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Redescription of *Hemicypris mizunoi* OKUBO, 1990 (Crustacea, Ostracoda) from Thailand, with a reassessment of the validity of the genera *Hemicypris* and *Heterocypris*

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Abstract

Hemicypris mizunoi OKUBO, 1990 is here redescribed, based on material from Thailand. The species can be distinguished by the presence of minute tubercles on postero- (and antero-) ventral margins of the right valve and on the anterior margin of the left valve, the broadly rounded anterior and posterior margins, the smooth bristles on third endite of the Mx1 and the shape of the α–seta of the Md-palp. *Hemicypris mizunoi* OKUBO, 1990 and *H. reticulata* (KLIE, 1930) reported here are the first records of the genus *Hemicypris* from Thailand. A species list of *Hemicypris* worldwide is given. Given the fact that *H. mizunoi* has tubercles on both valves, it is somewhat intermediate between the genera *Hemicypris* and *Heterocypris*.

Key words: Ostracods, *Hemicypris*, taxonomy, distribution, Thailand

INTRODUCTION

Only few papers on the non-marine ostracod fauna of Thailand have thus far been published. VAVRA (1906) reported 3 species (*Strandesia purpurascens* (BRADY, 1886); *Hungarocypris gawemuelleri* VAVRA, 1906 and *Stenocypris bimucronata* VAVRA, 1906) from Bangkok. VICTOR & FERNANDO (1982) summarized the distribution of ostracods in Southeast Asia based on their investigation in Malaysia, Indonesia and the Philippines and on the previous study of ostracods in this region, including Thailand. GIDO *et al.* (2007) mentioned an undescribed genus of the subfamily Timiriaseviinae in northern Thailand. Recently, a new genus and species (*Thaicythere srisumonae* SAVATENALINTON, BORGONIE & MARTENS, 2008) were described from this country (SAVATENALINTON *et al.*, 2008).

Thus far, *Hemicypris*, which is a circumtropical genus and rather common in Southeast Asia (VICTOR & FERNANDO, 1982), has never been recorded from Thailand. Five species (*H. anomala* (KLIE, 1938), *H. megalops* SARS, 1903, *H. ovata* SARS, 1903, *H. paucipustulosus* VICTOR & FERNANDO, 1981 and *H. pyxida* (MONIEZ, 1892)) were recorded from Malaysia, Indonesia and the Philippines (SARS, 1903; VICTOR & FERNANDO, 1976, 1979, 1981), whereas this genus comprises 43 species worldwide. Here, we redescribe *Hemicypris mizunoi* OKUBO, 1990, originally described from Japan, using new material from Thailand.

ABBREVIATIONS USED IN TEXT AND FIGURES

Valves: H, height of valves; L, length of valves; LV, Left valve; RV, right valve; W, width of carapace. **Limbs and soft parts**: A1, first antenna; A2, second antenna; Mx1, maxillula; Md, mandibula; T1, first thoracopod; T2, second thoracopod; T3, third thoracopod. Chaetotaxy of the limbs follows the model proposed by BROODBAKKER & DANIELOPOL (1982), revised for the A2 by MARTENS (1987). **Localities**: O.C., Ostracod Collections of the Royal Belgian Institute of Natural Sciences; R.B.I.N.Sc., Royal Belgian Institute of Natural Sciences; MSU-ZOC, Ostracod Collection of the Natural History Museum, Mahasarakham University.

TAXONOMIC DESCRIPTIONS

Class Ostracoda LATREILLE, 1806
Subclass Podocopa G.W. MÜLLER, 1894
Order Podocopida SARS, 1866
Suborder Podocopina SARS, 1866
Infraorder Cypridocopina JONES, 1901
Superfamily Cypridoidea BAIRD, 1845
Family Cyprididae BAIRD, 1845
Subfamily Cyprinotinae BRONSTEIN, 1947
Genus *Hemicypris* SARS, 1903

Hemicypris mizunoi OKUBO, 1990
(Figs 1–4)

NEW LOCALITIES

1. A rice field, Chom Thong District, Cheing Mai Province (TH 023). Coordinates: 18° 31′ 29.9″ N and 98° 37′ 35″ E. Collected: 23 Nov. 2005 by S. SAVATENALINTON. Accompanying ostracod fauna: *Cypretta* sp., *Cypris subglobosa* SOWERBY, 1840, *Hemicypris reticulata* (KLIE, 1930), *Notodromas* sp., *Pseudocypretta maculata* KLIE, 1932, *Stenocypris* sp.
2. A rice field, Kaset Somboon District, Chaiyaphume Province (TH 056). Coordinates: 16° 23′ 2.9″ N and 101° 58′ 46.9″ E. Collected: 28 Nov. 2005 by S. SAVATENALINTON. Accompanying ostracod fauna: *Candonopsis* sp., Cypridopsine spec. indet. spec.nov., *Cypris subglobosa*, *Ilyocypris* sp., *Notodromas* sp. (juvenile), *Physocypria* sp., *Strandesia* sp. (juvenile).

MATERIAL EXAMINED

Two females with valves stored dry in micropalaeontological slides and dissected soft parts preserved in a mounted glycerine slide (O.C. 3011-3012), one undissected female kept in a micropalaeontological slide (O.C. 3013); all three specimens also used for SEM and deposited in the Ostracod Collection of the Royal Belgian Institute of Natural Sciences (Brussels, Belgium). Two (one dissected, one undissected) females deposited in the Ostracod Collection of the Natural History Museum, Mahasarakham University (MSU-ZOC. 002-003), Mahasarakham, Thailand.

DIAGNOSIS

Carapace subquadrate in lateral view (height slightly more than two thirds of length), greatest height situated slightly in front of the middle, anterior and posterior margins broadly rounded, RV with protruding dorsal margin, RV overlapping LV along all sides, postero- and antero-ventral margin of RV and middle of anterior margin of LV set with minute tubercles. Natatory setae on A2 reaching beyond tips of end claws. Two bristles on third endite of Mx1 smooth. Md-palp with α–seta long, slim, syringe-shaped; β-seta slender and plumose; γ-seta stout, plumose and short (slightly reaching beyond the end of the terminal segment). Proximal seta of caudal ramus slim and unusually long (slightly longer than proximal claw). Male unknown.

DIFFERENTIAL DIAGNOSIS

Hemicypris mizunoi OKUBO, 1990 is similar to *H. megalops* SARS, 1903 and *H. pyxida* (MONIEZ, 1892). It can be distinguished from the former species by the carapace shape, especially in dorsal view, the protruding dorsal margin of the RV, the morphology of the T2 (shorter apical setae on penultimate segment) and the smooth bristles on third endite of Mx1. From the latter species it can be distinguished by the carapace shape, the shape of α-seta on Md-palp and the shorter proximal seta of the caudal ramus.

ADDITIONAL DESCRIPTION OF FEMALE

Carapace in left lateral view (Fig. 1C) sub quadrate, with both ends bluntly rounded, greatest height situated slightly in front of the middle, dorsal margin arched, ventral margin rather straight. Valve surface ornamented with long setae and with disperse shallow pits, somewhat deeper at anterior part (Fig. 1D) and with minute spines on postero- and antero-ventral margin of RV (Fig. 1E, H) and on the middle part of anterior margin of LV (Fig. 1D). RV overlapping LV on all sides, especially protruding over LV on antero-dorsal side.

Carapace in dorsal view (Fig. 1A) elliptical, greatest width situated slightly behind the middle, both ends bluntly pointed, the inner margin sinuate.

Carapace in ventral view (Fig. 1B) with ventral margin of RV slightly protruding at the middle of carapace, ventral margin of LV without outer list.

LV in inner view (Fig. 1F) dorsally curved, sloping toward anterior and posterior margins, the latter broadly rounded, ventrally rather straight, greatest height situated at the middle; no tubercles present at the middle of ventral margin; calcified inner lamella wide, posteriorly narrower.

RV in inner view (Fig. 1G-H) dorsally gently curved, with protruding dorsal valve margin, ventrally straight, anterior and posterior margins broadly rounded.

A1 (Fig. 2A): first segment ventrally with 2 long apical setae, dorsally with a small proximal Wouters organ and 1 long subapical seta; second segment with 1 subapical seta and short Rome organ; third segment with 2 apical setae, 1 long and 1 short (the latter reaching the end of the next segment); fourth segment with a group of two long setae, 1 long subapical seta and 1 short apical seta (reaching slightly beyond the end of the next segment); fifth segment with 2 pairs of long setae; sixth segment with 4 apical setae, 3 long, 1 shorter (the latter extending beyond the end of terminal segment); terminal segment

with 2 long, 1 short and aesthetasc Ya (c. 2/3 of the short seta).

A2 (Fig. 2B-D) with exopodite bearing 2 short and 1 long setae, the long one reaching the end of the first endopodite; first endopodite segment with 1 long apical seta, aesthetasc Y slim, short (c. 1/3 of the length of segment), natatory setae extending beyond the tip of end claws, the shortest seta reaching the end of penultimate segment; penultimate segment undivided, with 3 serrated claws, aesthetasc y_2 short (c. half the length of terminal segment); terminal segment bearing 2 serrated claws, a short g-seta, and a short aesthetasc y_3, the latter c. half the length of the accompanying seta).

Md (Fig. 3C-D): first segment of palp with a long, slender, syringe-shaped α–seta and 3 (2 broad and large, 1 slim and long) setae; second segment dorsally with 3 (2 long, 1 shorter) apical setae, the length of the shorter one slightly more than half of the long one, ventrally with a slim, plumose subapical β-seta, 3 long and 1 shorter seta; penultimate segment comprising of 3 groups of setae, dorsally with a group of unequally long setae, laterally with a short, stout, hirsute apical γ-seta and 3 (2 smooth, 1 apically hirsute) long subapical setae, ventrally with 1 long and 1 short (reaching slightly beyond the tip of the terminal segment); terminal segment (Fig. 3D) set with 3 claws and 3 setae. Md-coxa (Fig. 3E) elongated, with c. 14 blunt teeth.

Mx1-palp (Fig. 2E) 2-segmented; basal segment elongated, with 5 long but unequal apical setae and 2 (1 long, 1 shorter) subapical setae, the length of the shorter one slightly less than half that of the long one; terminal segment short, spatulate, with 3 claws and 3 setae; third endite with 2 large smooth bristles, a stout, short and hirsute seta and 7 other setae. Mx1-respiratory plate (Fig. 4D) large, with c. 18-19 setae along posterior and ventral margins and 6 reflexed anterior setae.

T1-protopodite (Fig. 3A-B) with an apical group of 14 (10 apical, 4 subapical) hirsute, unequal setae as well as with 2 short a-setae, 1 long b-seta and 1 long d-seta; endopodite a weakly built, asymmetrical palp, with 3 unequal apical setae, the longest one at the middle; exopodite forming a branchial plate, with 6 hirsute rays.

T2 (Fig. 4C) with d1-seta, d2-seta missing; second segment with 1 long apical seta (more than half the length of penultimate segment); penultimate segment divided into a and b segments, the former with 1 long apical seta, the latter with a group of 2 (1 short, 1 spine-like) apical setae; terminal segment with a long, slim claw (slightly less than twice the length of the penultimate segment) and with 2 (1 subapical, 1 apical) short setae.

T3 (Fig. 4 A-B) with first segment bearing 3 unequal, but long setae; second segment with 1 long apical seta; third segment undivided, with medially 1 lateral seta; terminal segment apically with a pincer structure and 1 reflexed subapical seta.

Caudal ramus (Fig. 4E-F) with 2 (1 apical, 1 subapical) claws and 2 setae; proximal claw with length c. 3/4 of distal claw; distal seta short (c. 1/3 of distal claw); proximal seta long (slightly longer than proximal claw); attachment of the caudal ramus long, slender, dorsal branch reduced, ventral branch with distal end swollen.

Male unknown.

MEASUREMENTS (in µm)

RV (n=3): length 834-872, height 589-598; LV (n=3): length 799-838, height 536-548; Carapace (n=2): length 790-806, height 561-566, width 455-468.

OCCURRENCE

Hemicypris mizunoi OKUBO, 1990 is now known from rice fields in Japan (OKUBO, 1990) and Thailand (present study). The water chemistry variables from the Thai localities were: conductivity 25.8-119.5 µm. cm^{-1}, water temperature 28.2-30.6 ° C, DO 6.49-7.94 mg/L and pH 6.63-6.83.

REMARKS

1. There are a few differences in the morphology of specimens from Japan and Thailand. The Japanese specimens are somewhat larger (c. 1 mm long); some specimens of the Japanese *H. mizunoi* have minute spines on both antero- and postero-ventral margins of the RV, whereas these are present along the postero-ventral margin of the RV in Thai material only; additionally, the tiny spines on the middle part of anterior margin of LV are present in Thai, but absent in Japanese, specimens.
2. Previous illustrations of *Hemicypris* species (e.g. BROODBAKKER, 1983; MARTENS, 1984b; MARTENS & WOUTERS, 1985) showed only 3 claws and 1-2 setae on the terminal segment of the Md-palp. The present species clearly has 3 claws and 3 setae there, as seems to be the normal pattern in this subfamily.

DISCUSSION

TAXONOMY

Hemicypris mizunoi is a peculiar species, combining characters that were thought to be diagnostic of different genera. It belongs amongst the typical Cyprinotinae, with clearly asymmetrical carapace, in which the smaller valves have tuberculated margins, seta d2 on T2 is absent and the caudal ramus has a strongly sclerified dorsal margin. The species belongs in *Hemicypris*, because the RV overlaps the LV on all sides, while the LV has the tuberculated margins. This is the opposite of the situation in *Heterocypris* and in *Cyprinotus*, while in *Homocypris* and *Riocypris* the valves do not overlap and do not have tuberculated margins.

However, *H. mizunoi* also has tubercles on the RV (as in *Heterocypris* and *Cyprinotus*) and has the RV dorsally arching over the LV, as in *Cyprinotus*.

Since the present species is thus somewhat intermediate between the three genera, one could thus hesitate in maintaining them as separate. Previously, species now allocated to *Hemicypris* and *Heterocypris,* have been described in *Cyprinotus*, the senior genus, and especially differences between *Cyprinotus* and *Heterocypris* have mostly been limited to the presence or absence of the dorsal hump of the RV. *Hemicypris* was always more clearly separated from the other two genera, because of the inverse carapace morphology. We will here briefly discuss the three characters and their character states.

1. Valve overlap

DADAY (1913) described *Cyprinotus inversus* from South West Africa, with supposedly large sexual dimorphism: in females, RV > LV, with LV tuberculated (as in *Hemicypris*), while in males LV>RV, with RV tuberculated (as in *Heterocypris*). However, MARTENS (1984a) argued that two species had been mixed here: an all female population of *Hemicypris*, while the males belonged to a species of *Heterocypris*, later (upon investigation of type materials) identified as *Heterocypris giesbrechti* (see MARTENS, 2001). The status of *Cyprinotus inversa* as a species with intermediate morphology was thus refuted. Whereas reversal of various morphologies can be linked to small genetic changes (see for example reviews on potential effects of regulatory sequence evolution in general (CARROLL, 2005) and on *cis*-regulatory mutations in particular (WRAY, 2007)), these morphologies appear to be quite stable in the evolution of the valve reversals in ostracods. This argument still holds, also for example between various genera in Cypridopsinae.

2. Tuberculated valve margins

The second argument in favour of maintaining *Heterocypris* and *Hemicypris* as separate genera was the occurrence of tubercles on the smaller valve. It thus appeared that both characters were linked to each other, through pleiotropic or other effects, and this strengthened the validity of the two genera. The presence of tubercles on both valves in the present species, *H. mizunoi*, now weakens this second argument.

In both *Cypria* and *Physocypria*, the LV overlaps the RV on all sides. Yet, only in the second genus do tubercles occur on the smaller valve (RV), no tubercles occur on this valve in *Cypria*. Neither genus has tubercles on the larger valve.

It would thus appear that presence or absence of tubercles on the valve margins are two different developmental programs in the two valves. The presence of the tubercles on the LV in *H. mizunoi* thus strengthens its allocation to *Hemicypris*, the unusual presence of such tubercles on the RV does not necessarily offer counter evidence.

3. Dorsal hump on RV

The genus *Cyprinotus* is very similar to *Heterocypris*, and its main differing character is the presence of a dorsal expansion (hump) on the RV. Whereas such expansions can also occur in other taxa (e.g. in some *Strandesia* s.s. – see SAVATENALINTON & MARTENS, 2008 – and even on the LV in *Heterocypris salina* – MARTENS, 1984b), they again seem quite stable in the lineage thus far considered as *Cyprinotus* s.s. In addition, the morphology of the dorsal expansion of the RV in *H. mizunoi* is very different from the *Cyprinotus* – hump.

In conclusion, we can confirm the allocation of *H. mizunoi* to *Hemicypris*, as well as maintain the validity of the three genera of the Cyprinotinae under discussion.

DISTRIBUTION

Since MONIEZ (1892) described *Hemicypris pyxida* (MONIEZ, 1892), previously in *Cyprinotus*, from Sumatra (Indonesia), 43 *Hemicypris* species have been reported from different parts of the world, mostly from the circumtropical belt (Table 1). In Southeast Asia, 6 species of *Hemicypris* were thus far recorded, four of which (*H. megalops* SARS, 1903, *H. ovata* SARS, 1903,

Table 1. Species list of *Hemicypris* of the world.
** Type species of the genus, * new records for Thailand

Hemicypris anomala (KLIE, 1938) PURPER & WURDIG-MACIEL, 1974: Taiwan, Malaysia, Philippines
Hemicypris arorai BATTISH, 1981: India
Hemicypris aurita (KLIE, 1939) PURPER & WURDIG-MACIEL, 1974: Kenya
Hemicypris bairdi MARTENS & WOUTERS, 1985: India
Hemicypris barbadensis BROODBAKKER, 1983: West Indies
Hemicypris bhatiai BATTISH, 1981: India
Hemicypris communis (KLIE, 1940) PURPER & WURDIG-MACIEL, 1974: Brazil
Hemicypris congenera (DADAY, 1910) (nec VAVRA, 1897): East Africa
Hemicypris decorata (DADAY, 1910) BATE, 1970: East Africa
Hemicypris dentatomarginata (BAIRD, 1859) MCKENZIE, 1972: India
Syn. *Hemicypris marginatodentatus* (BAIRD 1859)
Hemicypris derweshensis BATTISH, 1981: India
Hemicypris dissona VICTOR & FERNANDO, 1976: India
Hemicypris exigua BROODBAKKER, 1983: West Indies
Hemicypris falcata VICTOR & FERNANDO, 1976: India
Hemicypris fossulata (VAVRA, 1897) MCKENZIE, 1966: East Africa
Hemicypris fulleborni (DADAY, 1910) BATE, 1970: East Africa
Hemicypris futunaensis VICTOR & FERNANDO, 1978: New Hebrides
Hemicypris gillensis (BATTISH, 1981): India
Hemicypris humbertii (GAUTHIER, 1933) BATE 1970: Madagascar
Hemicypris intermedia (LINDROTH, 1953) BATE 1970: East Africa
Hemicypris inversa (DADAY, 1913) BATE, 1970: Southwest Africa
Hemicypris kaufmanni (VAVRA, 1906) BATE 1970: Japan
Hemicypris kawagaensis OKUBO, 2004: Japan
Hemicypris kibiensis OKUBO, 1990: Japan
Hemicypris kissi MARTENS, 1984: East Africa
nom.nov. pro. *H. dentatomarginata* KISS, 1959; nec BAIRD, 1859
Hemicypris kliei (LINDROTH, 1953) BATE, 1970: East Africa
Syn. *Hemicypris posterotruncata* BATE, 1970
Hemicypris largereticulata (ROME, 1969) FREELS, 1980: East Africa
Hemicypris levis (HARTMANN, 1964) PURPER & WURDIG-MACIEL, 1974: Iran
Hemicypris malerkotlaensis BATTISH, 1981: India
** *Hemicypris megalops* SARS, 1903: Indonesia, Malaysia, India
* *Hemicypris mizunoi* OKUBO, 1990: Japan, Thailand
Hemicypris nipponica OKUBO, 1990: Japan
Hemicypris nonstriata (LINDROTH, 1953) BATE, 1970: East Africa
Hemicypris okayamenensis OKUBO, 2004: Japan
Hemicypris ovata SARS, 1903: Indonesia, Philippines, India
Hemicypris pailensis BATTISH, 1981: India
Hemicypris paucipustulosa VICTOR & FERNANDO, 1981: Philippines
Hemicypris pyxidata (MONIEZ, 1892A) SARS, 1903: Southeast Asia, India, Sri Lanka
Hemicypris rara (KLIE, 1940) PURPER & WURDIG-MACIEL, 1974: Brazil
* *Hemicypris reticulata* (KLIE, 1930) BATE, 1970: Paraguay, West Indies, Thailand
Hemicypris salaria (HARTMANN, 1962) PURPER & WURDIG-MACIEL, 1974: Chile
Hemicypris stenoglypha (ROME, 1969) FREELS, 1980: East Africa
Hemicypris vulgaris OKUBO, 1990: Japan

H. paucipustulosus VICTOR & FERNANDO, 1981 and *H. pyxida* (MONIEZ, 1892)) were originally described from this region. *Hemicypris mizunoi* OKUBO, 1990, redescribed here, and *H. reticulata* (KLIE, 1930) are the first records of *Hemicypris* for Thailand; *H. paucipustulosus* VICTOR & FERNANDO, 1981 is thus far restricted to Southeast Asia, while the remaining Southeast Asian *Hemicypris* species can be found in the rest of the Oriental region (BATTISH, 1978; DEB, 1972; HARTMANN, 1964; KLIE, 1938; SARS, 1903; VICTOR & FERNANDO, 1979, 1981). At present, three species in this genus occur in both the Oriental region and in Japan: *H. pyxida* (MONIEZ, 1892) which has a wide distribution in the Oriental region (VICTOR & FERNANDO, 1982), *H. ovata* SARS, 1903 and *H. mizunoi* OKUBO, 1990 (SMITH, 2008; the present study). MCKENZIE (1966) reported *H. megalops* SARS, 1903 from Australia.

ECOLOGY

Hemicypris species, recorded from Southeast Asia, were mostly found in rice fields, which are man-made ecosystems. This type of habitat can be regarded as temporary floodplains or wetlands, which can dry periodically. The species diversity of ostracods in such man-made wetlands is relatively lower than in the natural wetlands.

The two Thai rice fields reported on here yielded 7 and 8 ostracod species respectively, while 19 and 27 taxa were recorded from natural wetlands in Italy (ROSSETTI *et al.*, 2004) and Brazil (HIGUTI *et al.*, 2007), respectively. However, the total number of rice field ostracods from Southeast Asia and North Italy are high: 54 species for the former (VICTOR & FERNANDO, 1980) and 52 species for the latter (ROSSI *et al.*, 2003).

Thus far, 10 species of *Hemicypris* (*H. anomala* (KLIE, 1938); *H. dentatomarginata* (BAIRD, 1859); *H. kibiensis* OKUBO, 1990; *H. megalops* SARS, 1903; *H. mizunoi* OKUBO, 1990; *H. nipponica* OKUBO, 1990; *H. ovata* SARS, 1903, *H. pyxida* (MONIEZ, 1892), *H. reticulata* (KLIE, 1930), *H. vulgaris* OKUBO, 1990) have been found in rice fields in general (OKUBO, 1990; ROSS *et al.*, 2003; VICTOR & FERNANDO, 1982; present study).

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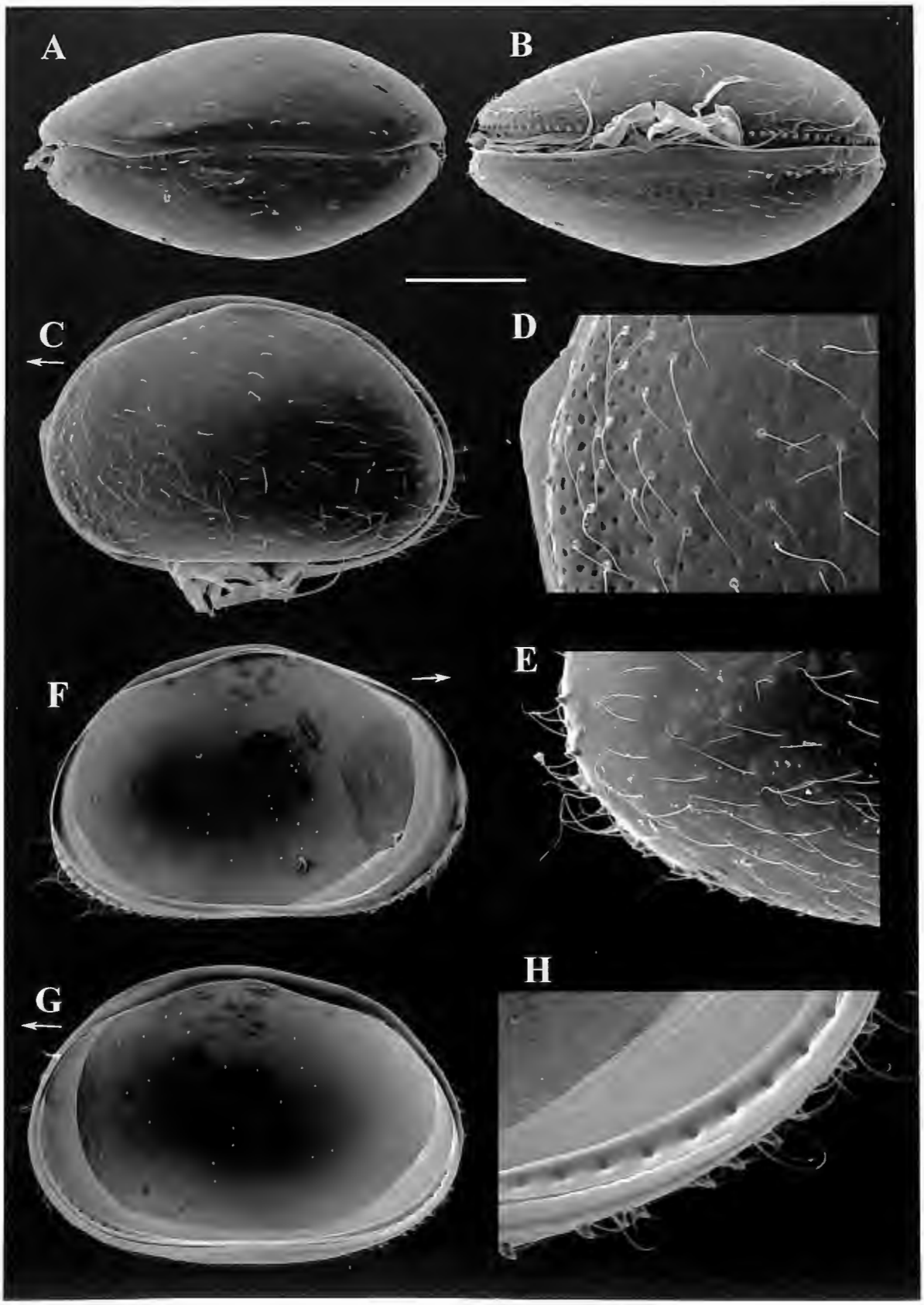

Fig. 1. *Hemicypris mizunoi* OKUBO, 1990. A. Carapace in dorsal view (O.C. 3013), B. Carapace in ventral view (O.C. 3013), C. Carapace in left lateral view (O.C. 3013), D. Detail of external anterior part of LV (O.C. 3013), E. Detail of external posterior part of RV (MSU-ZOC 002), F. Internal view of LV (O.C. 3011), G. Internal view of RV (O.C. 3011), H. Detail of internal posterior part of RV (O.C. 3011). Scale bars: 200 µm for A-C, F-G; 50 µm for D, H; 100 µm for E. Arrows point towards the anterior of the animals.

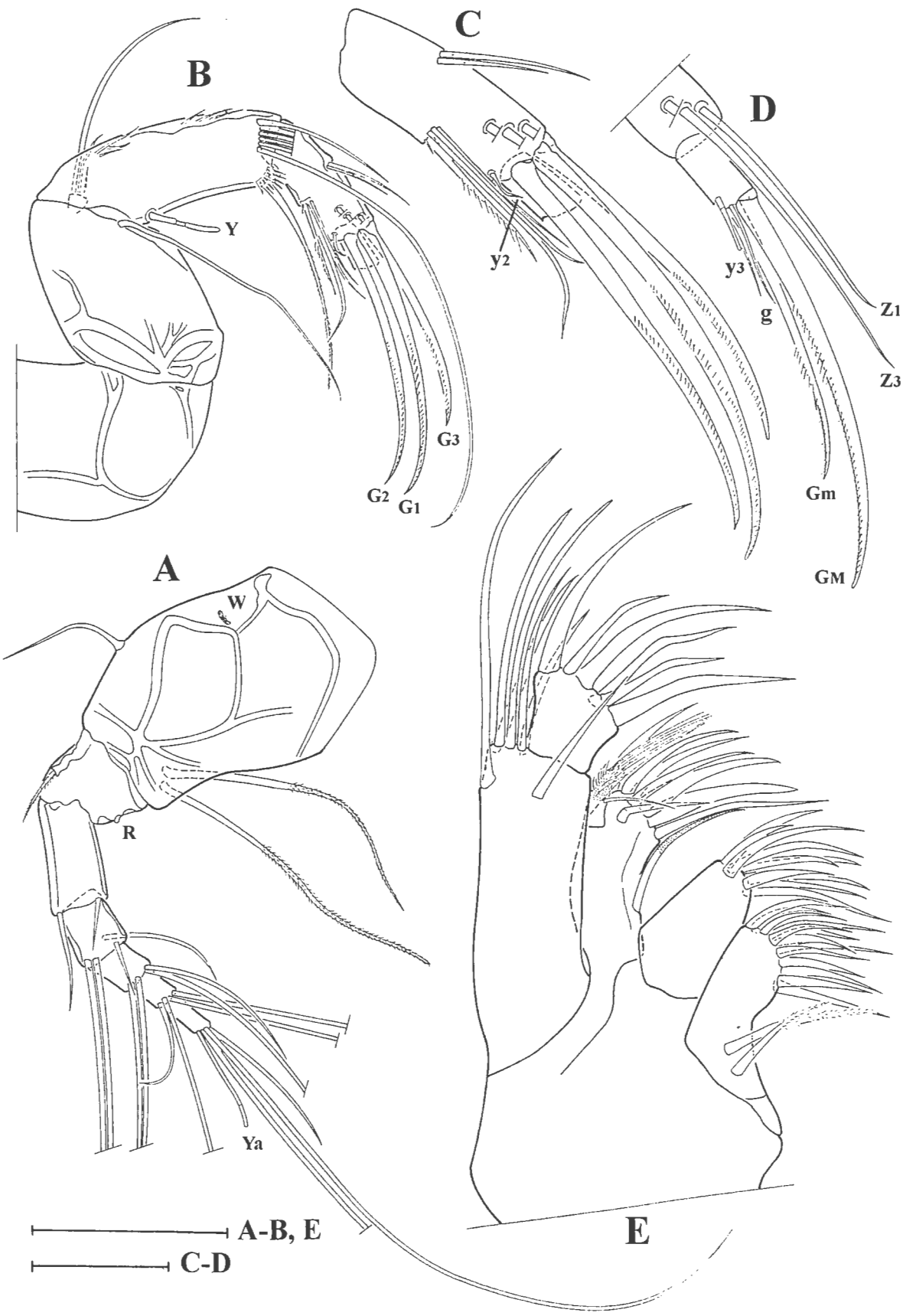

Fig. 2. *Hemicypris mizunoi* OKUBO, 1990. A. A1 (O.C. 3012), B. A2 (O.C. 3012), C. Penultimate and terminal segments of A2 (O.C. 3012), D. Terminal segment of A2 (O.C. 3012), E. Mx1 (O.C. 3012). Scale bars: 125 μm for A-B; 50 μm for C-E. R = Rome organ, W = Wouters organ.

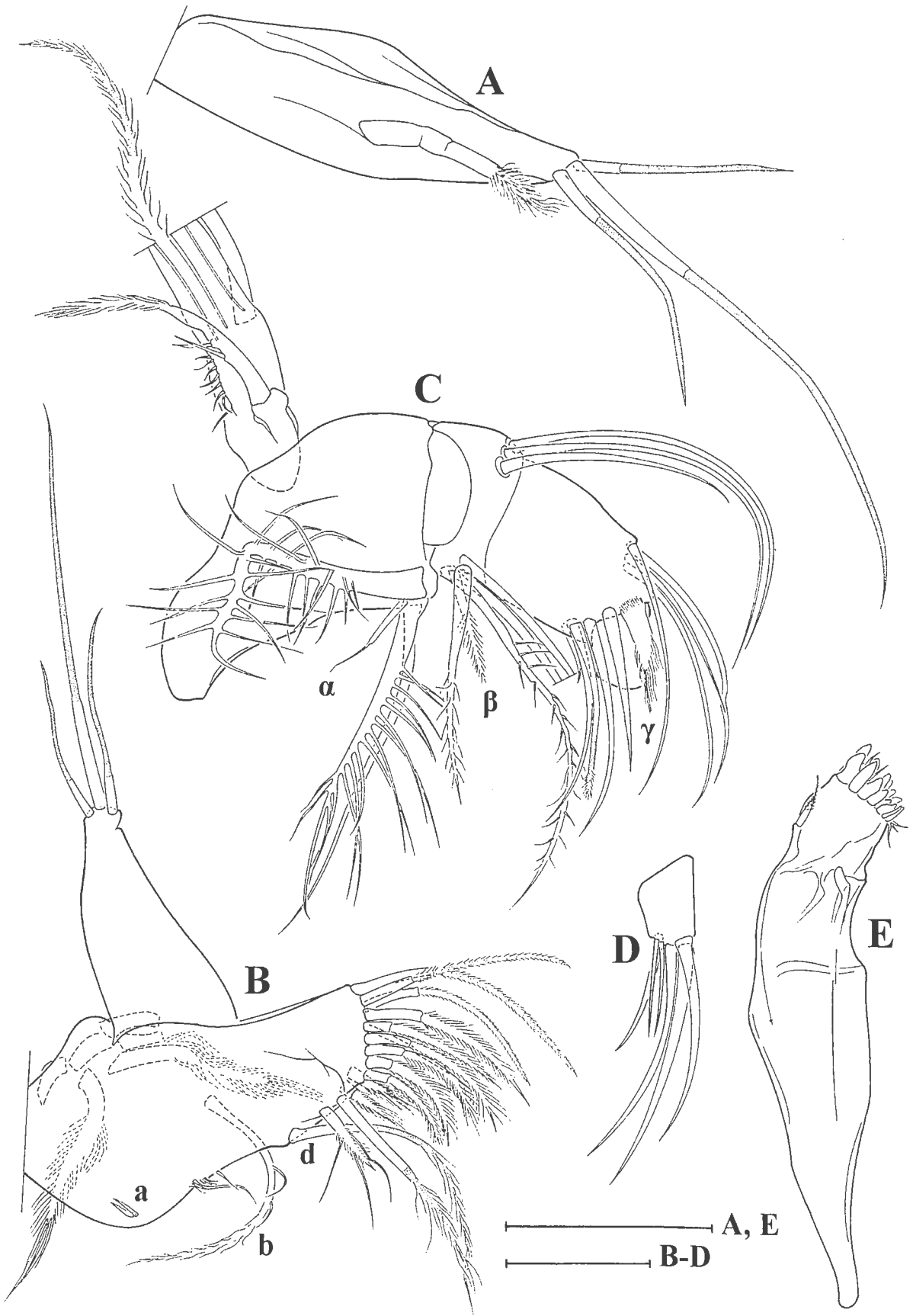

Fig. 3. *Hemicypris mizunoi* OKUBO, 1990. A. Aberrant endopodite of T1 (O.C. 3012), B. T1 (O.C. 3012), C. Md-palp and respiratory plate (O.C. 3012), D. Terminal segment of Md-palp (O.C. 3012), E. Md-coxa (O.C. 3012). Scale bar: 50 µm for A-D; 125 µm for E.

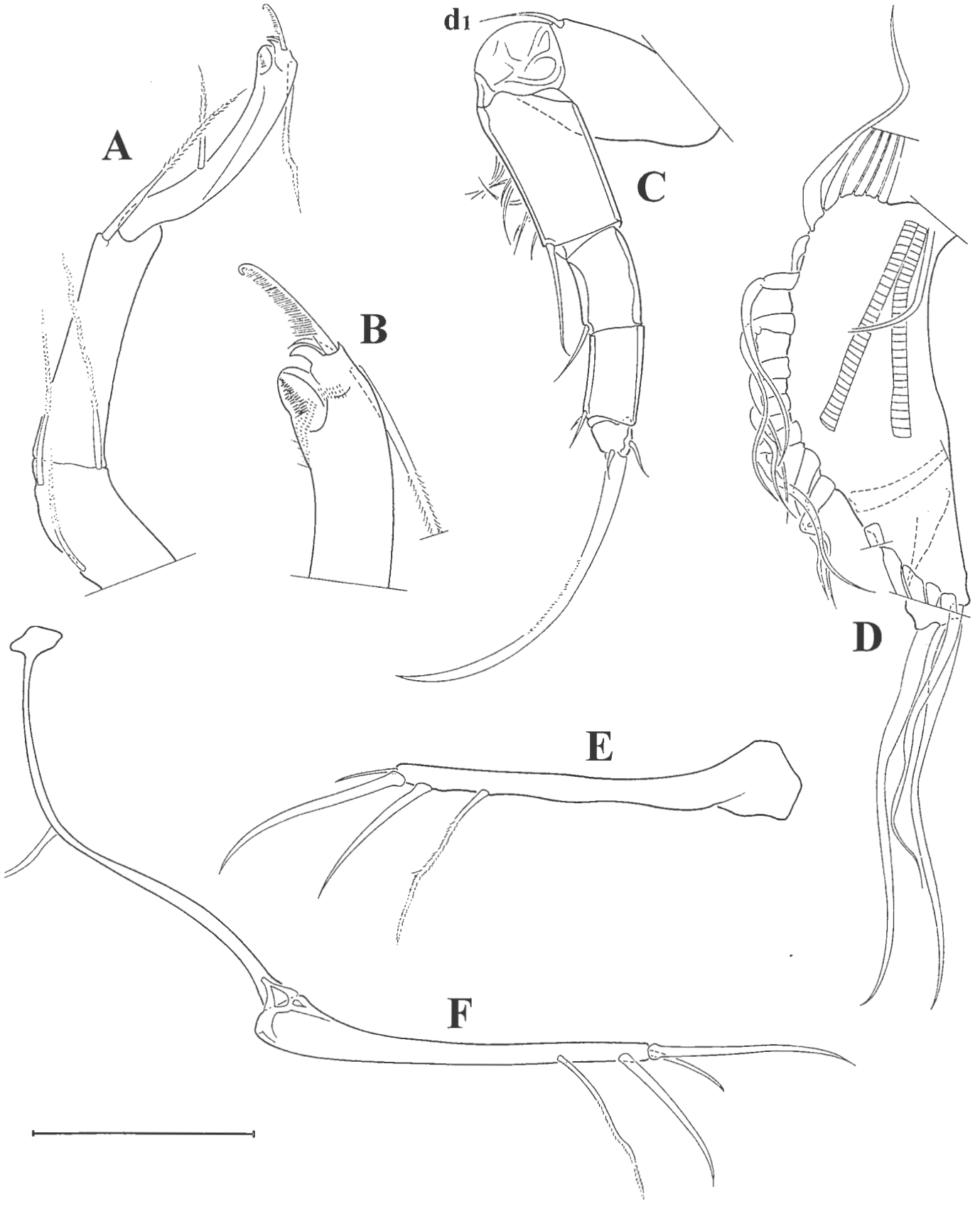

Fig. 4. *Hemicypris mizunoi* OKUBO, 1990. A. T3 (O.C. 3012), B. Terminal part of T3 (O.C. 3012), C. T2 (O.C. 3012), D. Respiratory plate of Mx1 (O.C. 3012), E. Furca (O.C. 3012), F. Furca and furcal attachment (O.C. 3012). Scale bar: 125 μm for A, C, E-F; 50 μm for B; 100 μm for D.