

## TWO NEW SPECIES OF *CARIDINA* (CRUSTACEA: DECAPODA: ATYIDAE) FROM HUNAN PROVINCE, CHINA

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**ABSTRACT.** - The present contribution describes the morphological characteristics and some ecological information of two new species of atyid shrimp (*Caridina solearipes* new species, *Caridina spinalifrons* new species) (Crustacea, Decapoda, Atyidae) from Hunan Province, China.

**KEY WORDS.** - New species, *Caridina*, Crustacea, China.

### INTRODUCTION

Ten species of *Caridina* have been found within Hunan Province over the years, viz. *C. ablepsia* Guo, Jiang & Zhang, 1992; *C. baojingensis* Guo, He & Bai, 1992; *C. glossopoda* Liang, Guo & Gao, 1993; *C. hofendopoda* Shen, 1948; *C. hunanensis* Liang in Liang et al., 1993; *C. lanceifrons* Yu, 1938; *C. lima* Liang, Guo & Gao, 1993; *C. longispina* Guo, He, Xu & Gui, 1992; *C. pedicultrata* Guo & Choy, 1994; and *C. spinosa* Liang, 1964. Recent studies revealed the presence of two additional new taxa which are here described.

The following abbreviations are used throughout the text: total length (TL, measured from the rostral tip to the posterior margin of the telson), carapace length (CL, measured from the postorbital margin to the posterior margin of the carapace), rostral length (RL, measured from the rostral tip to the postorbital margin). Setal terminology follows Felgenhauer (1992). All type specimens have been deposited in the collections of the Hunan Agricultural University (HAU).

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## SYSTEMATICS

### Genus *Caridina* H. Milne Edwards, 1837

#### *Caridina spinalifrons*, new species

(Fig. 1, Tables 1-2)

**Material examined.** - Holotype: adult male, TL 24.3mm, CL 5.3mm, RL 2.0mm, HAU 93-07-08-01, stream near Sangzhi City, Hunan Province, circa 29°10'N, 110°16'E, 650m altitude, coll. Z. L. Guo, 10 Jul. 1993.

Allotype: ovigerous female, TL 22.2mm, CL 5.5mm, RL 1.5mm, HAU 93-07-08-02, same data as holotype.

Paratype: adult male, TL 19.6mm, CL 5.3mm, RL 1.3mm, HAU 93-07-08-03, same data as holotype.

**Description.** - Carapace (Fig. 1A, B): Smooth, glabrous. Antennal spine below orbital angle, strong. Pterygostomial angle broadly rounded, with or without pterygostomial spine.

Rostrum (Fig. 1A, B): Short, only 0.27-0.37 of CL; curving downwards, reaching tip of basal antennular segment; 10-16 dorsal teeth with the distal 10 teeth somewhat smaller than the proximal teeth, 4-5 teeth situated behind post-orbital margin, terminal 0.4 of rostrum unarmed; 0-3 ventral teeth, placed distally if present; lateral carina present, dividing rostrum in two unequal parts.

Eyes (Fig. 1A, B): Small, short ocular peduncle; cornea globular, well developed.

Antennule (Fig. 1A, B): Stylocerite 0.65-0.85 length of basal segment, second segment about 0.56-0.62 length of basal segment and 1.3-1.5 times third segment; all segments with submarginal plumose setae.

Antenna (Fig. 1A, B): Scaphocerite reaches beyond end of antennular peduncle, outer margin straight, non-setose, with strong sub-apical spine, proximal lamella and interior margin with plumose setae.

Mandibles, maxillula, maxilla, first and second maxillipeds, similar to *C. solearipes* new species; branchial formula, see Table 2.

Third maxilliped (Fig. 1C): Reaches tip of antennular peduncle; endopod with basal segment approximately 3.7 times as long as broad, penultimate segment about 5.1 times as long as broad and about 1.1 times as long as basal segment, distal segment equal in length to basal segment, ending in large claw-like hamate seta surrounded by simple setae, 8-10 hamate setae on distal third of posterior margin, proximally with a clump of serrate and pappose setae; exopod reaching to 0.4 of second endopod segment, distally with long, plumose setae.

First pereiopod (Fig. 1D): Reaches tip of basal segment of antennular peduncle; chelae length 2.0-2.1 times width, movable finger length 3.0-3.7 times width, 0.98-1.50 times as long as palm; carpus ventrally attached to chelae, excavated disto-dorsally, carpus length 1.6-1.8 times width, 0.79-0.84 times as long as chelae, 0.87-0.93 times as long as merus.

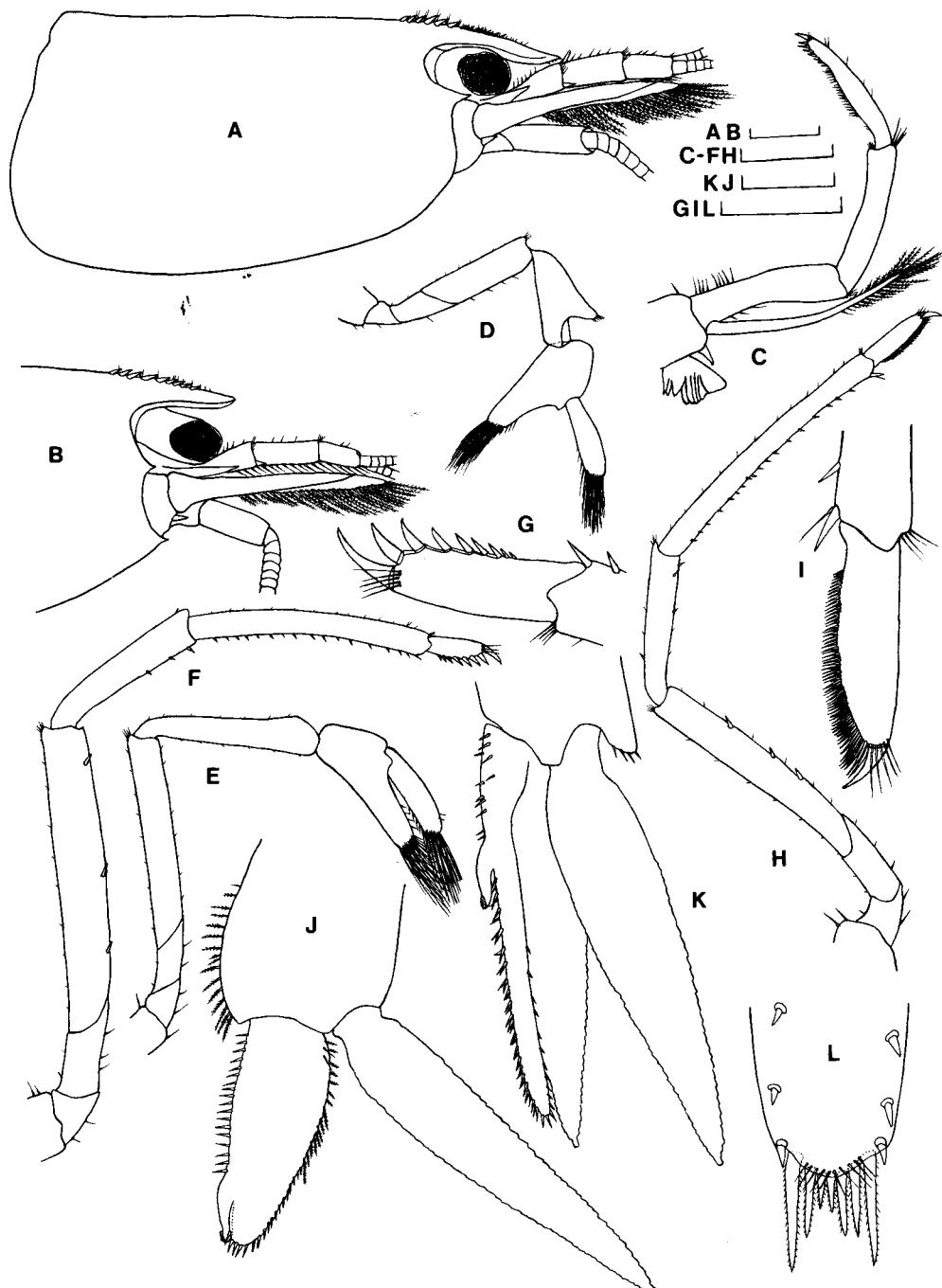


Fig. 1. *Caridina spinalifrons*, new species. A: cephalothorax; B: rostral and antennular region; C: third maxilliped; D: first pereiopod; E: second pereiopod; F: third pereiopod; G: dactylus of third pereiopod; H: fifth pereiopod; I: dactylus of fifth pereiopod; J: first pleopod; K: second pleopod; L: dorso-posterior region of telson. Scale bars indicate 1 mm (A-F, H), 0.4 mm (G, I, L) or 0.5 mm (K, J). A, C-K: holotype male; B: allotype female; L: paratype male.

Table 1. Length (L) and width (W) in mm, of pereiopod segments of primary type specimens of *Caridina spinalifrons*, new species.

	Dactylus		Propodus		Carpus		Meru		Ischium	
	L	W	L	W	L	W	L	W	L	W
<b>Holotype male</b>										
Pereiopod 1	0.96	0.26	1.38	0.67	1.11	0.61	1.27	0.33	0.38	0.28
Pereiopod 2	1.09	0.28	1.61	0.62	1.99	0.39	2.33	0.33	0.49	0.29
Pereiopod 3	0.83	0.21	2.64	0.27	1.94	0.38	3.28	0.53	0.62	0.39
Pereiopod 4	0.78	0.18	2.78	0.28	1.84	0.43	2.89	0.48	0.67	0.39
Pereiopod 5	0.94	0.21	3.06	0.27	1.78	0.31	2.59	0.39	0.54	0.36
<b>Allotype female</b>										
Pereiopod 1	0.80	0.27	1.28	0.64	1.08	0.66	1.22	0.32	0.38	0.29
Pereiopod 2	0.88	0.23	1.44	0.50	1.99	0.39	1.75	0.40	0.73	0.34
Pereiopod 3	0.96	0.18	2.11	0.27	1.56	0.33	2.84	0.46	0.72	0.33
Pereiopod 4	0.50	0.18	2.11	0.26	1.48	0.38	2.38	0.44	0.72	0.39
Pereiopod 5	0.72	0.17	2.44	0.21	1.50	0.34	1.88	0.39	0.84	0.33

Table 2. Branchial formula of *Caridina spinalifrons*, new species.

	Maxillipedes			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	1	1	1	1	1
Arthrobranchns	—	—	2	1	—	—	—	—
Podobranchs	—	1	—	—	—	—	—	—
Epipods	—	—	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

Second pereiopod (Fig. 1E): Reaches tip of second segment of antennular peduncle, more slender and longer than first pereiopod; chelae length 2.7-2.9 times width, movable finger length 3.2-3.9 times width, 1.3-1.5 times as long as palm; carpus length 4.7-5.1 times width, 1.2-1.4 times as long as chelae, 0.85-1.1 times as long as merus.

Third pereiopod (Fig. 1F, G): Overreaches antennular peduncle by about base of dactylus; dactylus length 3.5-5.3 times width, ending in prominent claw-like hamate spine surrounded by simple setae, posterior margin with 7-8 hamate setae; propodus length 7.8-9.9 times width, 2.2-3.5 times as long as dactylus, posterior margin and lateral surface with numerous hamate setae; carpus about 0.73-0.79 times as long as propodus, distal projection well developed, posterior and lateral surface with a few hamate setae; merus about 1.7-1.8 times as long as carpus, 3 stout hamate setae along posterior margin.

Fourth pereiopod: Similar to third.

Fifth pereiopod (Fig. 1H, I): Reaches to tip of second antennular peduncle segment; dactylus length 3.7-4.5 times width, ending in claw-like hamate seta surrounded by simple setae, posterior margin bearing comb-like row of 45-58 hamate setae; propodus length 10.0-11.6 times width, 3.2-3.7 times as long as dactylus, posterior margin with numerous hamate setae; carpus about 0.58-0.62 length of propodus, bearing a few hamate setae, distal projection well developed; merus distinctly short but broader than propodus, approximately 1.3-1.4 times length of carpus, bearing 2-3 large postero-lateral hamate setae.

First pleopod (Fig. 1J): Endopod of male is leaf shaped, wider proximally, about 2.6 times proximal width, trapezoidal, tip broadly rounded, inner margin bearing numerous nearly

equal hamate setae, basal part of outer border with numerous thin marginal plumose setae, distal third and tip bearing thin hamate setae; appendix interna well developed, arising from distal 1/3 of endopod, reaching tip of endopod, distally with numerous cincinuli.

Second pleopod (Fig. 1K): Endopod of male about 0.88 times as long as exopod, inner border near base with short marginal and submarginal hamate setae; appendix interna short, reaching past basal 1/4 of appendix masculina, distally with numerous cincinuli; appendix masculina long and slender, triangular file-shaped, reaching to 0.86 of endopod, distal and inner lateral margin with double row of short hamate setae, single row on distal 3/5 of outer border.

Abdomen: Well developed, rotund, glabrous; sixth abdominal somite 0.41-0.43 of CL.

Telson (Fig. 1L): About 0.58 of CL, distinctly longer than sixth abdominal segment, tapering posteriorly to a rounded margin; dorsal surface with 6-7 pairs of stout hamate setae, including pair at postero-lateral angle; posterior margin with 7-8 intermediate plumose setae, middle ones thinnest and shortest, all distinctly shorter than lateral pair. Uropods distinctly longer than telson, diaresis on exopod with 15-18 hamate setae.

Egg size: Eggs with undeveloped embryos large, measuring 0.62-0.72 by 0.89-1.11mm.

Live coloration: Body greyish with scattered dark brown spots.

**Etymology.** - The specific name is derived from *spina* (Latin: thorny) and *frons* (Latin: fore part), in reference to the rostral spination.

**Remarks.** - *C. spinalifrons* new species, is very similar to *C. lima* Liang, Guo & Gao, 1993, in the shape of the endopod of the male first pleopod and appendix masculina of the male second pleopod. It can be distinguished from *C. lima* by having 10-16 teeth on the dorsal margin of the rostrum (vs. no teeth); carpus of second pereiopod more slender, measuring 4.7 to 5.1 times as long as broad (vs. 3.1 to 3.8 times as long as broad) and the appendix masculina of the male second pleopod being shorter than the endopod (vs. longer).

**Habitat.** - The type-specimens were collected by handnet from a stream near Sangzhi City. It has its source in a cave at an elevation of 700m and is about 4km long with a width of 0.8-2.0m and a depth of 0.2-0.8m. The bottom of the stream consists of rocks interspersed with gravel and sand patches. The shrimps were encountered in the upper part of the stream, in areas with slow flowing current. The crab *Sinopotamon denticulatum* (H. Milne Edwards) was the only other decapod encountered.

***Caridina solearipes*, new species**  
(Figs. 2-3, Table 3)

**Type material.** - Holotype: adult male, TL 17.0mm, CL 4.7mm, RL 0.9mm, HAU 93-07-09-01, small stream near Dabaozi, Jingzhou County, Hunan province, circa 26°41'N, 109°25'E, altitude between 400-900m, coll. Z. L. Guo, 16 Jul.1993.

Allotype: female TL 18.6mm, CL 5.2mm, RL 0.8mm, HAU 93-07-09-02, same data as holotype.

Paratypes: ovigerous female, HAU 93-07-09-03, same data as holotype. — 3 non-ovigerous

females, HAU 93-07-09-04 to 06, same data as holotype. — 8 adult males, HAU 93-07-09-07 to 14, same data as holotype.

**Description.** - Habitus: Small, slender and sub-cylindrical, males reach 17.0mm TL and females 18.6mm TL.

Rostrum (Fig. 2A, B, C): Short and narrow, approximately 0.16-0.21 of CL, curving downwards, reaching past eyes but falling short of end of first antennular peduncle segment (60%) or falling short of eyes (40%); unarmed (53%) or armed with 1-5 pre-orbital dorsal teeth (47%); unarmed, setose ventral margin; lateral carina dividing rostrum in two unequal parts continuous with orbital margin.

Eyes (Fig. 2A-C): Small on short ocular peduncle; cornea globular, well developed.

Carapace (Fig. 2A-C): Smooth, glabrous; pterygostomial angle broadly rounded, pterygostomial spine absent; antennal spine sharply pointed, placed below lower orbital angle.

Antennule (Fig. 2D): Peduncle not reaching beyond scaphocerite; stylocerite 0.60-0.82 as long as proximal segment, anterolateral angle of proximal segment acutely pointed, reaching about 0.25 of second segment, which is about 0.57-0.62 times length of proximal segment; all segments furnished with submarginal plumose setae; distal segment laterally and apically fringed with plumose setae.

Antenna (Fig. 2E): Peduncle about 0.60 times as long as scaphocerite; scaphocerite reaching beyond tip of antennular peduncle; outer margin straight, non-setose, ending in a single strong sub-apical spine; length about 3.1 times width, proximal lamella and interior margin with plumose setae.

Mandibles (Fig. 2F, G): Right mandible laterally with about 7 strong, sharp incisor teeth; medially two groups of setae, one group with about 17 curved hamate setae, second group with about 50 finer straight plumose and simple setae; molar process ridged and with numerous fine simple setae along edge. Left mandible with about 5 strong teeth, three groups of setae medially, reducing in size towards ridged molar process.

Maxillula (Fig. 2H): Palp simple, distally slightly expanded; distally with about 9 long plumose, 3 long simple and one hamate setae; proximally with a few simple setae. Upper lacinia broadly elongate, inner edge straight, with several rows of strong hamate setae, outer and lower inner margins with plumose setae. Lower lacinia with broadly rounded margin, marginally with short and long simple setae.

Maxilla (Fig. 2I): Upper and middle endite with marginal simple, denticulate and plumose setae and submarginal simple setae. Lower endite with simple marginal setae and plumose submarginal setae; palp shorter than cleft of upper endite, proximally wider than distally, distally with marginal plumose setae. Scaphognathite with regular row of long plumose setae on distal margin and with shorter plumose setae continuing down proximal triangular process which has many long plumose setae, each with prominent dilation near base.

First maxilliped (Fig. 2J): Ultimate and penultimate segments of endopod indistinctly divided; inner margin of ultimate segment with marginal and submarginal long rows of plumose, denticulate and simple setae plus transverse rows of plumose setae on proximal

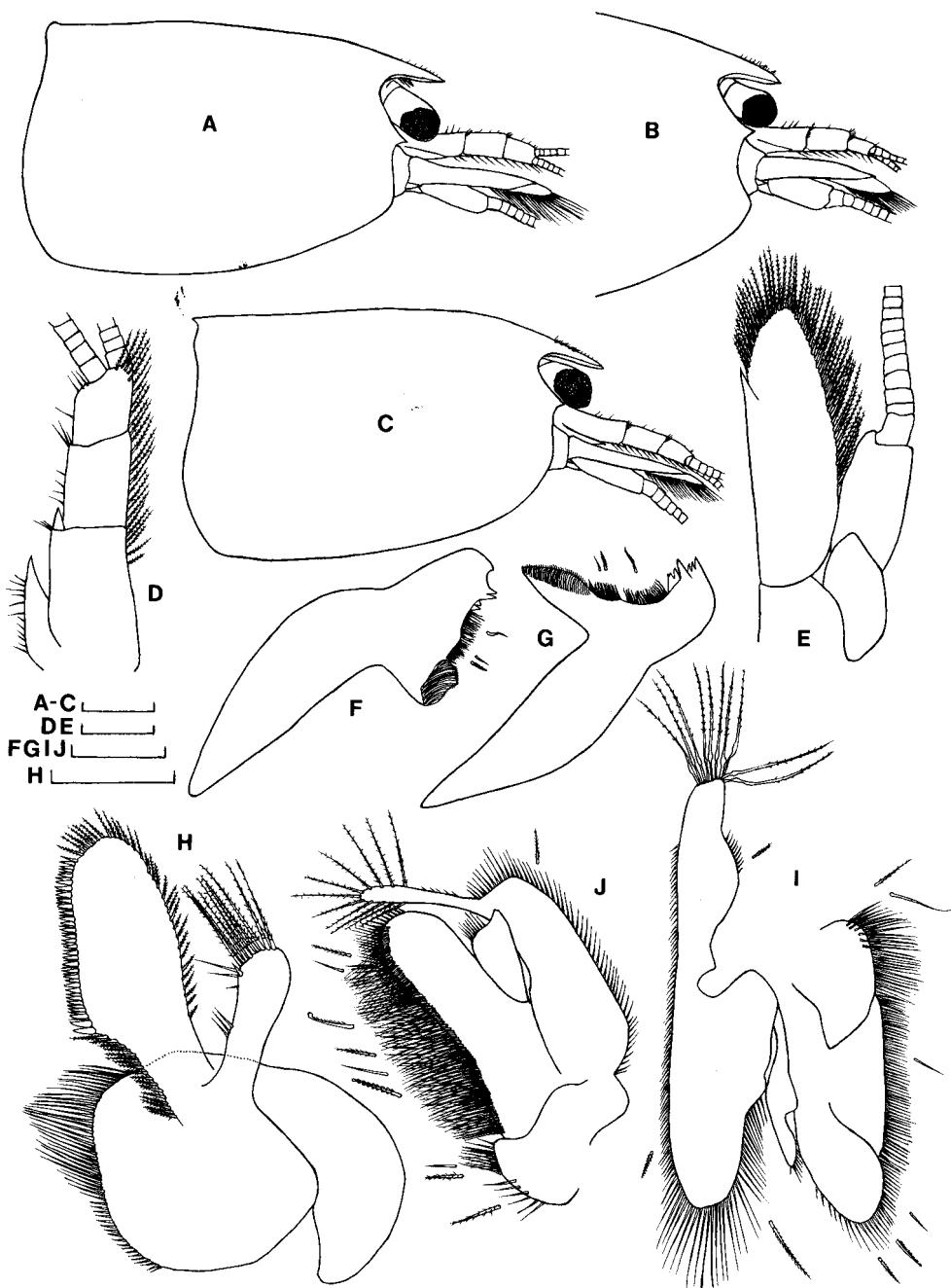


Fig. 2. *Caridina solearipes*, new species. A: cephalothorax; B, C: rostral and antennular region, D: antennule; E: antenna; F: left mandible, G: right mandible; H: maxillula; I: maxilla; J: first maxilliped. Scale bars indicate 1 mm (A-C), 0.5 mm (D-G, I-J) or 0.4 mm (H). A: holotype male, B: allotype female, C-J: paratype male.

portion. Palp broadly triangular, ending in pointed tip, with terminal plumose setae. Exopod flagellum distinct, well developed with marginal plumose setae. Caridean lobe narrow, with marginal plumose setae.

Second maxilliped (Fig. 3A): Endopod with fused dactylar and propodal segments. Inner margin of ultimate, penultimate and basal segments with long setae of various types. Exopod long and narrow with marginal plumose setae distally and simple setae proximally.

Branchial formula: same as *C. spinalifrons* (see Table 2).

Third maxilliped (Fig. 3B): Reaches to beyond tip of antennular peduncle; endopod three-segmented, length of basal segment about 4.7 times width, a few plumose setae distally; length of penultimate segment about 6.4 times width, about 0.88 times as long as basal segment, with a few long simple setae on distal inner margin and distally plus a row of short simple setae along outer margin; distal segment about as long as penultimate segment, ending in large claw-like hamate seta surrounded by simple setae, preceded by about 8-10 hamate setae on distal third of posterior margin, proximally a clump of long and short simple, serrate setae; exopod reaches to about half of second segment of endopod, distal margin with long plumose setae.

First pereiopod (Fig. 3C): Reaches tip of eyes; chela 1.7-2.2 times as long wide; movable finger 2.7-3.6 times as long as wide, 0.82-1.2 times length of palm; carpus ventrally attached to chelae, excavated disto-dorsally, 1.6-2.1 times as long as wide, 0.64-0.93 times as long as chela, 0.69-1.0 times length of merus.

Second pereiopod (Fig. 3D): Reaches tip of second segment of antennular peduncle, more slender and longer than first pereiopod; chela 2.6-3.6 times as long as wide; movable finger 4.4-5.9 times as long as wide, 1.3-1.6 times length of palm; carpus 5.3-6.6 times as long as wide, slightly excavated distally, 1.4-1.7 times as long as chela, 1.0-1.2 times length of merus.

Third pereiopod (Fig. 3E, F): Overreaches antennular peduncle tip by about 0.25 of propodus; dactylus 3.1-3.7 times as long as wide, ending in prominent hamate seta surrounded by simple setae, behind which posterior margin bears 5 hamate setae; propodus length 7.3-10.0 times width, 2.9-4.0 times length of dactylus, posterior margin and lateral surface bearing two rows of hamate setae; carpus 0.66-0.89 times length of propodus, well developed distal projection; merus 1.7-2.0 times as long as carpus, with about 3 hamate setae on postero-lateral margin.

Fourth pereiopod (Fig. 3G, H): Reaches tip of first segment to tip of second segment of antennular peduncle; dactylus 3.1-4.2 times as long as wide, ending in prominent claw-like hamate seta surrounded by simple setae, behind which posterior margin bears 5-7 (usually 6) hamate setae; propodus length 8.1-10.5 times width, 2.9-4.1 times length of dactylus, posterior margin bearing row of hamate setae; carpus 0.62-0.76 times length of propodus, well developed distal projection; merus 1.6-1.8 times as long as carpus, with 2-3 hamate setae along posterior margin.

Fifth pereiopod (Figs. 3I, J): Reaches tip of eyes to tip of first segment of antennular peduncle; dactylus 4.2-5.3 times as long as wide, ending in claw-like hamate seta. Bearing comb-like row of 44-52 hamate setae on posterior margin; propodus length 7.7-10.4 times

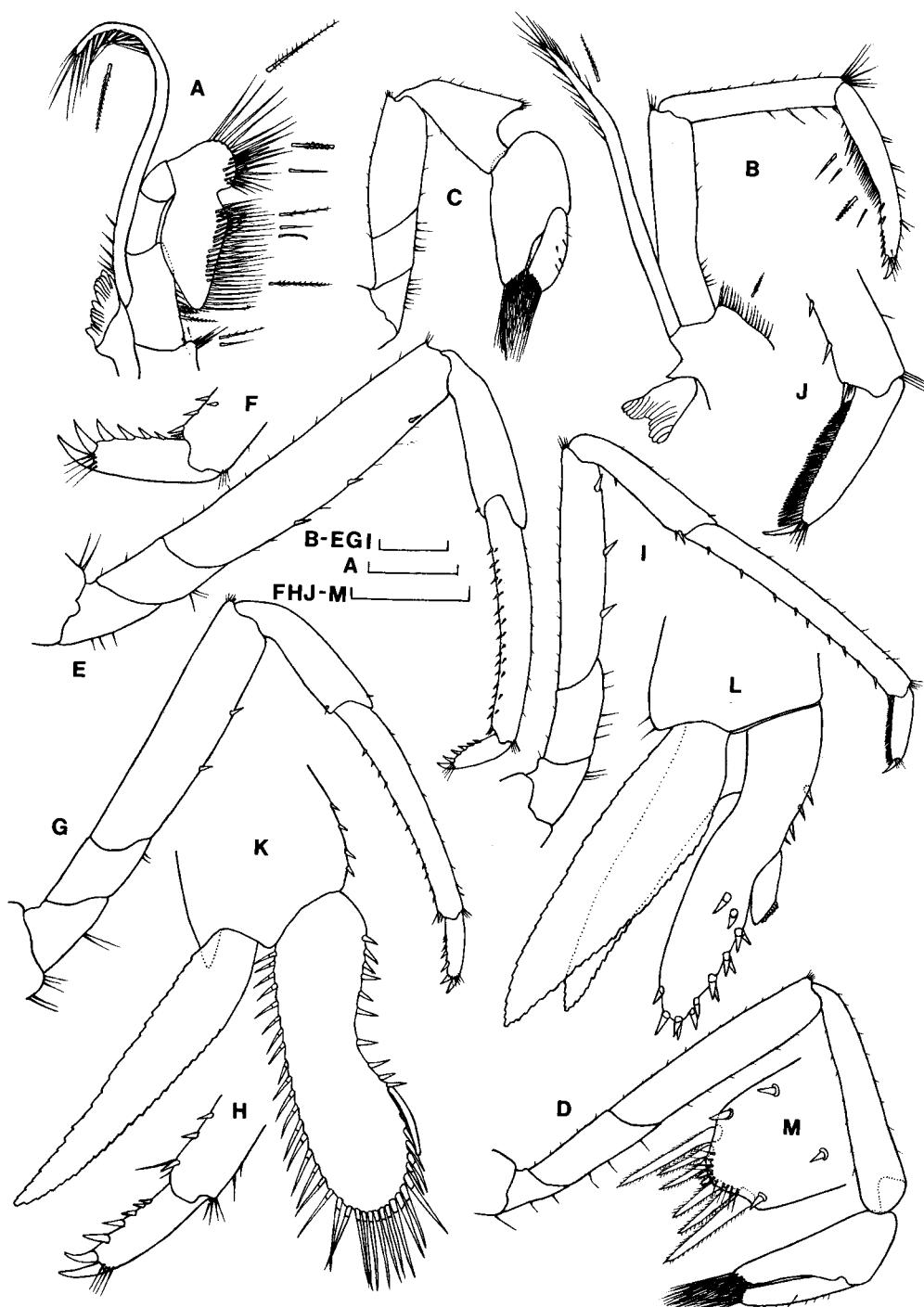


Fig. 3. *Caridina solearipes*, new species, paratype male. A: second maxilliped; B: third maxilliped; C: first pereiopod; D: second pereiopod; E: third pereiopod; F: dactylus of third pereiopod; G: fourth pereiopod; H: dactylus of fourth pereiopod; I: fifth pereiopod; J: dactylus of fifth pereiopod; K: first pleopod; L: second pleopod; M: dorso-posterior region of telson. Scale bars indicate 0.5 mm (A-E, G-I) or 0.4 mm (F, H, J-M).

Table 3. Length (L) and width (W) in mm, of pereiopod segments of primary type specimens of *Caridina solearipes*, new species.

	Dactylus		Propodus		Carpus		Merus		Ischium	
	L	W	L	W	L	W	L	W	L	W
<b>Holotype male</b>										
Pereiopod 1	0.72	0.22	1.18	0.60	1.10	0.56	1.09	0.39	0.32	0.31
Pereiopod 2	0.83	0.14	1.36	0.38	2.05	0.33	1.72	0.34	0.56	0.31
Pereiopod 3	0.61	0.16	1.86	0.22	1.39	0.33	2.61	0.45	0.61	0.35
Pereiopod 4	0.51	0.16	2.10	0.22	1.34	0.32	2.39	0.39	0.50	0.39
Pereiopod 5	0.72	0.17	2.10	0.23	1.33	0.26	1.78	0.34	0.52	0.37
<b>Allotype female</b>										
Pereiopod 1	0.78	0.22	1.33	0.71	1.17	0.67	1.18	0.44	0.31	0.31
Pereiopod 2	0.89	0.17	1.35	0.44	2.24	0.36	1.97	0.33	0.67	0.28
Pereiopod 3	0.50	0.13	1.99	0.21	1.33	0.32	2.67	0.34	0.72	0.28
Pereiopod 4	0.54	0.13	2.00	0.22	1.17	0.31	2.13	0.29	0.63	0.28
Pereiopod 5	0.84	0.16	2.11	0.23	1.22	0.28	1.78	0.33	0.67	0.24

width, 2.2-3.1 times length of dactylus, bearing row of hamate setae on posterior margin; carpus 0.51-0.70 times as long as propodus, bearing a few hamate setae on latero-posterior margin, well developed distal projection; merus 1.4-1.6 times as long as carpus, with 2-3 large hamate setae along posterior margin.

First pleopod (Fig. 3K): Endopod of adult male very long, about 0.88 times length of exopod, foot-like shaped, slightly wider distally, about 3.0 times as long as maximum width, inner margin deeply concave at middle, outer margin almost straight, both with marginal hamate setae and those at distal part longer and stout; appendix interna slender, arising from 1/3 of inner margin, not reaching past tip of endopod, distally with few cincinuli.

Second pleopod (Fig. 3L): Endopod of adult male about 0.88 times as long as exopod, inner margin near appendix interna with a few submarginal hamate setae; appendix interna short, reaching beyond 2/5 of appendix masculina, distally with numerous cincinuli; appendix masculina rod-shaped, reaches to about 0.90 times length of endopod, bearing two rows of stout hamate setae on inner lateral margin and distally.

Abdomen: Well developed, rotund, glabrous; sixth abdominal segment 0.36-0.42 of CL.

Telson (Fig. 3M): Distinctly longer than sixth abdominal segment, 0.40-0.47 times CL, tapering posteriorly, ending in rounded margin; dorsal surface with 5-6 (usually 5) pairs of stout hamate setae including pair at postero-lateral angle; posterior margin with 3-5 (usually 4) pairs of intermediate plumose setae, middle pair thinnest and shortest, all distinctly shorter and less stout than lateral pair; diaresis on exopod bearing 18-24 (usually 22) hamate setae.

Egg size: Eggs with well developed embryos measuring 0.76-0.87 by 1.12-1.34 mm; few in number.

Live colouration: Body of male generally of an orange colour and females light greenish-blue.

**Etymology.** - The specific name is derived from *solea* (Latin: bottom of foot) and *pes* (Latin: foot), in reference to the foot-like shape of the endopod of the male first pleopod.

**Remarks.** - *Caridina solearipes*, new species, resembles *C. brevispina* Liang & Yan, 1986, from Guizhou Province in rostral characters, shape and spination of the appendix masculina of the second male pleopod. The new species can be immediately distinguished from *C. brevispina* on the basis of the following characteristics: shape and spination of the endopod of the male first pleopod, non-recurred appendix interna (vs. recurred), posterior margin of telson without median spine (vs. no median spine), more hamate setae on uropodal diaresis and the relatively slender carpus of the first two pereiopods.

**Habitat.** - The type specimens were collected from a small stream in Dabaozi, Jingzhou County. The stream is approximately 3 km long, 1.0-1.5 m wide and 0.3-1.0 m deep, and situated at an altitude of 400-900m. The river bed consists of a mixture of silt and sand, with fringing grass plants frequently extending into the edge of the river. The shrimps were very common between the rootlets of the half submerged grass plants, a habitat in which no other decapods were found.

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