aspect showing nine body segments and caudal rami, antennule (except for last three segments), antenna (with allobasis), swimming legs, rounded medial expansion of basipodite of P4, P5, spinules on median part of pediger 5; UMNH IP 4841, CV larva, ventral aspect showing nine body segments and caudal rami, caudal setae II–V (none intact), mandible, maxillule, maxilla, P1–P5, spinules on ventral surface of pediger 5, paired spermatophores attached to genital segment; UMNH IP 4825 CV larva (male), ventral aspect showing nine body segments and caudal rami, caudal setae IV and V (none intact), 11-segmented antennule, antenna, P1–P5, rounded medial expansion of P4 basipodite, P4 intercoxal sclerite with spinules on caudal surface, and rounded spinulose protuberances on distal margin; UMNH IP 4851, CV larva, dorsal aspect showing nine body segments and caudal rami, caudal setae II–VII, antennule, lateral seta of P5 inserted dorsally on pediger 5; OUMNH NT.235, CV larva, dorsal aspect showing nine body segments and caudal rami, caudal setae II–V, antennule, lateral seta of P5 inserted dorsally on pediger 5; OUMNH NT.236, CV larva, ventral aspect showing nine body segments and caudal rami, caudal setae II–V, swimming legs (contaminated with detritus); UMNH IP 4847, CV larva, ventral aspect showing nine body segments and caudal rami, caudal setae II, IV and V, antenna (enp1–2), distal parts of maxillule and maxilla, P1–P5; UMNH IP 4848, CV larva, lateral aspect showing nine body segments and caudal rami, antennule, antenna and P1–P4; UMNH IP 4835, CIV larva, lateral aspects showing eight body segments and caudal rami, caudal setae III–VII (III, VI and VII intact), antennule (proximal segments covered with detritus), maxilla, P1–P6; UMNH IP 4849, CIII larva, dorsal aspect showing seven body segments and caudal rami, caudal setae II–VII, 9-segmented antennule.

## ADDITIONAL MATERIAL:

UMNH IP 4838, copepodid larva contaminated with detritus, whole body, ventral aspect showing caudal rami with setae, 10(?) -segmented antennule, antenna with allobasis, P1 exopodite (2-segmented); UMNH IP 4837, copepodid larva, body fragment, dorsal aspect showing anal somite and caudal rami with setae (II, III, and VI intact).

## EXTANT TAXA USED FOR COMPARISON:

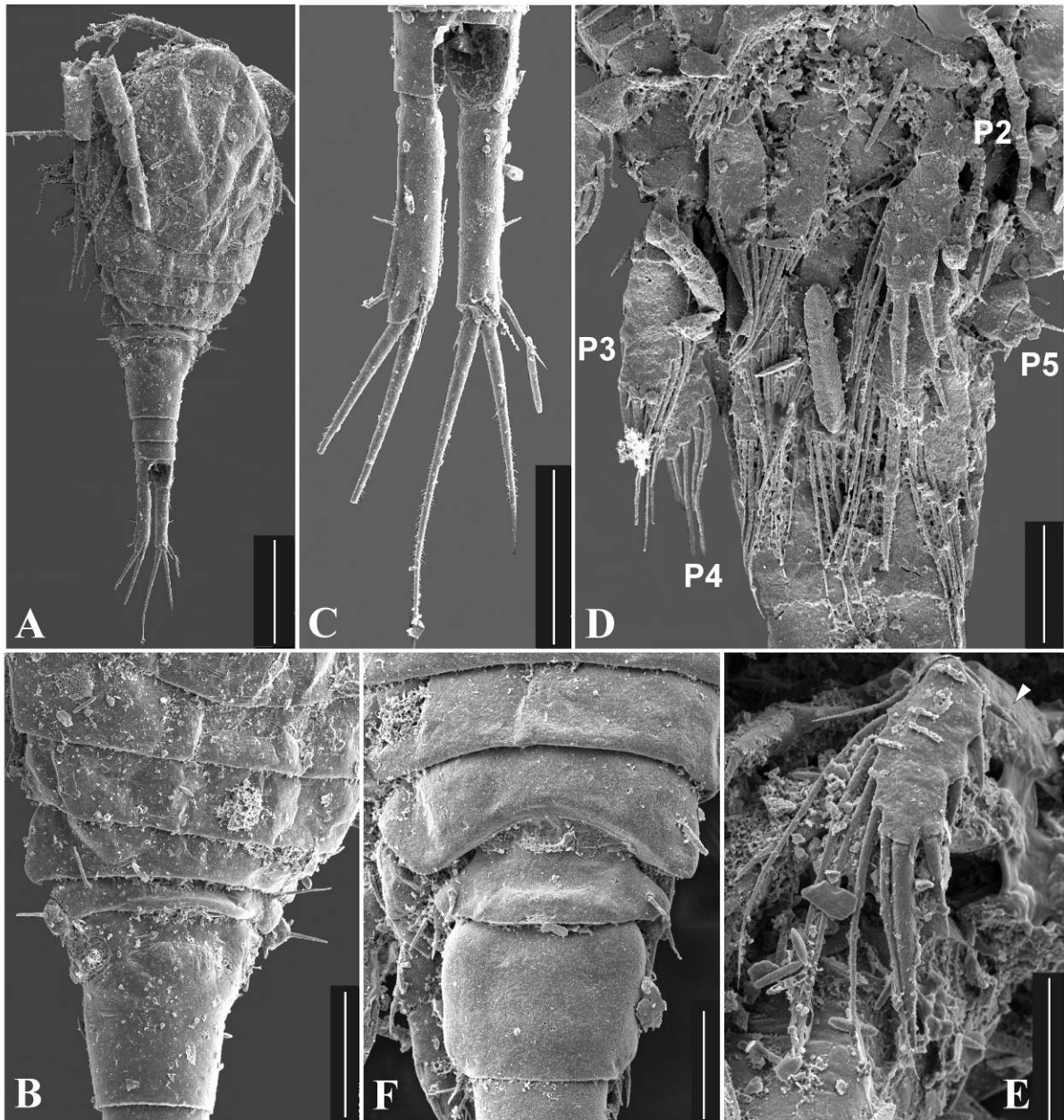
*Apocyclops panamensis* (Marsh, 1913) – Egypt: El Faiyum 29°18' N 30°50' E, fishpond, leg. G. El-Shabrawy one adult female [MIZ 2/2015/1] and four adult males [MIZ 2/2015/2–5]; Lake Manzilah (Nile Delta) 31°16' N 32°05' E, leg. G. El-Shabrawy, three adult females [MIZ 2/2015/6–8].

*Apocyclops* cf. *ramkhamhaengi* Chullasorn, Kangtia, Pinkaew and Ferrari, 2008 – Australia, Queensland Townsville 19°16' S 146°47' E, T-115, Boundary/Army Rd., service manhole, (high salinity), leg. B. H. Kay laboratory staff, 26 Jan. 1999, four adult females [MIZ 2/2015/9–12].

*Mesocyclops acanthoramus* Holyńska and Kay, 2003 – Australia, Queensland: Townsville 19°16' S 146°47' E, T-141, Railway/Putt., service manhole, leg. B. H. Kay laboratory staff, 22 Jan. 1999, one adult male [MIZ 2/2015/13]; Townsville 19°16' S 146°47' E, T-7, Morey/Bell service manhole, leg. B. H. Kay laboratory staff, 25 Jan. 1999, one CV female [MIZ 2/2015/14]; Culture, manhole from Ingham 18°39' S 146°09' E, leg. B. H. Kay laboratory staff, 08 Mar. 1999, one CV male [MIZ 2/2015/15].

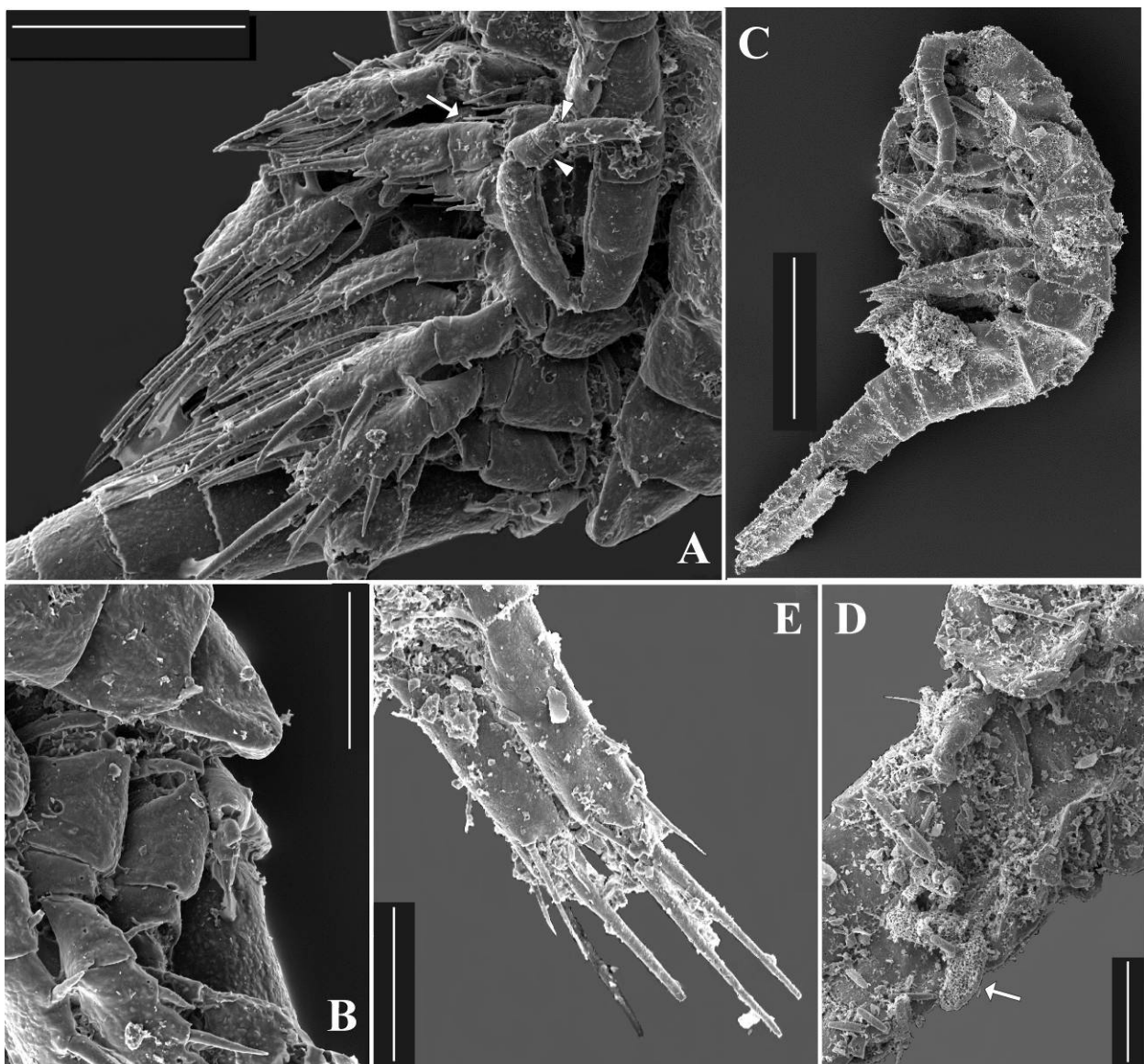
#### SOM 4

*Apocyclops californicus* sp. nov. **A–E.** Adult female. **A.** Habitus, dorsal view [UMNH IP 4852]. **B.** Pedigers 2–5 and genital double-somite, dorsal view [UMNH IP 4852]. **C.** Anal somite and caudal rami, dorsal view [UMNH IP 4852]. **D.** Second to fourth swimming legs, and leg 5, ventral view [UMNH IP 4826]. **E.** Third leg exopodite, arrowhead shows oblique spine on the first (proximal) segment [UMNH IP 4860]. **F.** Adult male: pedigers 3–6, dorsal view [UMNH IP 4856]. Scale bar: A, 200  $\mu$ m; B, C, 100  $\mu$ m; and D–F, 50  $\mu$ m.



**SOM 5**

*Apocyclops californicus* sp. nov. **A–B.** Adult male [UMNH IP 4858]. **A.** distal half of the antennule, and the swimming legs, lateroventral view – arrowheads show aberrant articulation between segments XXIV and XXV, and partial articulation between XXV and [XXVI–XVIII], an arrow points to the medial spine of leg 1 basipodite. **B.** Leg 5, and lateral parts of legs 2–4, lateroventral view. **C–E.** Copepodid V. **C.** Habitus, lateral view [female, UMNH IP 4857]. **D.** Urosomites 1–3, ventral view – arrow points to spermatophores on urosomite 2 [UMNH IP 4841]. **E.** Caudal rami, dorsal view [UMNH IP 4851]. Scale bar: A, 100  $\mu$ m; B, D, E, 50  $\mu$ m; and C, 200  $\mu$ m.





**SOM 6**

*Apocyclops californicus* sp. nov. **A.** 11-segmented antennule in copepodid V [male, UMNH IP 4825] – white bars point to five setae on the medial margin of the penultimate (second) endopodal segment of the antenna. **B.** Caudal rami in copepodid IV, lateral view [UMNH IP 4835] – Roman numerals denote caudal setae (explained in Holyńska et al. 2016: Other abbreviations section). **C.** Urosome comprising 3 segments in copepodid III, dorsal view [UMNH IP 4849]. Scale bar: A–C, 50  $\mu$ m.

