

Fig.3 *Gnorimosphaeroma rebunense* n. sp.

A. Dorsal view ; B. Antennule ; C. Antenna ; D. Right mandible ; E. maxillula ; F. Maxilla ; G. Maxilliped ; H. -N. Pereopods 1-7 ; O. Penes ; P-Q. Pleropods 2-3 ; S. Uoprod (All ; Holotype male).

4-headed and not chitinized 3-setae behind lacini a mobilis ; processus molaris wide. Palpal segment 2 with 8 setae ; palpal segment 3 with 13 setae. Maxillula. (Fig.3E) with endopod bearing 4 pectinated setae ; exopod bearing 10~11 teeth, all are simple type. Maxilla (Fig.3F) with endopod bearing 16 plumose setae ; exopod with 5 teeth and 16 teeth on inner lobe and outer lobe respectively, outermost 2 are especially long. Maxilliped (Fig.3G). Endite rectangular with a coupling hook and 6 stout setae and many hair on distal margin. Palp

stout ; segment 1 ; segment 2 big and triangular with 14~15 setae on inner margin and a seta at stouter distal corner ; segment 3 triangular and somewhat shorter than segment 2, with a shallow mouth and 17~20 setae on inner margin ; segment 4 rectangular, as long as segment 3 with 10 setae on inner margin and 3 setae on outer margin segment 5 with 12~13 setae around the margin..

Pereopod 1 (Fig.3H) relatively short. Basis rectangular, with a seta at inner distal corner with long seta at inner distal corner and 3 shorter setae on inner margin ; ischium a little shorter than basis with a little shorter than basis with short many hair and a long seta at the middle arc of inner margin ; merus short, half length of ischium, with 2-3 relatively long setae and many fine setae on inner margin and 4 long setae at outer distal corner;; carpus short and triangular with 2 stout setae on inner margin ; propodus as long as ischium with 2 stout setae on inner margin ; dactylus bifid with 2~3 setae .

Pereopod 2. (Fig.3I) Basis rectangular ; Ischium rectangular with 3~4 short setae and 3 setae on inner margin and a middle part of outer margin ; merus 3/4 of ischium with 2 setae on inner margin and 2 long setae at the outer distal area ; carpus as long as merus with 3 setae and seta at outer distal corner ; propodus as long as carpus with a swollen area on the basal half of inner margin bearing 3 setae and with 3 setae at outer distal corner. ; propodus with setae on inner margin ; dactylus bifid.

Pereopod 3. (Fig.3J) Basis long, 4 times as long as wide, with a long seta at the outer distal corner ; ischium 2/3 time as long as basis, with 3 setae on inner margin ; merus half length with a seta at inner distal corner and 2 setae at outer distal corner ; carpus as long as merus, with 7 setae on distal end ; propodus rectangular with 3 setae on inner margin and 2 setae on outer margin ; dactylus bifid.

Pereopod 4 (Fig.3K) Basis long, 5 times as long as wide ; ischium half length of basis, with 3 setae on inner margin ; merus a little shorter than ischium, densely pubescent along inner margin on inner margin and a 3 setae at outer distal corner ; carpus a little shorter than merus with fine hair on inner margin and 3 setae at outer distal corner ; propodus as long as ischium, with a seta on inner margin and 3 setae on outer margins ; dactylus bifid.

Pereopod 5 (Fig.3L). Basis rectangular, 4 times as long as wide with a seta at outer distal seta on inner margin ; ischium a little shorter than basis, with 2 setae on inner margin ; merus with 2 setae at outer distal corner ; carpus rectangular with 3 setae on inner margin and 2 setae on outer margin ; propodus rectangular with 3 setae on inner margin ; dactylus bifid.

Pereopod 6 (Fig.3M) Basis rather short, 4 times as long as wide with a relatively long setae at inner distal corner ; ischium a little shorter than basis, with relatively short setae on both margins ; merus rectangular with a long seta on each margin ; carpus a little shorter than merus, with 5 setae on inner margin ; propodus rectangular with a group of setae near outer distal area ; dactylus bifid.

Pereopod 7. (Fig.3N) Basis long, 4.5 times as long as wide without seta ; ischium 2/3 times as long as basis with many fine setae on inner margin ; merus a little shorter than ischium with short setae on inner margin and with a seta inner distal corner and a seta outer distal corner ; carpus as long as merus, with fine hair ; carpus as long as merus, bearing and a seta at inner distal corner and a outer distal corner ; propodus as long as carpus with 3 relatively ; long setae and many fine hair. ; dactylus bifid.

Penes (Fig.3O) Each penis 4 times as long as wide, slightly tapering towards the tip.

Pleopod 1. Basis with 4 coupling hooks ; endopod with 24~35 setae around the margin ; exopod with 41~44 setae around the margin

Pleopod 2. (Fig.3P) Basis low rectangular with 4 setae ; endopod with 16 plumose setae. Stylus stout and club-shaped times as long as wide.

Pleopod 3. basis with 15~16 setae exopod lanceolate with 16~20 setae around the margin.

Pleopod 4 (Fig.3Q). Basis with 2 coupling hooks.

Pleopod 5 (Fig.3R) : Basis round ; endopod with 20~23 short setae and 2 bosses;exopod 4/5 of endopod with 15-17 short setae around the margin.

Uropod (Fig.3S) relatively stout Basis endopod ; exopod 0.85 times as long as endopod.

*Remarks:* The present new species is allied to *G. ovatum* but differs from the latter in the following features (1) less numerous flagellum of antennule, (2) less numerous flagellum of antenna, (3) more numerous setae of mandible.

*Etymology:* The specific name is derived from the type locality

*Material examined:* 8 ♂♂ (1 ♂ holotype, 7.6 mm in body length and 7 ♂♂ paratypes 6.0~9.6 mm in body length) and 17 ♀♀ (paratypes 6.5~8.7 mm in body length), 10-40 cm Kushu-Lake. Rebun Island Hokkaido, coll. Noboru Nunomura July 10, 1995., Type series is deposited as follows: Holotype (TOYA Cr-12499) and 11 paratypes (TOYA Cr-12500~12510) at the Toyama Science Museum, 6 paratypes (OMNH Ar-3596~3961) at the Osaka Museum of Natural History; 6 paratypes (CBM ZC-4078) at the Natural History Museum and Institute, Chiba, and 6 paratypes (RTMCRU 15~20) at the Rishiri Town Museum.

***Gnorimosphaeroma hokurikuense* n. sp.**

(Jap. name: Hokuriku-kotsubumushi, new)

(Fig.4)

*Description:* Body 2.2 times as long as wide. Color blackish gray. Eyes mediocre in size, each eye with about 90 ommatidia. Hind margin of pleotelson rounded. Dorsal surface smooth with minute granules. Pleonite with 2 suture lines and anterior one slightly longer than the posterior one.

Antennule (Fig.4B) Flagellum composed of 8~10 segments. Antenna (Fig.4C), reaching the posterior half of pereopod segment 2, Flagellum composed of 11~13 segments.

Right mandible (Fig.4D) Pars incisiva 4-headed; lacinia mobilis thin and 4-headed but not chitinized; four setae behind lacinia mobilis; processus molaris stout; palpal segment 2 with 9 setae and a long seta; segment 3 with 15 setae on inner margin. Left mandible. Pars incisiva 4-headed; lacinia mobilis 3-headed; 3 setae behind lacinia mobilis; processus molaris wide; palpal segment 2 with 9 setae and a long seta; segment 3 with 15 setae on inner margin. palpal segment 2 with 6 long setae; segment 3 with 10 short setae. Maxillula (Fig.4E) Endopod with 9 pectinated setae, 2nd, 3rd, 4th and 6th are dentate. Endopod with 4 pectinated setae. Maxilla (Fig.4F) with 9 setae on endopod. Exopod with 9 setae on inner ramus and 13~14 setae on outer ramus. Maxilliped (Fig.4G) Endite with one or two coupling hooks on the lateral border, and 11~12 stout setae on distal margin; palpal segment 2 with 10~12 setae on inner margin and a seta at outer distal corner; segment 3 broad with segment; 4 with 12~14 setae on inner margin, terminal segment with 3 setae on inner margin, 3 setae on outer margin and 4 setae on distal area.

Pereopod 1 (Fig.4H). Basis with a seta on outer margin; ischium 2~3 as long as basis, with a long seta on inner margin and 2 setae in outer margin; merus a little shorter than ischium, densely pubescent along the inner margin, and with 3 setae on outer distal margin; carpus triangular with 7~10 setae on inner margin; propodus as long as ischium, with 5 stout setae on inner margin and 5~6 simple margin on outer margin; dactylus bifid.

Pereopod 2 (Fig.4I). Basis long, 4 times as long as wide with 2 short setae on outer margin; ischium 2/3 time as long as basis; merus as long as ischium with 6 setae on inner margin and 2 setae outer-distal margin; carpus as long as merus with 6 setae on inner margin; propodus, as long as carpus and slightly swollen, with 3 setae on inner margin and a seta on outer margin; dactylus bifid.

Pereopod 3 (Fig.4J). Basis long, 4.5 times as long as wide, with a seta at inner distal corner and many hair on both margins; ischium 4/5 time as long as basis with 4 setae on inner margin and 2 setae on outer margin; merus half length of ischium with a long seta and many short setae on inner margin; carpus a little shorter than merus, with a long seta and dense hair on inner margin; propodus, as long as ischium, with 3 setae on inner margin and 2 setae at outer distal corner; dactylus bifid.

Pereopod 4 (Fig.4K). Basis rectangular, 3 times as long as wide, with 3 setae on outer margin and a

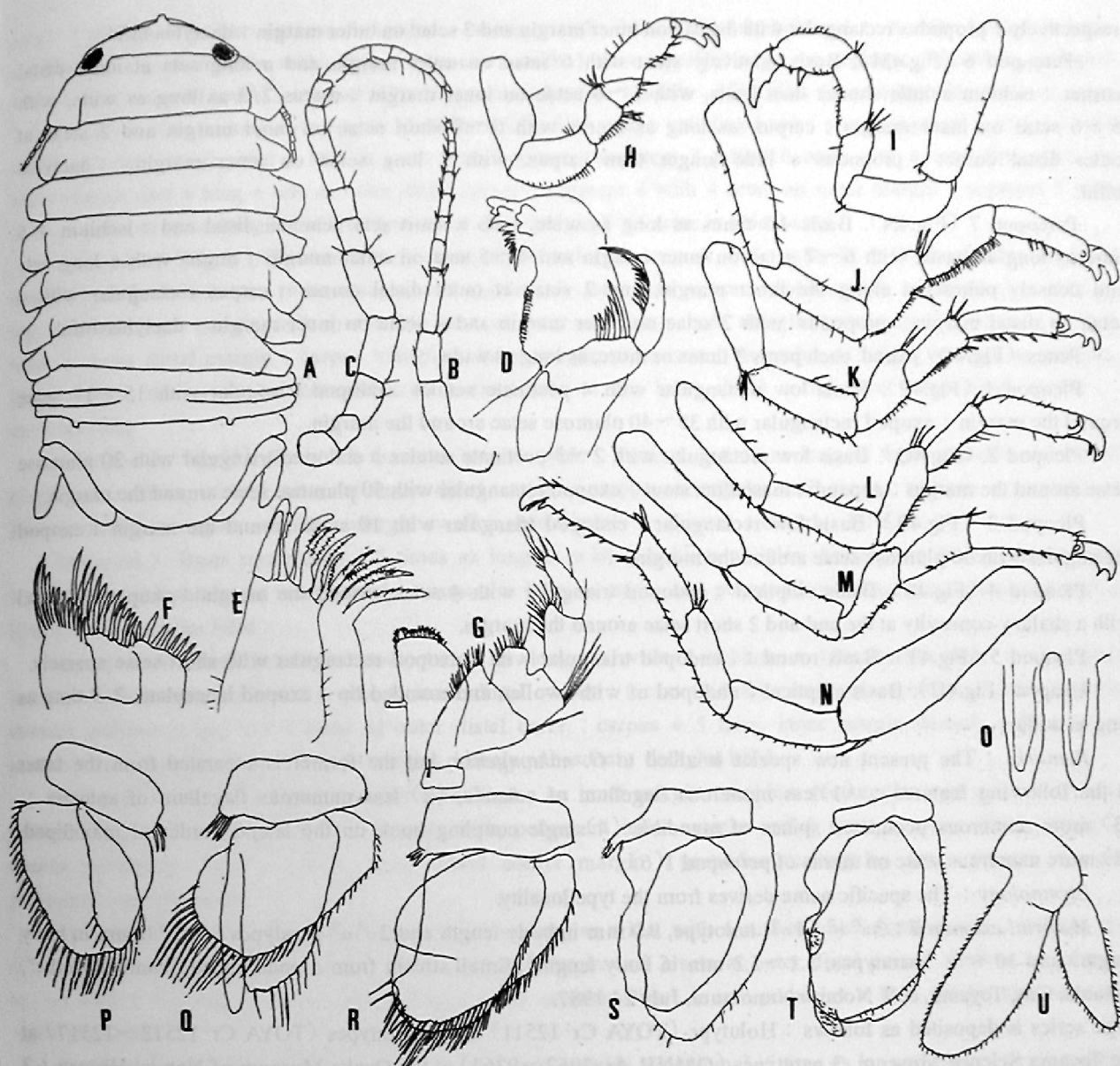


Fig.4. *Gnorimosphaeroma hokurikuense* n. sp

A. Dorsal view ; B. Antennule ; C. Antenna ; . D. Right mandible ; . E. Maxillula ; F Maxilla ; G. Maxilliped ; . H-N. Pereopods 1-7 ; O. Penes ; P-T. Pleopods 1-5 ; U. Uropod (All : Holotype male).

relatively long seta at inner distal corner ; ischium  $3/5$  time as long as basis with 2 setae on inner margin ; merus half length of ischium with a seta and many fine on inner margin ; carpus a little longer than merus, with 2 setae on inner margin and 2 setae on outer distal corner ; propodus as long as ischium, with 2 setae at outer distal corner ; dactylus bifid.

Pereopod 5 (Fig.4L) long 3.2 times as long as wide ; ischium  $2/3$  time as long as basis ; merus half length of ischium with a seta on margin ; carpus rectangular, with 2 setae on inner distal and outer distal margins,

respectively ; propodus rectangular with 3 setae on inner margin and 3 setae on outer margin ; dactylus bifid.

Pereopod 6 (Fig.4M). Basis relatively stout with 6 setae on outer margin and a long seta at inner distal corner ; ischium a little shorter than basis, with 5~6 setae on inner margin ; merus  $2/3$  as long as wide, with 5~6 setae on inner margin ; carpus as long as merus with 6~7 short setae on inner margin and 2 setae at outer distal corner ; propodus a little longer than carpus, with 2 long setae on inner margin.. ; dactylus bifid.

Pereopod 7 (Fig.4N). Basis 4.5 times as long as wide, with a short seta near the distal end ; ischium  $4/5$  time as long as basis, with 6~7 setae on inner margin and 4~5 seta on outer margin ; merus with a long seta and densely pubescent along the inner margin, and 2 setae at outer distal corner ; carpus rectangular with 4 setae on distal margin ; propodus with 2 setae on outer margin and 4 setae on inner margin ; dactylus bifid.

Penes (Fig.4O) paired, each penis 3 times or more, as long as wide.

Pleopod 1 (Fig.4P). Basis low rectangular with 4 pectinate setules .endopod triangular with 15~17 setae around the margin ; exopod rectangular with 35~40 plumose setae around the margin.

Pleopod 2. (Fig.4Q). Basis low rectangular with 2~3 pectinate setules ; endopod triangular with 20 plumose setae around the margin ; appendix masculina stout ; exopod rectangular with 50 plumose setae around the margin.

Pleopod 3 (Fig.4R). Basis low rectangular ; endopod triangular with 10 setae around the margin ; exopod rectangular with 30 plumose setae around the margin.

Pleopod 4 (Fig.4S). Basis elliptical ; endopod triangular with 4 setae around the margin ; exopod elliptical with a shallow concavity at the end and 2 short setae around the margin.

Pleopod 5 (Fig.4T). Basis round ; . endopod triangular with ; exopod rectangular with short setae sparsely.

Uropod (Fig.4U). Basis elliptical ; endopod of with swollen and rounded tip ; exopod lanceolate,  $2/3$  time as long as wide.

*Remarks* : The present new species is allied to *G. naktongense*, but the former is separated from the latter in the following features : (1)less numerous flagellum of antenna, (2) less numerous flagellum of antenna ; (3) more numerous pectinated spines of mandible (4)single coupling hook on the lateral border of maxilliped, (5) more numerous setae on merus of pereopod 1(6)

*Etymology* : The specific name derives from the type locality.

*Material examined* ; 3♂♂ (1♂, holotype, 9.0 mm in body length and 2♂♂ paratypes 6.1~7.0 mm in body length) and 10♀♀ (paratypes, 3.1~5.2 mm in body length), Small stream from a pond called "Yomokurouike", Takaoka City, Toyama, coll. Noboru Nunomura, July 24 1987.

Type series is deposited as follows : Holotype (TOYA Cr-12511) and 5 paratypes (TOYA Cr-12512~12517) at the Toyama Science Museum, 3 paratypes (OMNH Ar-3962~9364) at the Osaka Museum of Natural History ; 3 paratypes (CBM-ZC-4079) at the Natural History Museum and Institute, Chiba..

### *Gnorimosphaeroma akanense* n. sp.

(Akan-kotsubumushi, new)

(Fig.5)

*Description* : Male. Body ovate, 2.0 times as long as wide, Color blackish brown. Dorsal surface smooth with minute granules. Cephalon (Fig.5D) with a protruded medial area. Clypeus and frontal lamina (Fig.5E) trapezoid. Eyes relatively big, each eyes with 95~100 ommatidia. Pleonal somite with 2 suture lines and anterior one slightly longer than the posterior one. Adult male reaches 9 mm in length. Pleon with 2 pairs of suture lines, anterior ones only a little longer than the posterior one.

Antennule (Fig.5B) short with 3 peduncular and 5 flagellar segments. Antenna (Fig.5C), reaching the anterior half of pereonal somite 1., composed of with 5 peduncular segments and 13~15 flagellar segments.

Right mandible (Fig.5F) pars incisiva 3-headed ; lacinia mobilis 2-headed but not chitinized ; 5~6 setae behind lacinia mobilis ; processus molaris wide. Palpal segment 2 with 9~10 setae and palpal segment 3 with 12

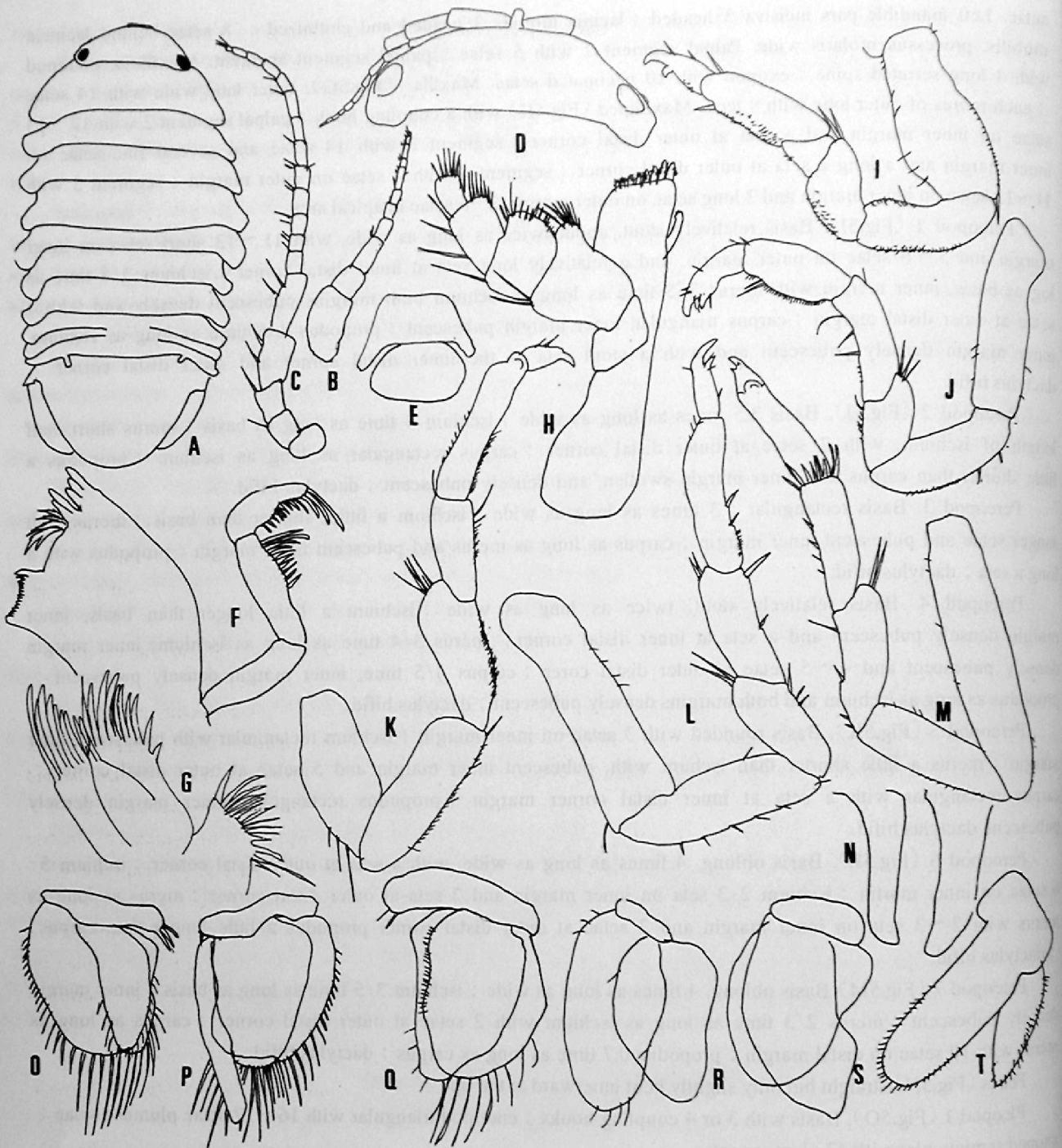


Fig.5 *Gnorimosphaeroma akanense* n. sp.

A. Dorsal view ; B. Antennule ; C. Antenna ; D. Dorsal view of cephalon ; E. Clypeus and frontal lamina ; F. Right mandible ; G. Maxilla ; H. Maxilliped ; I-J. Pereopods 1-2 ; K-M. Pereopods 5-7 ; N. Penes ; O-R. Pleopods 1-5 ; S. Uropod (All : Holotype male).

*Remarks* : The present new species is allied to *G. nacktongense*, but the former is separated from the latter in the following features : (1)less numerous flagellum of antennule, (2)less numerous flagellum of antenna, (3)

setae. Left mandible pars incisiva 3-headed ; lacinia mobilis 3-headed and chitinized ; 8 setae behind lacinia mobilis. processus molaris wide. Palpal segment 2 with 5 setae ; palpal segment segment. Maxillula, endopod with 4 long serrated spine ; exopod with 10 pectinated setae. Maxilla (Fig.5G). Inner lobe wide with 14 setae ; each ramus of outer lobe with 9 teeth Maxilliped (Fig.5H) with a coupling hook ; palpal segment 2 with 12~13 setae on inner margin and a seta at outer distal corner ; segment 3 with 14 setae and several fine setae on inner margin and a long a seta at outer distal corner ; segment 4 with 4 setae on outer margin ; segment 5 with 11~12 setae on inner margin and 2 long setae on outer margin 5~6 setae in apical area.

Pereopod 1 (Fig.5I). Basis relatively stout, about twice as long as wide, with 11~13 short setae on inner margin and 5~6 setae on outer margin, and a relatively long seta at inner distal corner ; ischium  $3/4$  time as long as basis, inner margin with merus  $3/5$  time as long as ischium both margins pubescent densely and with 2 setae at outer distal margin ; carpus triangular, inner margin pubescent ; propodus  $4/5$  time as long as ischium, inner margin densely pubescent and with a stout seta at the inner distal corner and outer distal corner ; dactylus bifid.

Pereopod 2 (Fig.5J). Basis 3.5 times as long as wide ; ischium 3 time as long as basis ; merus short, half length of ischium, with 2 setae at outer distal corner ; carpus rectangular as long as ischium ; propodus a little shorter than carpus and inner margin swollen, and densely pubescent ; dactylus bifid.

Pereopod 3. Basis rectangular ; 3 times as long as wide ; ischium a little shorter than basis ; merus with longer setae and pubescent inner margin ; carpus as long as merus and pubescent inner margin ; propodus with a long a seta ; dactylus bifid.

Pereopod 4. Basis relatively stout. twice as long as wide ; ischium a little longer than basis, inner margin densely pubescent and a seta at inner distal corner ; merus  $3/4$  time as long as ischium, inner margin densely pubescent and 4~5 setae at outer distal corer ; carpus  $4/5$  time, inner margin densely pubescent ; propodus as long as ischium and both margins densely pubescent ; dactylus bifid.

Pereopod 5 (Fig.5K). Basis rounded with 3 setae on inner margin ; ischium rectangular with pubescent inner margin ; merus a little shorter than ischum with, pubescent inner margin and 5 setae at outer distal corner ; carpus rectangular with a seta at inner distal corner margin ; propodus rectangular, inner margin densely pubescent. dactylus bifid.

Pereopod 6 (Fig.5L). Basis oblong, 4 times as long as wide, with a seta at outer distal corner ; ischium 5-6 setae on inner martin ; ischium 2-3 seta on inner margin and 2 seta at outer distal corner ; merus as long as merus with 2~3 seta on inner margin and 2 setae at outer distal corner propodus a little longer than carpus.. ; dactylus bifid.

Pereopod 7 (Fig.5M) Basis oblong, 4 times as long as wide ; ischium  $3/5$  time as long as basis ; inner margin densely pubescent ; merus  $2/3$  time as long as ischium with 2 setae at outer distal corner ; carpus as long as merus with 10 setae on distal margin ; propodus 0.7 time as long as carpus ; dactylus bifid.

Penes (Fig.5N) straight but only slightly bent innerward at the tip.

Pleopod 1 (Fig.5O). Basis with 3 or 4 coupling hooks ; endopod triangular with 16~17 setae plumose setae ; exopod semicircular with 42 plumose setae .

Pleopod 2 (Fig.5P). Basis with a coupling hook ; endopod semicircular with 18 plumose setae ; exopod semicircular with 40 plumose setae. Appendix masculina club shaped.

Pleopod 3 (Fig.5Q). Basis with 2 coupling hooks ; endopod lanceolate with 13 plumose setae ; exopod semicircular with 15 plumose setae.

Pleopod 4 (Fig.5R). Basis small ; endopod triangular without seta ; exopod semicircular with plumose setae.

Pleopod 5 (Fig.5S) Basis without coupling hooks ; endopod lanceolate without seta ; exopod semicircular without seta.

Uropod (Fig.5T). Basis small ; endopod 2 times longer than width ; both side parallel and apical end with fine setae around the margin ; exopod 0.8 time as long as endopod.

less numerous setae of palpal segment 3, (4) less numerous, (5) single coupling hook on endite of maxilliped.

The present new species is also allied to *G. hokurikuensis*, but it differs from the latter in the following features : (1)less numerous flagella of both antenna, (2)more numerous, (3)less numerous setae on endopod of maxillua and (4)less numerous setae on maxilla.

*Etymology* : The specific name derives from the type locality

*Material examined* : 8♂♂ (1♂, 6.6 mm in body length and 7♂♂ paratypes 4.8~7.2 mm) in body length and 31♀♀ paratypes 2.2-8.9 mm in body length), Freshwater of Akan-gawa, River from the Oskandake, Hokkaido, Riffle June 13, 1990, R. Kuranishi. Type series is deposited as follows : Holotype (TOYA Cr 12518) and 8 paratypes (12519~12526) at the Toyama Science Museum 10 paratypes (OMNH Ar 3965~3974) at the Osaka Museum of Natural History ; 10 paratypes (CBM-ZC-4080) at the Natural History Museum and Institute, Chiba, and 10 paratypes (RTMCRU 21~30) at the Rishiri Town Museum.

***Gnorimosphaeroma tsushimaense* n. sp.**

(Jap.name : Tsushima-kotsubumushi, new)

(Fig. 6)

*Description* : Body 1.7 times as long as wide. Color grayish brown. Hind margin of pleotelson rounded. Dorsal surface smooth with minute granules. Cephalon with a protruded medial area. Pleonal somite with 2 suture lines and anterior one slightly longer than the posterior one. Pleon with 2 pairs of suture lines, anterior ones only a little longer than the posterior one.

Antennule (Fig.6B) with flagellum 6~10 segmented, not reaching the posterior margin of the pereonite I. Antenna (Fig.6C) with 17~20 flagellar segments, exceeds beyond the posterior end of pereonite 3.

Right mandible (Fig.6D). pars incisiva 3-headed ; lacinia mobilis 3-headed but not chitinous ; 3 setae behind lacinia mobilis, processus molaris wide ; palpal segment 2 with 4 setae on inner margin ; segment 3 with 13-14 setae. Left mandible pars incisiva 2-headed ; lacinia mobilis 3-headed but chitinous ; 3 setae behind lacinia mobilis ; processus molaris wide. ; palpal segment 2 with 11 setae on inner margin ; segment 3 with 12~13 setae. Maxillula (Fig.6E). Endopod with 4 pectinated setae, exopod with 8 Spines 4 of which are dentate Endopod with senated setae. Maxilla (Fig.6F). Endopod with 11~12 plumose setae ; inner lobe of exopod with 8-11 recurved spines, and outer lobe 8-12 curved teeth. Maxilliped (Fig.6G). Endite with 2 (1 in some specimens) coupling hooks on lateral border and with 9 plumose spine on distal border. Palpal segment 2 with 6~7 setae on inner margin and a seta at outer distal corner ; segment 3 with 10~11 setae on inner margin and 2 setae on outer-distal margin segment 4 with 11 inner margin densely pubescent and 6 setae on outer margin ; terminal segment 9-12 setae around the margin.

Pereopod 1 (Fig.6H) elliptical, twice as long as wide, with a seta at inner distal corner ; ischium a little shorter than basis, inner margin densely pubescent and with a seta on outer margin ; merus half length of ischium, inner margin densely pubescent and 2~3 setae on inner margin and 2~3 longer setae at the outer-distal corner ; carpus short and triangular, inner margin densely pubescent and with a seta on inner margin ; propodus as long as ischium, inner margin densely pubescent and with 3 setae on inner margin ; dactylus bifid.

Pereopod 2 (Fig.6I). Basis long, 4 times as long as wide, ischium a little shorter than basis ; merus half length of ischium with a seta at inner-distal corner and 3 setae at outer distal corner ; merus ; carpus with inner margin with swollen area and 3 setae ; propodus with 2 setae ; dactylus bifid..

Pereopod 3 (Fig.6J). Basis rectangular, 2.5 times as long as wide ; ischium a little shorter than basis ; merus with pubescent inner margin ; carpus as long as merus with pubescent inner margin ; propodus a little longer than carpus with pubescent both margins ; dactylus bifid.

Pereopod 4 (Fig.6K). Basis oblong, 4 times as long as wide ; ischium with pubescent inner margin ; merus as long as ischium with 2 setae at outer distal corner ; carpus a little shorter than merus with 2 setae at outer