

## Supplementary Materials – Morphological descriptions of new species

### *Niphargus ardonicus* sp. nov.

(Figures S1–4; S11a,b)

**Description.** BODY: Body length up to 10.5 mm, depigmented, moderately slender.

HEAD (Figure S11a): length approximately 7–8% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae on each postero-dorsal margin.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S4a–c). Epimeral plate I: posterior and ventral margins convex; without spines along ventral margin; with 2 setae along posterior margin, posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior margin almost straight, ventral margin convex; with 3 spines along ventral margin; 4 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III: posterior margin clearly oblique, ventral margins straight; with 4 spines along ventral margin; with 4 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta.

UROSOMITES (Figure S11b): Urosomite I with 1 simple seta on each side dorsolaterally; urosomite II with 2 strong spines on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S1d,f; S3a,c,e,g,i): Coxal plate I of irregularly oval shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 0.9/1.0, 0.87–0.9/1.0, 0.86/1.0 and 0.9/1.0, respectively; anterior and ventral margins with 6 setae each. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with 2 and 1 setae, respectively; posterior margins with single seta each. Coxal plate VII half-rounded shaped with 1 posterior seta. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 0.65/1.0, 0.81/1.0, 1.1/1.0, 0.68/1.0 and 0.54/1.0, respectively.

ANTENNA I (Figure S1a): slender, 0.50–0.53 of body length; peduncular articles moderately slender, ratio 1.0/0.81/0.54; flagellum consists of 22 articles, most of them with 2 short aesthetascs each; accessory flagellum short, 2-articulated (Figure S2b). Length ratio of antennae I/II 1.0/0.63.

ANTENNA II (Figure S1c): peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 9 articles with relatively short setae; lengths of peduncle articles IV/V 1.0/1.07–1.10; flagellum 0.67 times of length of peduncular articles IV+V.

LABRUM (Figure S2a): typical.

LABIUM (Figure S2b): with entire, subrounded outer lobes and well developed smaller inner lobes.

MANDIBLES (Figure S2c–f): Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth; with row of 7 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar (Figure S4e,f). Right mandible: incisor process with 4 teeth, lacinia mobilis trifurcate, with row of

8 serrated setae between lacinia and molar (Figure 4c,d); ratio of mandibular palp articles II/III (distal) 1.0/0.97–1.0; proximal article of palp without setae; article II with 7–8 setae; distal article with group of 4–6 A-setae, 2–3 B-setae, 14–15 D-setae and 4–5 E-setae.

MAXILLA I (Figure S2g): inner lobe with 3 distal setae, outer lobe with 7 robust comb-like spines, carrying 4–5 thin teeth each (5–4–5–4–5–5) (Figure 4h)); palp 2-articulated, distal article with 6 simple setae distally.

MAXILLA II (Figure S2i): both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED (Figure S2j): inner plate short, with 3 distal robust setae intermixed with 5 distal simple setae, subdistally with 1 simple lateral setae; outer plate reaching half of palpal article II, with row of 12 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV without setae at outer margin; nail shorter than pedestal, with 1 seta near basis.

GNATHOPOD I (Figure S1d,e): basis width/length 0.37/1.0; ischium with group of 3–4 posterodistal setae; carpus 0.54 of basis length and 0.73 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure 3d), setose, with 6 rows of setae at posterior margin; anterior margin with single group of 5 setae in addition to anterodistal group of 8 setae; with several groups of short setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform seta and single supporting spiniform seta on inner surface; nail length 0.60–0.62 of total dactylus length, with single seta on anterior margin and 4 short setae along inner margin.

GNATHOPOD II (Figure S1f,g): basis width/length 0.27/1.0; ischium with 3 posterodistal setae; carpus 0.50 of basis length and 0.67 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure 7f), setose, larger than propodus of GI (I/II as 0.80/1.0), posterior margin with 7 rows of setae, anterior margin with single group of 2 setae in addition to 5–6 anterodistal setae, with 2 setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform seta and single supporting spiniform seta on inner surface (Figure 1g); dactylus with single seta on anterior margin and 4 short setae along inner margin, nail length about 0.48 of total length of dactylus.

PEREOPODS III–IV (Figure S3a–d): almost similar in size and shape; basis 5.0 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.1–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.8–0.9/1; propodus with group of spines along ventral margin; dactylus (Figure 3b, d) relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 0.9/1.0, nail length 0.49–0.52 of total length of dactylus.

PEREOPODS V–VII (Figure S3e,g,i): length ratio of PpV/VI/VII 1.0/1.30/1.28–1.29; length of PVII about half of total body length.

PEREOPOD V (Figure 3e, f): basis about 1.5 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin convex

in middle, with row of 9 slender marginal setae, without facial setae, anterior margin convex, with row of 7 slender marginal setae, which distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1.0; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 8 times as long as wide, with several bunches of short spines; dactylus (Figure S3f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S3g,h): basis length/width ratio 1.0/0.64, with little posteroventral lobe and barely concave posterior margin bearing row of 9 short marginal setae; anterior margin slightly convex, with row of 6 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 6–7 times as long as wide, with several group of short spines; dactylus (Figure S3h) with single small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S3i,j): basis length/width ratio 1.0/0.69, with little posteroventral lobe and convex posterior margin bearing row of 8 short marginal setae; anterior margin convex, with row of 4 longer marginal setae; ischium short, length/width ratio 0.8/1; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 6–7 times as long as wide, with several groups of short spines; dactylus (Figure S3j) with small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

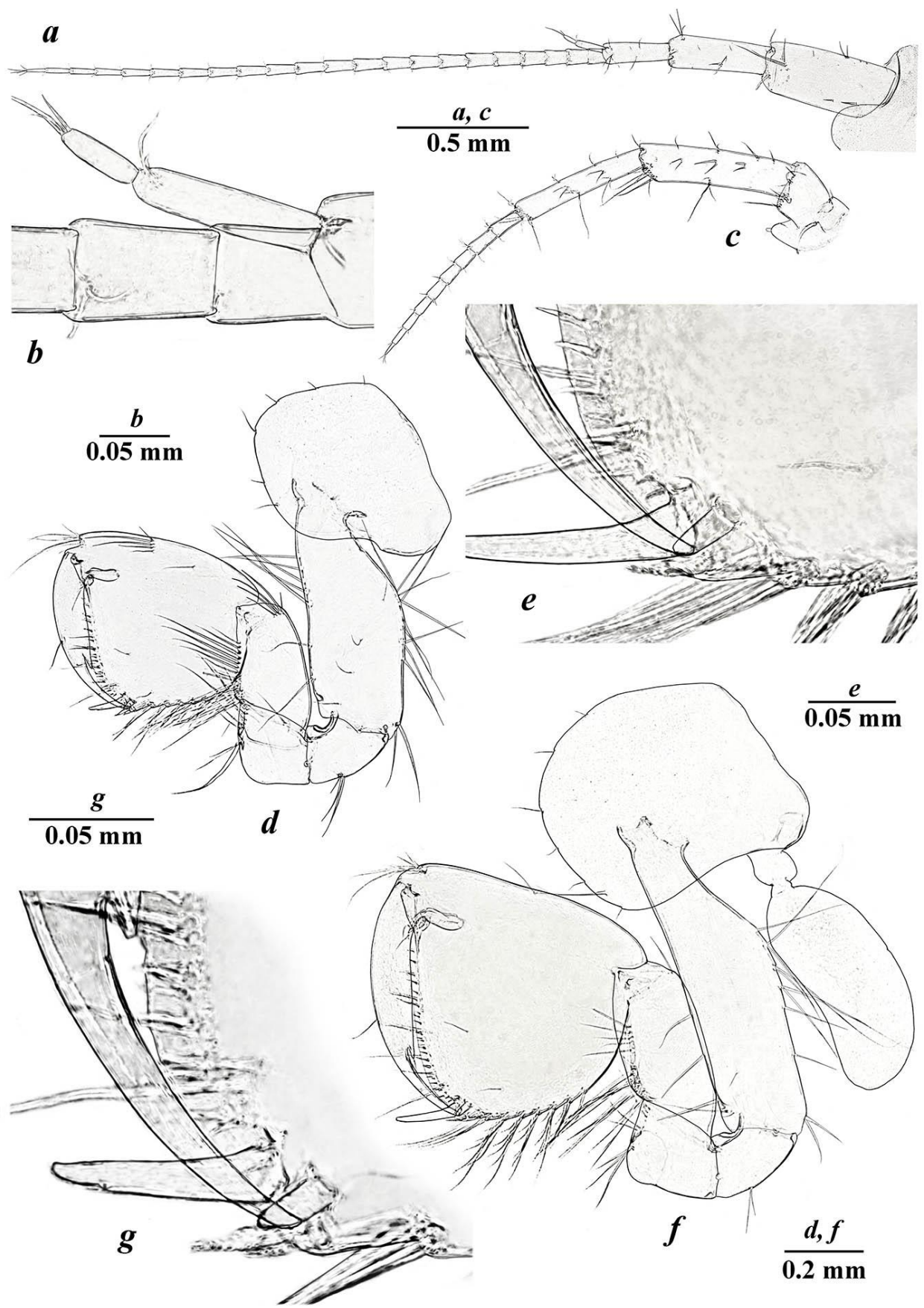
PLEOPODS (Figure S4f): pleopods I–II with basal segments smooth, with 5 hooks in retinacules (Figure S3f,g); pleopod III with basal segment armed single long seta, with 5 hooks in retinacules.

UROPOD I (Figure S4h): protopodite with 7 dorso-external and 3 dorso-internal spines and setae; rami straight and subequal in length at least in ♀; endopodite lengths 0.77 protopodite, straight; ratio of exopodite/endopodite lengths 0.95/1.0; exopodite not paddle-like, straight, with 2 single spiniform setae laterally and 4 spines apically; endopodite with 2 spiniform setae laterally and 4 spines apically.

UROPOD II (Figure S4i): protopodite 2.8–3.0 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/1.15.

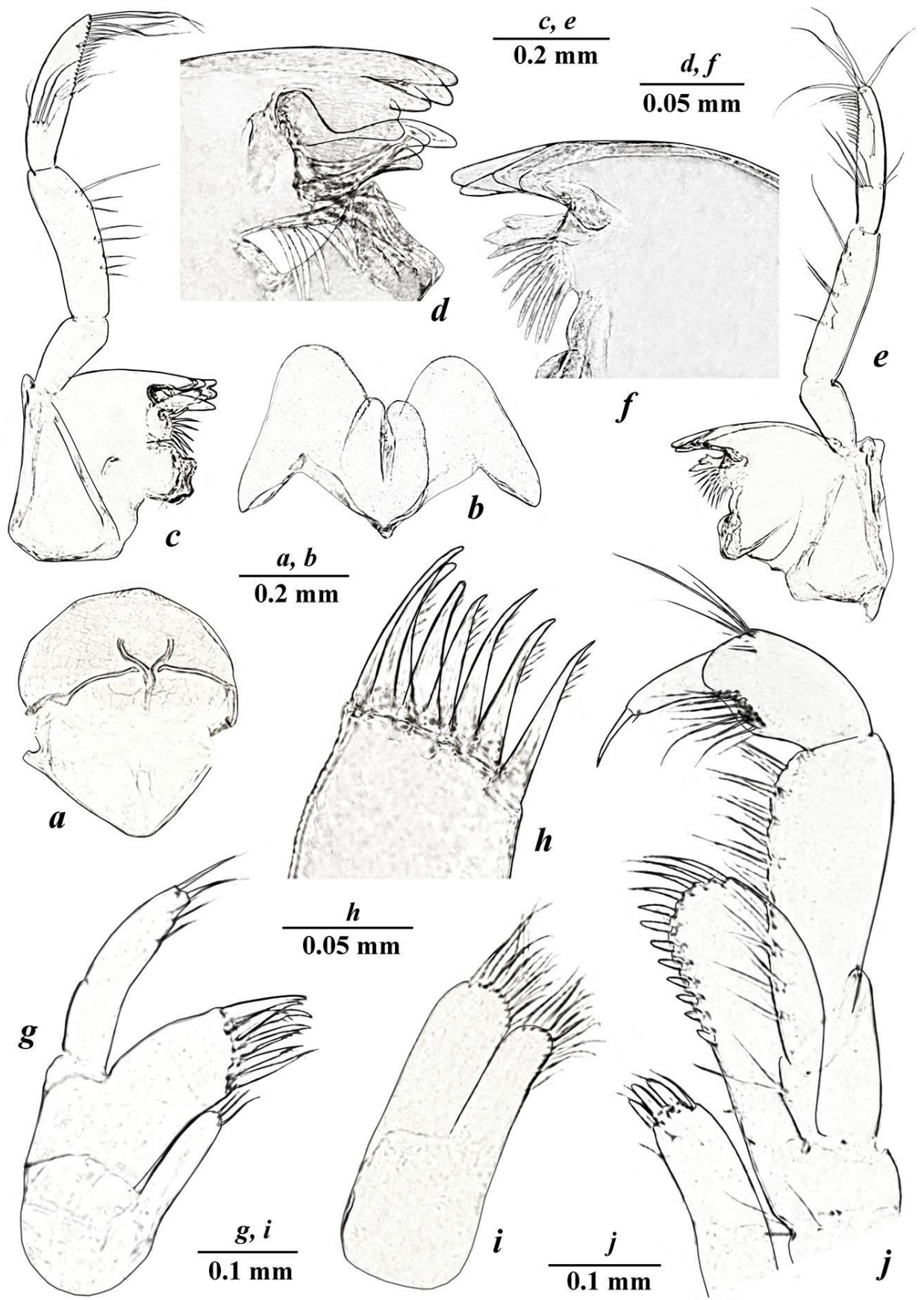
UROPOD III (Figure S4j): 0.18–0.20 of body length in ♀; protopodite 1.9–2.1 times as long as wide, with 2 lateral setae and 7–9 apical spines; rami unequal, endopodite short, about 8.5 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.47 of length of proximal article, with 4–5 long simple setae apically; proximal article with 4 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

TELSON (Figure S4d,e): ratio of length/width 1.0/0.89; cleft 0.72–0.74 telson length; margins weakly rounded or rounded and narrowing apically; with variable setal pattern, including 2–4 apical spiniform setae, 1–2 lateral spiniform setae, accompanying by 2 plumose setae on each side and 1–2 small medial setae dorsally; apical spiniform setae 0.50–0.55 of length of telson.

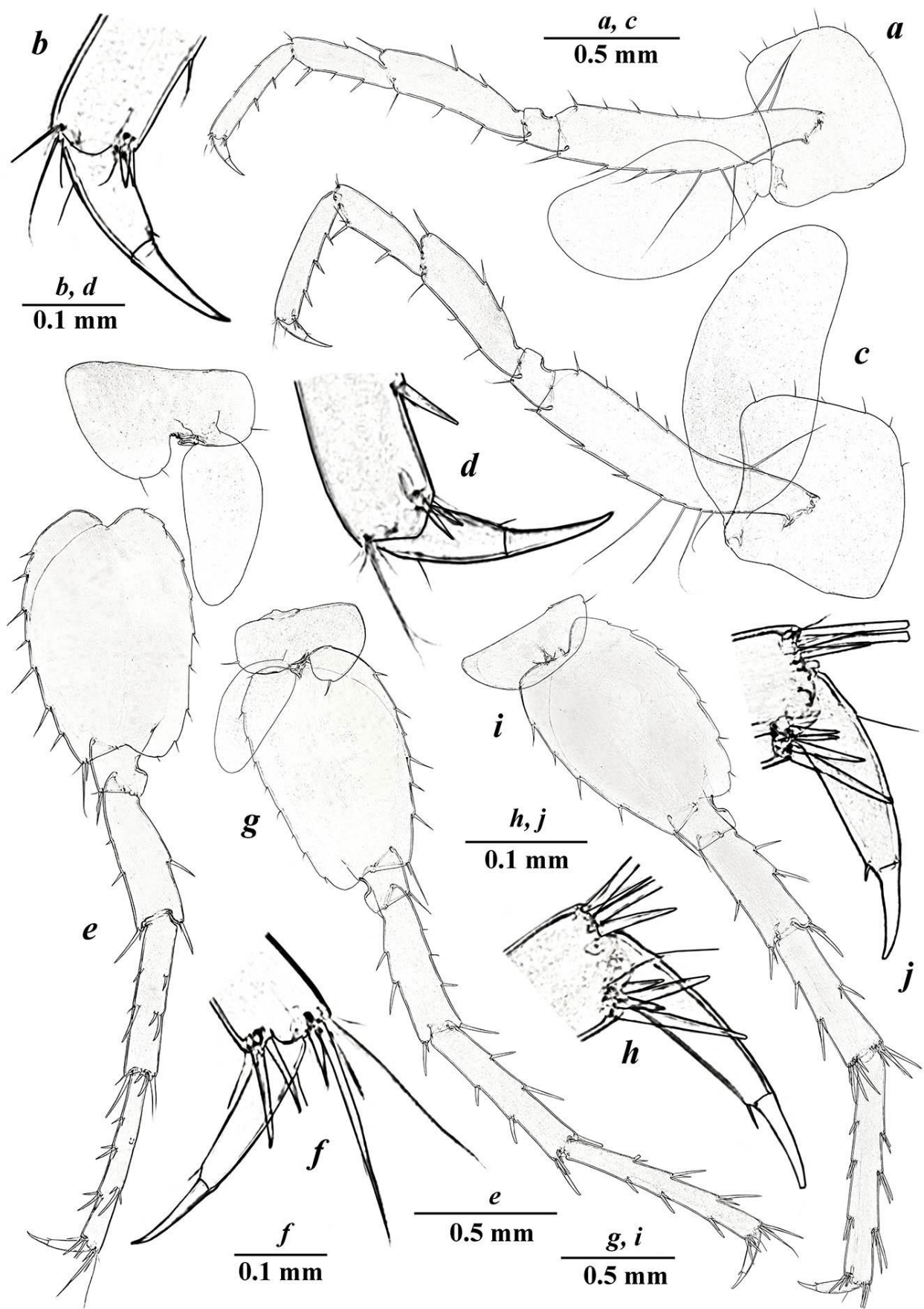


**Figure S1.** *Niphargus ardonicus* sp. nov., ♀: a – antenna I (AI); b – accessory flagellum of AI; c – antenna II; d – gnathopod I (GI); e – distoventral corner of palmar margin of chela of GI; f – gnathopod II (GII); g – distoventral corner of palmar margin of chela of GII; h – same, distoventral setae.



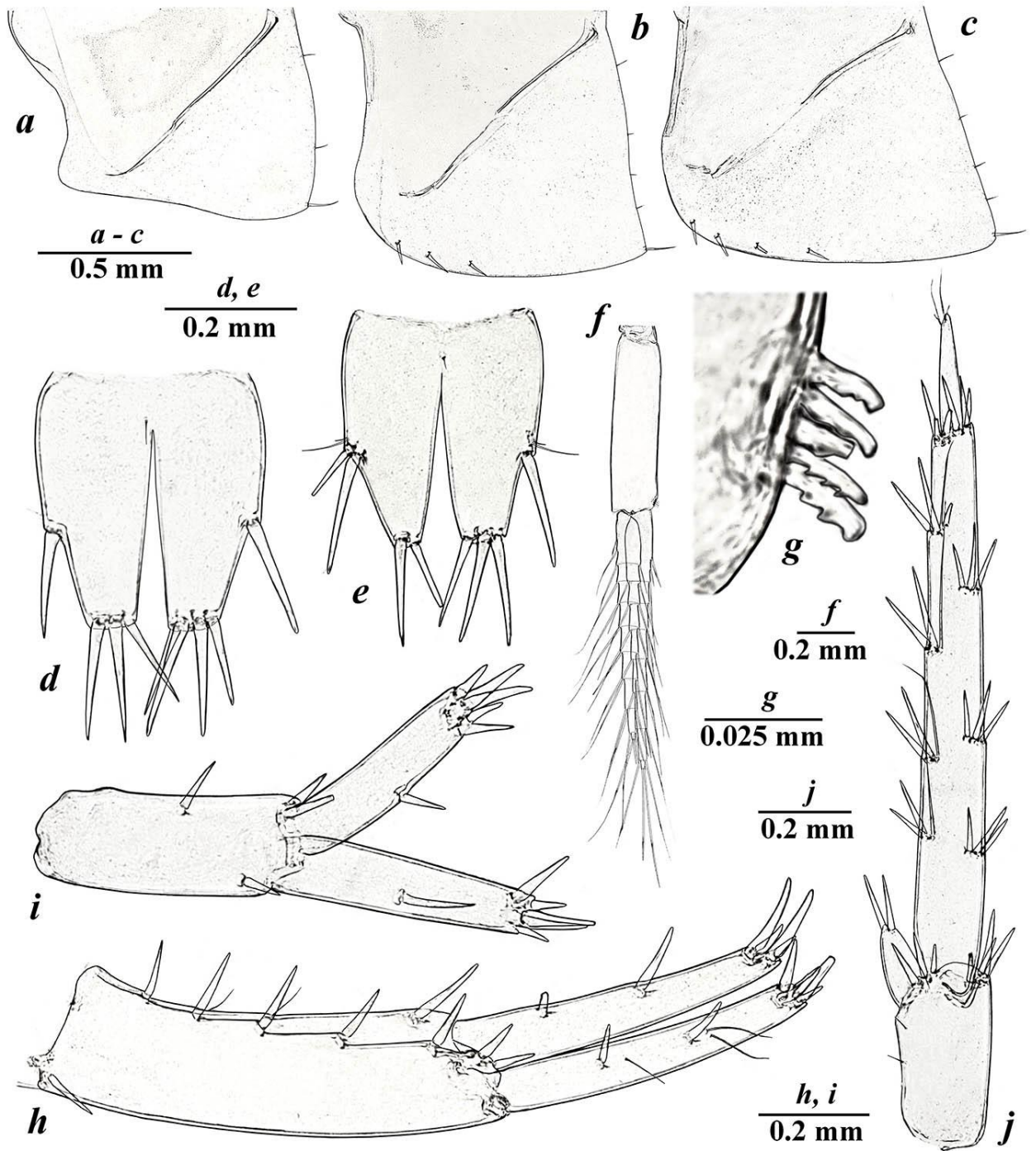


**Figure S2.** *Niphargus ardonicus* **sp. nov.**, ♀: a – labium; b – labrum; c, e – mandibles; d, f – incisor process and pars incisiva; g – maxilla I; h – same, distal margin of outer plate; i – maxilla II; j – maxilliped.



**Figure S3.** *Niphargus ardonicus* sp. nov., ♀: a– pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – dactylus of PVI; i – pereopod VII (PVII); j – dactylus of PVII.





**Figure S4.** *Niphargus ardonicus* sp. nov., ♀: a–c – epimeral plates I–III; d, e – telson; f – pleopod I; g – retinacula of pleopod I; h – uropod I; i – uropod II; j – uropod III.

*Niphargus fiagdonicus* sp. nov.

(Figures S5–6; S11c,d)

**Description.** BODY: Body length up to 12.0 mm, depigmented, slender.

HEAD (Figure S11c): length approximately 7–8% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae on each postero-dorsal margin.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S5a). Epimeral plate I: posterior and ventral margins convex; without spines along ventral margin; with 2 setae along posterior margin, posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior margin almost straight, ventral margin convex; with 3 spines along ventral margin, single seta on posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III (Figure 7a): posterior margin almost straight, ventral margins straight; with 4 spines along ventral margin; with 3 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta.

UROSOMITES (Figure S11d): Urosomite I with single seta on each side dorsolaterally; urosomite II with 2 strong spines on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S5e,f; S6a,c,e,g,h): Coxal plate I of irregularly oval shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 1.1/1.0, 0.88–0.9/1.0, 0.9/1.0 and 1.0/1.0, respectively; anterior and ventral margins with 6, 8, 7 and 6 setae, respectively. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with 2 setae each; posterior margins with 2 and 1 setae, respectively. Coxal plate VII half-rounded shaped with 3 posterior setae. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 0.62/1.0, 0.63/1.0, 0.77/1.0, 0.75/1.0 and 0.56/1.0, respectively.

ANTENNA I: slender, 0.43–0.48 of body length; peduncular articles moderately slender, ratio 1.0/0.96/0.59; flagellum consists of 16 articles, most of them with 2 short aesthetascs each; accessory flagellum 2-articulated. Length ratio of antennae I/II 1.0/0.62.

ANTENNA II: peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 7 articles with relatively short setae; lengths of peduncle articles IV/V 1.0/1.05; flagellum 0.62 times of length of peduncular articles IV+V.

LABRUM: typical.

LABIUM: with entire, subrounded outer lobes and well developed smaller inner lobes.

MANDIBLES. Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth; with row of 8 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar. Right mandible: incisor process with 4 teeth, lacinia mobilis trifurcate, with row of 6 serrated setae between lacinia and molar; ratio of mandibular palp articles II/III (distal) 1.0/0.98; proximal article of palp without setae; article II with 7–8 setae; distal article with group of 4–5 A-setae, 2 B-setae, 17–19 D-setae and 4–5 E-setae.



MAXILLA I: inner lobe with 3 distal setae, outer lobe with 7 robust comb-like spines, carrying 3–8 teeth each (3–3–3–8–8–8) (Figure 7d)); palp 2-articulated, distal article with 4 simple setae distally.

MAXILLA II: both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED: inner plate short, with 2 distal robust setae intermixed with 5 distal simple setae, subdistally with 1 simple lateral setae; outer plate reaching half of palpal article II, with row of 16 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV with 2 simple setae at outer margin; nail shorter than pedestal, with single seta near basis.

GNATHOPOD I (Figure S5e): basis width/length 0.31/1.0; ischium with group of 6–7 posterodistal setae; carpus 0.57 of basis length and 0.79 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, with 6 rows of setae at posterior margin; anterior margin with single group of 2 setae in addition to anterodistal group of 8 setae; palmar corner armed with 1 long spiniform palmar seta, 4 serrated spiniform seta and single supporting spiniform seta on inner surface; nail length 0.53–0.55 of total dactylus length, with single seta on anterior margin and 4 short setae along inner margin.

GNATHOPOD II (Figure S5f): basis width/length 0.25/1.0; ischium with 3 posterodistal setae; carpus 0.59 of basis length and 0.87 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, larger than propodus of GI (I/II as 0.83/1.0), posterior margin with 7 rows of setae, anterior margin without setae excluding to 5–6 anterodistal setae; 3 small setae on inner surface; palmar corner armed with 1 long spiniform seta, 3 serrated spiniform setae and single supporting spiniform seta on inner surface; dactylus with single seta on anterior margin and 4 short setae along inner margin, nail length about 0.55 of total length of dactylus.

PEREOPODS III–IV (Figure S6a–d): almost similar in size and shape; basis 5.0 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.1–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.83–0.86/1.0; propodus with group of spines along ventral margin; dactylus (Figure S8b, d) relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 1.1/1.0, nail length 0.47–0.54 of total length of dactylus.

PEREOPODS V–VII (Figure S6e,g,h): length ratio of PpV/VI/VII 1.0/1.36/1.36; length of PVII about half of total body length.

PEREOPOD V (Figure S6e,f): basis about 1.6 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin convex in middle, with row of 9 slender marginal setae, without facial setae, anterior margin convex, with row of 5 slender marginal setae, which distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 7 times as long as wide, with several

bunches of short spines; dactylus (Figure S6f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S6g): basis about 1.8 times as long as wide, with little posteroventral lobe and barely concave posterior margin bearing row of 9 short marginal setae; anterior margin slightly convex, with row of 7 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 9 times as long as wide, with several group of short spines; dactylus with single small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S6h,i): basis about 1.7 times as long as wide, with little posteroventral lobe and convex posterior margin bearing row of 7 short marginal setae; anterior margin convex, with row of 5 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 9 times as long as wide, with several groups of short spines; dactylus (Figure 8i) with single small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

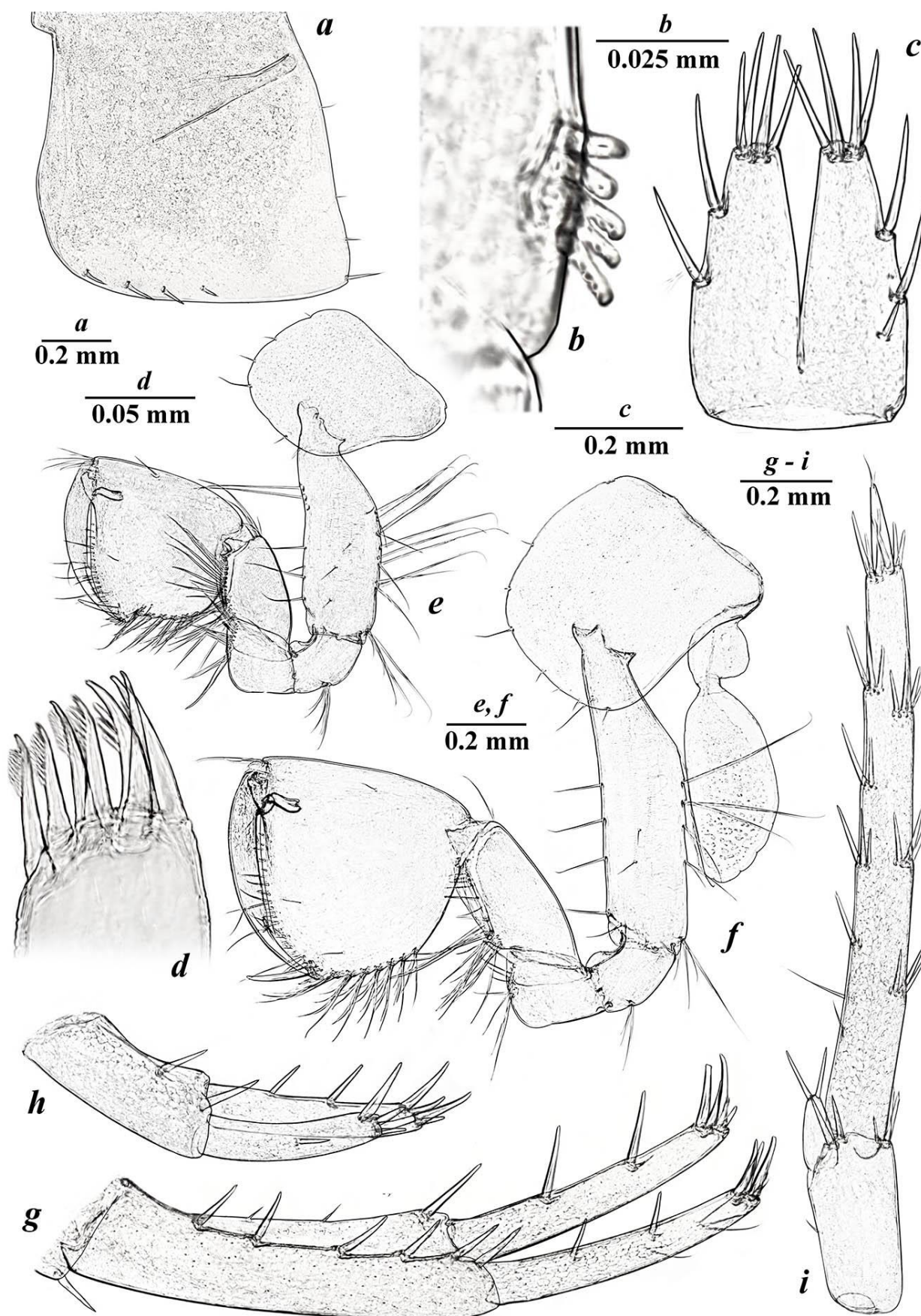
PLEOPODS: pleopods I and III with basal segments smooth, with 5 hooks in retinacules (Figure S5b); pleopod II with basal segment armed 2 simple long setae, with 5 hooks in retinacules of pleopods.

UROPOD I (Figure S5g): protopodite with 6 dorso-external and 3 dorso-internal spines and setae; rami straight and subequal in length at least in ♀; endopodite lengths 0.72 of protopodite, straight; ratio of exopodite/endopodite lengths 0.96/1.0; exopodite not paddle-like, straight, with 2 single spiniform setae laterally and 4 spines apically; endopodite with 2 spiniform setae laterally and 4 spines apically.

UROPOD II (Figure S5h): protopodite 2.4–2.7 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/1.18.

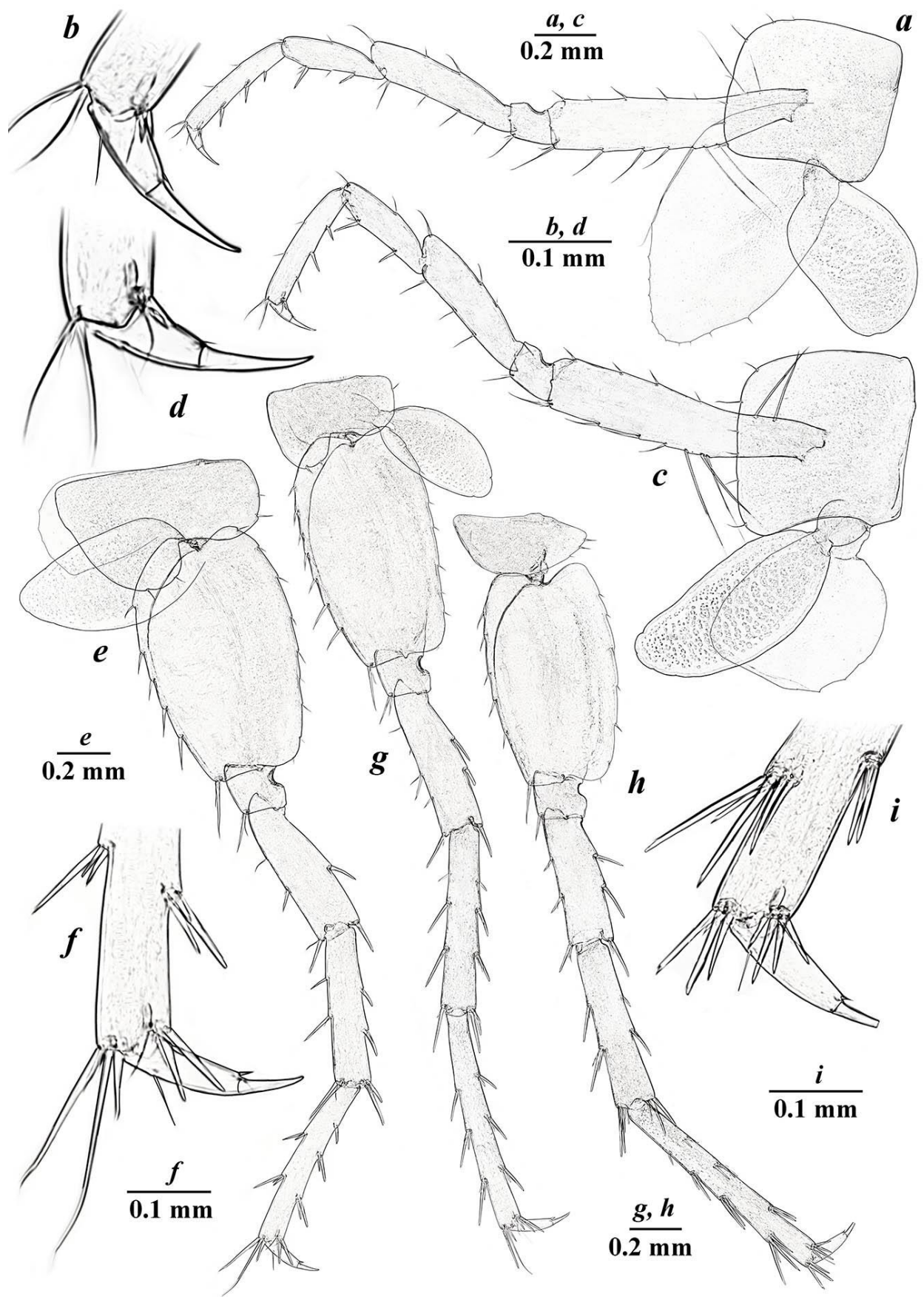
UROPOD III (Figure S5i): 0.18–0.20 of body length in ♀; protopodite 2.0–2.2 times as long as wide, with single lateral seta and 6–8 apical spines; rami unequal, endopodite short, about 8.7 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.20 of length of proximal article, with 4–5 long simple setae apically; proximal article with 5–6 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

TELSON (Figure S5c): ratio of length/width 1.0/0.75; cleft 0.68–0.70 telson length; margins weakly rounded or rounded and narrowing apically; with variable setal pattern, including 4 apical spiniform setae, 2–3 lateral spiniform setae, accompanying by 2 plumose setae on each side and 1–2 small medial setae dorsally; apical spiniform setae 0.40–0.43 of length of telson.



**Figure S5.** *Niphargus fiagdonicus* sp. nov., ♀: a – epimeral plate III; b – retinacula of pleopod III; c – telson; d – maxilla I; e – gnathopod I; f – gnathopod II (GII); g – uropod I; h – uropod II; i – uropod III.





**Figure S6.** *Niphargus fiagdonicus* sp. nov., ♀: a – pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – pereopod VII (PVII); i – dactylus of PVII.



***Niphargus osseticus* sp. nov.**

(Figures S7–10; S11e,f)

**Description.** BODY: Body length up to 11.5 mm, depigmented.

HEAD (Figure S11e): length approximately 7–9% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae on each posterodorsal margin.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S11a–c). Epimeral plate I: posterior and ventral margins convex; without spines along ventral margin; with 2 setae along posterior margin, posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior margin straight, ventral margin convex; with 3 spines along ventral margin; 2 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III: posterior margin clearly oblique, ventral margin straight; with 3 spines along ventral margin; with 4 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta.

UROSOMITES (Figure S11f): Urosomite I with single seta on each side dorsolaterally; urosomite II with 2 simple strong spines on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S7d,f; S9a,c,e,g,i): Coxal plate I of irregularly oval shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 1.1/1.0, 0.87–0.9/1.0, 0.79–0.83/1.0 and 1.0/1.0, respectively; anterior and ventral margins with 6, 6, 6 and 5 setae, respectively. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with single seta each; posterior margins with 2 setae each. Coxal plate VII half-rounded shaped with 2 posterior setae. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 1.13/1.0, 0.71/1.0, 1.34/1.0, 0.97/1.0 and 0.60/1.0, respectively.

ANTENNA I (Figure S7a): slender, 0.48–0.52 of body length; peduncular articles moderately slender, ratio 1.0/0.77/0.45; flagellum consists of 18 articles, most of them with 2 short aesthetascs each (Figure S9b); accessory flagellum short, 2-articulated. Length ratio of antennae I/II 1.0/0.55.

ANTENNA II (Figure S7c): peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 11 articles with relatively short setae; lengths of peduncle articles IV/V 1/0.88; flagellum 0.78 times of length of peduncular articles IV+V.

LABRUM (Figure S8a): typical.

LABIUM (Figure S8b): outer lobes subrounded; inner lobes well developed.

MANDIBLES (Figure S8c–f): Left mandible (Figure S10c,d): incisor with 5 teeth, lacinia mobilis with 4 teeth; with row of 7 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar. Right mandible (Figure S8e,f): incisor process with 4 teeth, lacinia mobilis bifurcate, with row of 6 serrated setae between lacinia and molar; ratio of mandibular palp articles II/III (distal) 1.0/0.98; proximal article of palp without setae; article II with 12–14 setae; distal article with group of 6–7 A-setae, 3–4 B-setae, 16–18 D-setae and 4–5 E-setae.

MAXILLA I (Figure S8g): inner lobe with 3 distal setae, outer lobe with 7 robust spines, carrying 2–4 teeth each (2–2–2–2–2–4) (Figure 8h)); palp 2-articulated, distal article with 4 simple setae distally.

MAXILLA II (Figure S8i): both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED (Figure S8j): inner plate short, with 4 distal robust setae intermixed with 3 distal simple setae, subdistally with 1 simple lateral setae; outer plate reaching half of palpal article II, with row of 20 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV with 1 simple seta at outer margin; nail shorter than pedestal, with 2 single setae near basis.

GNATHOPOD I (Figure S7d,e): basis width/length 0.29/1.0; ischium with group of 6–7 posterodistal setae; carpus 0.57 of basis length and 0.89 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, with 8 rows of setae at posterior margin; anterior margin with 2 groups of 6–8 setae each in addition to anterodistal group of 10 setae; palmar corner armed with 1 long spiniform palmar seta, 4 serrated spiniform seta and single supporting spiniform seta on inner surface (Figure 7e); nail length 0.60–0.62 of total dactylus length, with single seta on anterior margin and 5 short setae along inner margin.

GNATHOPOD II (Figure S7f): basis width/length 0.23/1.0; ischium with 4 posterodistal setae; carpus 0.50 of basis length and 0.74 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, larger than propodus of GI (I/II as 0.70/1.0), posterior margin with 11 rows of setae, anterior margin with 2 groups of 2–3 setae each in addition to 5–6 anterodistal setae; 5 small setae on inner surface; palmar corner armed with single long spiniform seta, 2 serrated spiniform setae and single supporting spiniform seta on inner surface (Figure S7g); dactylus with single seta on anterior margin and 5 short setae along inner margin, nail length about 0.63 of total length of dactylus.

PEREOPODS III–IV (Figure S9a–d): almost similar in size and shape; basis 5.7–6.0 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.1–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.87–0.90/1.0; propodus with group of spines along ventral margin; dactylus (Figure S6b,d) relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 1.16/1.0, nail length 0.48–0.49 of total length of dactylus.

PEREOPODS V–VII (Figure S9e,g,i): length ratio of PpV/VI/VII 1.0/1.32/1.32; length of PVII about half of total body length.

PEREOPOD V (Figure S9e,f): basis about 1.8 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin straight, with row of 9 slender marginal setae, without facial setae, anterior margin convex, with row of 4 slender marginal setae, which distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1.0; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 7.6 times as long as wide, with several bunches of short spines; dactylus (Figure S9f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S9g,h): basis about 1.9 times as long as wide, with little posteroventral lobe and barely concave posterior margin bearing row of 10 short marginal setae; anterior margin slightly convex, with row of 5 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 10 times as long as wide, with several group of short spines; dactylus (Figure 9h) with small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S9i,j): basis about 1.7 times as long as wide, with little posteroventral lobe and convex posterior margin bearing row of 9 short marginal setae; anterior margin slightly convex, with row of 6 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 10 times as long as wide, with several groups of short spines; dactylus (Figure S9j) with small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

PLEOPODS: pleopods I–II with basal segments smooth, with 5 hooks in retinacules (Figure S10g); pleopod III with basal segment armed 2–3 simple long setae (Figure S10f), with 5 hooks in retinacules.

UROPOD I (Figure S10h,i): protopodite with 7 dorso-external and 3 dorso-internal spines; rami straight, subequal in length; endopodite lengths 0.63 of protopodite; exopodite and endopodite subequal in length; exopodite not paddle-like, straight, with 2 single spiniform setae laterally and 4–5 spines apically; endopodite with 1–2 spiniform setae laterally and 4 spines apically.

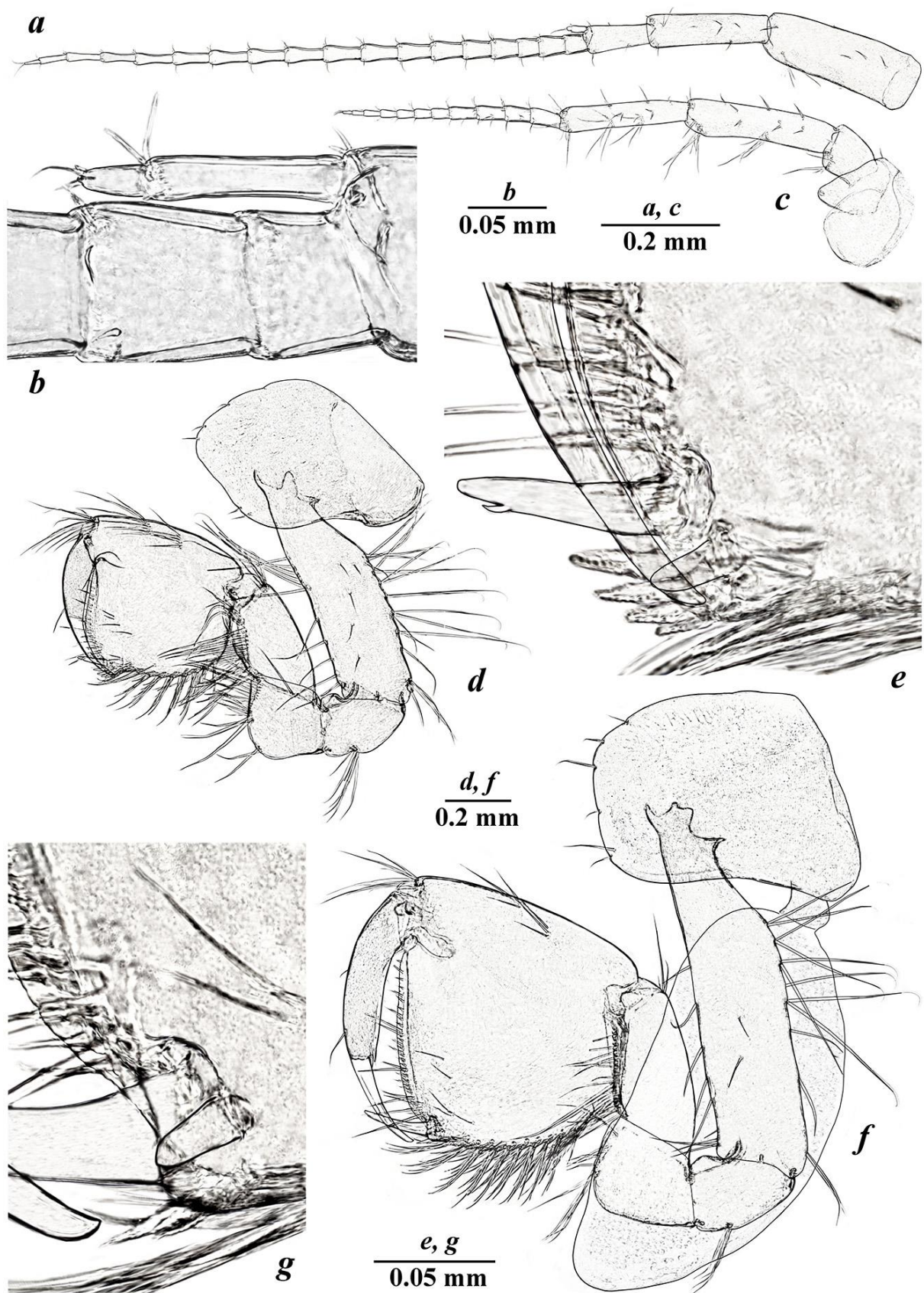
UROPOD II (Figure S10k,j): protopodite 2.6–3.4 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/1.05.

UROPOD III (Figure S10m,l): different in ♂♂ and ♀♀.

♀♀ (Figure S10m): 0.18–0.20 of body length; protopodite 1.9–2.0 times as long as wide, with single lateral seta and 6–8 apical spines; rami unequal, endopodite short, about 10.9 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.26 of length of proximal article, with 3–4 short simple setae apically and single seta laterally; proximal article with 3 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

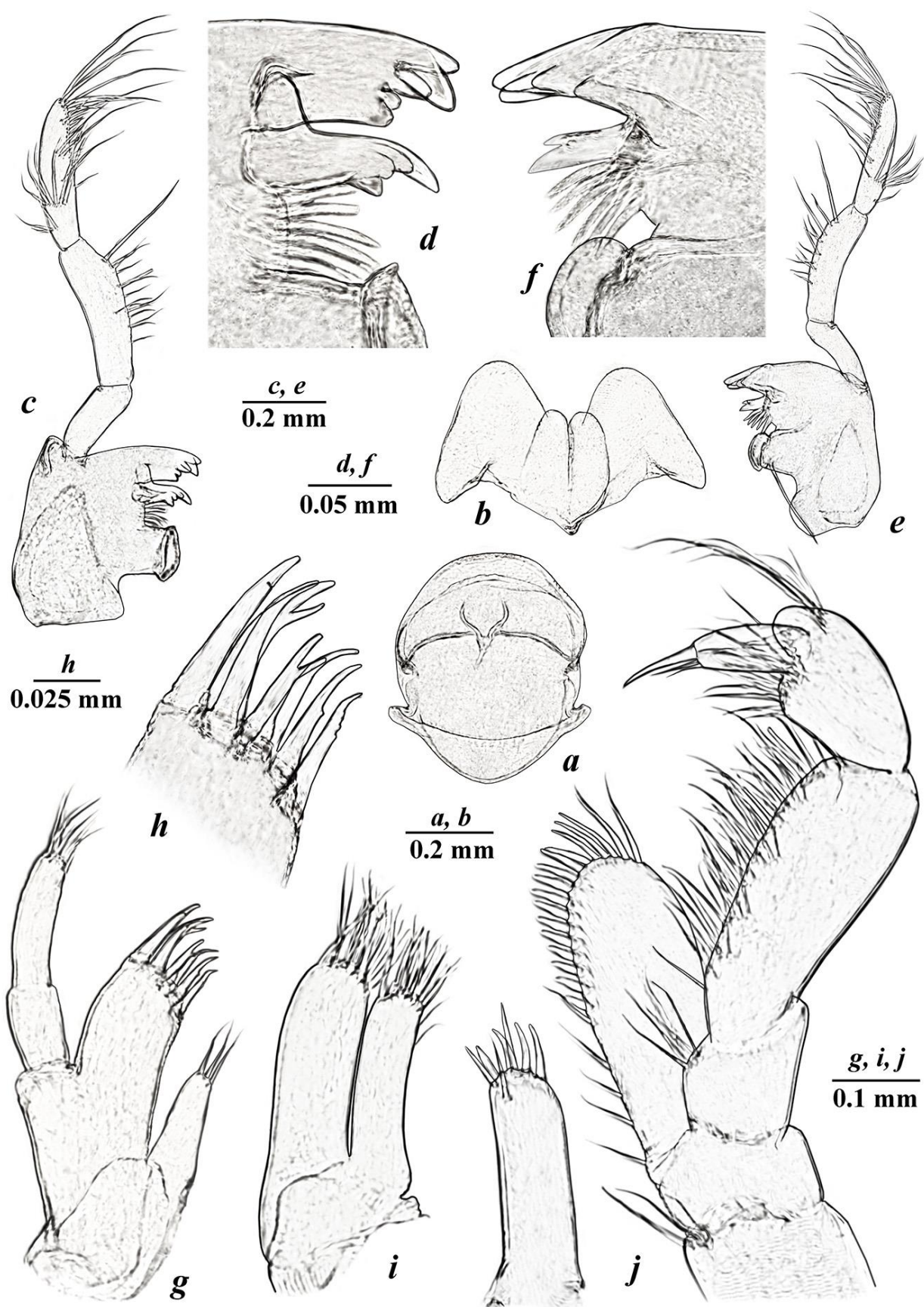
♂♂ (Figure S10l): 0.32–0.36 of body length; protopodite 2.0–2.2 times as long as wide, with single lateral seta and 6–8 apical spines; rami unequal, endopodite short, about 11.7 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.26 of length of proximal article, with three groups of lateral setae on each side and group of 5–6 long setae apically; proximal article with 4 groups of thin-flexible, spiniform and plumose setae along inner margin and 4 groups of spiniform setae along outer margin.

TELSON (Figure S10d,e): ratio of length/width 1.0/0.87; cleft 0.70–0.73 telson length; margins weakly rounded or rounded and narrowing apically; with variable setal pattern, including 3 apical spiniform setae, 2–3 lateral spiniform setae, accompanying by 2 plumose setae on each side and 1–2 small medial setae dorsally; apical spiniform setae 0.32–0.40 of length of telson.

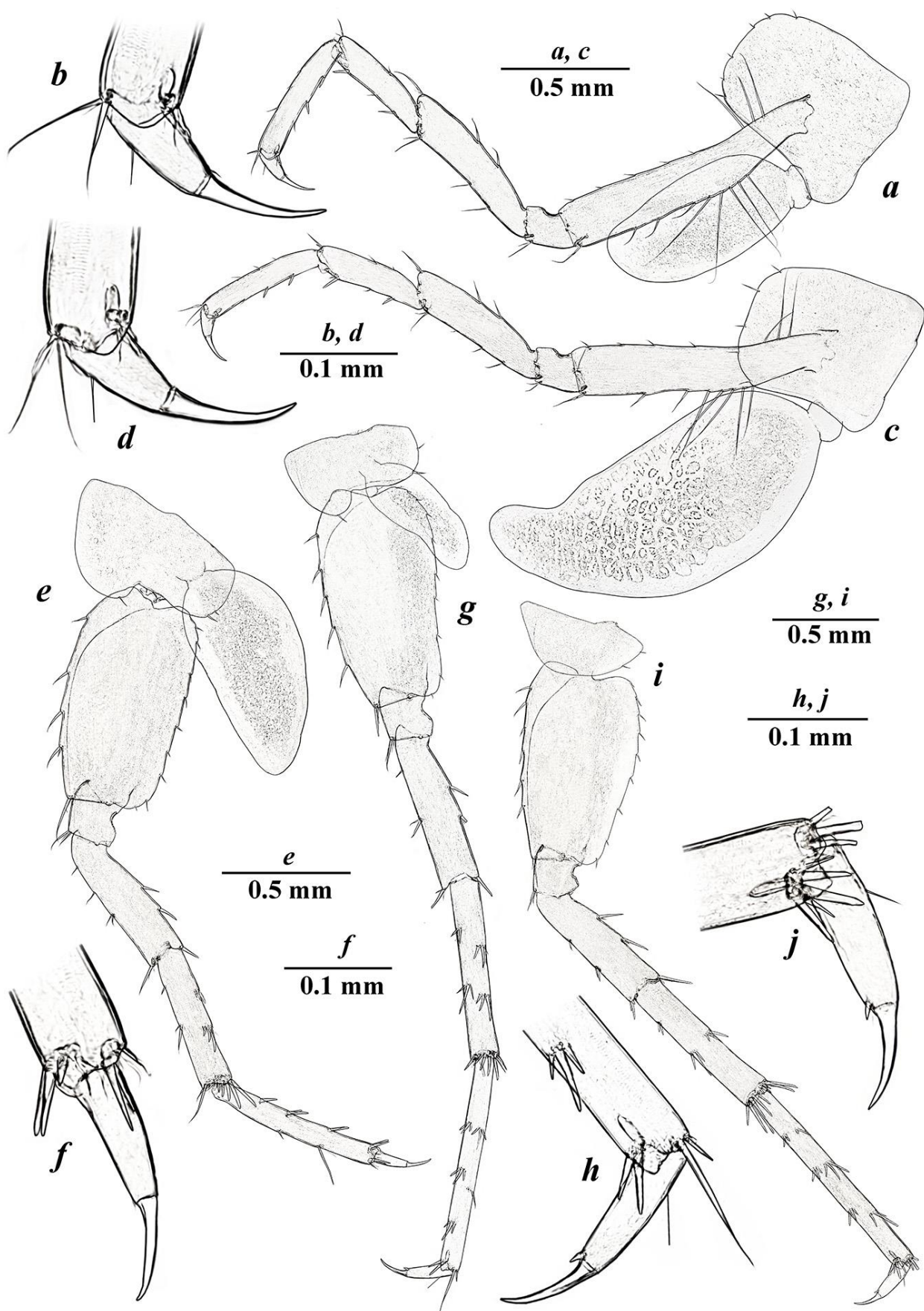


**Figure S7.** *Niphargus osseticus* **sp. nov.**, ♂: – antenna I (AI); b – accessory flagellum of AI; c –antenna II; d – gnathopod I (GI); e – distoventral corner of palmar margin of chela of GI; f – gnathopod II (GII); g –distoventral corner of palmar margin of chela of GII; h – same, distoventral setae.



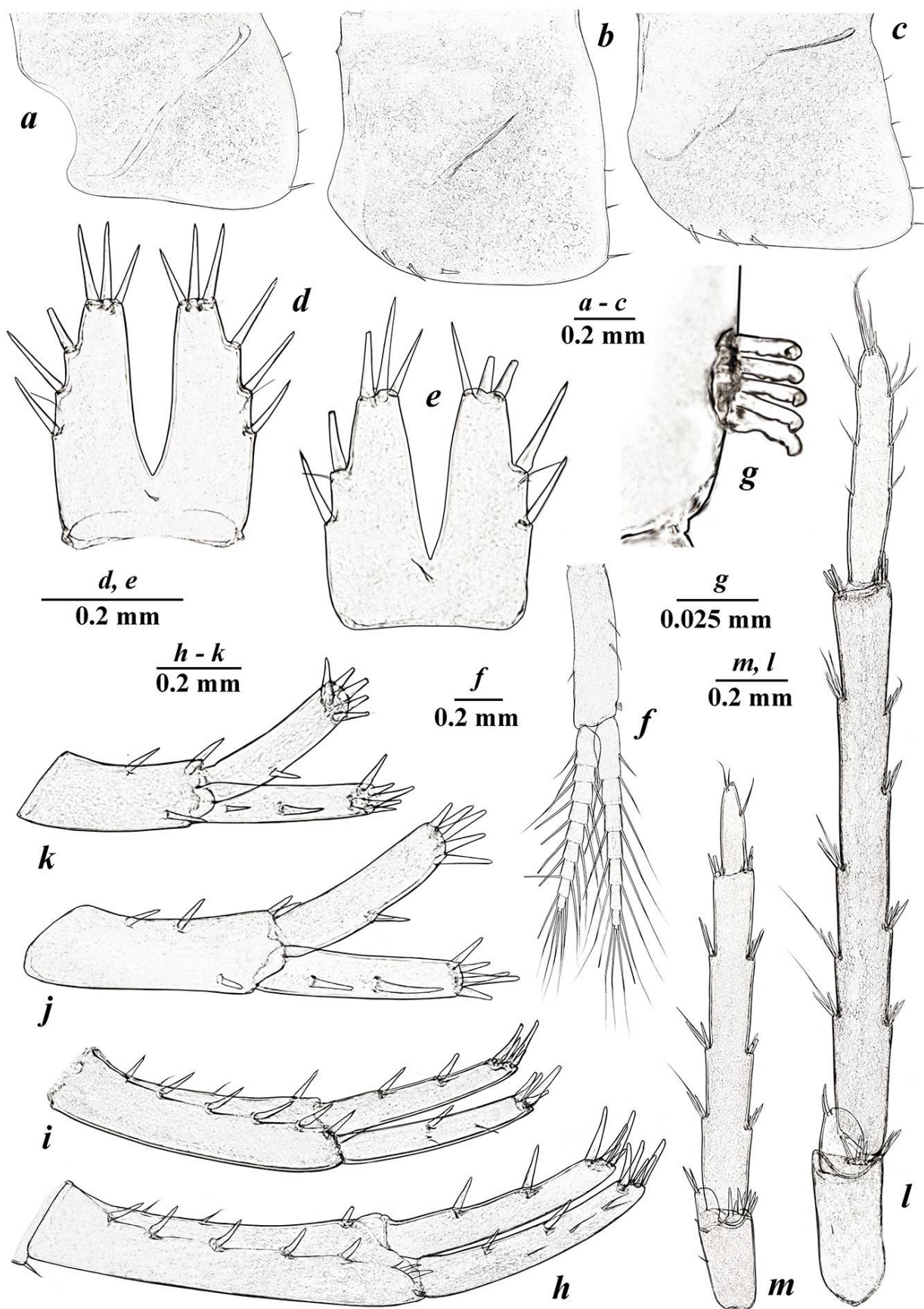


**Figure S8.** *Niphargus osseticus* sp. nov., ♂: a – labium; b – labrum; c, e – mandibles; d, f – incisor process and pars incisiva; g – maxilla I; h – same, distal margin of outer plate; i – maxilla II; j – maxilliped.

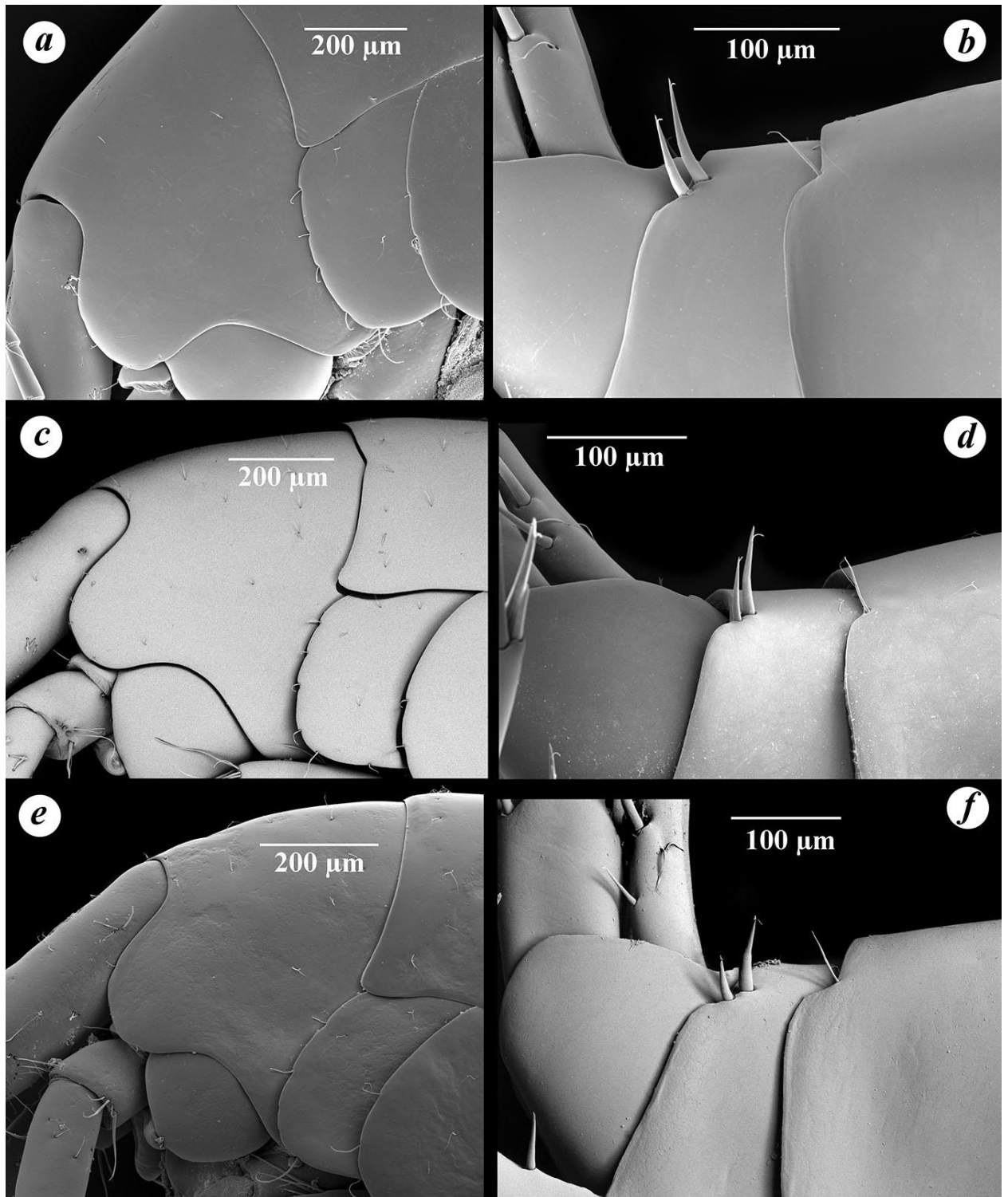


**Figure S9.** *Niphargus osseticus* sp. nov., ♂: a – pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – dactylus of PVI; i – pereopod VII (PVII); j – dactylus of PVII.





**Figure S10.** *Niphargus osseticus* sp. nov., ♂ (a-d, f-h, j, l) and ♀ (e, i, k, m): a-c – epimeral plates I-III; d, e – telson; f – pleopod III; g – retinacula of pleopod I; h, i – uropod I; j, k – uropod II; m, l – uropod III.



**Figure S11.** SEM photos of head (a, c, e) and urosomal somites (b, d, f): a, b – *Niphargus ardonicus* sp. nov.; c, d – *Niphargus faigdonicus* sp. nov.; e, f – *Niphargus osseticus* sp. nov.



*Niphargus sadonicus* sp. nov.

(Figures S12–15; S22a,b)

**Description.** BODY: Body length up to 10 mm, depigmented, moderately slender.

HEAD (Figures S22a): length approximately 7–9% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae on each postero-dorsal margin.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S15a–c). Epimeral plate I: posterior and ventral margins convex; with 1 small seta at ventral margin and with 2–3 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior and ventral margins straight or slightly convex; with 3 spines along ventral margin; 3 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III: posterior and ventral margins straight or slightly convex; with 3 spines along ventral margin; with 3–4 setae along posterior margin.

UROSOMITES (Figure S22b): Urosomite I with 1 long simple seta on each side dorsolaterally; urosomite II with 1 strong spine on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S12d,f; S14a,c,e,g,i): Coxal plate I of irregularly oval shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 0.9/1.0, 0.9–1.0/1.0, 0.96/1.0 and 1.0/1.0, respectively; anterior and ventral margins with 7, 8, 6 and 7 setae, respectively. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with 3 and 1 setae respectively; posterior margins with 2 and 3 setae respectively. Coxal plate VII half-rounded shaped with 3 posterior setae. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 0.42/1.0, 0.75/1.0, 0.64/1.0, 0.66/1.0 and 0.58/1.0, respectively.

ANTENNA I (Figure S12a): slender, 0.48–0.53 of body length; peduncular articles moderately slender, ratio 1.0/0.83/0.48; flagellum consists of 18 articles, most of them with 2 short aesthetascs each; accessory flagellum short, 2-articulated (Figure 14b). Length ratio of antennae I/II 1.0/0.68.

ANTENNA II (Figure S12c): peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 10 articles with relatively short setae; lengths of peduncle articles IV/V 1.0/1.0–1.04; flagellum 0.90 times of length of peduncular articles IV+V.

LABRUM (Figure S13a): typical.

LABIUM (Figure S13b): with entire, subrounded outer lobes and well developed smaller inner lobes.

MANDIBLES (Figure S13c–f): Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth; with row of 10 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar (Figure S15c, d). Right mandible: incisor process with 4 teeth, lacinia mobilis bifurcate, with row of 7 serrated setae between lacinia and molar (Figure S15e, f); ratio of mandibular palp articles II/III (distal) 1.0/0.9–1.0; proximal article of palp

without setae; article II with 7–8 setae; distal article with group of 4–5 A-setae, 1–2 B-setae, 12–14 D-setae and 4–5 E-setae.

MAXILLA I (Figure S13g): inner lobe with single long distal seta, outer lobe with 7 robust spines, carrying 2–4 teeth each (2–2–2–2–2–4) (Figure S15h)); palp 2-articulated, distal article with 6 simple setae distally.

MAXILLA II (Figure S13i): both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED (Figure S13j): inner plate short, with 2 distal robust setae intermixed with 4 distal simple setae, subdistally with 1 simple lateral seta; outer plate reaching half of palpal article II, with row of 15 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV with single seta at outer margin; nail shorter than pedestal, with 1 seta near basis.

GNATHOPOD I (Figure S12d,e): basis width/length 0.32/1.0; ischium with group of 4 posterodistal setae; carpus 0.55 of basis length and 0.72 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure S14d), setose, with 6 rows of setae at posterior margin; anterior margin with 3 groups of setae of 2–6 setae each in addition to anterodistal group of 8 setae; with several short setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform seta and single supporting spiniform seta on inner surface; nail length 0.51–0.55 of total dactylus length, with single seta on anterior margin and 4 short setae along inner margin.

GNATHOPOD II (Figure S12f,g): basis width/length 0.23/1.0; ischium with 3 posterodistal setae; carpus 0.46 of basis length and 0.58 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure S12f), setose, larger than propodus of GI (I/II as 0.67/1.0), posterior margin with 9 rows of setae, anterior margin with single group of 3 setae in addition to 5–6 anterodistal setae, with 2–3 small setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 1–2 serrated spiniform seta and single supporting spiniform seta on inner surface (Figure S14g); dactylus with single seta on anterior margin and 4 short setae along inner margin, nail length about 0.48 of total length of dactylus.

PEREOPODS III–IV (Figure S14a–d): almost similar in size and shape; basis 5.4–5.5 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.1–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.80–0.86/1.0; propodus with group of spines along ventral margin; dactylus (Figure 14b, d) relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 1.0/1.0, nail length 0.52–0.56 of total length of dactylus.

PEREOPODS V–VII (Figure S14e,g,i): length ratio of PpV/VI/VII 1.0/1.42/1.42; length of PVII about half of total body length.

PEREOPOD V (Figure S14e,f): basis about 1.9–2.0 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin slightly convex in middle, with row of 8 slender marginal setae, without facial setae, anterior margin convex, with row of 6 slender marginal setae, which

distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1.0; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 8.9 times as long as wide, with several bunches of short spines; dactylus (Figure S14f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S14g,h): basis about 1.9–2.0 times as long as wide, with little posteroventral lobe and barely concave posterior margin bearing row of 10 short marginal setae; anterior margin slightly convex, with row of 5 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 11–12 times as long as wide, with several group of short spines; dactylus (Figure 14h) with single small ventral seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S14i,j): basis about 1.7–1.8 times as long as wide, with little posteroventral lobe and convex posterior margin bearing row of 8 short marginal setae; anterior margin convex, with row of 5 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 10 times as long as wide, with several groups of short spines; dactylus (Figure S14j) with small ventral seta at base of nail and single short plumose seta at outer margin.

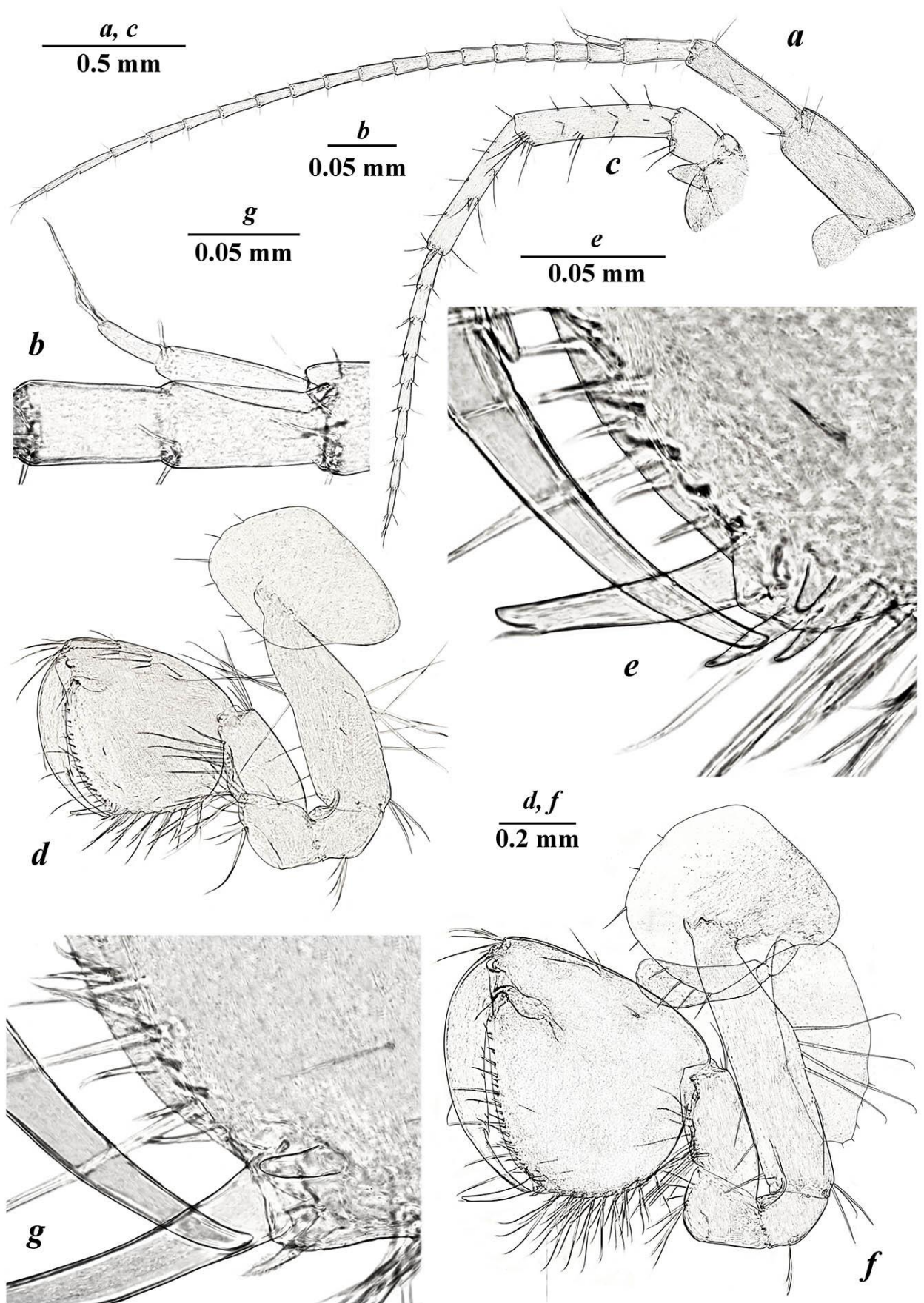
PLEOPODS: pleopods I with basal segments armed 3 long setae and with 3–4 hooks in retinacules; pleopods II with basal segments smooth, with 5 hooks in retinacules; basal segment of pleopod III armed single long seta, with 3 hooks in retinacules (Figure S15e,f).

UROPOD I (Figure S17g): protopodite with 6 dorso-external and 4 dorso-internal spines and setae; rami straight, exopodite shorter than endopodite; endopodite lengths 0.82 of protopodite, straight; ratio of exopodite/endopodite lengths 0.9/1.0; exopodite not paddle-like, straight, with 4 spiniform setae laterally and 4 spines apically; endopodite with 2 spiniform setae and 3 groups of long setae laterally and 4 spines apically.

UROPOD II (Figure S15h): protopodite 2.8–3.0 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/0.76.

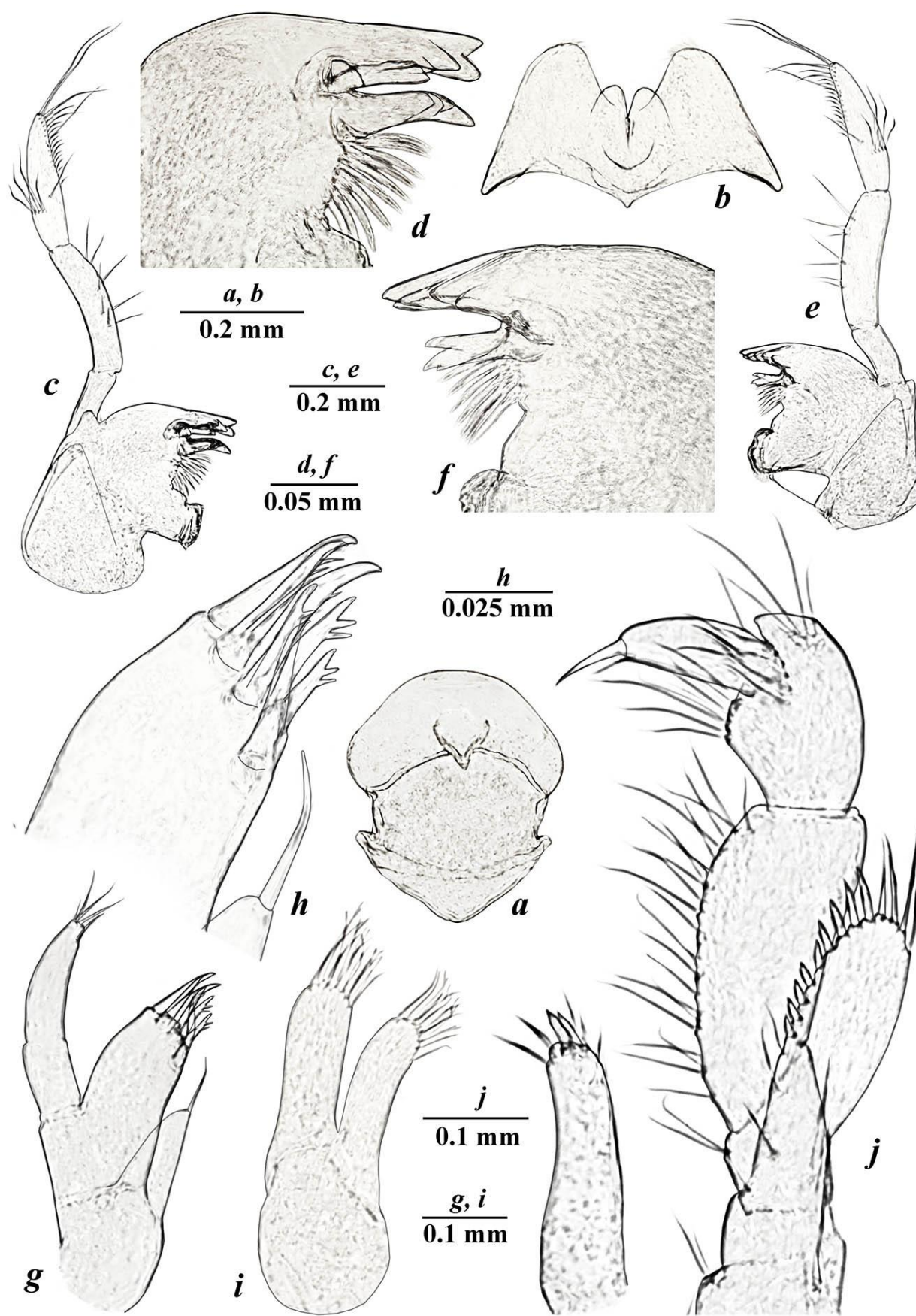
UROPOD III (Figure S15i): 0.18–0.20 of body length in ♀; protopodite 1.9 times as long as wide, with 1 lateral seta and 7–9 apical spines; rami unequal, endopodite short, about 8.1 times shorter than exopodite, with single spiniform seta laterally and 3 spiniform setae apically; distal article of exopodite 0.21 of length of proximal article, with 4 long simple setae apically; proximal article with 4 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

TELSON (Figure S15d): ratio of length/width 1.0/0.85; cleft 0.77 of telson length; margins straight and narrowing apically; with variable setal pattern, including 3 long apical spiniform setae, single lateral spiniform seta, accompanying by 2 plumose setae on each side, and 1–2 small medial setae dorsally; apical spiniform setae 0.57–0.58 of telson.

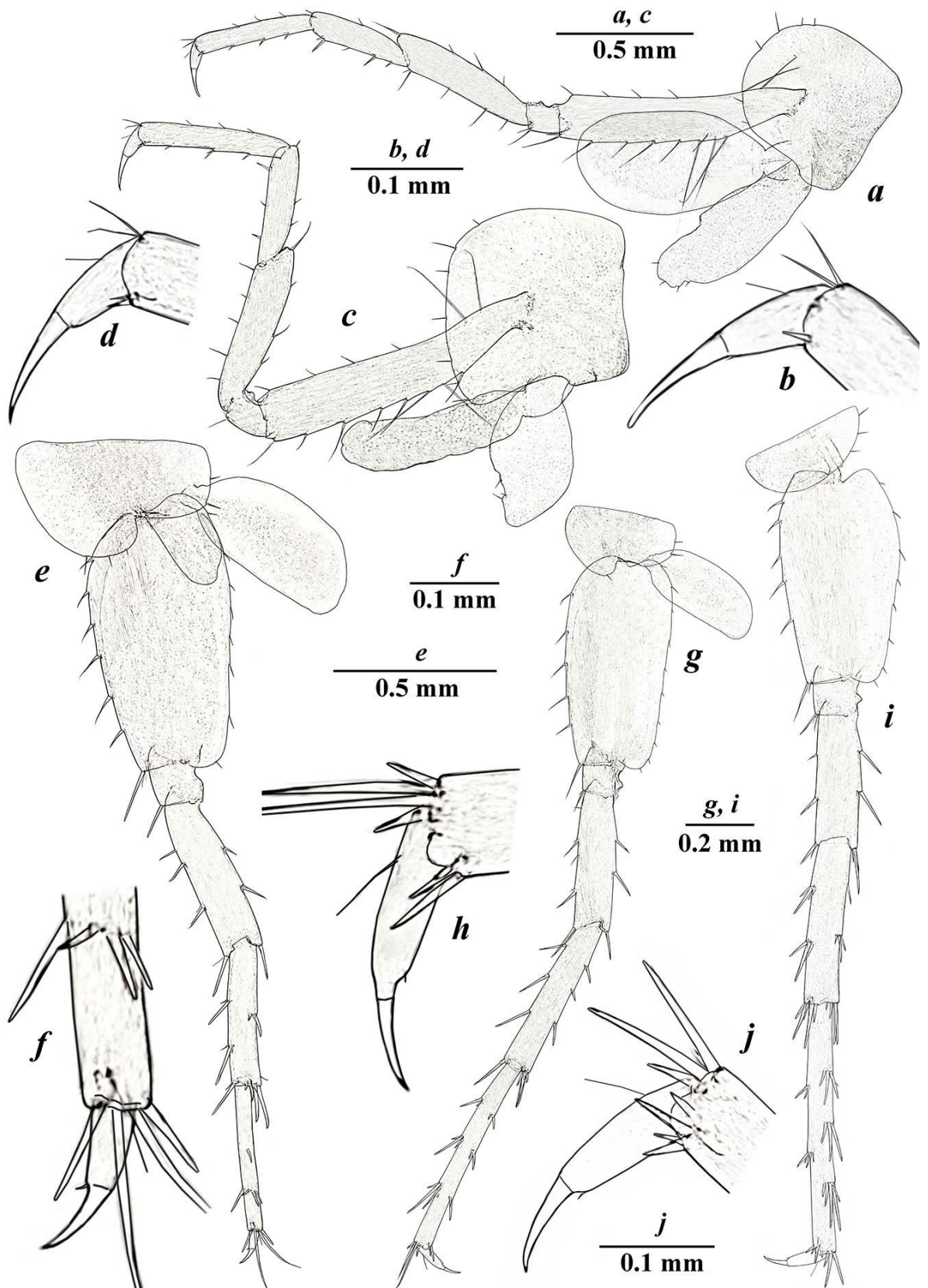


**Figure S12.** *Niphargus sadonicus* sp. nov., ♀: a – antenna I (AI); b – accessory flagellum of AI; c – antenna II; d – gnathopod I (GI); e – distoventral corner of palmar margin of chela of GI; f – gnathopod II (GII); g – distoventral corner of palmar margin of chela of GII; h – same, distoventral setae.



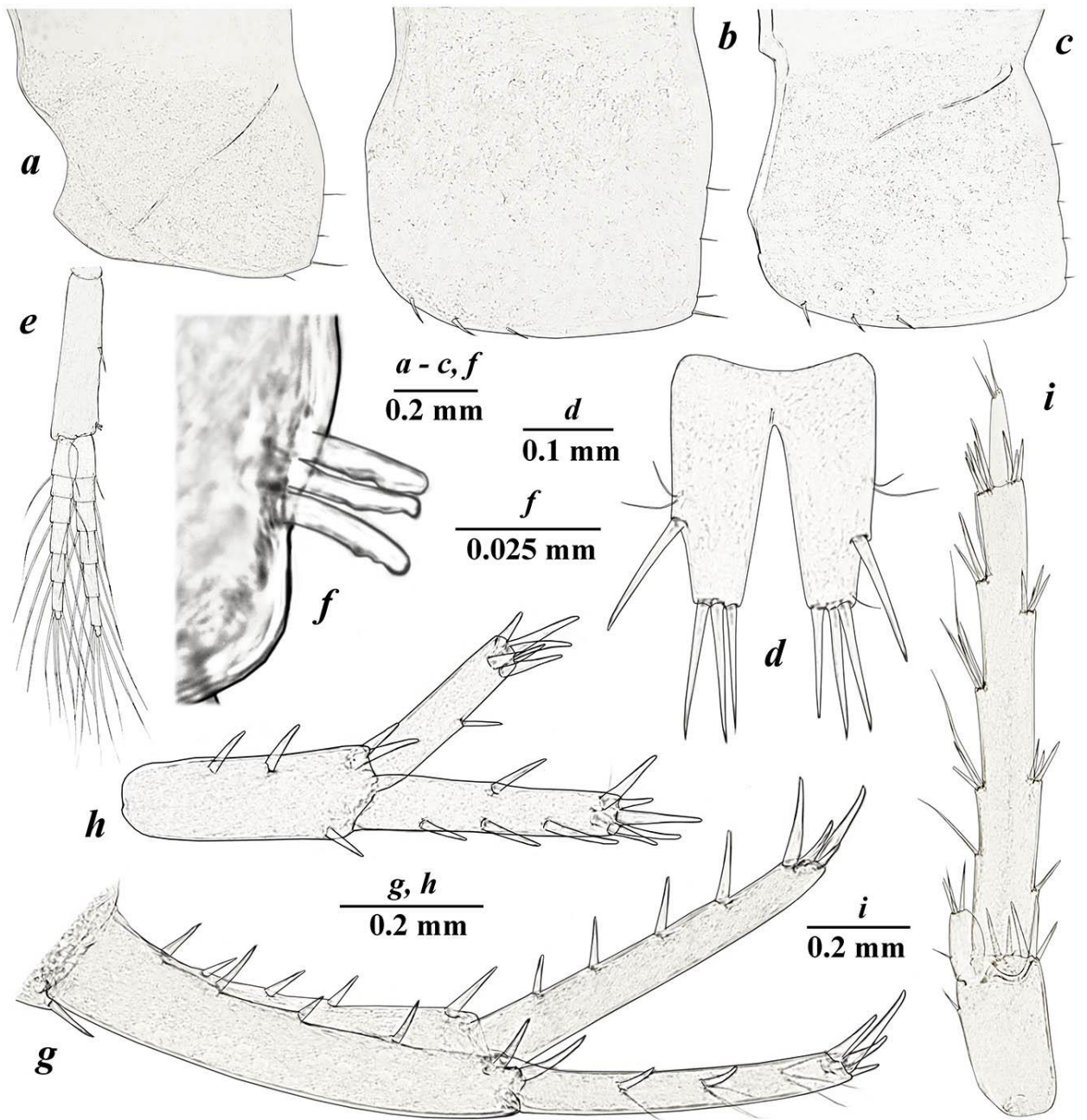


**Figure S13.** *Niphargus sadonicus* sp. nov., ♀: a – labium; b – labrum; c, e – mandibles; d, f – incisor process and pars incisiva; g – maxilla I; h – same, distal margin of outer plate; i – maxilla II; j – maxilliped.



**Figure S14.** *Niphargus sadonicus* sp. nov., ♀: a – pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – dactylus of PVI; i – pereopod VII (PVII); j – dactylus of PVII.





**Figure S15.** *Niphargus sadonicus* sp. nov., ♀: a-c – epimeral plates I–III; d – telson; e – pleopod III; f – retinacula of pleopod III; g – uropod I; h – uropod II; i – uropod III.

*Niphargus tschertschesovae* sp. nov.

(Figures S16; S17; S22c,d)

**Description.** BODY: Body length up to 9.5 mm, depigmented, moderately slender.

HEAD (Figures S22c): length approximately 7–9% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae on each postero-dorsal margin.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S16a). Epimeral plate I: posterior and ventral margins convex; without setae at ventral margin and with 1–2 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior and ventral margins straight or slightly convex; with 3 spines along ventral margin; 2 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III (Figure 16a): posterior margin clearly oblique, ventral margins straight or slightly convex; with 5 spines along ventral margin; with 3–4 setae along posterior margin.

UROSOMITES (Figure S22d): Urosomite I with 1 long simple seta on each side dorsolaterally; urosomite II with 1 strong spine on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S16f,g; S17a,c,e,g,i): Coxal plate I of irregularly oval shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 1.1/1.0, 0.90–1.0/1.0, 0.96–1.0/1.0 and 1.1/1.0, respectively; anterior and ventral margins with 3, 5, 5 and 5 setae, respectively. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with 2 and 1 setae respectively; posterior margins with 1 and 2 setae respectively. Coxal plate VII half-rounded shaped with 1 posterior seta. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 0.63/1.0, 0.88/1.0, 0.77/1.0, 0.94/1.0 and 0.73/1.0, respectively.

ANTENNA I: slender, 0.45–0.50 of body length; peduncular articles moderately slender, ratio 1.0/0.79/0.51; flagellum consists of 16 articles, most of them with 2 short aesthetascs each; accessory flagellum short, 2-articulated. Length ratio of antennae I/II 1.0/0.68.

ANTENNA II: peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 9 articles with relatively short setae; lengths of peduncle articles IV/V 1.0/1.1; flagellum 0.75 times of length of peduncular articles IV+V.

LABRUM: typical.

LABIUM: with entire, subrounded outer lobes and well developed smaller inner lobes.

MANDIBLES. Left mandible: incisor with 5 teeth, lacinia mobilis with 4 teeth; with row of 7 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar. Right mandible: incisor process with 4 teeth, lacinia mobilis bifurcate, with row of 6 serrated setae between lacinia and molar; ratio of mandibular palp articles II/III (distal) 1.0/0.9–1.0;



proximal article of palp without setae; article II with 6–8 setae; distal article with group of 4–5 A-setae, 1–2 B-setae, 12–14 D-setae and 4–5 E-setae.

MAXILLA I (Figure S16b,c): inner lobe with single long distal seta, outer lobe with 7 robust spines, carrying 2–4 teeth each (2–2–2–3–10) (Figure 18c)); palp 2-articulated, distal article with 5 simple setae distally.

MAXILLA II: both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED: inner plate short, with 3 distal robust setae intermixed with 4 distal simple setae, subdistally with 1 simple lateral seta; outer plate reaching half of palpal article II, with row of 14 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV with single seta at outer margin; nail shorter than pedestal, with 1 seta near basis.

GNATHOPOD I (Figure S16f): basis width/length 0.30/1.0; ischium with group of 4 posterodistal setae; carpus 0.60 of basis length and 0.90 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, with 5 rows of setae at posterior margin; anterior margin with 2 groups of setae of 5–7 setae each in addition to anterodistal group of 6 setae; with several short setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 3 serrated spiniform seta and single supporting spiniform seta on inner surface; nail length 0.48–0.50 of total dactylus length, with single seta on anterior margin and 4 short setae along inner margin.

GNATHOPOD II (Figure S16g): basis width/length 0.21/1.0; ischium with 3 posterodistal setae; carpus 0.53 of basis length and 0.73 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal, setose, larger than propodus of GI (I/II as 0.70/1.0), posterior margin with 5 rows of setae, anterior margin with 2 groups of 2 setae in addition to 5–6 anterodistal setae, with 2–3 small setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform seta and single supporting spiniform seta on inner surface; dactylus with single seta on anterior margin and 4 short setae along inner margin, nail length about 0.42 of total length of dactylus.

PEREOPODS III–IV (Figure S16a–d): almost similar in size and shape; basis 5.1–5.3 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.2–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.79–0.84/1.0; propodus with group of spines along ventral margin; dactylus relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 1.0/1.0, nail length 0.55–0.59 of total length of dactylus.

PEREOPODS V–VII (Figure S16e,g,i): length ratio of PpV/VI/VII 1.0/1.17/1.47; length of PVII about half of total body length.

PEREOPOD V (Figure S16e,f): basis about 1.7 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin slightly convex in middle, with row of 9 slender marginal setae, without facial setae, anterior margin convex, with row of 5 slender marginal setae, which

distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1.0; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 8.3 times as long as wide, with several bunches of short spines; dactylus (Figure S16f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S16g,h): basis about 1.8 times as long as wide, with little posteroventral lobe; posterior margin slightly convex in middle, with row of 8 short marginal setae; anterior margin slightly convex, with row of 5 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 9.5 times as long as wide, with several group of short spines; dactylus (Figure S16h) with single small ventral seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S16i,j): basis about 1.7 times as long as wide, with little posteroventral lobe and convex posterior margin bearing row of 8 short marginal setae; anterior margin convex, with row of 6 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 8.3 times as long as wide, with several groups of short spines; dactylus (Figure S16j) with small ventral seta at base of nail and single short plumose seta at outer margin.

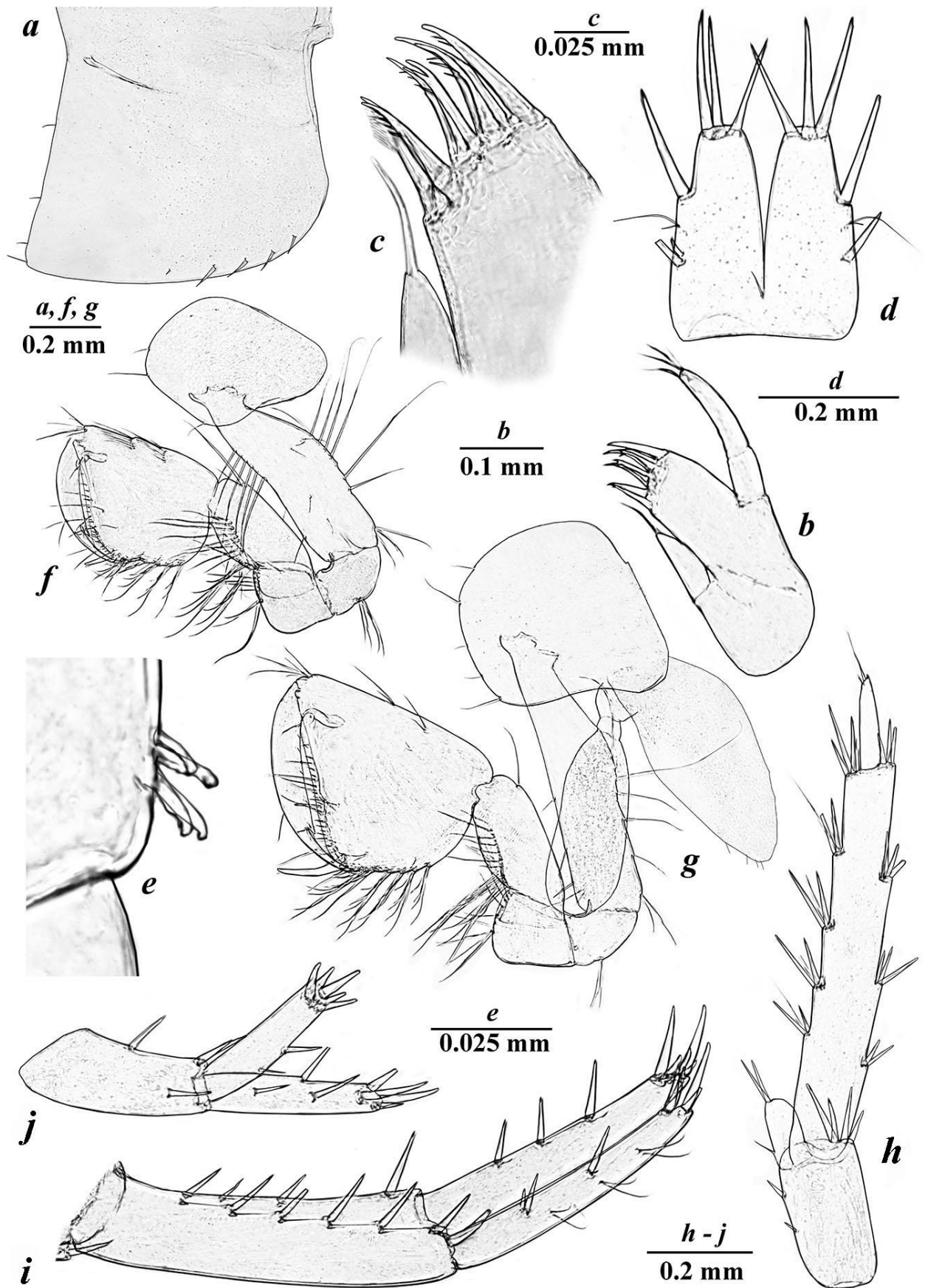
PLEOPODS: pleopods I with basal segments 3–4 long setae and with 3 hooks in retinacules; pleopods II with basal segments smooth, with 4 hooks in retinacules; pleopod III with basal segment armed 2 long setae, with 4 hooks in retinacules (Figure S16e).

UROPOD I (Figure S16h): protopodite with 7 dorso-external and 3 dorso-internal spines and setae; rami straight, exopodite shorter than endopodite; endopodite lengths 0.84 of protopodite, straight; ratio of exopodite/endopodite lengths 0.92/1; exopodite not paddle-like, straight, with 3 spiniform setae laterally and 4 spines apically; endopodite with 2–3 spiniform setae and 3 groups of long setae laterally and 4 spines apically.

UROPOD II (Figure S16i): protopodite 2.6–2.7 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/0.82.

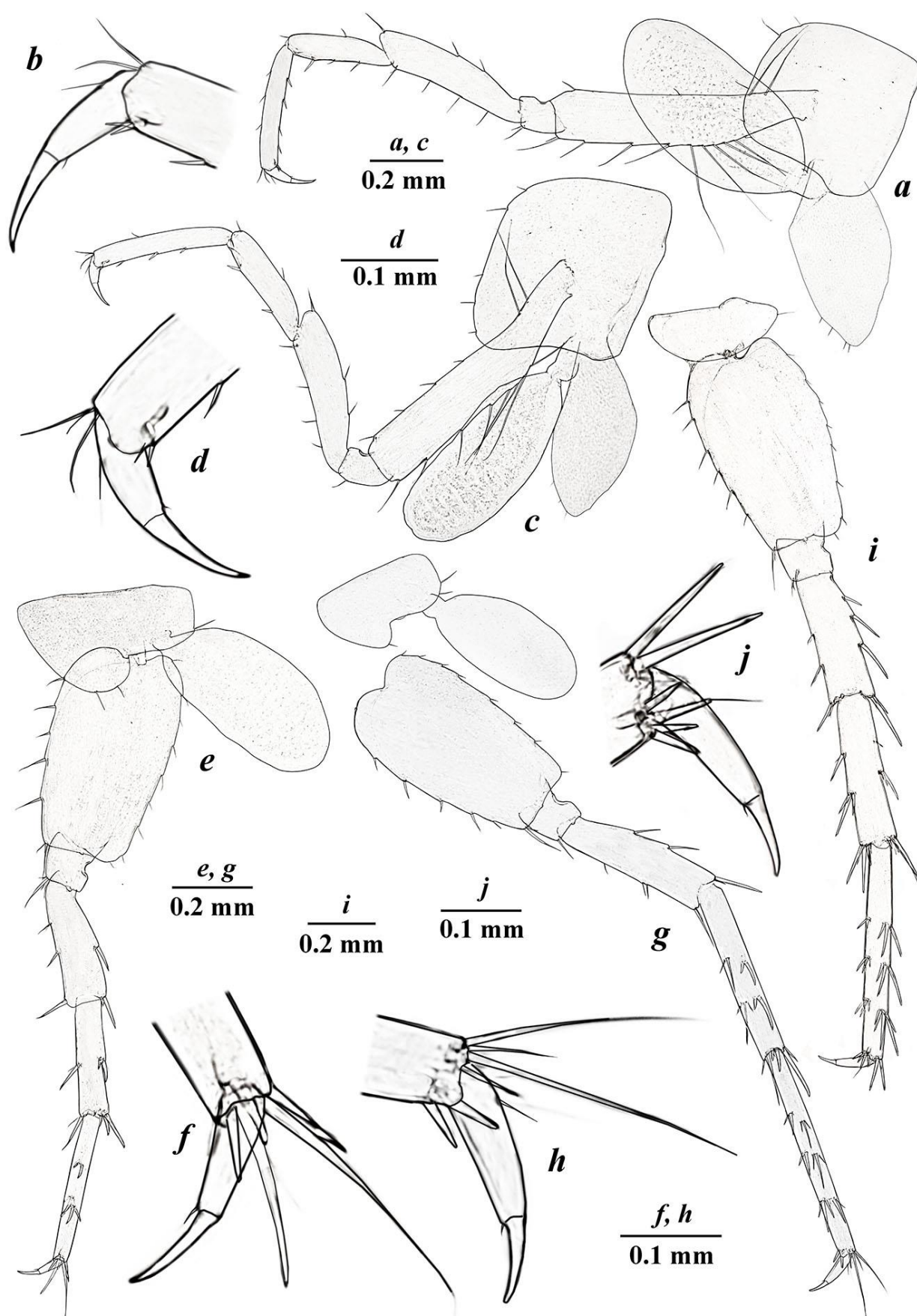
UROPOD III (Figure S16g): 0.18–0.20 of body length in ♀; protopodite 1.9 times as long as wide, with 2 lateral spiniform setae and 7–9 apical spines; rami unequal, endopodite short, about 6.8 times shorter than exopodite, with single spiniform seta laterally and 2 spiniform setae apically; distal article of exopodite 0.23 of length of proximal article, with 3 long and short simple setae apically; proximal article with 4 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

TELSON (Figure S16d): ratio of length/width 1.0/0.89; cleft 0.73 of telson length; margins straight and narrowing apically; with variable setal pattern, including 3 long apical spiniform setae, 1–3 single lateral spiniform seta, accompanying by 2 plumose setae on each side, and 1 small medial seta dorsally; apical spiniform setae 0.57–0.58 of telson.



**Figure S16.** *Niphargus tschertschesovae* sp. nov., ♀: a – epimeral plate III; b – maxilla I; c – same, distal setae; d – telson; e – retinacula of pleopod III; f – gnathopod I; g – gnathopod II; h – uropod I; i – uropod II; j – uropod III.





**Figure S17.** *Niphargus tschertschesovae* sp. nov., ♀: a – pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – dactylus of PVI; i – pereopod VII (PVII); j – dactylus of PVII.

*Niphargus zeyensis* sp. nov.

(Figures S18–21; S22e,f)

**Description.** BODY: Body length up to 12.5 mm, depigmented, moderately slender.

HEAD (Figure S22e): length approximately 7–9% of body length; rostrum and pigmented spots on anterior lobe absent, with subrounded lateral cephalic lobes and excavated anteroventral sinus.

PEREON: pereonites I–VII without setae, smooth.

PLEOSOMA: pleonites I–III with several short marginal setae.

EPIMERAL PLATES. Epimeral plates I–III with rounded posteroventral angles (Figure S21a–c). Epimeral plate I: posterior and ventral margins convex; without spines but with single seta at ventral margin; with 5 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate II: posterior and ventral margins convex; with 3 spines along ventral margin, 2 of which closely spaced (2+1); 6 setae along posterior margin; posteroventral angle subrounded, with 1 strong seta. Epimeral plate III with convex posterior and ventral margins; ventral margin with 2 closely spaced spines; with 5 setae on posterior margin; posteroventral angle subrounded, with 1 seta.

UROSOMITES (Figure S22f): Urosomite I with 1 simple seta on each side dorsolaterally; urosomite II with 1 simple strong spine and 1 simple seta on each side dorsolaterally; urosomite III unarmed.

COXAE (Figures S18d,f; S20a,c,e,g,i): Coxal plate I of subrectangular shape, with rounded anteroventral corner. Width/depth ratios of coxal plates I–IV 0.72/1.0, 0.82/1.0, 0.93/1.0 and 0.85/1.0, respectively; anterior and ventral margins with 8, 8, 8 and 7 setae, respectively. Coxal plate IV ventrally concave. Coxal plates V–VI anteriorly with large lobe with 3 and 2 setae respectively; posterior margins with 3 setae each. Coxal plate VII half-rounded shaped with 4 posterior setae. Coxal gills II–VI ovoid, length ratios of gills/bases of PpIII–VII 0.65/1.0, 0.81/1.0, 1.1/1.0, 0.68/1.0 and 0.54/1.0, respectively.

ANTENNA I (Figure S18a): slender, 0.50–0.55 of body length; peduncular articles moderately slender, ratio 1.0/0.82/0.44; flagellum consists of 25 articles, most of them with 2 short aesthetascs each; accessory flagellum short, 2-articulated (Figure S20b). Length ratio of antennae I/II 1.0/0.48–0.50.

ANTENNA II (Figure S18c): peduncular articles moderately stout, with several long setae along ventral margin, dorsal setae shorter than inner ones; flagellum relatively short, consisting of 9–11 articles with relatively short setae; lengths of peduncle articles IV/V 1.0/0.86–0.88; flagellum 0.77 times of length of peduncular articles IV+V.

LABRUM (Figure S19a): typical.

LABIUM (Figure S19b): outer lobes entire, subrounded; inner lobes well developed.

MANDIBLES (Figure S19c–f): Left mandible: incisor with 4 teeth, lacinia mobilis with 3 teeth; with row of 6 serrated setae between lacinia and molar, few spatulate setae and single long seta at base of molar (Figure S21d). Right mandible: incisor process with 4 teeth, lacinia mobilis quadfurcate, with row of 6 serrated setae between lacinia and molar (Figure S21f); ratio of mandibular palp articles II/III (distal) 1.0/0.93–0.95; proximal article of palp

without setae; article II with 11–14 setae; distal article with group of 5–6 A-setae, 2–3 B-setae, 14–16 D-setae and 4–5 E-setae.

MAXILLA I (Figure S19g): inner lobe with 2 distal setae, outer lobe with 7 robust spines, carrying 1–4 thin teeth each (1–1–1–1–4) (Figure S21h); palp 2-articulated, distal article with 5 simple setae distally.

MAXILLA II (Figure S19i): both plates with numerous long distal simple setae, outer lobe with row of fine setae along outer margin.

MAXILLIPED (Figure S19j): inner plate short, with 3 distal robust setae intermixed with 5 distal simple setae, subdistally with 1 simple lateral setae; outer plate reaching half of palpal article II, with row of 18–20 distolateral spines and distal setae; palpal article III with 1 median and 1 distal bunches of setae at outer margin; palpal article IV with single seta at outer margin; nail shorter than pedestal, with 2 thin setae near basis.

GNATHOPOD I (Figure S18d,e): basis width/length 0.38/1.0; ischium with group of 7–8 posterodistal setae; carpus 0.59 of basis length and 0.75 of propodus length, with single distal group of setae anteriorly, with transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure S20d), setose, with 8 rows of setae at posterior margin; anterior margin with 3 groups of 2–8 setae in addition to anterodistal group of 10 setae; with several groups of short setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform seta and single supporting spiniform seta on inner surface (Figure S18e); dactylus with 5 long setae on outer margin, 3 of which grouped together; 8 short setae along inner margin; nail length 0.45–0.48 of total dactylus length.

GNATHOPOD II (Figure S18f,g): basis width/length 0.28/1.0; ischium with 5 posterodistal setae; carpus 0.58 of basis length and 0.85 of propodus length, with distal group of setae anteriorly, few transverse rows of setae along posterior margin and row of setae posterolaterally; propodus trapezoidal (Figure 20f), setose, larger than propodus of GI (I/II as 0.88/1.0), posterior margin with 10 rows of setae, anterior margin with 2 groups of 4–7 setae in addition to 6–7 anterodistal setae, with several groups of setae on inner surface; palmar corner armed with 1 long spiniform palmar seta, 2 serrated spiniform setae and single supporting spiniform seta on inner surface (Figure 18g); dactylus with 6 long setae on outer margin, 3 of which grouped together; 8 short setae along inner margin; nail length 0.41–0.45 of total dactylus length.

PEREOPODS III–IV (Figure S18a–d): almost similar in size and shape; basis 4.2–4.3 times as long as wide, with posterior margin bearing long marginal setae, with distoventral group of setae; ischium short, length/width ratio 1.1–1.0/1.0, with ventrodistal group of setae; merus with slender simple setae along dorsal and ventral margins; ratio carpus/propodus 0.8–0.9/1; propodus with group of spines along ventral margin; dactylus (Figure S22b, d) relatively stout, curved, sharp distally, with 1 small ventral seta at base of nail and 1 small plumose seta at outer margin; ratio of dactyli of propodus of PpIII/IV 0.87/1.0, nail length 0.51–0.61 of total length of dactylus.

PEREOPODS V–VII (Figure S18e,g,i): length ratio of PpV/VI/VII 1.0/1.30/1.29; length of PVII about half of total body length.

PEREOPOD V (Figure S20e,f): basis about 1.76 times as long as wide, almost rectangular, with little posteroventral lobe, posterior margin straight, with row of 11 slender marginal setae, without facial setae, anterior margin



convex, with row of 4 slender marginal setae, which distinctly longer than posterior ones, and group of setae in distal part; ischium short, length/width ratio 0.9/1.0; merus with bunches of slender spines along dorsal and ventral margins; propodus slender, 9 times as long as wide, with several bunches of short spines; dactylus (Figure 20f) with 1 small ventral seta at base of nail and 1 short plumose seta at outer margin.

PEREOPOD VI (Figure S20g,h): basis about 2.1 times as long as wide, with little posteroventral lobe and straight posterior margin bearing row of 11 short marginal setae; anterior margin slightly convex, with row of 6 longer marginal setae; ischium short, length/width ratio 0.9/1.0; merus with several bunches of short spines along dorsal and ventral margins; carpus with group of spines intermixed with single short setae; propodus slender, about 10 times as long as wide, with several group of short spines; dactylus (Figure 22h) with single small ventral spiniform seta at base of nail and single short plumose seta at outer margin.

PEREOPOD VII (Figure S20i,j): basis about 1.8 times as long as wide, with little posteroventral lobe and slightly convex posterior margin bearing row of 9 short marginal setae; anterior margin convex, with row of 6 longer marginal setae; ischium short, length/width ratio 0.8/1.0; merus with several bunches of slender spines along dorsal and ventral margins; carpus with group of long slender spines along dorsal and ventral margins; propodus slender, about 11.3 times as long as wide, with several groups of short spines; dactylus (Figure 20j) with small ventral seta at base of nail and single short plumose seta at outer margin.

PLEOPODS (Figure S21f,g): pleopods I with basal segment armed single long seta, with 6 hooks in retinacules (Figure 21g); pleopods II with basal segment armed 2 single long setae, with 5 hooks in retinacules; pleopod III with basal segment smooth, without setae (Figure 21f), with 5 hooks in retinacule.

UROPOD I (Figure S21h,i): protopodite with 7 dorso-external and 3–4 dorso-internal spines and setae; rami straight and subequal in length; endopodite lengths 0.68 of protopodite, straight; ratio of exopodite/endopodite lengths 0.89/1.0; exopodite not paddle-like, straight, with 1–2 spiniform setae laterally and 5 spines apically; endopodite with 1–2 spiniform setae and 3 groups of long setae laterally and 5 spines apically.

UROPOD II (Figure S21j,k): protopodite 2.6–2.8 times as long as wide, rami subequal in length; rami with lateral and distal slender spines; ratio of exopodite/endopodite 1.0/1.03.

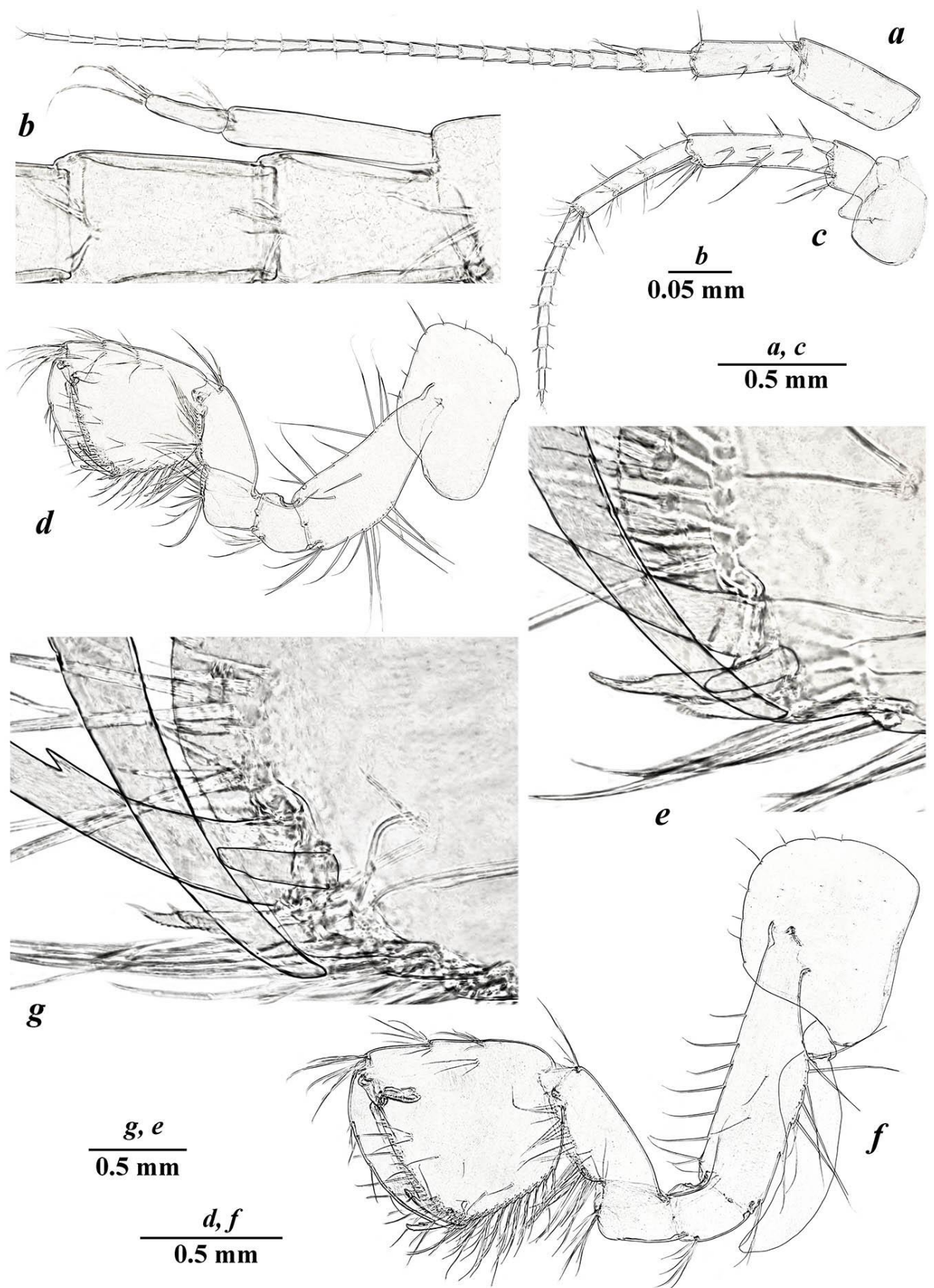
UROPOD III (Figure S21m,l): different in ♂♂ and ♀♀.

♀♀ (Figure S21m): 0.18–0.20 of body length; protopodite 2.1–2.3 times as long as wide, with 3–4 lateral setae and 6–8 apical spines; rami unequal, endopodite short, about 11 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.35 of length of proximal article, with 4–5 short simple setae apically and 1–2 groups of setae laterally; proximal article with 3 groups of thin-flexible, spiniform and plumose setae along inner margin and 2 groups of spiniform setae along outer margin.

♂♂ (Figure S21l): 0.52–0.54 of body length; protopodite 1.9–2.2 times as long as wide, with 3 lateral setae and 4–6 apical spines; rami unequal, endopodite short, about 18 times shorter than exopodite, without setae laterally and 2 setae apically; distal article 0.86 of length of proximal article,

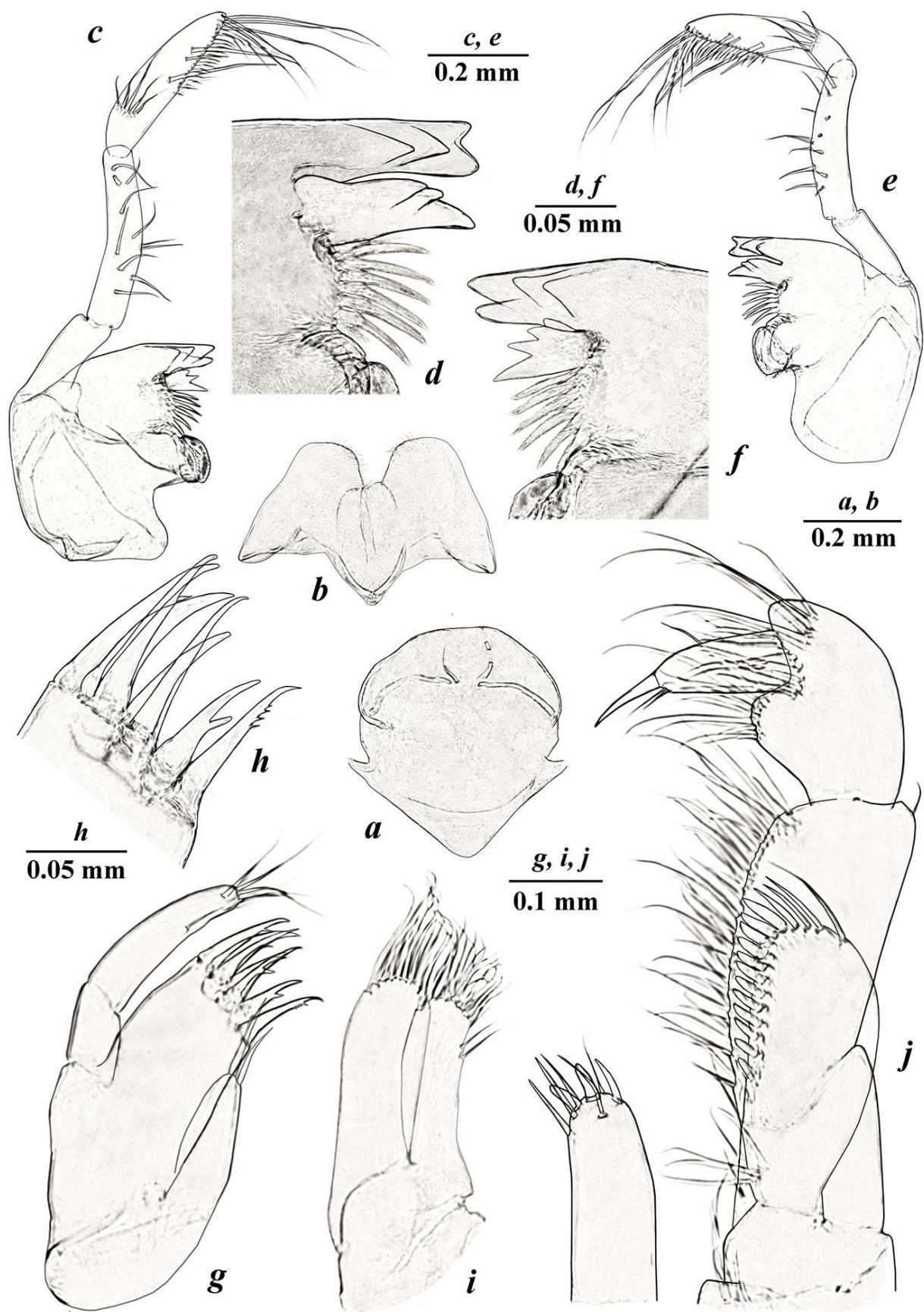
with 5 groups of lateral setae on each side and group of 8–10 long setae apically; proximal article with 3 groups of thin-flexible, spiniform and plumose setae along inner margin and 3 groups of spiniform setae along outer margin.

TELSON (Figure S21d,e): ratio of length/width 1.0/0.84; cleft 0.67–0.70 of telson length; margins weakly rounded or rounded and narrowing apically; with 4–5 relatively long distal spines, 2–3 long lateral spines accompanying by 2 thin plumose setae on each outer side, 0–1 short spine on inner margin of lobes and 0–1 short seta on dorsal surface of each lobe apical spiniform setae 0.46–0.50 of length of telson.

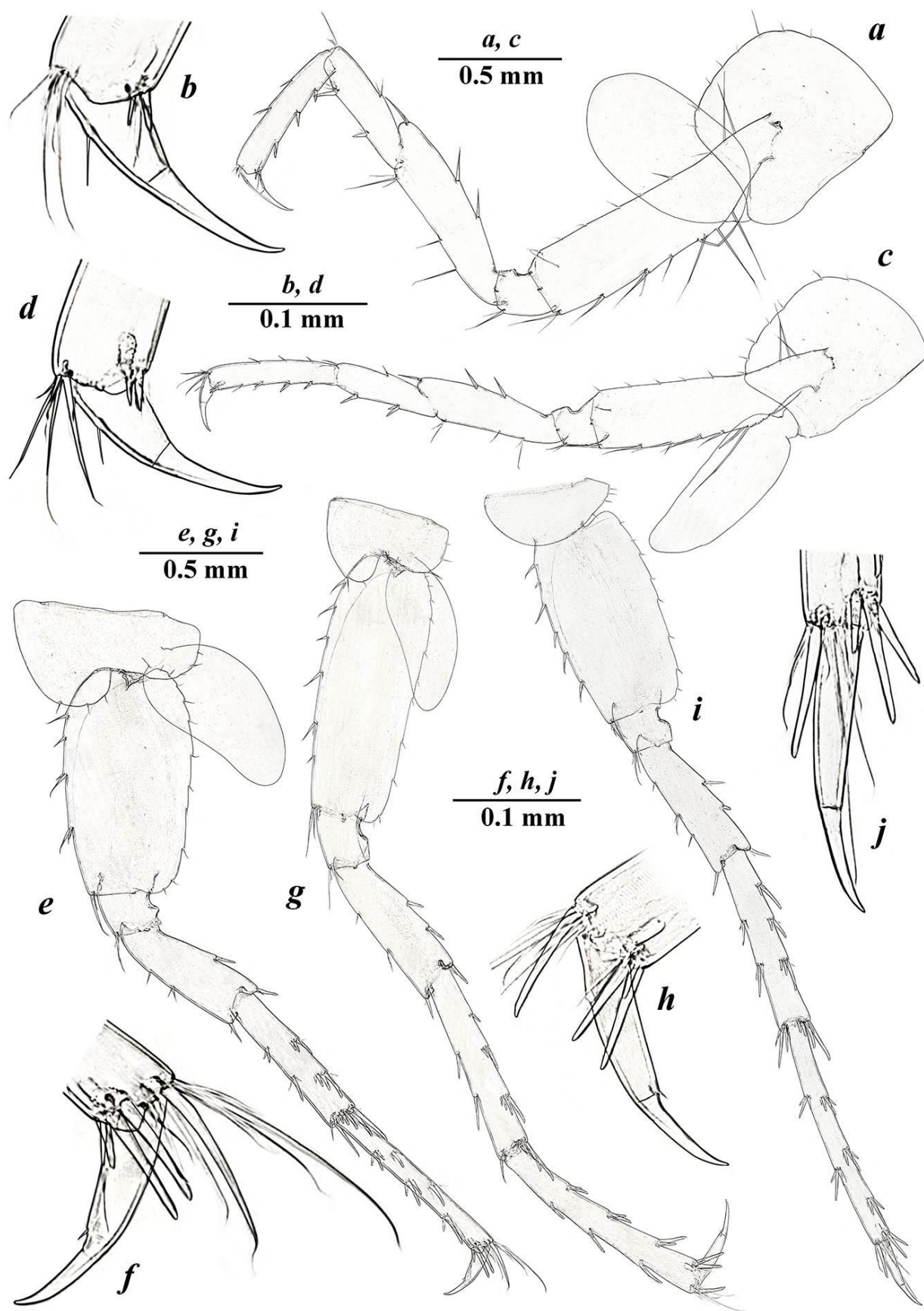


**Figure S18.** *Niphargus zeyensis* sp. nov., ♂: a – antenna I (AI); b – accessory flagellum of AI; c – antenna II; d – gnathopod I (GI); e – distoventral corner of palmar margin of chela of GI; f – gnathopod II (GII); g – distoventral corner of palmar margin of chela of GII.



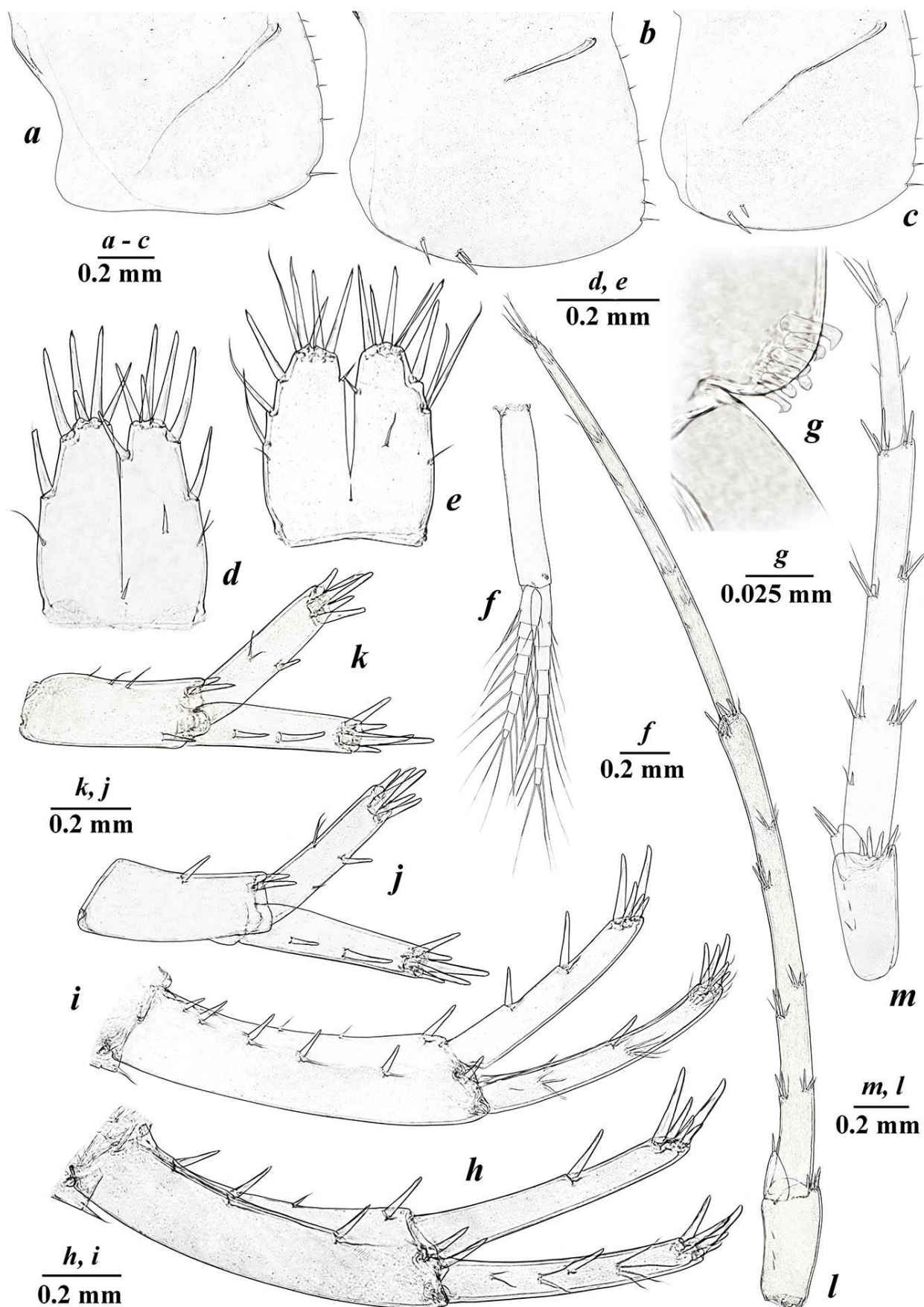


**Figure S19.** *Niphargus zeyensis* sp. nov., ♂: a – labium; b – labrum; c, e – mandibles; d, f – incisor process and pars incisiva; g – maxilla I; h – same, distal margin of outer plate; i – maxilla II; j – maxilliped.

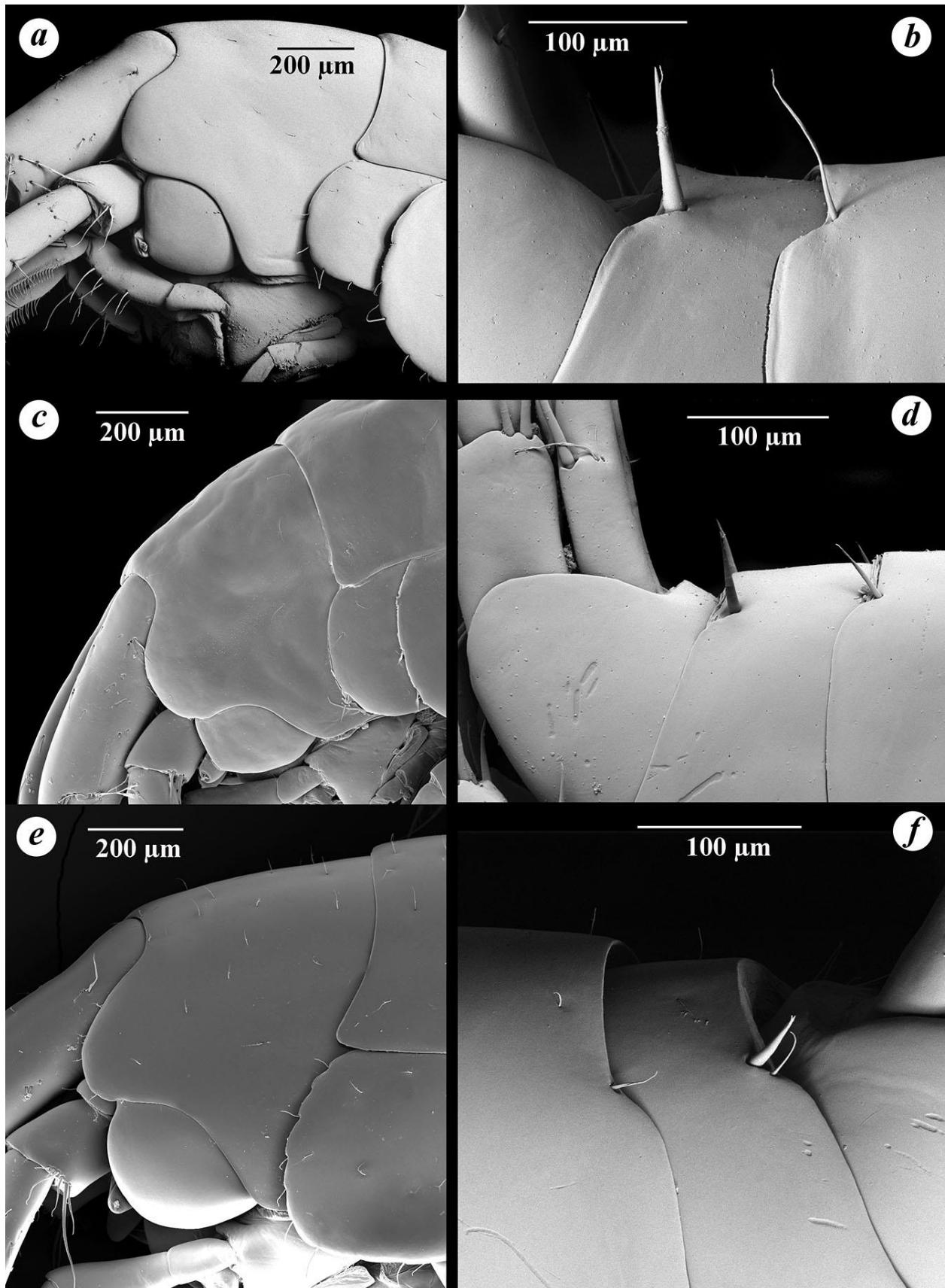


**Figure S20.** *Niphargus zeyensis* sp. nov., ♂: a– pereopod III (PIII); b – dactylus of PIII; c – pereopod IV (PIV); d – dactylus of PIV; e – pereopod V (PV); f – dactylus of PV; g – pereopod VI (PVI); h – dactylus of PVI; i – pereopod VII (PVII); j – dactylus of PVII.





**Figure S21.** *Niphargus zeyensis* sp. nov., ♂: a–c – epimeral plates I–III; d, e – telson; f – pleopod III; g – retinacula of pleopod I; h, i – uropod I; j, k – uropod II; l, m – uropod III.



**Figure S22.** SEM photos of head (a, c, e) and urosomal somites (b, d, f): a, b – *Niphargus sadonicus* sp. nov.; c, d – *Niphargus tschertschesovae* sp. nov.; e, f – *Niphargus zeyensis* sp. nov.