Cladistic and quantitative shape analyses of five new syntopic *Sarsamphiascus* (Copepoda, Harpacticoida): problems and solutions for diosaccin systematics and taxonomy

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SUPPLEMENTARY MATERIAL

Sarsamphiascus jackiei sp. nov.
(Figs. 2, 3, 10.2; Supplementary Figs. S1 – S5, S25.4)

DESCRIPTION: *Female* [based on holotype and six paratypes] Body length, from tip of rostrum to posterior margin of caudal rami (excluding caudal setae and appendages), from 590 to 630 µm. Colour of preserved specimens yellowish. Nauplius eye not visible. Prosome comprising cephalothorax (Ct) with completely fused first pedigerous somite and three free pedigerous somites (Fp1 – Fp3); urosome comprising six urosomites (U1 – U6), which include fifth pedigerous somite (U1), genital double-somite (fused genital (U2) and first abdominal (U2) somites), two free abdominal somites without appendages (U4 and U5), and anal somite (U6) with caudal rami (Cr) on posterior margin. Habitus (Figs. 2.1, 10.2) most robust of all Korean species, cylindrical, without distinct demarcation between prosome and urosome; prosome/urosome ratio about 1.1; greatest width at posterior end of cephalothorax. Integument of all somites well sclerotized, smooth, prosomites without pits or spinules, urosomites with numerous rows of minute spinules in addition to large posterior spinules (except first urosomite). Hyaline fringes of all somites wide (except last urosomite, which carries caudal rami, and genital somite, which fused to third urosomite); those of cephalothorax and free pedigerous somites smooth (Figs. 2.2, 2.3), those of urosomites finely serrated (Figs. 2.4, 2.6, 3.1, 3.2). Surface of somites and caudal rami with total maximum of 177 cuticular organs (14 pairs of cuticular pores, 74 pairs of sensilla, and one unpaired dorsal sensillum); additional pores (but not sensilla) present on some appendage segments, and also many setae and spines on antennula and mouth appendages with pore on top (only observable by SEM).

Rostrum (Figs. 2.2, 3.3) large, almost as long as first two segments of antennula combined, sharply pointed, beak-like, well demarcated at base from cephalothorax, about three times as long as wide, with single dorsal pair of sensilla (Ct-1) at about 3/5 of its length.

Cephalothorax (Fig. 2.2) smooth, cylindrical in dorsal view, tapering towards anterior end in lateral view, representing nearly 38 % of total body length (excluding rostrum). Cephalothoracic shield with two pairs of pores (Ct-I and Ct-II), 32 pairs of sensilla (Ct-2 to Ct-15 and Ct-17 to Ct-34), and one unpaired dorsal sensillum (Ct-16); both pores of similar size, about as large as circular base of sensilla; all sensilla of similar size, long, simple, and slender; sensilla pair Ct-2 at base of rostrum; lateral marginal zone includes sensilla Ct-3, Ct-4, Ct-7, Ct-15, Ct-22, and Ct-27; posterior marginal zone includes sensilla Ct-29 to Ct-34 (see Fig. 2.2).

Pleuron of first free prosomite (second pedigerous somite) (Fig. 2.3) with 10 pairs of long sensilla (Fp1-1 to Fp1-10), one unpaired dorsal pore (Fp1-I), and one pair of lateral anterior pores (Fp1-II); posterior marginal zone includes sensilla Fp1-1, Fp1-2, and Fp1-4 to Fp1-9, while sensillum Fp1-3 situated slightly more anteriorly; lateral marginal zone includes only sensillum Fp1-10; sensilla Fp1-9 and Fp1-10 probably serially homologous to sensilla Ct-34 and Ct-27 on cephalothorax respectively, while serial homology of other sensilla difficult to determine.

Pleuron of second free prosomite (third pedigerous somite) (Fig. 2.3) very similar in shape and size to that of first free prosomite, but with only eight pairs of sensilla (Fp2-1 to Fp2-8), all of them with easily recognizable serial homologues on first free prosomite: sensilla pairs Fp2-1 to Fp2-4 probably serially homologous to their counterparts with same Arabic numerals on first free prosomite, while other serial homologies include Fp2-5 to Fp1-6, Fp2-6 to Fp1-7, Fp2-7 to Fp1-9, and Fp2-8 to Fp1-10.

Pleuron of third free prosomite (fourth pedigerous somite) (Fig. 2.3) similar in shape to that of second free prosomite but narrower and shorter, with only six pairs of sensilla (Fp3-1 to Fp3-6), all of them with easily recognizable serial homologues on second free prosomite: Fp3-1 to Fp2-1, Fp3-2 to Fp2-2; Fp3-3 to Fp2-5, Fp3-4 to Fp2-6, Fp3-5 to Fp2-7, and Fp3-6 to Fp2-8.

First urosomite (fifth pedigerous somite) (Fig. 2.3) smaller and shorter than pleuron of third free prosomite, with four pairs of sensilla (U1-1 to U1-4); U1-1 and U1-2 possibly serially homologous to their counterparts with same Arabic numerals on pleurons of free prosomites, but serial homology of other two pairs (U1-3 and U1-4) not obvious; hyaline fringe finely serrated dorsally but smooth laterally.

Second urosomite (Figs. 2.4, 3.1, 3.2) fused with third urosomite into genital double-somite, with lateral internal ridges and accompanying surface large spinules and cuticular organs as only evidence of ancestral segmentation (thus no hyaline fringe), with four pairs of posterior sensilla (U2-1 to U2-4) dorsolaterally and two pairs of small pores ventrolaterally, all of them of uncertain serial homology; some 12-15 large spinules filling all space in between sensilla U2-1 and U2-4 and even slightly ventrally from U2-4, but no large spinules in between left and right U2-1.

Third urosomite (Figs. 2.4, 3.1, 3.2) fused with second urosomite, with wide, straight, and finely serrated hyaline fringe, one pair of ventrolateral pores (U3-I), and five pairs of posterior sensilla: three dorsal (U3-1 to U3-3), one lateral (U3-4), and one ventral (U3-5); sensilla U3-1 to U3-4 probably serially homologous to their counterparts with same Arabic numerals on second urosomite, while sensillum U3-5 without homologue; establishing serial homology of pores not easy.

Genital double-somite about 0.9 times as long as wide (ventral view). Genital complex (Fig. 3.1) with single large and round copulatory pore in distal part of second urosomite, partly covered by small and round epicopulatory bulb, short and wide copulatory duct, two small kidney-shaped seminal receptacles (each slightly smaller than epicopulatory bulb), and two large genital apertures in anterior part of second urosomite, each covered by reduced sixth leg.

Fourth urosomite (Figs. 2.4, 3.1, 3.2) narrower and shorter than genital double-somite, with wide and finely serrated hyaline fringe, three pairs of posterior sensilla (U4-1 to U4-3), single pair of ventral pores (U4-I); and large spinules covering almost all spaces between sensilla, except for small ventrolateral and dorsal spots; ventral spinules longer than dorsal or lateral ones.

Fifth urosomite (preanal) (Figs. 2.6, 3.1, 3.2) significantly narrower and slightly shorter than fourth urosomite, without sensilla, with single pair of ventrolateral pores (U5-I), and five or six large lateral spinules; hyaline fringe wide and finely serrated, extended dorsally into large pseudoperculum.

Sixth urosomite (anal) (Figs. 2.6, 3.1, 3.2) slightly narrower and significantly shorter than fifth urosomite, cleft medially in posterior part, with one pair of large dorsal sensilla (U6-1) very close to posterior margin, four pairs of pores (U6-I to U6-IV), and continuous row of large spinules along posterior margin; anal operculum broad, short, and slightly convex, with finely serrated posterior margin, representing about 43 % of somite's width; anal sinus widely opened, with weakly sclerotized walls and three rows of long, hair-like spinules boarding anus.

Caudal rami (Figs. 2.6, 3.1, 3.2) strongly sclerotized, cylindrical, very short and small, less than half as long as sixth urosomite, about half as long as wide; with several short rows of large spinules dorsomedially, smaller spinules at base of lateral setae, three simple small surface pores (one dorsal: Cr-I; two ventral: Cr-II and Cr-III), one ventral tubular pore directed posteriorly (Cr-IV), and seven setae (three lateral, one dorsal, and three apical). Dorsal seta slender and smooth, twice as long as ramus, inserted in posteriomedial corner, triarticulate at base (i.e., inserted on two pseudojoints). All lateral setae inserted close to each other at about 3/4 of ramus length; ventral one most slender and twice as long as ramus; central one as long as ramus and spiniform; dorsal one twice as long as ramus, strong and unipinnate. Innermost apical seta smooth but strong, 2.5 times as long as ramus. Central apical seta with breaking plane, very strong, distally pinnate, nearly twice as long as entire urosome. Outer apical seta also with breaking plane, slightly shorter and less robust than central apical seta, also distally pinnate.

Antennula (Figs. 2.1, 2.2; Supplementary Fig. S2.1) eight-segmented, as long as cephalothorax, with robust and long aesthetasc on fourth segment fused basally to slightly longer seta, slender and much shorter apical aesthetasc on eighth segment fused basally to two slightly longer setae, and setal formula 1.11.7.4.2.4.4.7. Two lateral setae on seventh segment and four lateral setae on eighth segment biarticulate (i.e., inserted on short pseudojoint); all setae slender and smooth. First segment with dorsal cuticular pore and median short row of large spinules; second segment with small outer pore; other segments without surface ornamentation. Length ratio of antennular segments, from proximal end and along caudal margin, 1 : 1.2 : 0.5 : 0.9 : 0.2 : 0.3 : 0.3: 0.5. First segment widest, other progressively narrower; second segment 2.1 times as long as wide; fourth segment 3.6 times as long as wide, with prominently protruded anterior distal corner at base of large easthetasc.

Antenna (Supplementary Fig. S2.2) comprising coxa, basis, two-segmented endopod, and much smaller three-segmented exopod. Coxa very short, 0.3 times as long as wide, unarmed, and unornamented. Basis partly fused to first endopodal segment, cylindrical, about as long as wide, and more than twice as long as coxa, unarmed, with longitudinal row of spinules along inner margin. First endopodal segment cylindrical, 2.2 times as long as wide, twice as long as basis, with strong and short seta at about 3/5 of its length. Second endopodal segment as long as first endopodal segment, more slender proximally but also generally cylindrical, 3.5 times as long as wide, with two surface frills distally and row of large spinules along inner margin; lateral armature consisting of two strong, smooth spines, flanking two slender setae; apical armature consisting of seven elements: one smooth, slender, short seta, one bipinnate short spine, one unipinnate slender seta, and four geniculate setae, longest fused basally to slender pinnate seta; all geniculate setae of similar length, about 1.6 times as long as second endopodal segment. Exopod very slender, cylindrical but slightly curved, about as long as first endopodal segment, first segment five times as long as wide, 7.8 times as long as second segment, and twice as long as third segment; with posterior row of minute spinules on first and third segment, one distolateral seta each on first two segments, one lateral pinnate seta on third segment (inserted about 1/3 of segment's length), and three apical setae (one smooth and slender, as long as third segment; one short and strong, distally pinnate, 0.7 times as long as third segment; and one very strong, bipinnate, and twice as long as third segment).

Labrum (Fig. 3.4) large, trapezoidal, rigidly sclerotized, with slightly convex cutting edge, with numerous slender apical and subapical spinules, those on outer distal corners strongest.

Paragnaths (Fig. 3.5) simple ovoid lobes, joined by central bridge, ornamented with one long longitudinal row of large spinules on anterior surface and several apical rows of spinules of various size and thickness.

Mandibula (Supplementary Fig. S2.3) composed of large coxa and slightly smaller palp; palp composed of basis, one-segmented endopod, and two-segmented exopod. Cutting edge of coxa narrow, with three large bi- or tricuspidate teeth, one long unipinnate dorsal seta, six smaller and simple teeth of various thickness in between, and six or seven small spinules at base of teeth on posterior surface. Basis pentagonal, about half as long as coxa, 2.3 times as long as wide, with row of six long subapical spinules and three apical pinnate setae, central seta as long as basis and 1.6 times as long as other two setae. Endopod cylindrical, 2.6 times as long as wide and half as long as basis, with two lateral and six apical smooth and slender setae; lateral setae inserted very close to each other, at about 2/5 of endopod, partly fused basally. Exopod also cylindrical, minute but distinctly two-segmented, only 0.3 times as long as exopod; first segment twice as long and wide as second, with one subapical bipinnate seta; second segment with two apical setae, outer one bipinnate, twice as long as inner smooth and slender seta, and 3.6 times as long as entire exopod.

Maxillula (Supplementary Fig. S2.4) composed of praecoxa, coxa, basis, one-segmented endopod, and one-segmented exopod. Praecoxa large, ovoid, with smaller and rectangular arthrite, and several rows of spinules; arthrite highly mobile, 1.3 times as long as wide and half as long as main body of preacoxa, with seven strong apical spines and two strong subapical dorsalmost setae, additional two slender and smooth setae on anterior surface, and several large spinules on dorsal surface. Coxa small, with small spinules, one slender and smooth apical seta, and one curved and strong unipinnate apical seta, both of similar length and twice as long as coxa. Basis significantly wider and twice as long as coxa, three times as long as wide, with several rows of small spinules, and two pinnate and three smooth setae along inner margin. Endopod 0.4 times as long as basis and nearly three times as long as wide, with one inner bipinnate seta and three apical smooth setae; central apical seta longest, almost three times as long as endopod. Exopod about half as long as endopod, slightly longer than wide, with two spinules on inner margin and two apical bipinnate slender setae of about same length and four times as long as exopod.

Maxilla (Supplementary Fig. S2.5) composed of syncoxa, basis and one-segmented endopod. Syncoxa large, ovoid, with two rows of large outer spinules and three inner endites; endites of about same length, cylindrical, twice as long as wide, central with two setae, proximal and distal with three setae each; all setae pinnate, those on distal and central endites also very strong. Basis much smaller than syncoxa, elongated, with strong apical spine transformed into claw-like structure, additionally with one strong apical seta and two smooth and slender setae, one on anterior, and one on posterior surface. Endopod about as large as syncoxal endites, slightly longer than wide, with two lateral and five apical slender setae.

Maxilliped (Supplementary Fig. S2.6) prehensile, three-segmented, composed of syncoxa, basis, and one-segmented endopod. Syncoxa cylindrical, 1.8 times as long as wide, with three rows of long spinules, three long and pinnate setae, and one minute and smooth seta; all setae inserted close to each other on inner distal corner. Basis largest segment, three times as long as wide and 1.6 times as long as syncoxa, cylindrical but wider in central part, with one longitudinal row of large spinules on posterior surface, one longer longitudinal row of smaller spinules on anterior surface, and two slender and smooth inner setae; distal seta inserted at 4/5 of basis and 1.6 times as long as proximal seta, which inserted at 3/5 of basis. Endopod smallest segment, 3.5 times as long as wide and one third of basis length, cylindrical but slightly curved, with one apical claw-like spine and three subapical slender setae; apical spine twice as long as endopod and 1.4 times as long as longest endopodal seta.

All swimming leg (Supplementary Fig. S3) slender, long, composed of small unarmed triangular praecoxa, large unarmed rectangular coxa, smaller pentagonal armed basis, three-segmented armed exopod, and three-segmented armed endopod. Endopod of first swimming leg prehensile, while all other endopods and all exopods straight. Coxae in all pairs of legs connected by unornamented and unarmed intercoxal sclerite with concave distal margin; sclerites of second to fourth leg with sharp distal spiniform processes.

First swimming leg (Supplementary Fig. S3.1) with shortest intercoxal sclerite (nearly three times as wide as long), biggest praecoxa, smallest coxa, longest basis, and longest endopod of all swimming legs. Coxa 1.5 times as wide as long, narrower in distal part than proximal, with single anterior pore close to inner margin and seven rows of spinules of various lengths (four on anterior surface, two on posterior surface, one along outer margin). Basis 1.8 times as wide as long, with single anterior pore close to outer margin, one strong outer bipinnate spine, one strong inner bipinnate spine, and four rows of spinules on anterior surface (one at base of each spine, one at base of endopod, and one on inner margin); outer spine 1.2 times as long as inner spine. Exopod with all first to segments of similar length, third segment slightly shorter, each segment twice as long as wide and with large spinules along outer margin, second also with slender spinules along inner margin; first segment with strong outer spine, which longer than segment; second segment with strong outer spine, which as long as segment, and slightly longer inner slender and bipinnate seta; third segment with three outer spines, which progressively longer towards distal end, and two apical geniculate setae; inner geniculate seta on third segment slightly shorter than entire exopod, 1.3 times as long as outer geniculate seta, and 1.8 times as long as distal outer spine. Endopod significantly longer than exopod; first endopodal segment alone 1.3 times as long as entire exopod, 6.4 times as long as wide, and three times as long as second and third endopodal segments combined, with longitudinal rows of spinules along inner and outer margins, and with strong inner seta inserted close to distal end and 0.4 times as long as segment; second endopodal segment small, rhomboidal, with spinules along outer margin and slender short inner seta; third endopodal segment twice as long as second endopodal segment, 2.7 times as long as wide, with spinules along outer margin, slender and short inner seta, geniculate and strong apical seta, and strong prehensile outer spine; endopodal apical seta 1.5 times as long as endopodal outer spine, 2.8 times as long as third endopodal segment, and 0.85 times as long as longer exopodal geniculate seta.

Second swimming leg (Supplementary Fig. S3.2) with very short praecoxa, intercoxal sclerite longer than wide and with very sharp distal processes, and with exopod and endopod of similar length and thickness. Coxa 1.6 times as wide as long, with anterior pore near inner distal corner, two anterior and one posterior rows of spinules. Basis twice as wide as long, with sharp process on inner distal corner similar in size to processes on intercoxal sclerite, bipinnate outer spine, and three anterior rows of spinules. Exopodal segments progressively narrower towards distal end, their length ratio 1 : 0.75 : 1.4; first and second segment with outer distal corners drawn into spiniform processes, inner frills, strong spinules along outer margin, outer strong spine and inner slender seta; third segment 3.7 times as long as wide, with spinules along outer margin in proximal third, three outer spines, two apical spiniform setae, and two outer slender and long setae. Endopodal segments also progressively narrower towards distal end, their length ratio 1 : 1.2 1.7; first and second segments also with strong spinules along outer margin, inner frills, and outer distal corners drawn into spinifrom processes but smaller than in exopod and with anterior pore at base; first segment with single short inner seta, second with two inner setae; third segment 4.2 times as long as wide, with spinules along outer margin, anterior pore near inner margin, one long inner seta, two long apical setae, and one strong outer spine.

Third swimming leg (Supplementary Fig. S3.3) similar to second, except basis with slender seta instead of spine, inner spiniform process on basis shorter, and third endopodal segment with three inner setae.

Fourth swimming leg (Supplementary Fig. S3.4) similar to third leg, except intercoxal sclerite shorter, endopod only 0.8 times as long as exopod, third endopodal segment 3.3 times as long as wide and with only two inner setae, and third exopodal segment with one additional minute inner seta and two other setae more robust than in third leg.

Fifth leg (Fig. 2.5; Supplementary Fig. S5.1) composed of conical baseoendopod and ovoid exopod. Baseoendopod 1.1 times as long as wide, with large spinules along outer distal margin, three simple small cuticular pores, slender and smooth outer basal seta inserted on large setophore, and five strong and pinnate endopodal setae with length ratio from inner side 1 : 1.2 : 1.6 : 2 : 1.1; longest endopodal seta half as long as baseoendopod. Exopod 1.6 times as long as wide, 0.7 times as long as baseoendopod, with long spinules along inner and outer margins, one anterior simple and small cuticular pore near distal end, one tubular pore in proximal third near outer margin, and six setae with length ratio from inner side 1 : 1.7 : 1.4 : 0.7 : 0.6 : 0.8; second and third seta from inner side slender and smooth, inserted on short setophores, other four setae strong, spiniform, and pinnate; innermost exopodal seta 0.6 times as long as exopod and 1.5 times as long as innermost endopodal seta.

Sixth leg (Fig. 3.6) minute cuticular plate, three times as wide as long, with innermost spiniform process and three small pinnate setae with length ratio from inner side 1 : 0.7 : 0.2; smallest seta smaller than some sensilla and spinules on urosome; distal tip of longest seta reaching middle of genital double-somite.

Male [based on allotype and two paratypes] Body length from 570 to 590 μm. Habitus shape (Supplementary Fig. S1.1), body proportions, and segmentation as in female, except second and third urosomites not fused. Ornamentation and shape of cephalothorax (Supplementary Fig. S1.2), all free prosomites (Supplementary Fig. S1.3), and first urosomite (Supplementary Fig. S1.3), as well as colour and nauplius eye (Supplementary Fig. S25.4), as in female.

Second urosomite (genital somite) (Supplementary Figs. S1.3, S4.1, S4.2) twice as wide as long in dorsal view, as in female with four pairs of sensilla (U2-1 to U2-4), but with only one pair of pores (U2-I) and their position more dorsal than in female, and with large spinules also between dorsal pair of sensilla (U2-1).

Third urosomite (Supplementary Figs. S1.3, S4.1, S4.2) as in female with five pairs of sensilla (U3-1 to U3-5), but with additional dorsal anterior pair of pores (U3-II), without ventral posterior pores, and with large spinules in between ventral pair of sensilla (U3-5).

Fourth urosomite (Supplementary Figs. S1.4, S4.1, S4.2) as in female, except ventral pores (U4-I) spaced more widely.

Fifth urosomite (Supplementary Figs. S1.4, S4.1, S4.2), sixth urosomite (Supplementary Figs. S1.4, S4.1, S4.2), and caudal rami (Supplementary Figs. S1.4, S4.1, S4.2) as in female, except only one ventral pore visible on caudal rami (Cr-II).

Antennula (Supplementary Figs. S1.5, S5.2), strongly prehensile, robust, with first two and last two segments as in female, but with highly transformed central part in shape, segmentation, and armature, although large aesthetasc inserted on protruded corner helps homologize largest segment to female fourth segment, suggesting that probably female third, fifth, and sixth segments partly of completely subdivided in male, resulting in 11-segmented state; geniculation present between seventh and eight segments, which also strengthened with several longitudinal ridges and strongly chitinized; setal formula: 1.11.6. 3. 8. 2.1.0.1.4.7; two setae on fifth segment and one seta on sixth segment very short and ornately pinnate, other setae smooth; same six setae on last two segments biarticulated as in female.

Antenna (Supplementary Fig. S1.6), labrum, paragnaths, mandibula (Supplementary Fig. S4.3), maxillula, maxilla, maxilliped, exopod and endopod of first swimming leg, exopod of second swimming leg, third swimming leg, and fourth swimming leg as in female.

Basis of first swimming leg (Supplementary Fig. S4.4) with highly modified inner margin, furnished with three spiniform processes, proximal one smaller than other two; inner spine curved outwards and pinnate only along concave margin.

Endopod of second swimming leg (Supplementary Fig. S5.3) highly modified, two-segmented; first segment same as in female; second segment with two proximal inner setae as in female second segment, except inner margin of segment with prominent proximal bulge; no visible suture indicating ancestral segmentation, but distal part of male second segment with four elements just as third segment in female, except their position and shape modified: inner seta most similar to female inner seta, but longer and inserted closer to distal margin; distal inner seta much shorter than in female; distal inner seta and outer spine both inserted close to each other on outer margin, at about 3/4 of second segment, both transformed into large smooth spines forming pincers, outer one slightly stronger and with pointed tip, while inner one more slender proximally and with wider, bifid tip; length ratio of armature on second segment from outer side 1 : 1 : 0.7 : 2.2 : 1 : 0.4; outer spine as long as section of second segment proximal to its insertion; second segment, measured up to insertion of outer spine, 1.5 times as long as first endopodal segment, and 2.3 times as long as wide;.

Fifth legs (Supplementary Figs. S1.3, S4.1, S5.4) smaller than in female and with partly fused baseoendopods, with only two elements on endopodal lobe but with six elements on exopod, as in female, although second element from inner side strong and spiniform; endopodal lobe trapezoidal but with outer distal corner produced into spiniform process, with only one pore (at base of basal seta); outer endopodal spiniform seta 1.4 times as long as inner endopodal spiniform seta and 0.9 times as long as innermost exopodal spiniform seta; exopod more spindle-shaped than ovoid, 1.5 times as long as wide, with tubular pore close to simple pore and both near distal end; length ratio of exopodal armature from inner side 1 : 1 : 1.4 : 0.5 : 0.4 : 1.

Sixth leg (Supplementary Fig. S4.1) short cuticular plate but larger than in female, with three elements as in female, but inner one spiniform while other two slender and smooth, their length ratio from inner side 1 : 3.4 : 2.4.

Sarsamphiascus titoi sp. nov.
(Fig. 4; Supplementary Figs. S6 & S7)

DESCRIPTION: *Female* [based on holotype] Body length 530 µm. Habitus shape, colour, body segmentation, proportion of somites and their hyaline fringes, appendage segmentation, armature formula of all appendages, and proportion of segments and armature on most appendages as in previous species. Sensilla and pore pattern on prosomites not mapped and illustrated, as cephalothoracic shield and tergites of free prosomites mostly destroyed and awkwardly folded during dissection and slide preparation, but without any difference from previous species in areas clearly visible and nicely mounted (less than half of entire area). Urosomites without minute spinules. Rostrum and first urosomite also as in previous species.

Second urosomite (Figs. 4.1, 4.2) as in previous species, but without ventral pores, with smaller space between sensilla U2-1 and U2-2, smaller spinules, slightly larger and not perfectly round epicopulatory bulb (1.1 times as long as wide), and slightly larger receptacula seminis in proportion to somite.

Third urosomite (Figs. 4.1, 4.2) as in previous species, but without ventral pores, with smaller space between dorsal sensilla pair (U3-1), and slightly smaller posterior spinules.

Genital double-somite also about 0.9 times as long as wide in ventral view, as in previous species, and also with widely spaced ventral pair of sensilla (U3-5).

Fourth urosomite (Figs. 4.1, 4.2) with three pairs of posterior sensilla (U4-1 to U4-3), as in previous species, but without ventral pores, with novel pair of dorsolateral pores (U4-II), space between dorsal pair of sensilla (U4-1) somewhat smaller and without spinules (arrowed in Fig. 4.2), space between ventral pair of sensilla (U4-3) much smaller and with smaller spinules (arrowed in Fig. 4.1), and also without spinules laterally from dorsal sensilla.

Fifth urosomite (Figs. 4.1, 4.2) similar to that in previous species, but without lateral spinules, with more closely spaced ventral pores (U5-I), and with novel dorsolateral pores (U5-II); pseudoperculum also slightly more convex.

Sixth urosomite (Figs. 4.1, 4.2) slightly narrower than in previous species, with only one pair of pores (U6-IV) and smaller posterior spinules, although they form a continuous posterior row as in previous species; anal operculum representing about 39 % of somite's width.

Caudal rami (Figs. 4.1, 4.2) shape, armature, and ornamentation as in previous species, except central apical seta inflated around braking plane (arrowed in Fig. 4.1), dorsal seta inserted further away from inner distal corner (arrowed in Fig. 4B), and inner apical seta with small kink.

Antennula (Supplementary Figs. S6.1) segmentation, armature formula, and ornamentation as in previous species, and same six setae on last two segments biarticulated; length ratio of antennular segments, from proximal end and along caudal margin, 1 : 1.4 : 0.7 : 1 : 0.3 : 0.4 : 0.4: 0.7; second segment 1.8 times as long as wide; fourth segment 2.6 times as long as wide.

Antenna (Supplementary Fig. S6.2) segmentation, armature formula, and ornamentation as in previous species, but exopod not curved and less slender (arrowed in Supplementary Fig. S6.2), exopod without spinules, and proportions of segments and some armature different; basis also partly fused to first endopodal segment, about as long as wide, and more than twice as long as coxa; first endopodal segment 1.7 times as long as wide, twice as long as basis, with short seta at about 3/5 of its length; second endopodal segment as long as first endopodal segment, more slender proximally but also generally cylindrical, 2.9 times as long as wide; first exopodal segment 2.6 times as long as wide, six times as long as second segment, and 1.6 times as long as third segment; apical strong exopodal seta as long as apical slender exopodal seta and 1.8 times as long as third exopodal segment.

Labrum, paragnaths, mandibula (Supplementary Fig. S6.3), maxillula (Supplementary Fig. S6.4), and maxilla (Supplementary Fig. S6.5) as in previous species.

Maxilliped (Supplementary Fig. S7.1) segmentation, armature, and ornamentation as in previous species, but first endopodal segment less slender, about twice as long as wide.

Swimming legs (Supplementary Figs. S6.6, S7.2-S7.6) segmentation, shape, armature, and most ornamentation as in previous species.

First swimming leg (Supplementary Fig. S6.6) with fewer spinules on anterior surface than previous species; coxa 1.6 times as wide as long; basis 1.2 times as wide as long; first endopodal segment 1.3 times as long as entire exopod, 5.3 times as long as wide, and 3.4 times as long as second and third endopodal segments combined; endopodal apical seta 1.6 times as long as endopodal outer spine, 2.5 times as long as third endopodal segment, and 0.8 times as long as longer exopodal geniculate seta.

Second swimming leg (Supplementary Fig. S7.2) with slightly shorter inner spiniform process on basis than in previous species; third exopodal segment 3.6 times as long as wide; third endopodal segment four times as long as wide.

Third swimming leg (Supplementary Figs. S7.3, S7.4) with slightly shorter and rounder first two endopodal segments than in previous species; third exopodal segment 3.5 times as long as wide.

Fourth swimming leg (Supplementary Figs. S7.5, S7.6) similar to previous species; third exopodal segment 3.4 times as long as wide; third endopodal segment 3.6 times as long as wide.

Fifth leg (Supplementary Fig. S6.7) general shape, segmentation, number of armature, and most ornamentation as in previous species, except endopodal lobe narrower distally, exopod more rounded and without tube pore, all exopodal setae slender, and apical exopodal setae inserted on much shorter setophores (arrowed in Supplementary Fig. S6.7);

baseoendopod 1.1 times as long as wide; endopodal setae length ratio from inner side 1 : 1.2 : 1.9 : 2.2 : 1.7; longest endopodal seta 0.6 times as long as baseoendopod; exopod 1.7 times as long as wide, 0.8 times as long as baseoendopod; length ratio of exopodal setae from inner side 1 : 1.9 : 1.1 : 0.7 : 0.7 : 0.8; first exopodal seta from inner side bipinnate, other exopodal setae smooth.

Sixth leg (Fig. 4.1) shape, size, armature formula, and ornamentation as in previous species; length ratio of setae from inner side 1 : 0.4 : 0.14; smallest seta smaller than ventral sensilla on third urosomite (U3-5).

Sarsamphiascus jermainei sp. nov.
(Figs. 5, 6, 10.3; Supplementary Figs. S8 – S12, S25.3)

DESCRIPTION: *Female* [based on holotype and five paratypes] Body length from 400 to 413 µm. Colour, nauplius eye, body segmentation, and appendage segmentation as in previous two species. Habitus (Figs. 5.1, 10.3) least robust of all Korean species, cylindrical, without distinct demarcation between prosome and urosome; prosome/urosome ratio about 1.3; greatest width at posterior end of cephalothorax. Integument of all somites smooth, without pits or minute spinules, urosomites with posterior rows of large spinules. Hyaline fringes of all prosomites smooth and of urosomites finely serrated, as in previous two species, except fringe of third urosomite smooth ventrally. Surface of somite with fewer sensilla but more pores than in previous two species, especially on cephalothorax.

Rostrum (Supplementary Fig. S9.1) as long as first two segments of antennula combined, 2.8 times as long as wide, similar in shape to two previous species, with single dorsal pair of sensilla (Ct-1) at about 3/5 of its length.

Cephalothorax (Fig. 5.2) represents 36 % of total body length (excluding rostrum); cephalothoracic shield with seven pairs of pores (Ct-I and Ct-VII), although pore Ct-VI missing on left side of one paratype (Fig. 5.2), 32 pairs of sensilla (Ct-2 to Ct-15, Ct-17 to Ct-19, Ct-21 to Ct23, Ct-25-28, and Ct-32), and one unpaired dorsal sensillum (Ct-16); pores Ct-I and Ct-III several times larger than other pores, which about as large as circular base of sensilla; all sensilla of similar size, long, simple, and slender; sensilla pair Ct-2 at base of rostrum; as in previous two species, lateral marginal zone includes sensilla Ct-3, Ct-4, Ct-7, Ct-15, Ct-22, and Ct-27; posterior marginal zone includes only sensillum Ct-32 (see Fig. 5.2); compared to two previous species seven sensilla pairs and one pore pair missing (Ct-20, Ct-24, Ct-29 to Ct-31, Ct-33, Ct-34, and Ct-II), while four pore pairs novel structures (Ct-IV to Ct-VII); relative positions of certain sensilla also slightly different from previous two species, with sensillum Ct-19 inserted more posteriorly compared to sensillum Ct-18, and sensilla Ct-14 and Ct-21 inserted closer to each other.

Pleuron of first free prosomite (Fig. 5.3) with only eight pairs of long sensilla (Fp1-1 to Fp1-4, Fp1-6, and Fp1-8 to Fp1-10), but with one novel pair of lateral pores (Fp1-I); none of them probably with serial homologues on cephalothorax.

Pleuron of second free prosomite (Fig. 5.3) with only seven pairs of sensilla (Fp2-1 to Fp2-4 and Fp2-6 to Fp2-8), most of them with easily recognizable serial homologues on first free prosomite: sensilla pairs Fp2-1 to Fp2-4 probably serially homologous to their counterparts with same Arabic numerals on first free prosomite, while other serial homologies include Fp2-7 to Fp1-9, and Fp2-8 to Fp1-10; sensillum Fp2-6 probably not serially homologous to sensillum Fp1-8.

Pleuron of third free prosomite (Fig. 5.3) as in previous two species with six pairs of sensilla (Fp3-1 to Fp3-6), two dorsal and two ventral with easily recognizable serial homologues on second free prosomite, while either sensilla Fp3-3 or Fp3-4 hard to serially homologize with Fp2-6.

First urosomite (Fig. 5.3) as in previous two species with four pairs of sensilla (U1-1 to U1-4), but with one novel pair of lateral pores (U1-I).

Second urosomite (Figs. 5.4, 6.1, 6.2) with strong internal ridges, indicating fusion with third urosomite, visible dorsally and laterally; with four pairs of sensilla (U2-1 to U2-4), as in previous two species, but sensilla U2-1 to U2-3 more closely spaced; pore U2-I lateral, while pore (U2-II) ventrolateral.

Third urosomite (Figs. 5.4, 6.1, 6.2) with only four pairs of sensilla (U3-1, U3-2, U3-4, and U3-5) and with fewer spinules than in previous two species, but ventral sensilla pair (U3-5) still very widely spaced.

Genital double-somite (Fig. 6.1) slightly more elongated than in previous two species (about as long as wide in ventral view); epicopulatory bulb large, ellipsoid, 1.7 times as long as wide, with chitinous divide at about 3/5 of its length; receptacula seminis more ovoid than in previous two species, 0.6 times as long as epicopulatory bulb.

Fourth urosomite (Figs. 5.4, 6.1, 6.2) with three pairs of sensilla (U4-1 to U4-3), and in previous species, but no pores; ventral pair of sensilla (U4-3) narrowly spaced as in *S. titoi* but no spinules between them (arrowed in Fig. 6.1); four or five spinules around lateral sensillum (U4-2) and six or seven spinules lateral from dorsal sensillum (U4-1).

Fifth urosomite (Figs. 5.5, 6.1, 6.2) with same shape and pseudoperculum as in previous two species, but without pores.

Sixth urosomite (Figs. 5.5, 6.1, 6.2) less tapering posteriorly than in previous two species (almost cylindrical), with only two pairs of pores (U6-II and U6-IV), and without spinules along posterior margin dorsally (arrowed in Fig. 6.2); anal operculum represents 38 % of somite's width; anal sinus more widely opened than in previous two species.

Caudal rami (Figs. 5.5, 6.1, 6.2) narrower and longer (arrowed in Fig. 6.2) than in previous two species, about as long as wide in dorsal view, without dorsal spinules, and with only three pores (Cr-II to Cr-IV).

Antennula (Fig. 5.1, 5.2; Supplementary Fig. S9.1) segmentation, ornamentation, and general shape as in previous two species; setal formula 1.11.6.4.2.4.4.7; length ratio of antennular segments 1 : 1.2 : 0.4 : 0.7 : 0.2 : 0.3 : 0.3: 0.6; second segment 2.2 times as long as wide; fourth segment 2.2 times as long as wide.

Antenna (Supplementary Fig. S9.2) segmentation, most ornamentation, and all armature as in previous two species, except third exopodal segment with only two apical setae; first endopodal segment 2.3 times as long as wide and 2.7 times as long as basis, with slender seta at about 2/5 of its length; second endopodal segment as long as first endopodal segment; exopod straight and slender, about as long as first endopodal segment, first exopodal segment 3.5 times as long as wide, 7.7 times as long as second exopodal segment, and 1.4 times as long as third exopodal segment; with posterior row of minute spinules on third exopodal segment; pinnate apical seta on third exopodal segment 1.7 times as long as slender apical seta, and 1.2 times as long as third exopodal segment.

Labrum and paragnaths as in previous two species.

Mandibula (Supplementary Fig. S9.3) shape, segmentation, armature, and ornamentation as in previous two species, except coxa slightly shorter, and cutting edge of coxa slightly wider and without small spinules.

Maxillula (Supplementary Fig. S9.4) shape, segmentation, and armature as in previous two species, but without spinules, except one on praecoxal arthrite.

Maxilla (Supplementary Fig. S9.5) shape, segmentation, ornamentation and most armature as in previous two species, except spinules on syncoxa smaller and proximal endite with only two setae.

Maxilliped (Supplementary Fig. S9.6) shape, segmentation, and most ornamentation and armature as in previous two species, except more spinules and no minute seta on syncoxa and no spinules on anterior surface of basis; basis 2.7 times as long as wide and 1.8 times as long as syncoxa; endopod 3.3 times as long as wide; apical spine on endopod twice as long as endopod and 1.4 times as long as longest endopodal seta.

Swimming legs (Supplementary Fig. S10.1-S10.4) segmentation, shape, ornamentation, and most armature as in previous species.

First swimming leg (Supplementary Fig. S10.1) armature as in previous two species; first endopodal segment 1.2 times as long as entire exopod and nearly six times as long as wide; third endopodal segment 2.8 times as long as second endopodal segment and 3.6 times as long as wide; endopodal apical seta 1.6 times as long as endopodal outer spine, 2.3 times as long as third endopodal segment, and 0.83 times as long as longer exopodal geniculate seta.

Second swimming leg (Supplementary Fig. S10.2) with significantly shorter distal inner seta on third exopodal segment (arrowed in Supplementary Fig. S10.2) than in previous two species; third exopodal segment 2.9 times as long as wide; third endopodal segment 4.2 times as long as wide.

Third swimming leg (Supplementary Fig. S10.3) with only one inner seta on second endopodal segment, and with shorter distal inner seta on third exopodal segment (both arrowed in Supplementary Fig. S10.3); third endopodal segment 3.7 times as long as wide.

Fourth swimming leg (Supplementary Fig. S10.4) with longer distal inner seta on third exopodal segment (arrowed in Supplementary Fig. S10.4), its distal tip reaching distal tip of distal outer spine; third exopodal segment four times as long as wide; third endopodal segment 3.2 times as long as wide.

Fifth leg (Fig. 5.6; Supplementary Fig. S12.1) segmentation and armature numbers as in previous two species, but endopodal lobe shorter, exopod much more elongated (arrowed in Supplementary Fig. S12.1), and third endopodal seta from inner side significantly longer than second endopodal seta from inner side (arrowed in Supplementary Fig. S12.1); baseoendopod as long as wide, with spinules along outer distal margin and between third and fourth seta from inner side, all setae spiniform but more slender than in previous two species, their length ratio from inner side 1 : 1 : 1.7 : 1.6 : 1.1; longest endopodal seta 0.9 times as long as baseoendopod; exopod almost rectangular, 2.1 times as long as wide, nearly as long as baseoendopod, with long spinules along inner and outer margins, one anterior simple and small cuticular pore near distal end, one tubular pore in proximal third near outer margin, and six setae with length ratio from inner side 1 : 2.4 : 1 : 0.4 : 0.4 : 1; first exopodal seta from inner side bipinnate, all other exopodal setae slender and smooth; second and third exopodal setae from inner side inserted on short setophores, resulting in concave distal margin of exopod in between them; innermost exopodal seta 0.6 times as long as exopod and 1.2 times as long as innermost endopodal seta.

Sixth leg (Fig. 6.1) similar to previous two species, but without spiniform process, all setae smooth, and with longer inner seta, its distal tip reaching 3/5 of genital double-somite; length ratio of setae from inner side 1 : 0.4 : 0.14; smallest seta as long as ventral sensilla on third urosomite.

Male [based on allotype and two paratypes] Body length from 385 to 396 µm. Habitus shape (Supplementary Figs. S8.1, S25.3), body proportions, and segmentation as in female, except second and third urosomites not fused. Ornamentation and shape of cephalothorax (Supplementary Fig. S8.2), all free prosomites (Supplementary Fig. S8.3), and first urosomite (Supplementary Fig. S8.3), as well as colour and nauplius eye (Supplementary Fig. S25.3C), as in female.

Second urosomite (Supplementary Figs. S8.4, S11.1, S11.2) twice as wide as long in dorsal view, as in female with four pairs of sensilla (U2-1 to U2-4), but with additional dorsal central pore (U2-III), large spinules between dorsal pair of sensilla (U2-1) and two or three spinules ventrally from lateral sensillum (U2-4); elongated, completely formed, spermatophore visible inside left half of second urosomite, about as long as second urosomite and 2.5 times as long as wide.

Third urosomite (Supplementary Figs. S8.4, S11.1, S11.2) as in female with four pairs of sensilla, but with additional pair of dorsolateral pores (U3-II), one dorsal central pore (U3-III), and with four to six spinules at base of sensilla U3-4 and U3-5; no ventral central spinules (arrowed in Supplementary Fig. S11.1).

Fourth urosomite (Supplementary Figs. S8.4, S11.1, S11.2) as in female, except ventral sensilla pair (U4-3) more widely spaced and with large spinules in between, and with dorsolateral (U4-II) and dorsal central (U4-III) pores; unlike in previous species, no spinules between dorsal pair of sensilla (U4-1; arrowed in Supplementary Fig. S11.2).

Fifth urosomite (Supplementary Fig. S11.1, S11.2) as in female, except with ventrolateral (U5-I) and dorsal central pores (U5-III).

Sixth urosomite (Supplementary Figs. S8.6, S11.1, S11.2) as in female, without dorsal spinules (arrowed in Fig. 17.2), but with dorsal pores (U6-I) clearly visible.

Caudal rami (Supplementary Figs. S8.6, S11.1, S11.2) as in female, except only one ventral pore present (Cr-II) and dorsal pore (Cr-I) clearly visible next to dorsal seta; caudal rami significantly longer than in previous species (arrowed in Supplementary Fig. S11.1).

Antennula (Supplementary Fig. S12.2) shape, segmentation and most armature as in *S. jackiei*, except second segment longer, without pore, and with 12 setae; fourth segment with single seta; fifth segment with seven setae (one small seta missing); last five segments also comparatively shorter, last segment 2.4 times as long as wide.

Antenna, labrum, paragnaths, mandibula, maxillula, maxilla, maxilliped, exopod and endopod of first swimming leg, exopod of second swimming leg, third swimming leg, and fourth swimming leg as in female.

Basis of first swimming leg (Supplementary Fig. S12.3) slightly narrower than in *S. jackiei*, but also with three spiniform processes on inner margin and slightly curved inner spine.

Endopod of second swimming leg (Supplementary Fig. S12.4) shape, segmentation, armature, and ornamentation as in *S. jackiei*, but second segment comparatively shorter, transformed setae forming pincers comparatively longer, and distalmost inner seta shorter and unipinnate; second segment, measured up to insertion of outer spine, 1.1 times as long as first endopodal segment, and 1.8 times as long as wide; outer spine with wide tip, while outer distal seta with pointed tip (arrowed in Supplementary Fig. S12.4); length ratio of armature on second segment from outer side 1 : 0.9 : 0.7 : 1.1 : 0.8 : 0.3; outer spine twice as long as section of second segment proximal to its insertion.

Fifth leg (Supplementary Figs. S8.5, S11.1, S12.5) shape, segmentation, ornamentation, and most armature as in *S. jackiei*, but exopod more elongated and with only five setae (arrowed in Supplementary Fig. S11.1) and only first and second exopodal setae from inner side spiniform; also outer spiniform process on endopodal lobe slightly smaller.

Sixth leg (Supplementary Figs. S8.5, S11.1) as in *S. jackiei*, but central seta longer, its distal tip reaching posterior margin of fourth urosomite; length ratio of armature from inner side 1 : 3.5 : 2.1.

Sarsamphiascus marloni sp. nov.
(Fig. 7; Supplementary Figs. S13 – S15)

DESCRIPTION: *Female* [based on holotype] Body length 535 µm. Habitus shape, colour, body segmentation, proportion of somites and their hyaline fringes, appendage segmentation, armature formula of most appendages, and proportion of segments and armature on most appendages as in previous species. Sensilla and pore pattern on prosomites not mapped and illustrated, as cephalothoracic shield and tergites of free prosomites mostly destroyed and awkwardly folded during dissection and slide preparation.

Rostrum (Fig. 7.3) slightly shorter than in previous species, about 2.4 times as long as wide.

Second urosomite (Fig. 7.1) as in previous species, but with slightly more elongated epicopulatory bulb, which about 1.8 times as long as wide.

Third urosomite (Fig. 7.1) as in previous species, but without dorsal spinules, with ventrally serrated hyaline fringe, and with ventral pair of sensilla (U3-5) much more closely spaced (arrowed in Fig. 7.1).

Fourth urosomite (Fig. 7.1) as in previous species, but without any spinules.

Fifth urosomite (Fig. 7.1) as in previous species.

Sixth urosomite (Fig. 7.1) as in previous species, but tapering towards posterior end, and with ventrolateral pores (U6-II) positioned more anteriorly; anal operculum represents about 38 % of somite's width; no dorsal spinules along posterior margin.

Caudal rami (Fig. 7.1) shorter than in previous species and with straight inner margin (arrowed in Fig. 7.1), with dorsal pore (Cr-I) clearly visible, but with only one ventral pore (Cr-II).

Antennula (Fig. 7.2) shape, segmentation, and most armature as in previous species, but first segment with spinules in proximal part, second segment more elongated (arrowed in Fig. 7.2) and with pore near distal end; same six setae on last two segments biarticulated as in all three previous species; setal formula 1.11.5.4.2.4.4.7; length ratio of antennular segments, from proximal end and along caudal margin, 1 : 1.2 : 0.4 : 0.8 : 0.2 : 0.3 : 0.3: 0.5; second segment three times as long as wide; fourth segment 3.2 times as long as wide.

Antenna (Supplementary Fig. S13.1) with coxa, basis, and endopod mostly as in previous species, but exopod one-segmented (arrowed in Supplementary Fig. S13.1) and with only two lateral setae (also arrowed in Supplementary Fig. S13.1); basis also partly fused to first endopodal segment, about as long as wide, and twice as long as coxa, but with smaller spinules along inner margin and with three large spinules at base of exopod; first endopodal segment 2.3 times as long as wide, twice as long as basis, with short seta at about 2/5 of its length; second endopodal segment 1.2 times as long as first endopodal segment; exopod curved, widest in central part, 3.7 times as long as wide, only 0.6 times as long as first endopodal segment, with two lateral setae in distal third, two apical setae, and several small posterior spinules; larger exopodal apical seta bipinnate, 1.75 times as long as smooth apical exopodal seta, and 1.1 times as long as exopod.

Labrum (Fig. 7.4) as in previous three species, but with fewer posterior spinules.

Paragnaths (Fig. 7.5) as in previous three species, except slightly shorter and with fewer apical spinules.

Mandibula (Supplementary Fig. S13.2) as in previous species, except with longer armature on basis and exopod.

Maxillula (Supplementary Fig. S13.3) as in previous species, except basis with two rows of spinules and exopod slightly wider.

Maxilliped (Supplementary Fig. S13.4) as in previous species, except syncoxa with minute seta in addition to three large setae and with only one row of spinules; basis 2.6 times as long as wide and 2.6 times as long as endopod; apical endopodal spine twice as long as endopod.

Swimming legs (Supplementary Figs. S14.1, S14.2, S15.1-S15.3) segmentation, shape, armature formula, ornamentation, and most proportions of armature elements as in previous species.

First swimming leg (Supplementary Fig. S14.1) with slightly shorter endopod than in previous species; coxa 1.8 times as wide as long; basis 1.5 times as wide as long; first endopodal segment 1.1 times as long as entire exopod, 6.4 times as long as wide, and 2.3 times as long as second and third endopodal segments combined; endopodal apical seta 1.9 times as long as endopodal outer spine, 2.3 times as long as third endopodal segment, and as long as longer exopodal geniculate seta.

Second swimming leg (Supplementary Fig. S14.2) as in previous species, except basis with one additional row anterior spinules and no posterior spinules and distal inner seta on third exopodal segment (arrowed in Supplementary Fig. S14.2) as strong and almost as long as proximal inner seta on that segment; third exopodal segment 3.6 times as long as wide; third endopodal segment 4.2 times as long as wide.

Third swimming leg (Supplementary Fig. S15.1) as in previous species, except basis with one additional row anterior spinules and distal inner seta on third exopodal segment (arrowed in Supplementary Fig. S15.1) as strong and almost as long as proximal inner seta on that segment; third exopodal segment 3.3 times as long as wide; third endopodal segment 4.5 times as long as wide.

Fourth swimming leg (Supplementary Figs. S15.2, S15.3) as in previous species, except basis with one additional row anterior spinules; first endopodal segment on left leg abnormal, with two inner setae (Supplementary Fig. S15.3), while same segment on right leg normal (Supplementary Fig. S15.2); third exopodal segment 3.1 times as long as wide; third endopodal segment 3.7 times as long as wide.

Fifth leg (Supplementary Fig. S13.5) general shape, segmentation, number of armature, and most ornamentation as in previous species, except endopodal lobe longer and with convex outer margin, one simple pore near distal margin of endopodal lobe and no spinules between third and fourth endopodal seta from inner side; all endopodal setae short and all except outermost very robust (arrowed in Supplementary Fig. S13.5); innermost exopodal setae smooth and slender, and fourth and fifth exopodal setae from inner side inflated basally and kinked (arrowed in Supplementary Fig. S13.5); baseoendopod 1.1 times as long as wide; endopodal setae length ratio from inner side 1 : 1.1 : 1.7 : 1.7 : 1.3; longest endopodal seta 0.4 times as long as baseoendopod; exopod 1.8 times as long as wide, 0.8 times as long as baseoendopod; length ratio of exopodal setae from inner side 1 : 2.5 : 2.2 : 0.6 : 0.4 : 0.9.

Sixth leg (Fig. 7.1) as in previous species, without spiniform process and with three setae, but outermost seta bipinnate and innermost seta reaching only to midlength of genital double-somite; length ratio of setae from inner side 1 : 0.5 : 0.1; smallest seta smaller than ventral sensilla on third urosomite (U3-5).

Sarsamphiascus michaeli sp. nov.

(Figs. 8, 9, 10.1, 10.4-10.7; Supplementary Figs. S16 – S24, S25.1, S25.2, S25.5)

DESCRIPTION: *Female* [based on holotype, six paratypes, and 35 specimens from other localities] Body length from 560 to 595 µm. Colour, nauplius eye, body segmentation, and appendage segmentation as in previous two species. Habitus (Figs. 8.1, 10.1, 10.4-10.7; Supplementary Fig. S16.1) medium robust compared to other Korean species, cylindrical, without distinct demarcation between prosome and urosome; prosome/urosome ratio about 1.1; greatest width at posterior end of cephalothorax. Integument of all somites smooth, without pits, urosomites with only several short rows of minute spinules in addition to posterior somewhat larger spinules (although smallest of all Korean species). Hyaline fringes of all prosomites smooth and of urosomites finely serrated. Cuticular pore and sensilla pattern on somites very similar to *S. jermainei*, except with several more sensilla and many more pores.

Rostrum (Supplementary Figs. S17.3, S20.1) twice as long as first antennular segment and 2.7 times as long as wide, its distal tip reaching midlength of second antennular segment, similar in shape to other Korean species, with single dorsal pair of sensilla (Ct-1) at about 3/5 of its length.

Cephalothorax (Fig. 8.2; Supplementary Figs. S16.2, S16.3) represents 35 % of total body length (excluding rostrum); with sensilla pattern as in *S. jermainei*, except with one more pair of posterior dorsal sensilla (Ct-29), which also present in *S. jackiei*; pore pattern similar to that in *S. jermainei*, but with six additional pore pairs, one of them present in *S. jackiei* (Ct-II), while others novel (Ct-VIII to Ct-XII); as in *S. jermainei* two pairs of pores very large (Ct-I and Ct-III), while all other pores about as large as circular base of sensilla.

Pleuron of first free prosomite (Fig. 8.3; Supplementary Fig. S16.4) with nine pairs of long sensilla (Fp1-1 to Fp1-6, and Fp1-8 to Fp1-10), and as *S. jermainei* one pair of lateral pores (Fp1-I); dorsalmost pair of sensilla (Fp1-1) probably serially homologous to posterior dorsal sensilla on cephalothorax (Ct-29), but other serial homologies difficult to establish.

Pleuron of second free prosomite (Fig. 8.3; Supplementary Fig. S16.4), pleuron of third free prosomite (Fig. 8.3; Supplementary Fig. S16.4), and first urosomite (Fig. 8.3; Supplementary Fig. S16.4) as in *S. jermainei*.

Second urosomite (Figs. 8.4, 9.1, 9.2; Supplementary Figs. S16.5, S24.1, S24.2) with strong internal ridge visible only laterally; with four pairs of sensilla (U2-1 to U2-4) as in *S. jermainei*, but sensilla U2-1 to U2-3 slightly more closely spaced and spinules among them much smaller; number of spinules variable (Fig. 9.2; Supplementary Fig. S24.2); as in *S. jermainei* pore U2-I lateral, pore (U2-II) ventrolateral, but additional dorsal unpaired pore present (U2-III), as in male of *S. jermainei*.

Third urosomite (Figs. 8.4, 9.1, 9.2; Supplementary Figs. S16.5, S24.1, S24.2) with four pairs of sensilla (U3-1, U3-2, U3-4, and U3-5), and ventral pair (U3-5) narrowly spaced as in *S. marloni*; posterior spinules small, present only between sensilla U3-1 and U3-2 (Figs. 8.4, 9.2) and sometimes also several spinules laterally from sensillum U3-2 (Supplementary Figs. S16.5, S24.2); as in male of *S. jermainei* one dorsolateral pair of pores (U3-II) and dorsal unpaired pore (U3-III), but some specimens missing dorsolateral pores and with novel ventral, closely-spaced pores (U3-IV) (Supplementary Fig. S24).

Genital double-somite (Figs. 8.4, 9.1, 9.2; Supplementary Figs. S16.5, S24.1, S24.2) about as long as wide, slightly wider in posterior half than in anterior half; epicopulatory bulb as in previous two species large and ellipsoid, 1.5 times as long as wide, with chitinous divide at about 3/5 of its length; receptacula seminis 0.7 times as long as epicopulatory bulb, as in all previous species kidney-shaped.

Fourth urosomite (Figs. 8.4, 9.1, 9.2; Supplementary Fig. S16.5) with three pairs of sensilla (U4-1 to U4-3), and as in in previous two species dorsal sensilla (U4-3) narrowly spaced; short row of small spinules present around lateral sensilla (U4-2) and longer rows of small spinules on both sides of dorsal sensilla (U4-1), although lateral portion sometimes missing on one (Fig. 9.2) or both sides; as in males of *S. jermainei* pores U4-II and U4-III visible in dorsal view, although central dorsal pore with two small openings very close to each other; additional novel pores on ventral side, very close to each other (U4-IV).

Fifth urosomite (Figs. 8.5, 9.1, 9.2; Supplementary Fig. S17.6) with same shape and pseudoperculum as in all previous species, although psudoperculum slightly longer than in any other species; as in male of *S. jermainei* ventral pores present in anterior half (U5-I), but no dorsal central pore.

Sixth urosomite (Figs. 8.5, 9.1, 9.2; Supplementary Figs. S16.6, S24.3) as in *S. jermainei* with three pair of pores (U6-I, U6-II, U6-IV), but tapering posteriorly and with dorsal spinules along posterior margin; anal operculum represents 45 % of somite's width.

Caudal rami (Figs. 8.5, 9.1, 9.2; Supplementary Figs. S16.6, S24.3) very similar in shape to *S. marloni*, but with spinules at base of lateral setae, more spinules along straight inner margin, and with three pores (Cr-I to Cr-III); inner apical setae with tuft of long setules in proximal half.

Antennula (Fig. 8.6; Supplementary Fig. S20.1) shape, segmentation, ornamentation, and armature formula as in *S. jermainei*; length ratio of antennular segments 1 : 1.5 : 0.7 : 1 : 0.3 : 0.4 : 0.4: 0.6; second segment 2.4 times as long as wide; fourth segment 2.7 times as long as wide.

Antenna (Supplementary Figs. S20.2, S24.4) general shape, segmentation, most ornamentation, most armature as in previous species, except first endopodal segment unarmed (arrowed in Fig. 29.2) and more slender, exopod more slender (arrowed in Supplementary Fig. S20.2) and with stronger and shorter apical pinnate seta; first endopodal segment 2.5 times as long as wide and 2.1 times as long as basis; second endopodal segment 1.2 times as long as first endopodal segment; exopod slightly curved, about 0.7 times as long as first endopodal segment, seven times as long as wide, with several short rows of minute spinules on anterior surface; pinnate apical seta from twice as long to as long as slender apical seta, and 0.4 times as long as exopod.

Labrum and paragnaths as in previous species.

Mandibula (Supplementary Figs. S20.3, S20.4) shape, segmentation, armature, and most ornamentation as in previous species, except coxa with row of large spinules, cutting edge of coxa slightly wider and with fewer simple teeth, and basis much slenderer distally.

Maxillula (Supplementary Fig. S20.5) shape, segmentation, and armature as in previous two species, but endopod slightly longer and exopod shorter, and also with more spinules on all other segments.

Maxilla as in previous two species.

Maxilliped (Supplementary Fig. S20.6) as in previous species, except basis slightly slenderer, and with denser spinules in anterior row; basis three times as long as wide and 2.5 times as long as endopod; endopod 3.8 times as long as wide; apical spine on endopod 1.7 times as long as endopod and 1.5 times as long as longest endopodal seta.

Swimming legs (Supplementary Figs. S21.1-S21.5, S24.5, S24.6) general shape, segmentation, armature and most ornamentation as in *S. jermainei*, including reduced distal inner setae on third exopodal segment of second and third leg (arrowed in Supplementary Figs. S21.2, S21.4), except shorter apical endopodal seta on first leg (arrowed in Supplementary Fig. S21.1), shorter inner distal seta on third exopodal segment of fourth leg, shorter third endopodal and third exopodal segments on all legs, anterior pore on third exopodal segments of all legs, and anterior pore on second endopodal segment of first leg.

First swimming leg (Supplementary Fig. S21.1) without spinules along inner margin of basis and with long spinules along inner margin of first endopodal segment; first endopodal segment 1.2 times as long as entire exopod and six times as long as wide; third endopodal segment 1.4 times as long as second endopodal segment and twice as long as wide; endopodal apical seta 1.3 times as long as endopodal outer spine, 2.6 times as long as third endopodal segment, and 0.7 times as long as longer exopodal geniculate seta.

Second swimming leg (Supplementary Figs. S21.2, S24.5, S24.6) with proximal seta on second endopodal segment from 0.3 to 0.65 times as long as distal seta on that segment; first endopodal segment from 0.9 to 1.5 times as long as wide; third endopodal segment from 3.2 to 4.5 times as long as wide; third exopodal segment 2.3 times as long as wide.

Third swimming leg (Supplementary Figs. S21.3, S21.4) with third endopodal segment 3.5 times as long as wide; third exopodal segment 2.9 times as long as wide.

Fourth swimming leg (Supplementary Fig. S21.5) with longer endopod compared to exopod than in *S. jermainei* (0.85 vs. 0.72); third endopodal segment three times as long as wide; third exopodal segment 2.8 times as long as wide.

Fifth leg (Fig. 8.4; Supplementary Figs. S18.1-S18.6, S20.7, S24.7, S24.8) general shape, segmentation, armature, and most ornamentation as in *S. titoi*, but exopod slightly more rounded and with tubular pore, and baseoendopod with only two small pores; baseoendopod 1.1 times as long as wide, with small pore near distal margin of endopodal lobe, between third and fourth setae from inner side, and one small pore at base of outer basal seta; length ratio of endopodal setae varies slightly, in holotype all of about same length and all bipinnate; longest endopodal seta less than 0.4 times as long as baseoendopod; exopod from 1.5 to 1.85 times as long as wide, nearly 0.8 times as long as baseoendopod, with long spinules along inner and outer margins, one anterior simple and small cuticular pore near distal end (usually between first and second seta from inner side, but sometimes closer to third seta), one tubular pore near outer margin at about 2/5 of somite length, and six setae with length ratio from inner side (in holotype) 1 : 2 : 1.6 : 0.9 : 0.7 : 1.3; first exopodal seta from inner side bipinnate, all other exopodal setae slender and smooth; innermost exopodal seta 0.4 times as long as exopod and only slightly shorter than innermost endopodal seta.

Sixth leg (Supplementary Fig. S20.8) as in *S. titoi* with spiniform process and with outermost seta bipinnate, but innermost seta smooth as in *S. michaeli*, but reaching 3/5 of genital double somite; length ratio of setae from inner side 1 : 0.5 : 0.16; smallest seta as long as ventral sensilla on third urosomite.

Male [based on allotype, two paratypes, and nine specimens from other localities] Body length from 385 to 396 μm. Habitus shape (Supplementary Figs. S16.1, S25.1, S25.2, S25.5), body proportions, and segmentation as in female, except second and third urosomites not fused. Ornamentation and shape of cephalothorax (Supplementary Fig. S17.2), all free prosomites (Supplementary Fig. S17.3), and first urosomite (Supplementary Figs. S17.3, S22.1, S22.2), as well as colour and nauplius eye (Supplementary Figs. S25.1, S25.2, S25.5), as in female.

Second urosomite (Supplementary Figs. S17.4, S22.1, S22.2) as in *S. jermainei*, except no spinules in between dorsal pair of sensilla (U2-1) (arrowed in Supplementary Fig. S22.2), spermatophore inside right side of somite, all spinules smaller, and dorsolateral pores (U2-I) positioned more laterally; spermatophore about 1.3 times as long as second urosomite and 2.4 times as long as wide.

Third urosomite (Supplementary Figs. S17.4, S22.1, S22.2) as in *S. jermainei*, except all spinules smaller and ventral row of spinules in between sensilla U3-5 continuous.

Fourth urosomite (Supplementary Figs. S17.4, S22.1, S22.2) as in *S. jermainei*, except all spinules smaller, and dorsally present inside dorsal sensilla (U4-1) not outside.

Fifth urosomite (Supplementary Figs. S17.6, S22.1, S22.2) as in *S. jermainei*, except with dorsolateral pores (U5-II).

Sixth urosomite (Supplementary Figs. S17.6, S18.1, S22.1, S22.2) as in female.

Caudal rami (Supplementary Figs. S17.6, S18.1, S22.1, S22.2) as in female, except no spinules along inner margin, innermost apical seta smooth, and with only one ventral anterior pore (probably Cr-II).

Antennula (Supplementary Figs. S18.3, S18.4, S23.1) general shape, ornamentation, and most armature as in *S. jermainei*, but with much wider segment bearing long aesthetasc, two segments succeeding geniculation completely fused (arrowed in Supplementary Fig. S23.1), segment bearing long easthetasc fused with subsequent segment (resulting in nine-segmented condition of antennula), one less seta on second segment, additional small spiniform seta and tubular pore on segment bearing long easthetasc, additional small spiniform seta on segment preceding geniculation, and additional cuticular ridges on segment succeeding geniculation.

Antenna (Supplementary Figs. S18.2, S18.5), labrum, paragnaths, mandibular (Supplementary Fig. S18.5), maxillula (Supplementary Figs. S18.2, S18.5), maxilla (Supplementary Fig. S18.2), maxilliped (Supplementary Fig. S18.2), exopod and endopod of first swimming leg (Supplementary Fig. S18.6), exopod of second swimming leg (Supplementary Fig. S18.6), third swimming leg, and fourth swimming leg as in female.

Basis of first swimming leg (Supplementary Figs. S18.6, S23.2) with single large spiniform process on inner margin (arrowed in Supplementary Fig. S23.2) and with smooth inner spine.

Endopod of second swimming leg (Supplementary Figs. S18.6, S23.3) as in *S. jermainei*, except with slightly longer second segment and longer inner seta on ancestral third segment; second segment, measured up to insertion of outer spine, 1.3 times as long as first endopodal segment and 1.8 times as long as wide; length ratio of armature on second segment from outer side 1 : 1 : 0.7 : 1.3 : 0.5 : 0.4; outer spine 1.5 times as long as section of second segment proximal to its insertion.

Fifth leg (Supplementary Figs. S17.5, S22.1, S23.4, S23.5) shape, ornamentation, and armature as in *S. jermainei*, including five setae on exopod; endopodal lobe in one paratype with three spiniform setae on right side (Supplementary Fig. S23.4), while normal on left side and in all other specimens; exopod from 1.4 to 1.7 times as long as wide.

Sixth leg (Supplementary Figs. S17.5, S22.1) as in *S. jermainei*, but central seta shorter, its distal tip hardly reaching posterior margin of third urosomite; length ratio of armature from inner side 1 : 3.5 : 1.9.

Discussion

Affinities of Korean *Sarsamphiascus*

Sarsamphiascus jackiei shares the shape and armature of the caudal rami and all appendages, as well as many details of the male urosomite ornamentation, with the Californian population of *S. minutus* (Claus, 1863). Major characters that distinguish the Californian population from the new species are: female fourth urosomite without ventral spinules and with ventral sensilla narrowly spaced, first exopodal segment of the antenna shorter and not curved, female baseoendopod of the fifth leg with convex outer margin, male basis of the first leg with only two spiniform processes, and male endopod of the second leg with longer apical seta. European and North African populations of *minutus* differ even more from *jackiei*, most of them having the third endopodal seta on the female fifth leg significantly longer than the second endopodal seta, much longer or shorter female fifth leg exopod, different proportions of segments on the first leg, shorter distal seta on the second endopodal segment of the male second leg, etc. (Lang, 1948). Differences between populations of *minutus* are such that I have no doubt they represent several different species, but this was already implicit in Lang's (1965) provisional identification of Californian specimens. Male basis of the first leg with three spiniform inner processes, that was found in *jackiei* (but also in *jermainei*), is a common character state in all three groups of *Sarsamphiascus* where males are known (see Lang, 1948), so it is probably plesiomorphic.

Sarsamphiascus titoi is most similar to *S. demersus* (Nicholls, 1939). They share the shape and armature of all female appendages (males of *demersus* are also unknown as are those of *titoi*), including the shape of the fifth leg exopod, as well as the basally inflated inner principal caudal seta. Characters that distinguish *demersus* from *titoi* include: longer dorsal caudal setae, slightly longer third endopodal segment of the first leg, longer distalmost inner seta on the third exopodal segment of the fourth leg, slightly shorter endopodal lobe of the fifth leg (when compared to exopod), and larger space between the second and third exopodal setae on the fifth leg from the outer side (in *titoi* the largest space is between the first and second exopodal setae). Unfortunately, Nicholls' (1939) description was very short and did not include any details of urosomite ornamentation, so many characters cannot be compared. Basally inflated inner principal caudal seta was also described for *S. lobatus* (Hicks, 1971) from intertidal seaweeds in New Zealand (Hicks, 1971), but this species differs from *titoi* by having only one inner seta on the second endopodal segment of the third leg, as well as a different shape of the fifth leg exopod.

Sarsamphiascus jermainei is most similar to *S. dentiformis* (Coull, 1971). The two share an elongated female fifth leg exopod and armature of the swimming legs, including a dwarfed distal inner seta on the third exopodal segment of the third leg, and proportion and ornamentation of the antennal exopod. Characters that distinguish *dentiformis* from *jermanei* include: basally inflated outer principal caudal seta, spiniform process on the first antennular segment, normally developed distal inner seta on the third exopodal segment of the second leg, and shorter third endopodal seta on the female fifth leg from the inner side. Coull's (1971) description was also very short and did not include any details of urosomite ornamentation, so those cannot be compared. Coull (1071) compared *dentiformis* to *S. gauthieri* (Monard, 1936), which was even more briefly described from a shallow littoral on muddy bottom in Algeria (Lang, 1948; Monard, 1936), but the latter has a wider female fifth leg exopod. It additionally differs from *jermainei* by a shorter third endopodal seta on the female fifth leg from the inner side.

Basally inflated exopodal setae on the female fifth leg, as observed in *Sarsamphiascus marloni*, could be found in *Robertgurneya similis bulbamphiascoides* Noodt, 1955 and in almost all species of the genus *Bulbamphiascus* Lang, 1944, but they all differ from *marloni* by many characters, including a three-segmented antennal exopod (Gee, 2005; Lang, 1948; Mu & Gee, 2000; Noodt, 1955; Rouch, 1962). One-segmented antennal exopod found in *marloni* has not been described in any other species of *Sarsamphiascus* (except in the newly described *michaeli*) and it is very rare in diosaccins. Even in genera with a reduced segmentation and armature of appendages, such as *Schizopera* Sars, 1905, antennal exopod is two-segmented (Karanovic & Cho, 2016; Karanovic & Cooper, 2012; Karanovic, Kim & Grygier, 2015; Karanovic & McRae, 2013). A one-segmented antennal exopod could be found in the family Miraciidae (in the genera *Miracia* Dana, 1846, *Protopsammotopa* Geddes, 1968, *Parialysus* Nicholls, 1941, and *Diosaccus* Boeck, 1873) but they all differ in so many characters from *marloni* that there could be no doubt in the convergent evolution of this character (see Bouck & Thistle, 2004; Geddes, 1968; Huys & Böttger-Schnack, 1994; Itô, 1974, 1982; Lang 1948, 1965). Of the three species currently recognised in the genus *Pseudamphiascopsis* Lang, 1944 two have a two-segmented and one has a one-segmented antennal exopod, but they always have only one lateral seta (Lang 1948). Very short and strong setae on the female fifth leg endopodal lobe, as observed in *marloni*, are also quite rare in the family, and there are no species where four are strong and the outermost one is slender. For example, *Robertsonia glomerata* Fiers, 1996 has all five setae short and strong (Fiers, 1996), while *Helmutkunzia variabilis* Wells & Rao, 1987 has only two setae short and strong (Wells & Rao, 1987). Both of these species differ from *marloni* in numerous characters, which is to be expected from heterogeners.

Sarsamphiascus michaeli has a unique shape and armature of the female fifth leg in the genus, with a nicely ellipsoid but elongated exopod and very short but not strong endopodal setae that are all of similar length. Somewhat similar female fifth leg exopod was found in *S. elongatus* (Itô, 1972), described from crab gills in Japan (Itô, 1972), but the latter species has the outermost exopodal seta inserted much more proximally, as well as a longer endopodal lobe and longer setae on it, in addition to a three-segmented antennal exopod, different shape and armature of the male fifth leg exopod, and a different shape of the male first leg basis. *Sarsamphiascus polaris* (Sars, 1909) has an ellipsoid female fifth leg exopod that resembles that of *michaeli*, but this species differs in the shape, armature, and ornamentation of the fifth leg endopodal lobe, as well as the ornamentation of urosomites (Hicks, 1989; Lang, 1948; Sars, 1909). The shape of the male first leg basis of *michaeli* is also unique in *Sarsamphiascus*, but males are still unknown in several species in this genus (including two newly described ones), so some caution is needed when emphasizing this character. A similar shape was reported for many species of the genus *Schizopera* (see Karanovic & Cho, 2016; Karanovic & Cooper, 2012), so *michaeli* could be the missing link that shows us how this genus with many reductions evolved from a *Sarsamphiascus*-like ancestor. However, this character could also be homoplastic in the family, as a similar looking male first leg basis was also observed in members of the genera *Amphiascoides* Nicholls, 1941, *Paramphiascella* Lang, 1944, *Pseudamphiascopsis* Lang, 1944, and *Robertsonia* Brady, 1880 for example (Lang, 1948, 1965; Wells & Rao, 1987).

Unfortunately, many *Sarsamphiascus* species are known from a limited set of morphological characters, which limits our ability to compare them with the new species. This could also skew our perceptions of species affinities, but it is unavoidable without re-descriptions of types (when available) and extensive revisions (both of which are outside of the scope of the present paper).

Justification for separating *Sarsamphiascus* from *Amphiascus* and *Pseudamphiascopsis*

Lang (1944, 1948) separated the genus *Pseudamphiascopsis* from *Amphiascus* (now *Sarsamphiascus*) mostly based on the shape and armature of the antennal exopod (one- or two-segmented, with only three setae). He included three species in this genus: *P. herdmani* (Scott, 1896), *P. attenuatus* (Sars, 1906), and *P. ismaelensis* (Monard, 1936). Lang (1948) provided some original drawings of the male first leg basis and female genital field for *attenuatus,* in addition to reproducing some drawings of Scott (1896), Sars (1906), and Monard (1936). There is some similarity between the male first leg basis illustrated by Lang (1948) and that of the Korean *michaeli*, but, as mentioned above, a similar shape can be found in several diosaccin genera. Noodt (1955) described *P. attenuatus orientalis* Noodt, 1955 from Turkey, which was later also reported from Bulgaria by Apostolov (1977). Both authors illustrated a completely different male first leg basis from that in the nominotypical subspecies, in addition to an antennal exopod with three apical setae (four in total), and a completely different shape of the female fifth leg exopod, so there can be little doubt that they were dealing with a different species. Unfortunately, Lang (1944) assigned *herdmani* as the type species for his new genus, the only species without known males and the only species with a different shape and armature of the female fifth leg, which could prove destabilising for this genus in future revisions. A reduced armature and segmentation of the antennal exopod in *Pseudamphiascopsis* might justify some comparisons with the Korean *marloni* and *michaeli*, but their different shape and number of lateral setae leaves little doubt that the reductions are a result of convergent evolution. This is not to say that species currently considered members of *Pseudamphiascopsis* have little in common. All of them have three inner setae on the third exopodal segment of the third leg (unlike any *Sarsamphiascus*), and three of them have the same unusual armature of the female fifth leg endopodal lobe and basally inflated inner principal caudal setae: *attenuatus, ismaelensis,* and *P. orientalis* Noodt, 1955 stat. nov. However, all four species are incompletely described and many characters could not be compared.

The genus *Amphiascus*, as redefined by Huys (2009), is a slightly larger taxon, containing nine valid species: *A. bulbiseta* (Apostolov, 2011); *A. ekmani* (Lang, 1965); *A. giesbrechti* Sars, 1906; *A. longirostris* (Claus, 1863); *A. pallidus* Sars, 1906; *A. paromolae* (Soyer, 1973); *A. soyeri* (Lang, 1965); *A. triarticulatus* (Moore, 1976); and *A. waihonu* (Hicks, 1986). Keys to species were provided by Lang (1948, 1965), Soyer (1973), and Hicks (1986); males were described for all species except for *bulbiseta* (see Apostolov, 2011); five species are known in association with other invertebrates (Hicks, 1986). As already mentioned, the type species (*longirostris*) was fixed by Nicholls (1941), and the generic diagnosis referenced by Huys (2009) is that provided by Lang (1944, 1948) for *Paramphiascopsis* (an objective junior synonym of *Amphiascus*). Two major distinguishing features of this genus from *Sarsamphiascus*, as defined by Lang (1944, 1948), are the second exopodal segment of the antennal exopod unarmed (vs. armed in *Sarsamphiascus*) and the third exopodal segment of the third leg with three setae (vs. two in *Sarsamphiascus*). While the latter character state is a plesiomorphy in diosaccids, the former character state is a synapomorphy. Other characters that distinguish it from other closely related diosaccin genera (such as a short second exopodal segment and a long third endopodal segment of the first leg) could also be found in some *Sarsamphiascus* species (Lang, 1948). Lang (1965, p. 288) made a mistake in his key to genera (couplet 23), as all species of both genera have one dwarfed and two long setae on the third exopodal segment of the fourth leg. Another obvious difference between these two genera, that was not emphasized by Lang (1944, 1948, 1965), is the length of the second endopodal segment of the male second leg prior to insertion of the outer transformed spine, which is as long as first segment in *Amphiascus* vs. nearly twice as long in *Sarsamphiascus*. The shape of this segment is very similar in all *Amphiascus* species, while in *Sarsamphiascus* there is some variability (and many species are still known only after females). All three Korean new species with known males have the same shape of the male second leg endopod, despite numerous differences in other characters. Perhaps this could be a useful character for a revision of diosaccins, especially when used in cladistic and geometric morphometric analyses. The importance of this character was already recognised by Wells, Hicks, & Coull (1982), who used it in their intuitive reconstruction of diosaccin phylogeny, although their conclusions were not much different from those made by Lang (1948). Lang (1948) used the shape of the caudal rami and first leg endopod to distinguish the three species then included in this genus (*giesbrechti, longirostris,* and *pallidus*), but they could be much easier distinguished by the shape of their fifth legs (for more details on all three see Sars, 1906). In fact, most species could be distinguished by this character, and the genus seems to represent a tight group, with interspecific variability mostly involving urosomal ornamentation, proportions of the caudal rami, proportions of some appendage segments, and proportions of some armature elements. This is in stark contrast to *Sarsamphiascus*, where interspecific differences often involve segmentation and armature formulae, and were a revision is desperately needed. Newly discovered Korean species are a good illustration of this, with at least three distinct clades suggested by the cladistic analysis. However, some caution is needed when evaluating morphological differences in this genus. While the armature of the male fifth leg exopod with five setae in *jermainei* and *michaeli* and with six setae in *jackiei* seems like a significant difference, Itô (1972) reported these as mere asymmetries in some specimens of *S. elongatus* Itô, 1972. We should probably pay more attention to the presence/absence of individual setae on this segment than to their overall number.

All of the above would suggest that *Sarsamphiascus, Amphiascus,* and *Pseudamphiascopsis* need to be revised together, and preferably both based on molecular and morphological characters. Based on the limited set of morphological characters discussed, it would seem that *Amphiascus* and *Pseudamphiascopsis* are less likely to prove polyphyletic than *Sarsamphiascus*. Whether *Amphiascus* and *Pseudamphiascopsis* are monophyletic or paraphyletic remains to be discovered.

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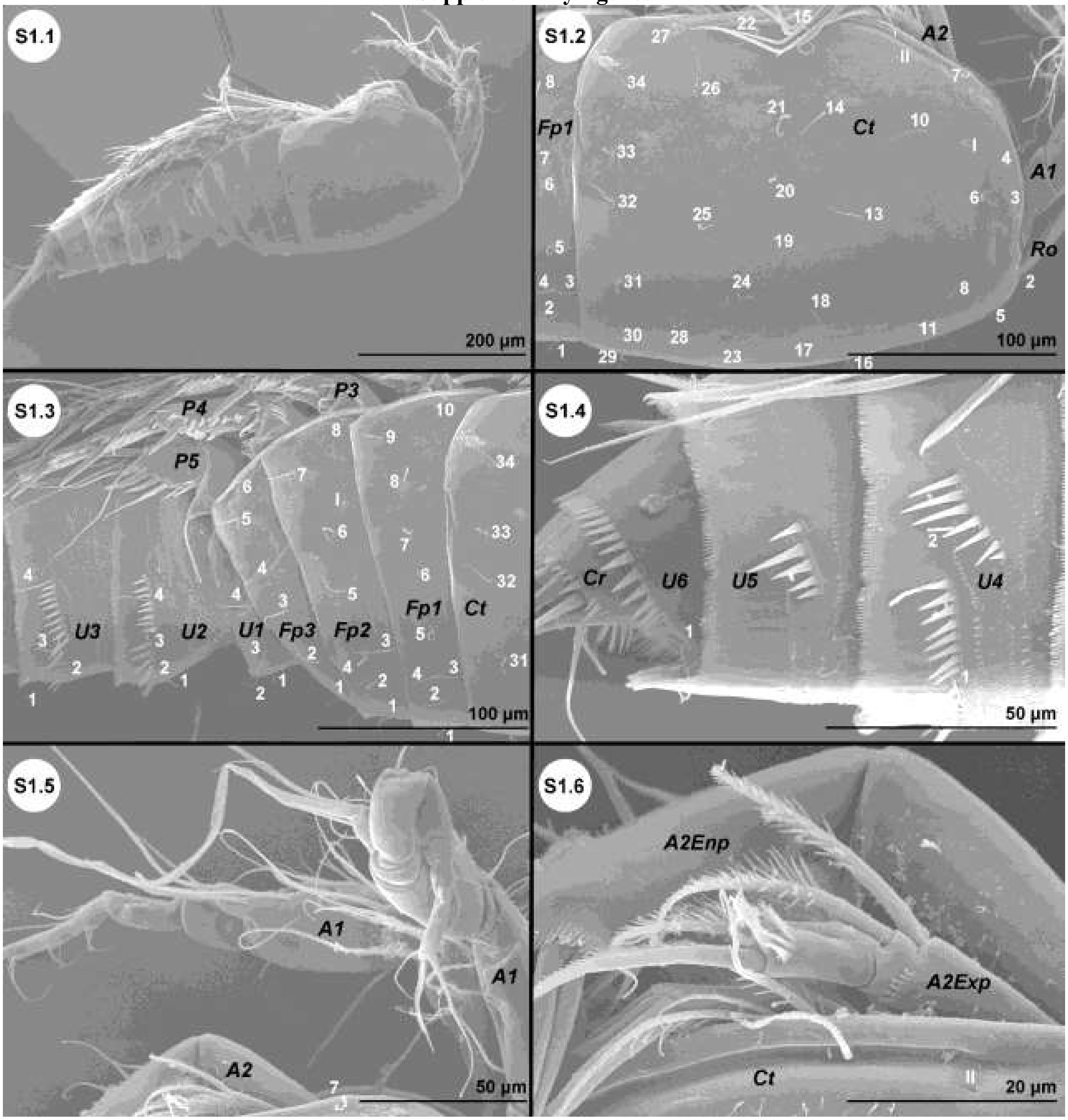
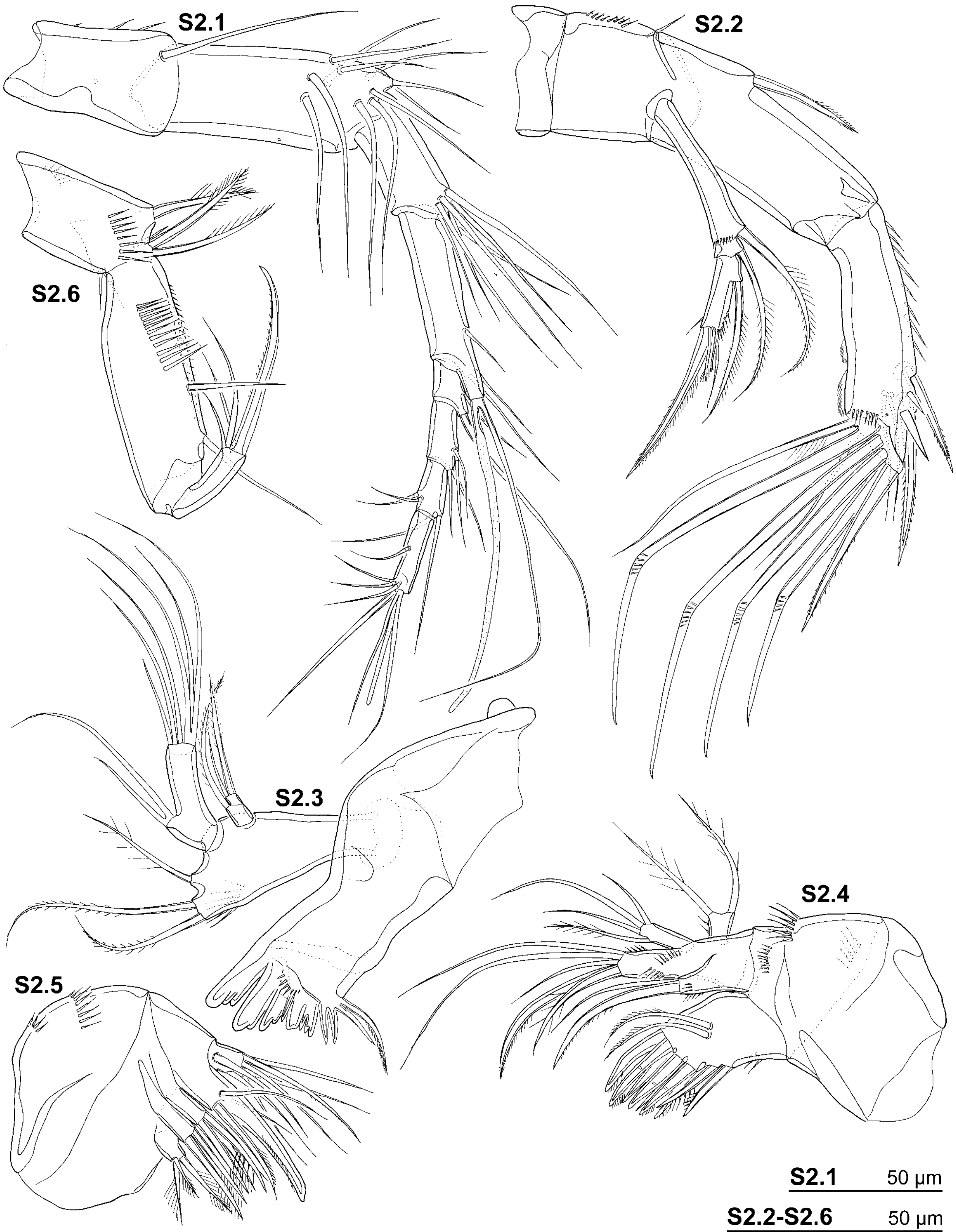
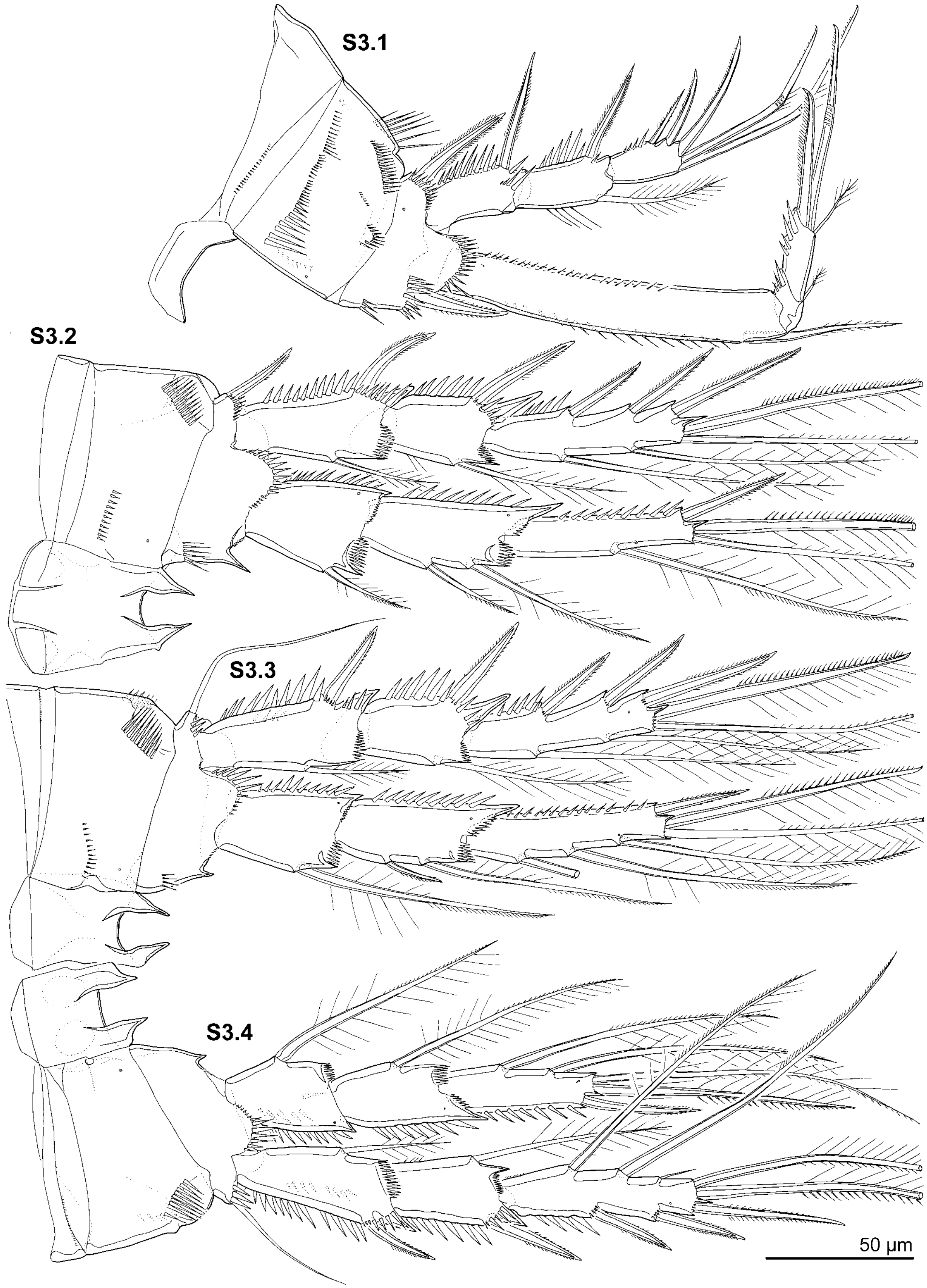
Supplementary figures



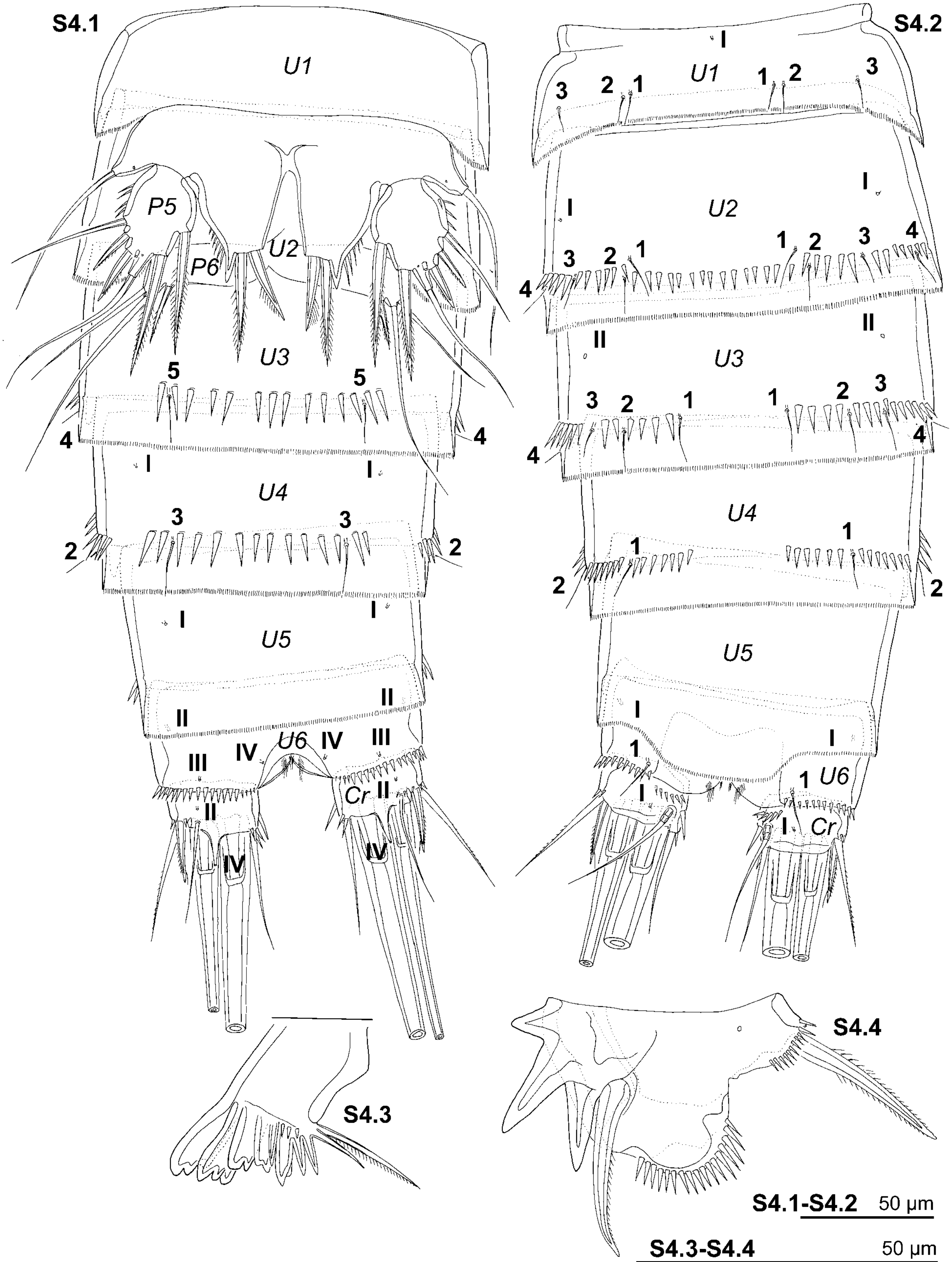
SUPPLEMENTARY FIGURE S1. *Sarsamphiascus jackiei* sp. nov., paratype male, SEM photographs, all in lateral view: S1.1, habitus; S1.2, cephalothorax (Ct) with rostrum (Ro), anterior part of first free prosomite (Fp1), and proximal parts of antennula (A1) and antenna (A2); S1.3, posterior part of cephalothorax (Ct), tergites of three free prosomites (Fp1-Fp3), and first three urosomites (U1-U3), with parts of third to fifth legs (P3-P5); S1.4, last three urosomites (U4-U6) and caudal rami (Cr); S1.5, both antennulae (A1) and left antenna (A2); S1.6, lateral detail of cephalothorax (Ct), with details of antennal endopod (A2Enp) and exopod (A2Exp). Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in female.



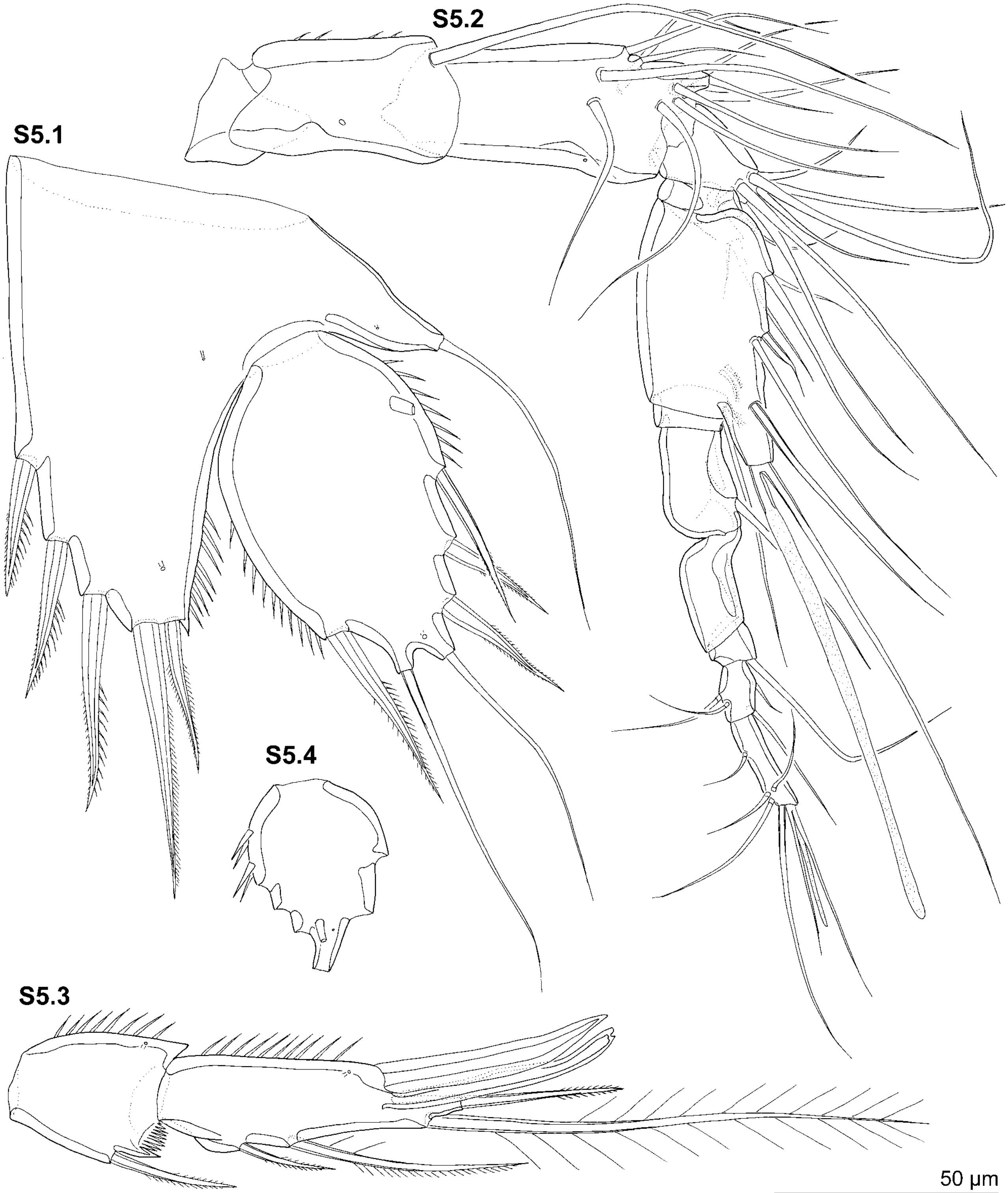
SUPPLEMENTARY FIGURE S2. *Sarsamphiascus jackiei* sp. nov., holotype female, line drawings: S2.1, antennule, ventral; S2.2, antenna, anterior; S2.3, mandibula, posterior; S2.4, maxillula, anterior; S2.5, maxilla, posterior; S2.6, maxilliped, anterior.



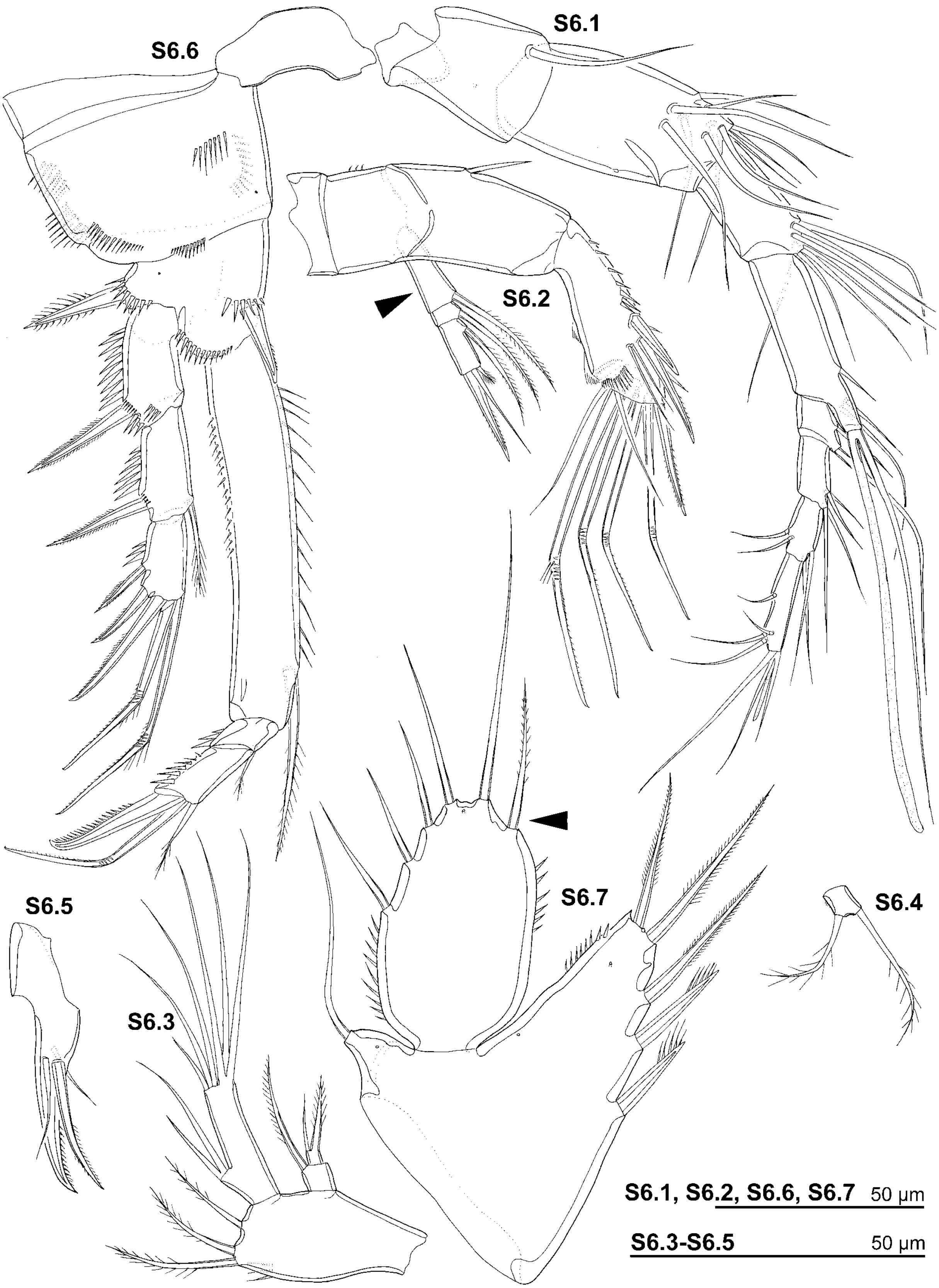
SUPPLEMENTARY FIGURE S3. *Sarsamphiascus jackiei* sp. nov., holotype female, line drawings: S3.1, first swimming leg, anterior; S3.2, second swimming leg, anterior; S3.3, third swimming leg, anterior; S3.4, fourth swimming leg, anterior.



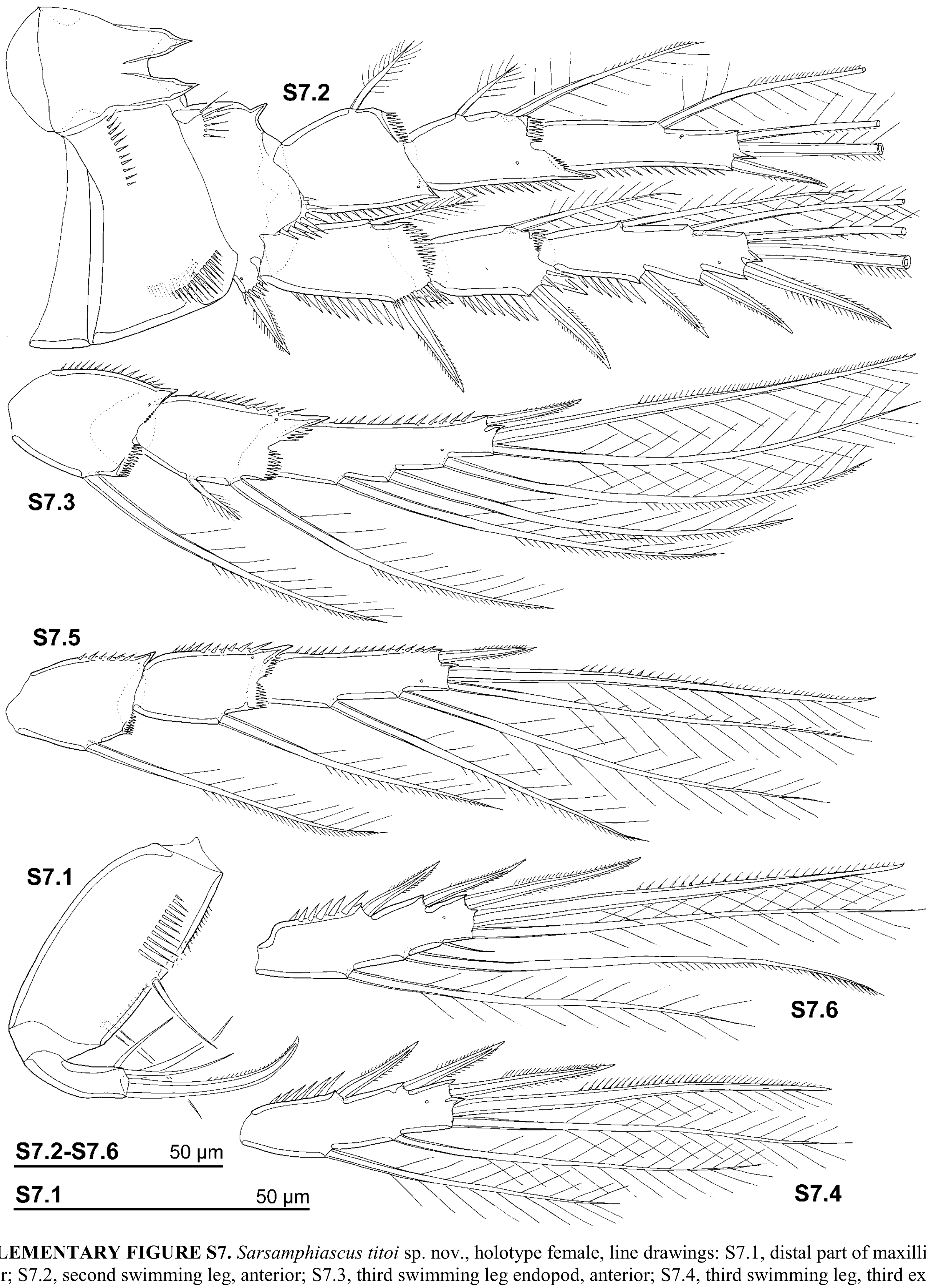
SUPPLEMENTARY FIGURE S4. *Sarsamphiascus jackiei* sp. nov., allotype male, line drawings: S4.1, first to sixth urosomites (U1-U6) and caudal rami (Cr), with fifth (P5) and sixth legs (P6), ventral; S4.2, first to sixth urosomites (U1-U6) and caudal rami (Cr), dorsal; S4.3, cutting edge of mandibular coxa, posterior; S.4.4, basis of first swimming leg, anterior. Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in female; novel ones assigned consecutive numbers. Minute surface spinules on urosomites omitted for clarity.



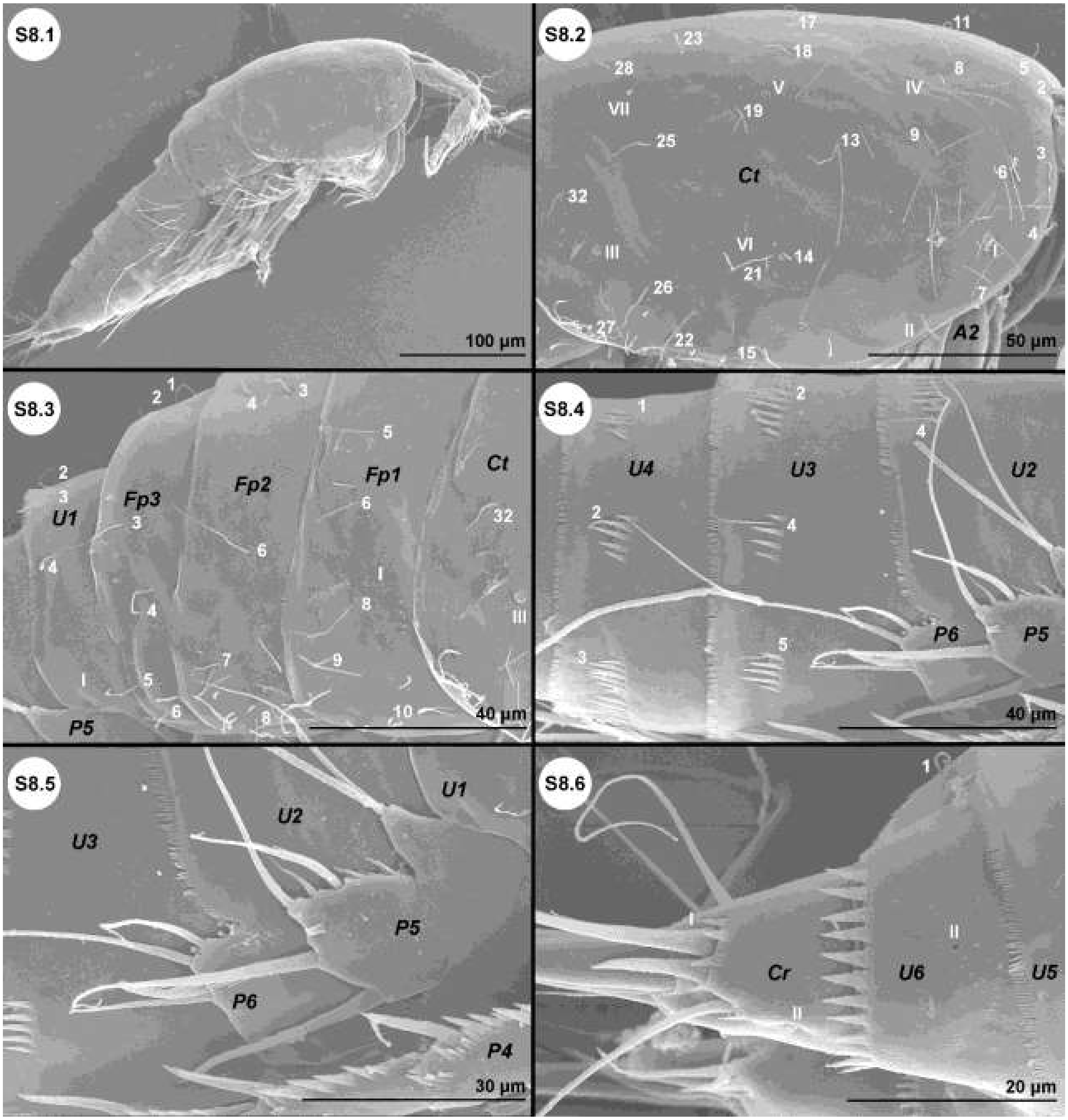
SUPPLEMENTARY FIGURE S5. *Sarsamphiascus jackiei* sp. nov., line drawings: S5.1, holotype female, fifth leg, anterior; S5.2, allotype male, antennula, ventral; S5.3, allotype male, second swimming leg endopod, anterior; S5.4, allotype male, fifth leg exopod, anterior, flattened and without armature.



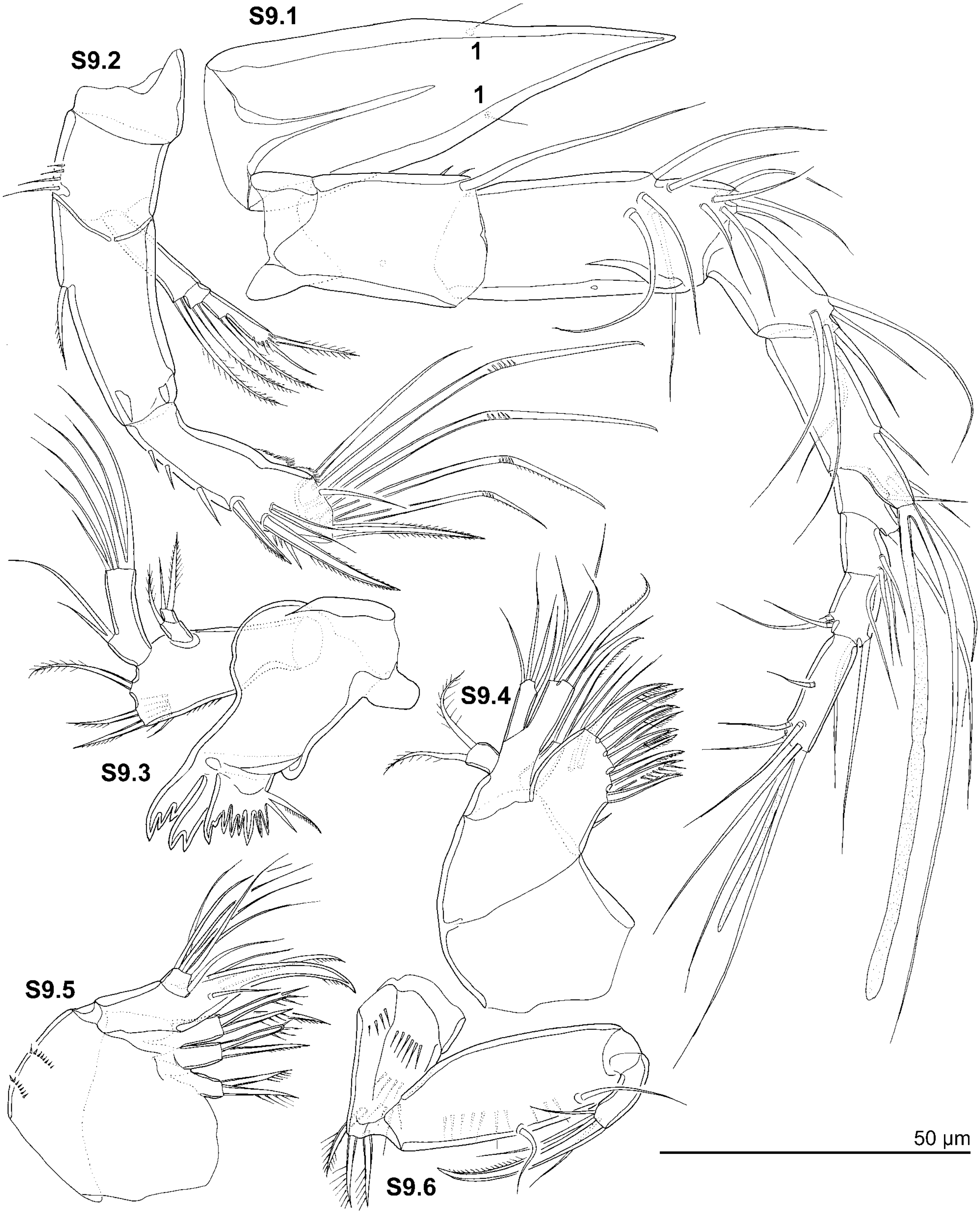
SUPPLEMENTARY FIGURE S6. *Sarsamphiascus titoi* sp. nov., holotype female, line drawings: S6.1, antennule, ventral; S6.2, antenna, posterior; S6.3, mandibular palp, posterior; S6.4, maxillular exopod, posterior; S6.5, maxillar basis, posterior; S6.6, first swimming leg, anterior; S6.7, fifth leg, anterior. Arrowheads indicate major differences from previous species.



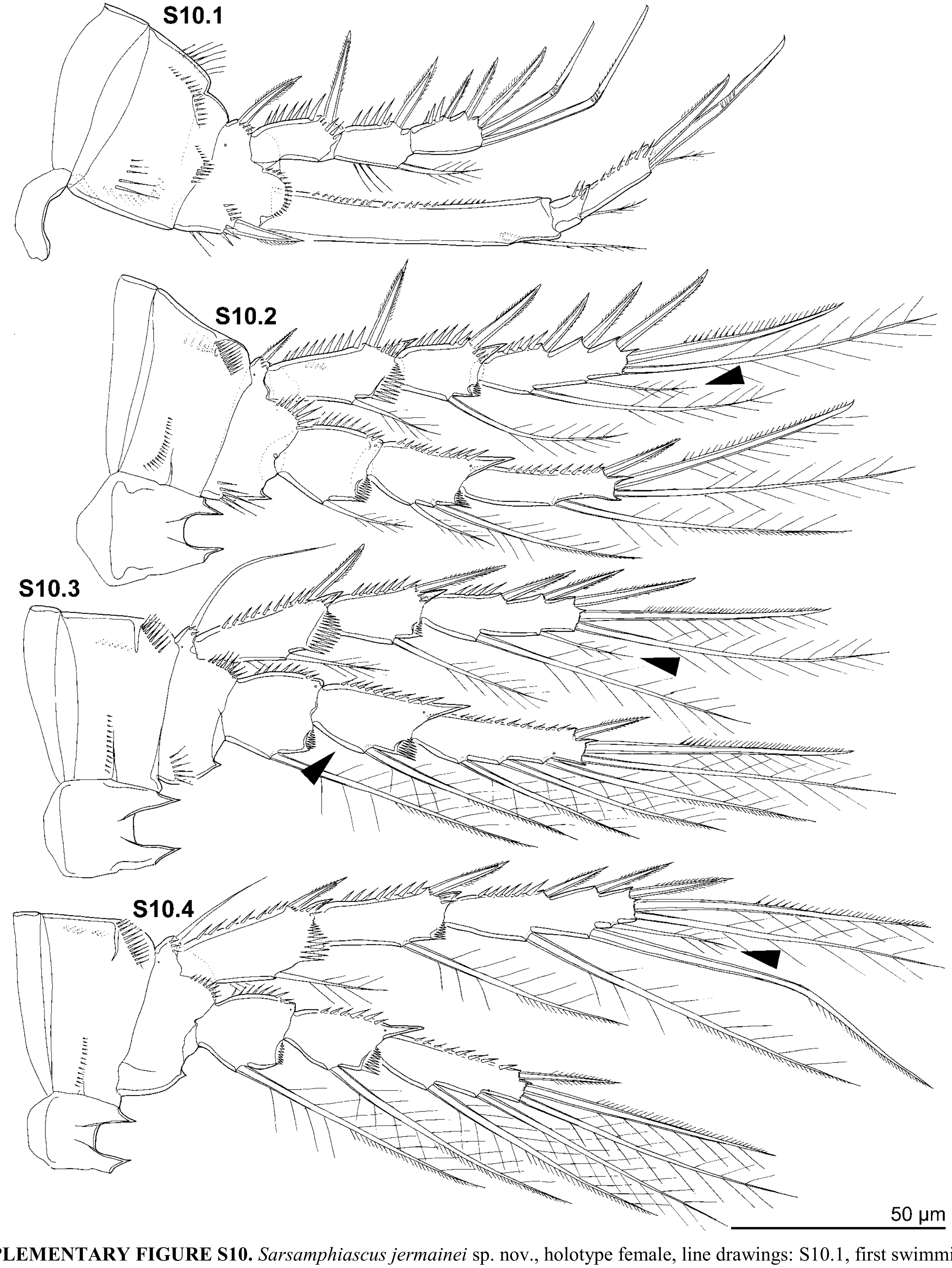
SUPPLEMENTARY FIGURE S7. *Sarsamphiascus titoi* sp. nov., holotype female, line drawings: S7.1, distal part of maxilliped, anterior; S7.2, second swimming leg, anterior; S7.3, third swimming leg endopod, anterior; S7.4, third swimming leg, third exopodal segment, anterior; S7.5, fourth swimming leg endopod, anterior; S7.6, fourth swimming leg, third exopodal segment, anterior.



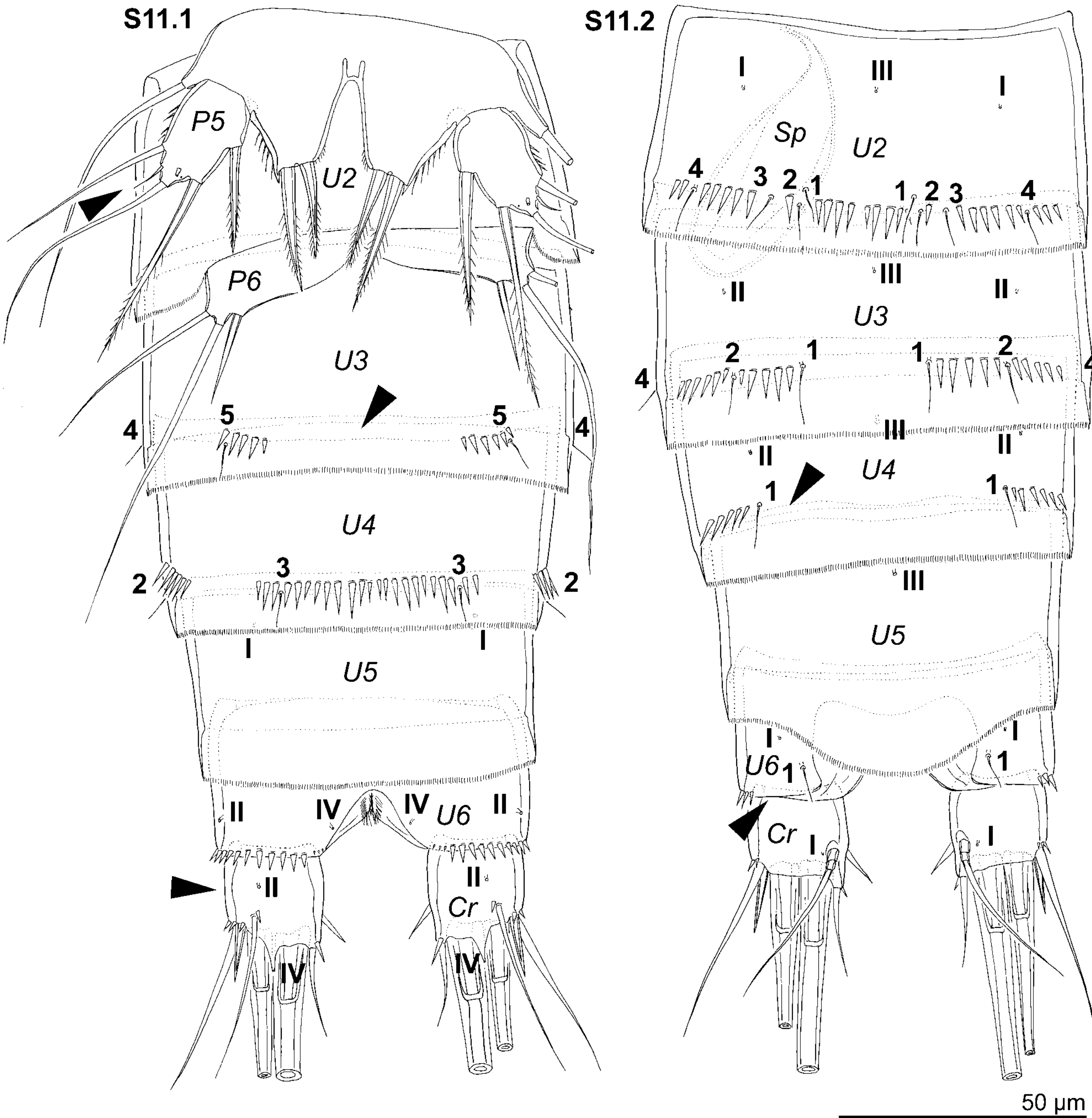
SUPPLEMENTARY FIGURE S8. *Sarsamphiascus jermainei* sp. nov., paratype male, SEM photographs, all in lateral view: S8.1, habitus; S8.2, cephalothorax (Ct) with part of antenna (A2); S8.3, posterior part of cephalothorax (Ct), tergites of three free prosomites (Fp1-Fp3), and first urosomite (U1), with part of fifth leg (P5); S8.4, second to fourth urosomites (U2-U4) and parts of fifth (P5) and sixth legs (P6); S8.5, detail of first three urosomites (U1-U3) and fifth (P5) and sixth legs (P6); S8.6, last two urosomites (U5-U6) and caudal rami (Cr). Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in female.



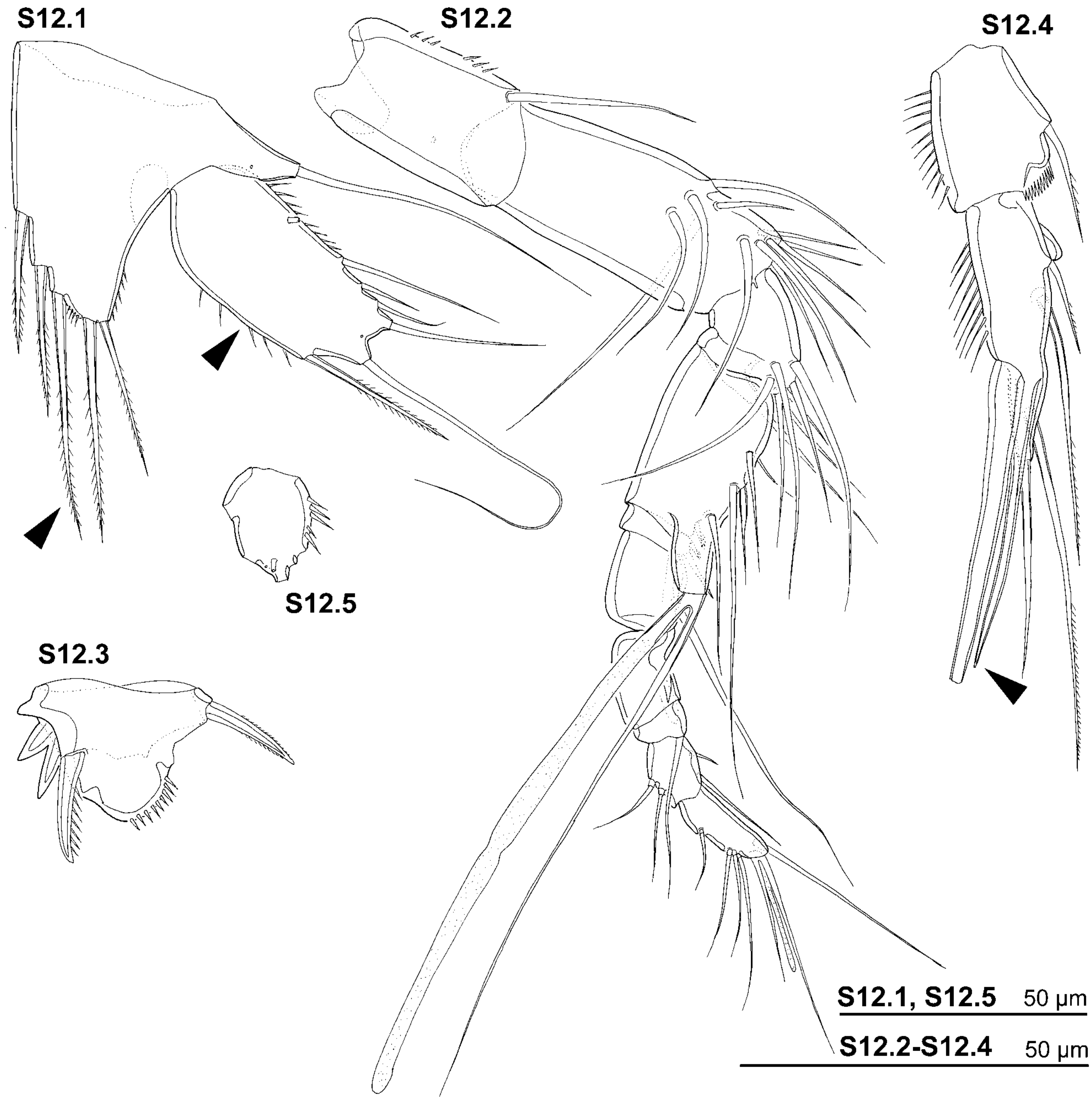
SUPPLEMENTARY FIGURE S9. *Sarsamphiascus jermainei* sp. nov., holotype female, line drawings: S9.1, rostrum and antennule, ventral; S9.2, antenna, posterior; S9.3, mandibular, posterior; S9.4, maxillula, posterior; S9.5, maxilla, anterior; S9.6, maxilliped, anterior.



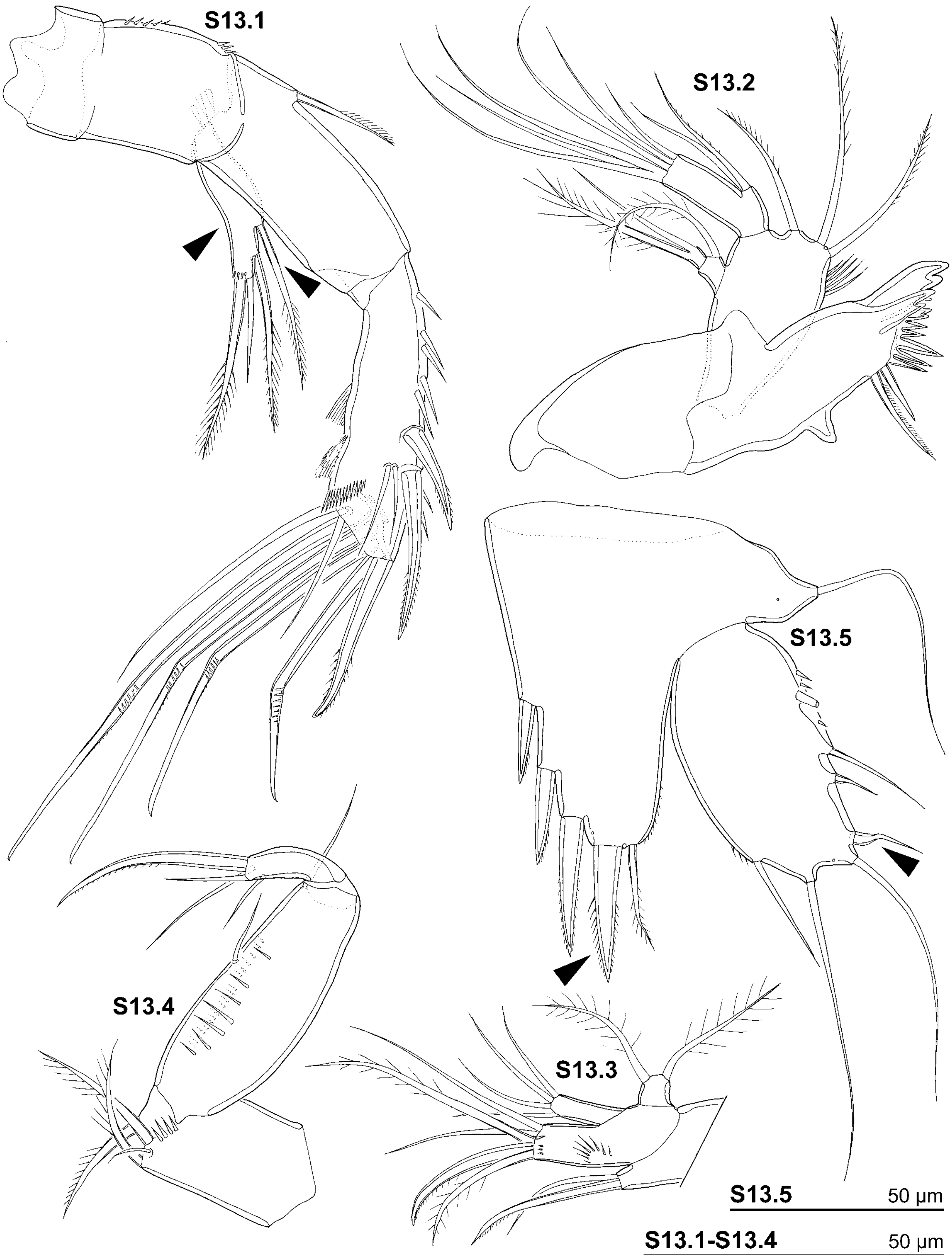
SUPPLEMENTARY FIGURE S10. *Sarsamphiascus jermainei* sp. nov., holotype female, line drawings: S10.1, first swimming leg, anterior; S10.2, second swimming leg, anterior; S10.3, third swimming leg, anterior; S10.4, fourth swimming leg, anterior. Arrowheads indicate major differences from previous two species.



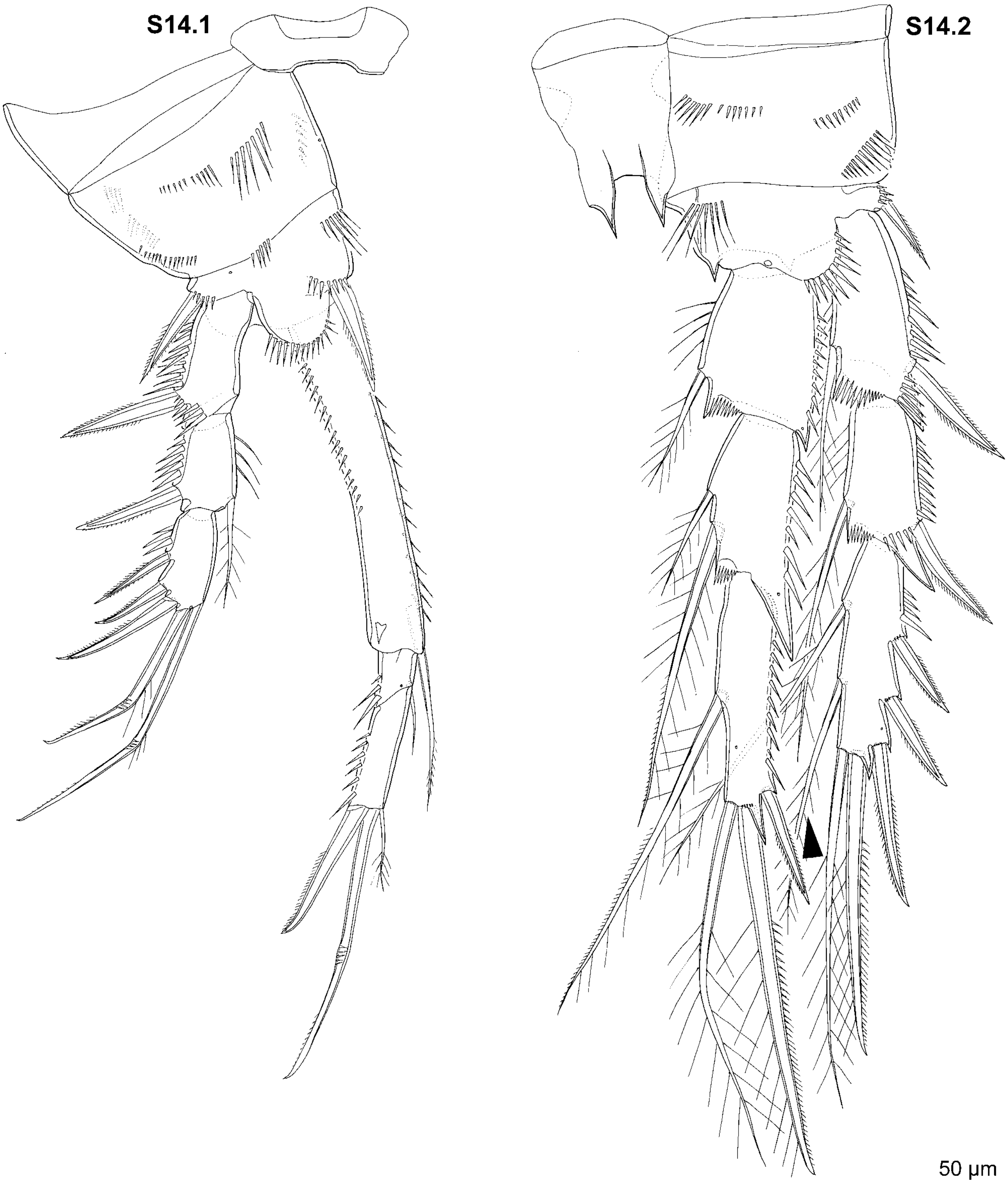
SUPPLEMENTARY FIGURE S11. *Sarsamphiascus jermainei* sp. nov., allotype male, line drawings: S11.1, second to sixth urosomites (U2-U6) and caudal rami (Cr), with fifth (P5) and sixth legs (P6), ventral; S11.2, second to sixth urosomites (U2-U6) and caudal rami (Cr), with internal spermatophore (Sp), dorsal. Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in female and previous two species; novel ones assigned consecutive numbers. Arrowheads indicate major differences from *S. jackiei* sp. nov.



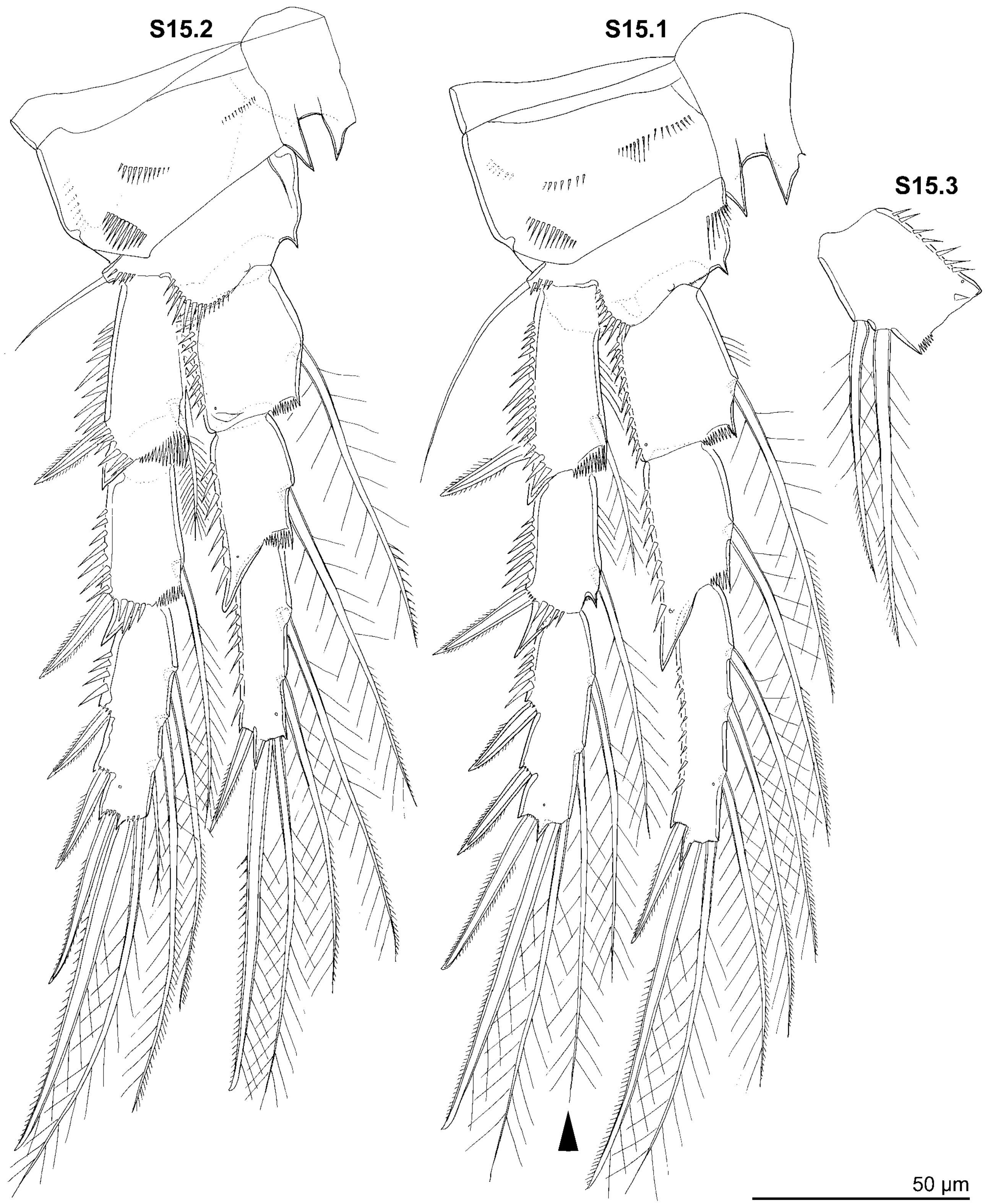
SUPPLEMENTARY FIGURE S12. *Sarsamphiascus jermainei* sp. nov., line drawings: A12.1, holotype female, fifth leg, anterior; S12.2, allotype male, antennula, ventral; S12.3, allotype male, first leg basis, anterior; S12.4, allotype male, second leg endopod, anterior; S12.5, allotype male, fifth leg exopod, anterior, dissected and flattened, without armature. Arrowheads indicate major differences from previous two species.



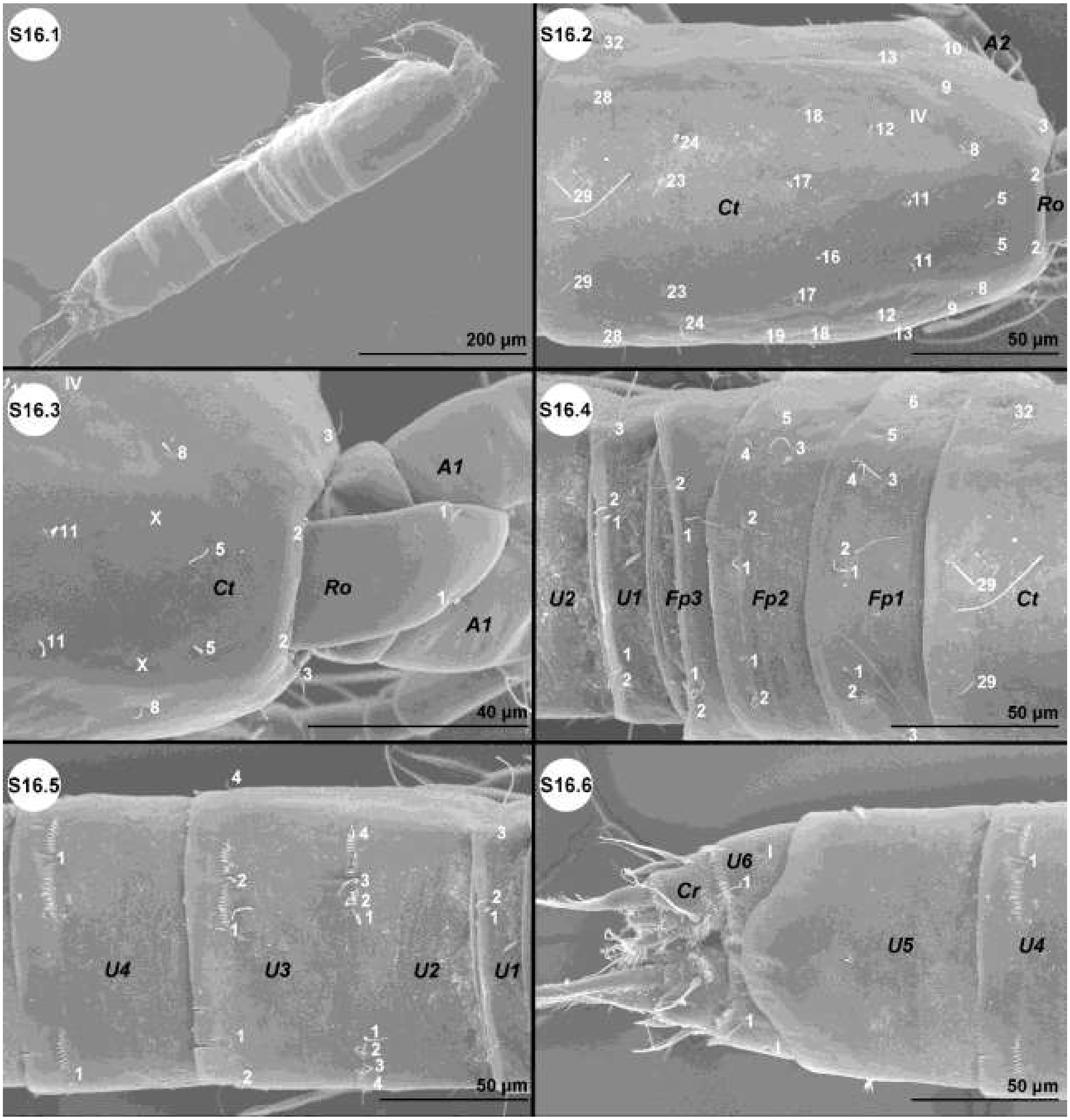
SUPPLEMENTARY FIGURE S13. *Sarsamphiascus marloni* sp. nov., holotype female, line drawings: S13.1, antenna, posterior; S13.2, mandibular, posterior; S13.3, distal part of maxillula, anterior; S13.4, maxilliped, anterior. Arrowheads indicate major differences from previous three species.



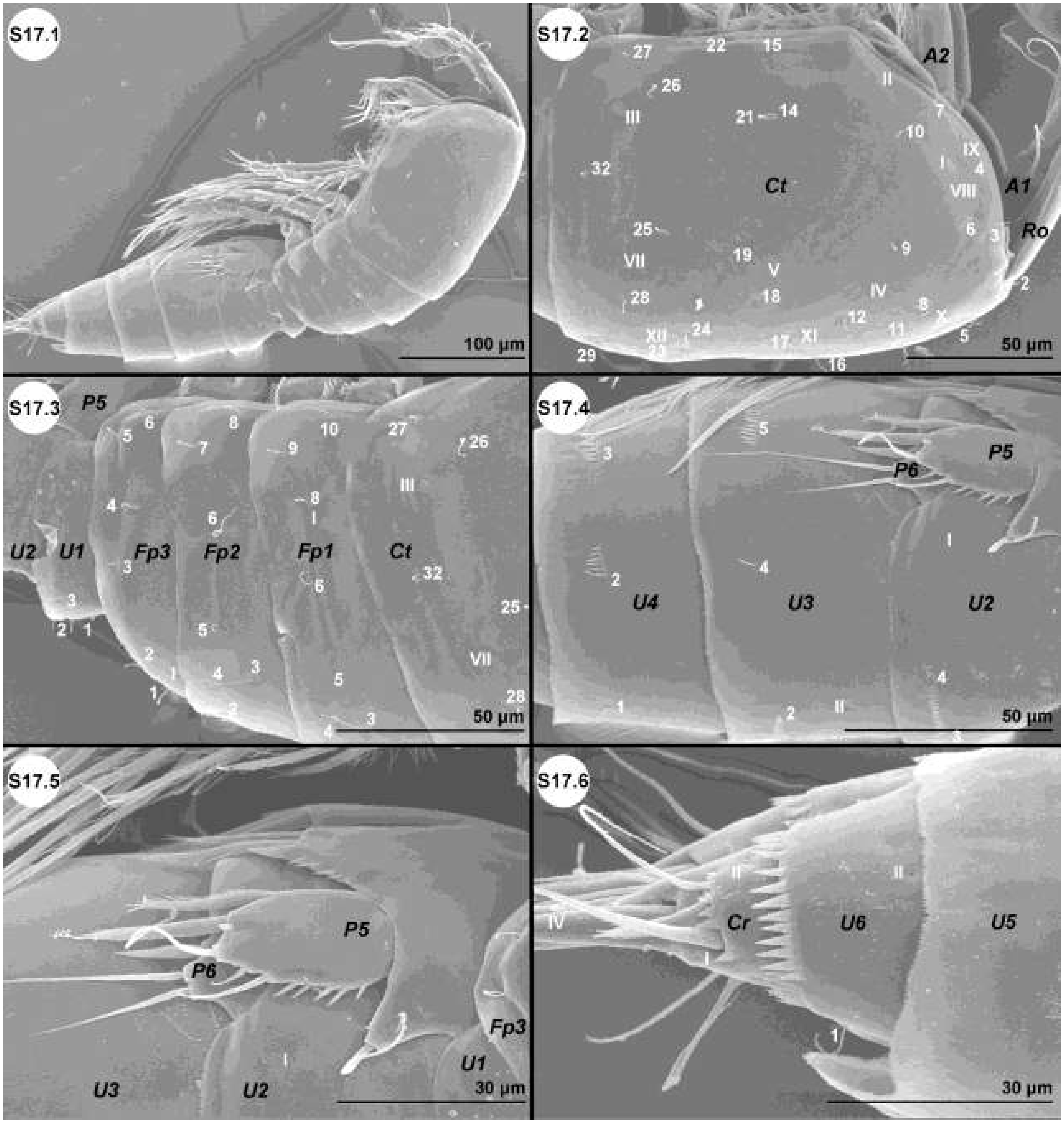
SUPPLEMENTARY FIGURE S14. *Sarsamphiascus marloni* sp. nov., holotype female, line drawings: S14.1, first swimming leg, anterior; S14.2, second swimming leg, anterior. Arrowhead indicates a major difference from *S. jermainei* sp. nov.



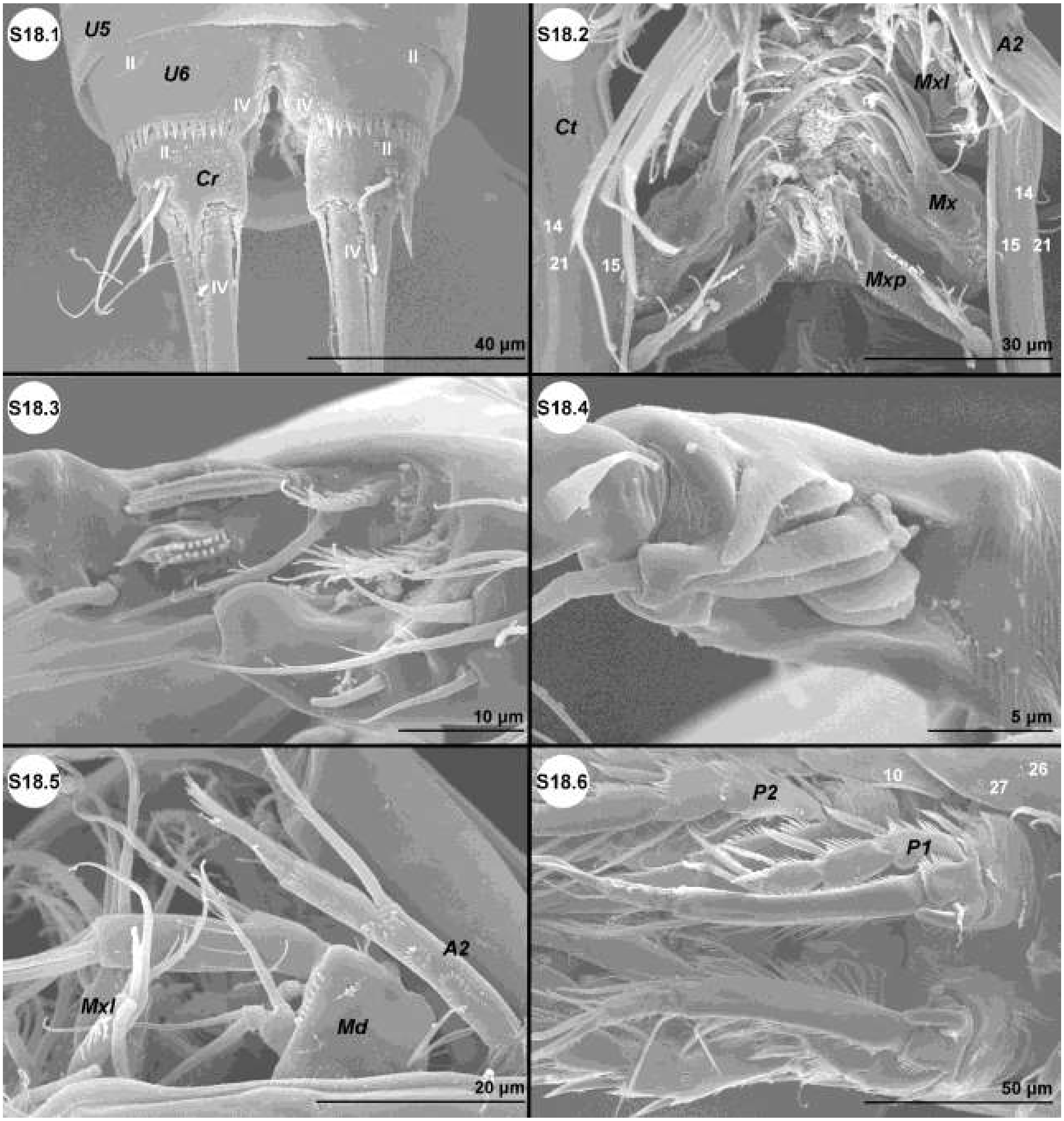
SUPPLEMENTARY FIGURE S15. *Sarsamphiascus marloni* sp. nov., holotype female, line drawings: S15.1, third swimming leg, anterior; S15.2, right fourth swimming leg, anterior; S15.3, left fourth swimming leg, abnormal first endopodal segment, anterior. Arrowhead indicates major difference from *S. jermainei* sp. nov.



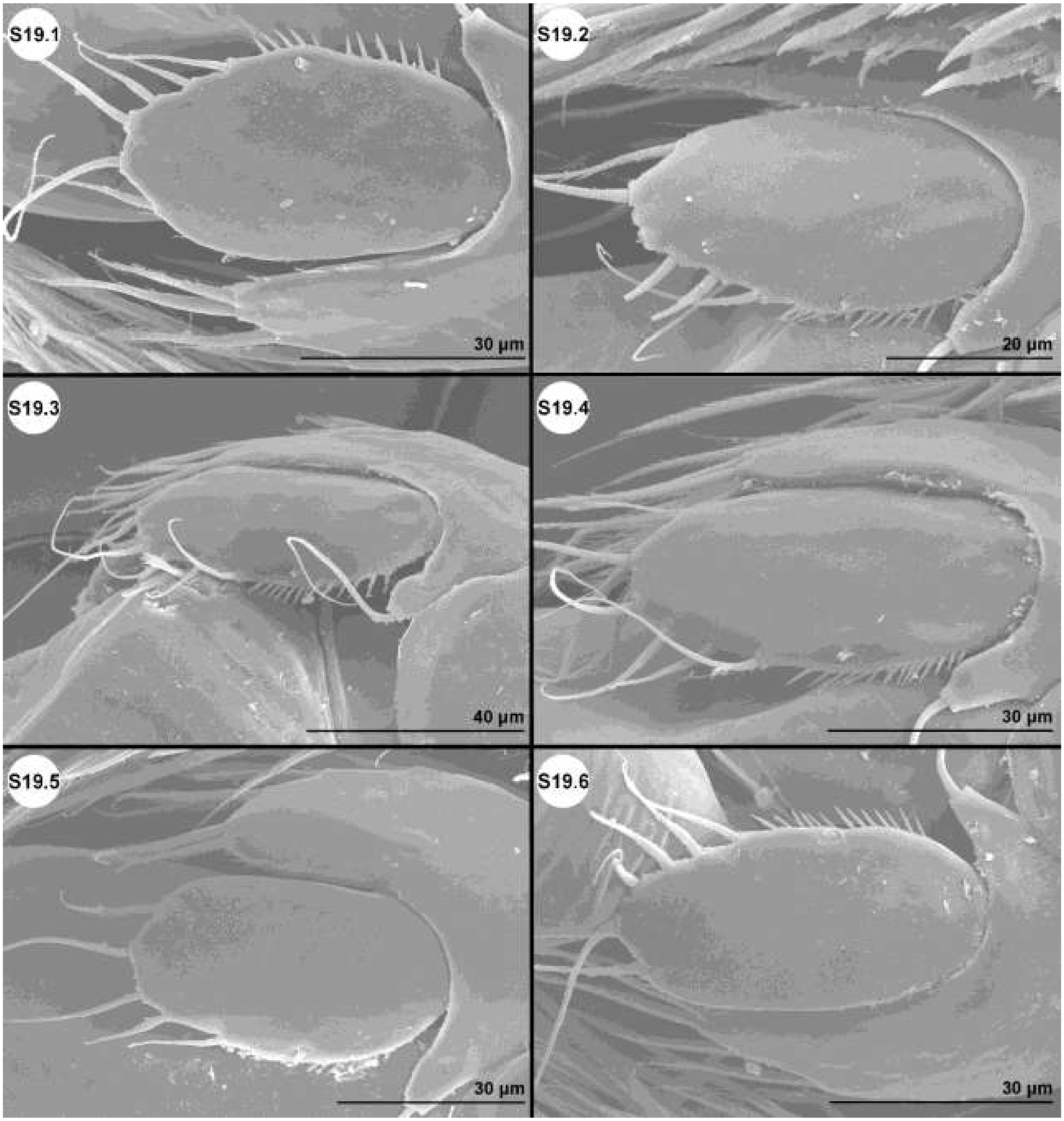
SUPPLEMENTARY FIGURE S16. *Sarsamphiascus michaeli* sp. nov., paratype female 2, SEM photographs, all in dorsal view: S16.1, habitus; S16.2, cephalothorax (Ct) with rostrum (Ro) and proximal part of antenna (A2); S16.3, anterior part of cephalothorax (Ct) with rostrum (Ro) and proximal parts of antennulae (A1); S16.4, posterior part of cephalothorax (Ct), tergites of free prosomites (Fp1-Fp3), and first two urosomites (U1-U2); S16.5, first four urosomites (U1-U4); S16.6, last three urosomites (U4-U6) and caudal rami (Cr). Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in previous four species; novel ones assigned consecutive numbers.



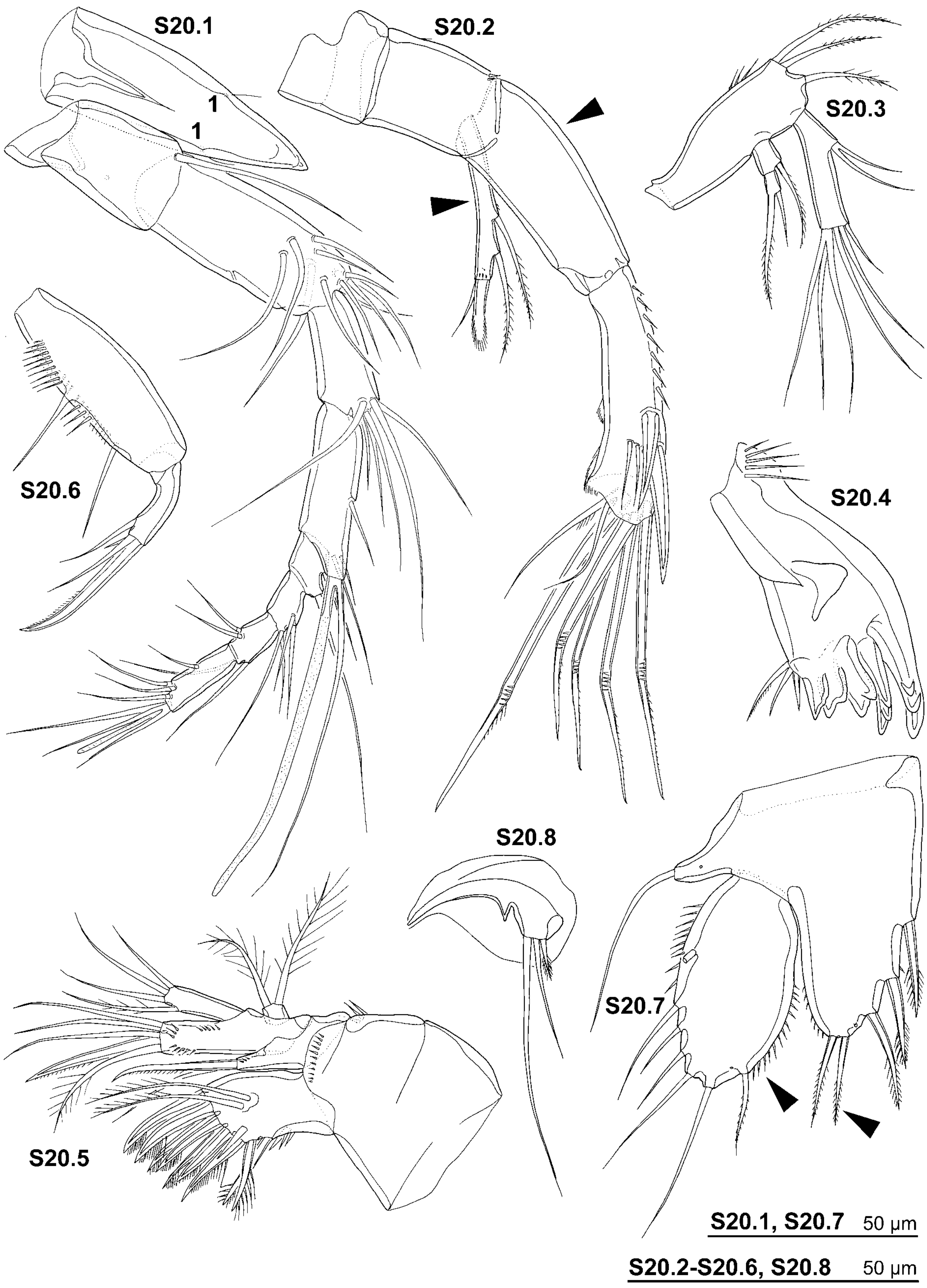
SUPPLEMENTARY FIGURE S17. *Sarsamphiascus michaeli* sp. nov., paratype male, SEM photographs, all in lateral view: S17.1, habitus; S17.2, cephalothorax (Ct) with rostrum (Ro) and proximal parts of antennula (A1) and antenna (A2); S17.3, posterior part of cephalothorax (Ct), tergites of free prosomites (Fp1-Fp3), and first two urosomites (U1-U2), with part of fifth leg (P5); S17.4, second to fourth urosomites (U2-U4) with fifth (P5) and sixth leg (P6); S17.5, fifth (P5) and sixth legs (P6) with details of first three urosomites (U1-U3) and lateral corner of third free prosomite (Fp3); S17.6, last two urosomites (U5-U6) and caudal ramus (Cr). Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in previous four species; novel ones assigned consecutive numbers.



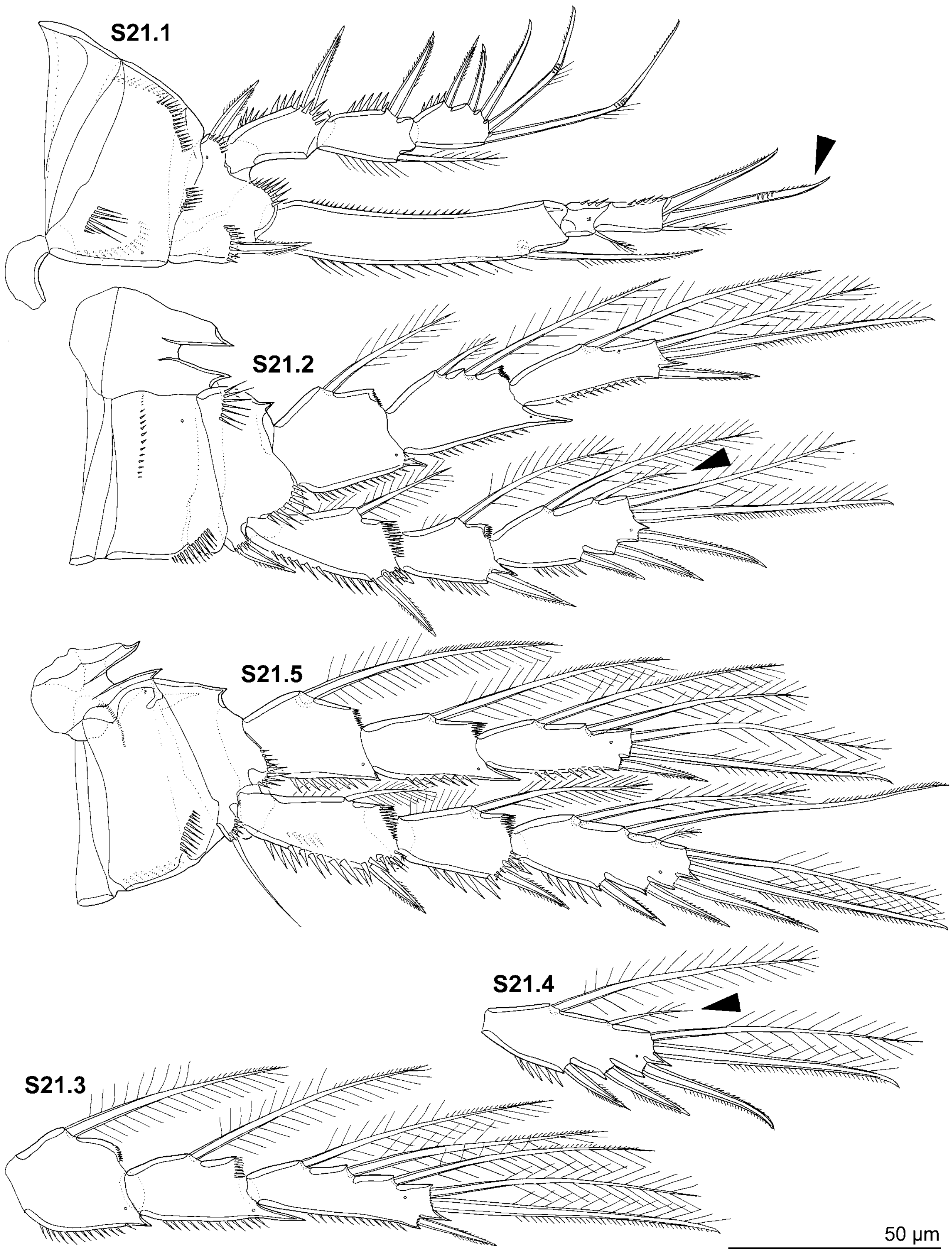
SUPPLEMENTARY FIGURE S18. *Sarsamphiascus michaeli* sp. nov., males from Wido, Seokgeum-gil (S18.1 & S18.2), Yeosu (S18.3, S18.4 & S18.6) and Jeju (S18.5), SEM photographs: S18.1, last two urosomites (U5-U6) and caudal rami (Cr), ventral; S18.2, posterior part of cephalothorax (Ct), with maxillula (Mxl), maxilla (Mx), maxilliped (Mxp), and distal part of antenna (A2), ventral; S18.3, fourth antennular segment, anterior; S18.4, sixth antennular segment, anterior; S18.5, parts of antenna (A2), mandibula (Md), and maxillula (Mxl), lateral; S18.6, first (P1) and second swimming legs (P2), anterior. Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in previous four species; novel ones assigned consecutive numbers.



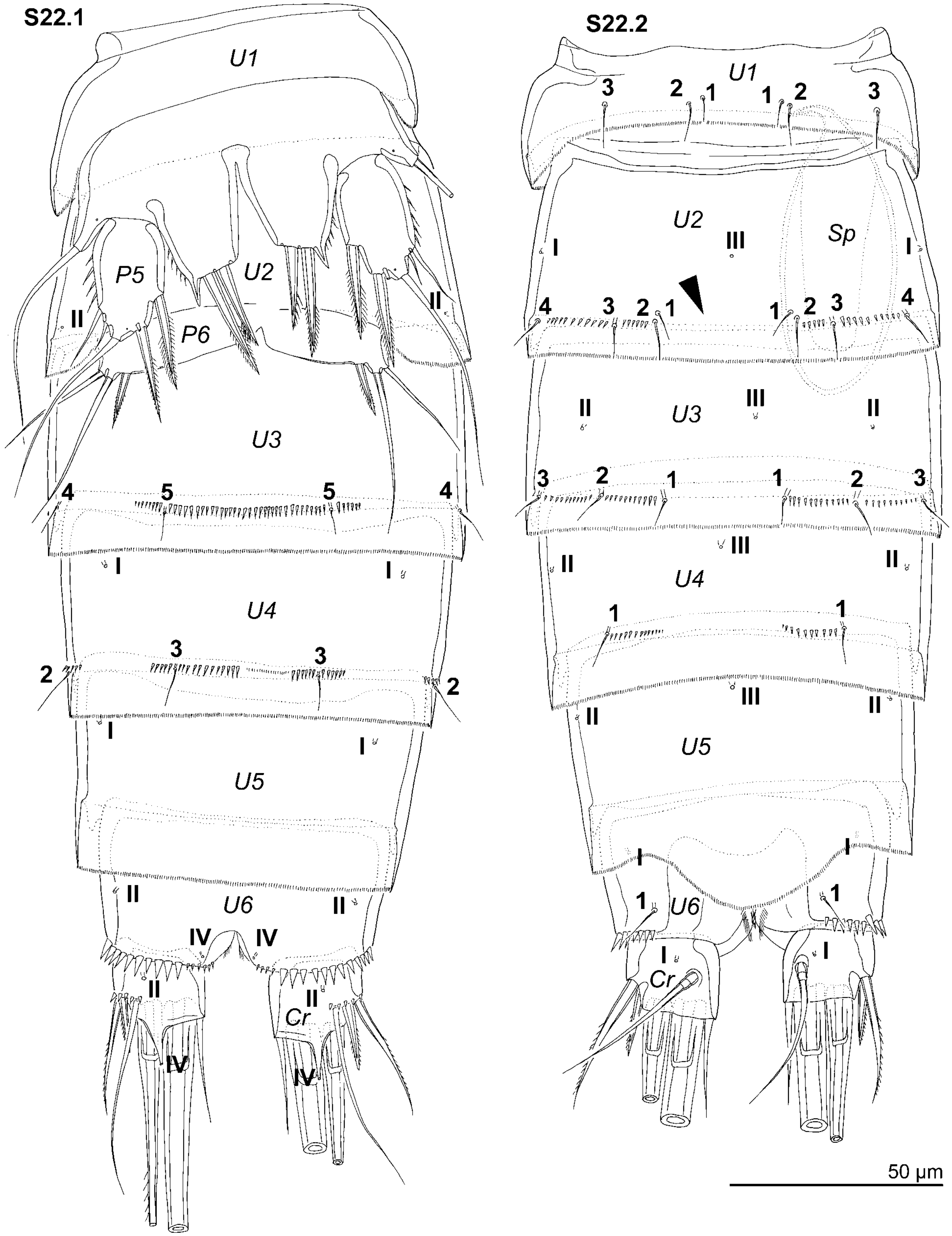
SUPPLEMENTARY FIGURE S19. *Sarsamphiascus michaeli* sp. nov., SEM photographs of female fifth leg exopod: S19.1, paratype female 1; S19.2, female from Busan; S19.3, female from Yeosu; S19.4, female from Jeju; S19.5, female 1 from Wido, Seokgeum-gil; S19.6, female 2 from Wido, Seokgeum-gil.



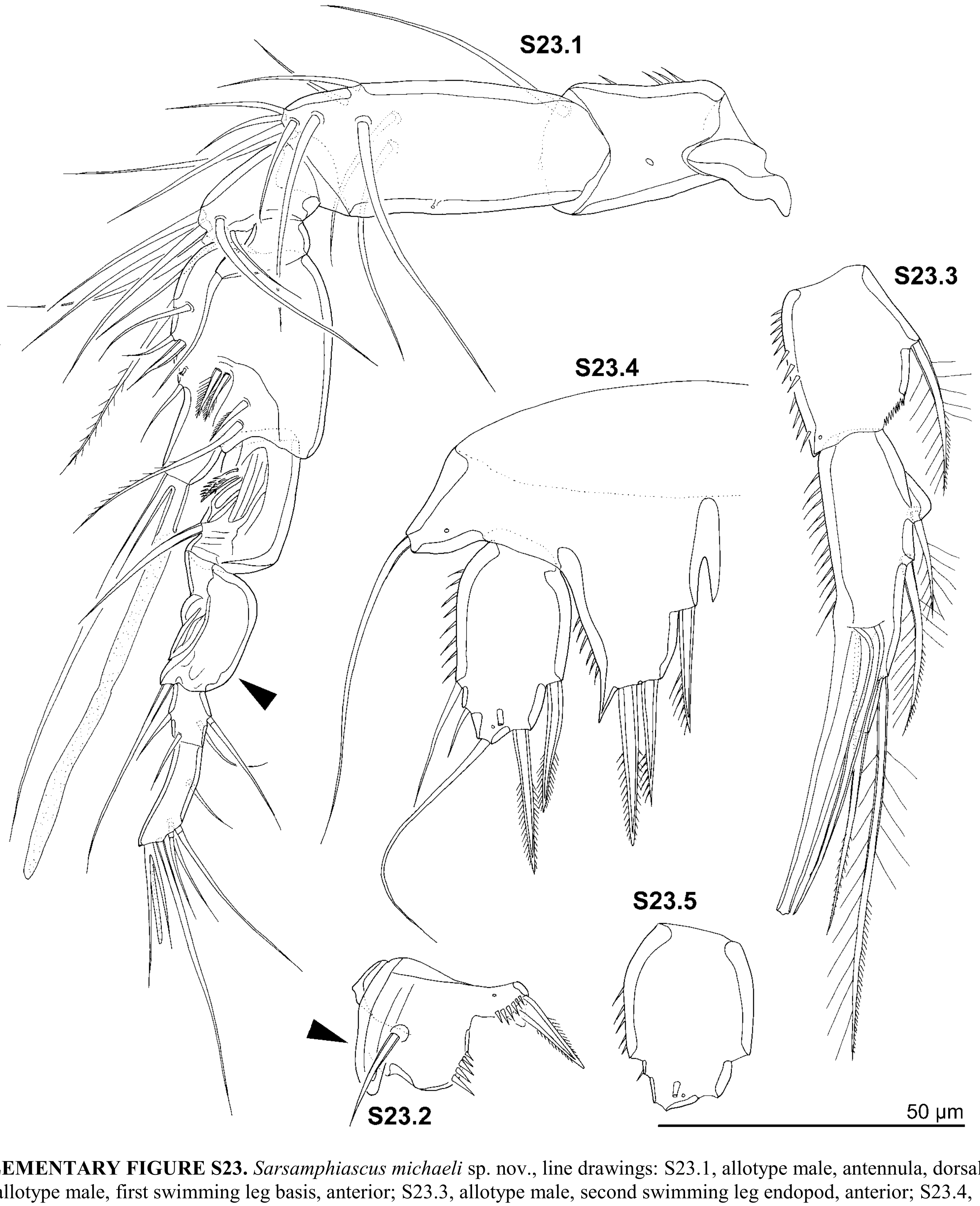
SUPPLEMENTARY FIGURE S20. *Sarsamphiascus michaeli* sp. nov., holotype female, line drawings: S20.1, rostrum and antennula, ventral; S20.2, antenna, posterior; S20.3, mandibular palp, posterior; S20.4, mandibular coxa, anterior; S20.5, maxillula, anterior; S20.6, distal part of maxilliped, anterior; S20.7, fifth leg, anterior; S20.8, sixth leg, covering gonopore. Arrowheads indicate major differences from previous four species.



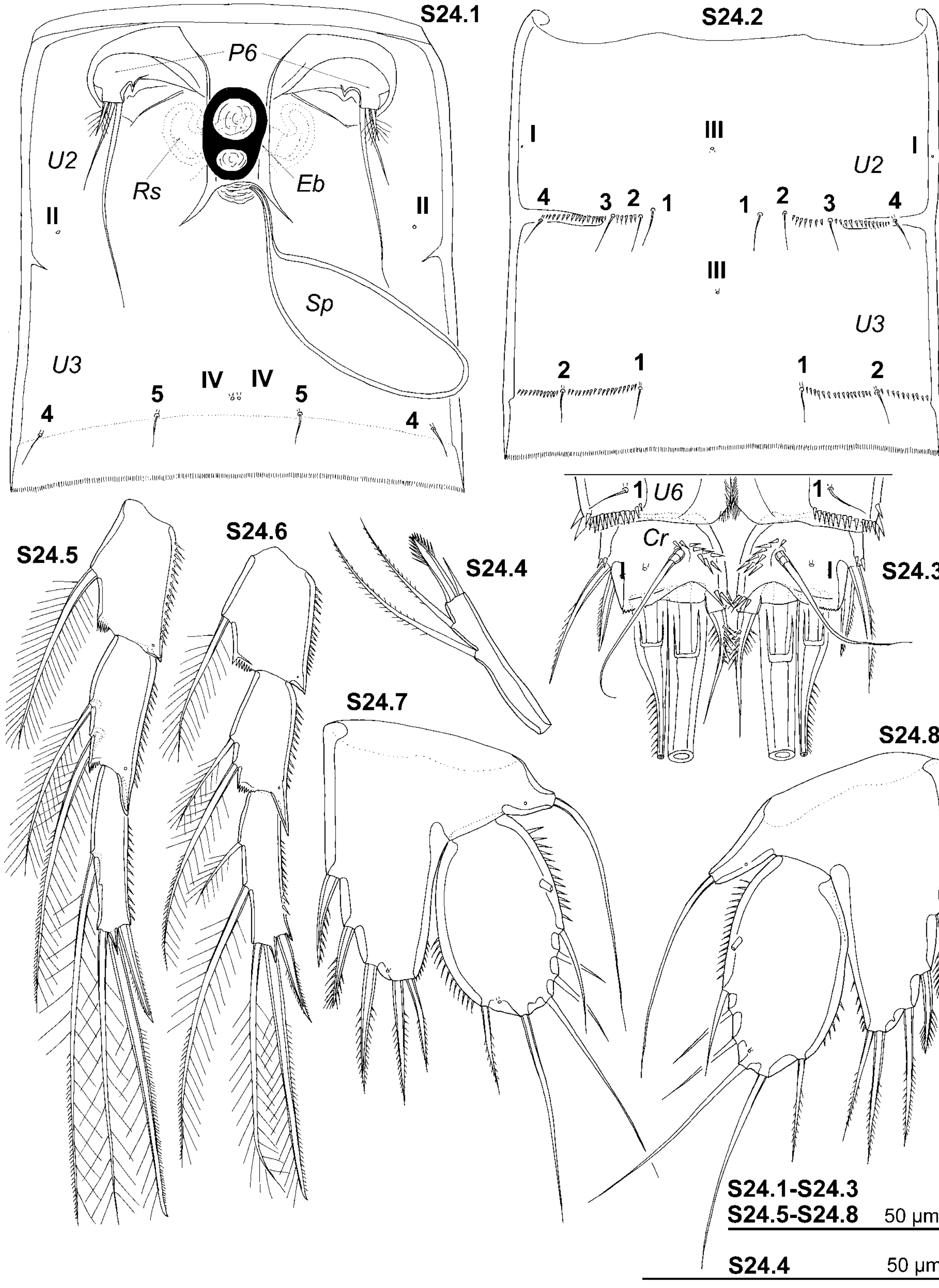
SUPPLEMENTARY FIGURE S21. *Sarsamphiascus michaeli* sp. nov., holotype female, line drawings: S21.1, first swimming leg, anterior; S21.2, second swimming leg, anterior; S21.3, third swimming leg endopod, anterior; S21.4, third swimming leg, third exopodal segment, anterior; S21.5, fourth swimming leg, anterior. Arrowheads indicate major differences from *S. marloni* sp. nov.



SUPPLEMENTARY FIGURE S22. *Sarsamphiascus michaeli* sp. nov., allotype male, line drawings: S22.1, first to sixth urosomites (U1-U6) and caudal rami (Cr), with fifth (P5) and sixth legs (P6), ventral; S22.2, first to sixth urosomites (U1-U6) and caudal rami (Cr), with internal spermatophore (Sp), dorsal. Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those previous four species; novel ones assigned consecutive numbers. Arrowhead indicates major difference from *S. jackiei* sp. nov. and *S. jermainei* sp. nov.



SUPPLEMENTARY FIGURE S23. *Sarsamphiascus michaeli* sp. nov., line drawings: S23.1, allotype male, antennula, dorsal; S23.2, allotype male, first swimming leg basis, anterior; S23.3, allotype male, second swimming leg endopod, anterior; S23.4, paratype male, fifth leg, anterior; S23.5, allotype male, fifth leg exopod, anterior, dissected and flattened, without armature. Arrowheads indicate major differences from *S. jackiei* sp. nov. and *S. jermainei* sp. nov.



SUPPLEMENTARY FIGURE S24. *Sarsamphiascus michaeli* sp. nov., females from Wido, Seokgeum-gil (S24.1-S24.5 & S24.7) and Jeju (S24.6 & S24.8), line drawings: S24.1, second and third urosomites (U2-U3), with sixth legs (P6), internal receptacula seminis (Rs), and epicopulatory bulb (Eb), ventral; S24.2, second and third urosomites (U2-U3), dorsal; S24.3, sixth urosomite (U6) and caudal rami (Cr), dorsal; S24.4, antennal exopod, anterior; S24.5 & S24.6, second swimming leg endopod, anterior; S24.7 & S24.8, fifth leg, anterior. Same Arabic numerals for cuticular sensilla and Roman numerals for pores on each somite and caudal rami homologous to those in previous four species; novel ones assigned consecutive numbers.

SUPPLEMENTARY FIGURE S25. Light photograph of males of three new species, on the same slide in glycerol: S25.1, *Sarsamphiascus michaeli* sp. nov. from Wido, Seokgeum-gil; S25.2, *S. michaeli* sp. nov. from Yeosu; S25.3, *S. jermainei* sp. nov. from Goseong (allotype); S25.4, *S. jackiei* sp. nov. from Goseong (allotype); S25.5, *S. michaeli* sp. nov. from Goseong (allotype).