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Cancrocaeca xenomorpha, new genus and species, a blind troglobitic freshwater hymenosomatid (Crustacea: Decapoda: Brachyura) from Sulawesi, Indonesia.

by

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CANCROCAECA XENOMORPHA, NEW GENUS AND SPECIES, A BLIND TROGLOBITIC FRESHWATER HYMENOSOMATID (CRUSTACEA: DECAPODA: BRACHYURA) FROM SULAWESI, INDONESIA

Peter K. L. Ng

ABSTRACT. - A new genus and species of blind troglobitic freshwater hymenosomatid crab, *Cancrocaeca xenomorpha*, new genus, new species, is described from a cave in Maros, Sulawesi. This is the first cave-dwelling as well as the first blind hymenosomatid known; possessing all the characters (pale coloration, blindness, long legs) associated with troglobitic crabs. The ocular structures of *Cancrocaeca* are completely absent; and the orbits have degenerated into very shallow depressions. This is the most extreme case of ocular degeneration known for any brachyuran crab. The eggs are few and relatively large which suggest semi- or completely abbreviated larval development.

INTRODUCTION

During the 1989 expedition to Sulawesi (Celebes) by the French Association Pyrénéene de Spéléologie, various brachyuran crabs were collected from caves. As in earlier expeditions, the material was kindly referred to the author for study (see Ng, 1988a). While most of the recent material were mainly epigeal species (*Parathelphusa*), one male specimen proved to be a very unusual hymenosomatid. Not only was this the first record of a freshwater hymenosomatid from caves, the specimen also proved to be a true troglobite (obligate cave dweller), with pale colouration and being completely blind (see Holthuis, 1986; Ng & Goh, 1987; Guinot, 1988). Unlike other blind cave crabs of the families Potamidae, Pseudothelphusidae, Grapsidae and "Goneplacidae" (see Holthuis, 1979, 1986; Guinot, 1988a; Ng & Goh, 1987); the cornea, eye stalks and orbits of the Sulawesi specimen are not merely reduced but have degenerated completely, with no trace of these structures been present. A subsequent expedition in 1990 by the same speleological team managed to collect more specimens, including females.

The Sulawesi hymenosomatid specimens are here recognised as belonging to a new genus and species, *Cancrocaeca xenomorpha*, new genus, new species. The description and discussion of the affinities of *Cancrocaeca xenomorpha* form the basis of this present paper.

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MATERIALS AND METHODS

The abbreviations G1 and G2 are used for the male first and second pleopods respectively. Descriptive terms used here essentially follow those used by Lucas (1980) and Ng (1988b). Measurements of the carapace, in millimetres, are of the width and length respectively. The telson is regarded as one of the abdominal segments here for purposes of discussion.

The male gonopods were cleared by heating in 10% potassium hydroxide solution for five to 10 minutes. They were stained with 10% chlorazol black to highlight the features. One paratype male (including its left G1) was prepared for scanning electron microscopy (SEM) after drawings were made.

Specimens are deposited in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore, and the Muséum Nationale d'Histoire Naturelle (MNHN), Paris, France.

SYSTEMATICS

Hymenosomatidae MacLeay, 1838

Cancrocaeca, new genus

Type-species: *Cancrocaeca xenomorpha*, new species

Diagnosis. - Rostrum absent; lateral margins confluent with frontal and posterior ones, lateral spines absent. No trace of eyes; two oval shallow depressions below front may represent remnants of orbits. Antennal fossae broad, approximately rectangular, almost horizontal in position, shallow, not deeply excavated, fossae separated by distinct blunt, laterally flattened tooth. Posterior margin of epistome cristate, median lobe broad, truncate. Third maxillipeds not meeting medially, about half of mouth field exposed; merus almost twice length of ischium along outer lateral edge; exopod longer than and reaching upper outer edge of merus, with distinct flagellum; palp 3-segmented, longer than merus. Ambulatory legs very long, length of second leg 3.7 times carapace width; dactylus with terminal hook and no ventral teeth. Male abdomen with 6 articulating segments, without intercalating plates between fifth and sixth segments; female abdomen 6-segmented, dome-shaped. G1 stout, twisted at base, distal part with three main processes, one of which is covered with small spines and armed with large pectinate projection.

Etymology. - The name *Cancrocaeca* is derived from the Latin "Cancer" for crab, and "caecus" for blind. The gender is feminine.

Remarks. - This taxon is so unusual that it does not appear to have affinities with the seven known true freshwater hymenosomatid species or any other known genus (see Holthuis, 1968; Lucas, 1980). Certainly, no hymenosomatid has been reported from caves and all other known taxa have well developed eyes (see Holthuis, 1986; Guinot, 1988a). Guinot & Geoffroy (1987: 20) indicated that cavernicolous hymenosomatids might be expected to be discovered in the future as some species have been reported from very high altitudes in Papua New Guinea (see Holthuis, 1968, 1982).

Only two other monotypic genera lack rostra - *Hymenicoides* Kemp, 1917 (type species *Hymenicoides carteri* Kemp, 1917, northeast India) and *Halicarcinides* Lucas, 1980 (type *Halicarcinus nuytsi* Hale, 1927, southeast Australia); both being brackish water or intertidal taxa. Both genera, however, are very different in carapace, abdominal and gonopod features (see Lucas, 1980 for details).

Perhaps the genus most likely to be allied to *Cancrocaeca* is *Amarinus* Lucas, 1980, which contains seven species, four of which are wholly freshwater in habit. All the male and female abdominal segments in members of *Amarinus*, as in *Cancrocaeca*, are freely articulating. All *Amarinus* species, like *Cancrocaeca*, also possess well formed brood cavities.

The striking G1 of *C. xenomorpha* closely resembles that of the Australian euryhaline species, *A. laevis* (Targioni-Tozetti, 1877), which has been described and figured in detail by Lucas (1980). The distal part of the G1 in both species is complex, possessing several well defined lobes or processes. The form of these lobes, however, is different. Moreover, the G1 of *C. xenomorpha* is distinctly twisted at the basal part whereas in *A. laevis*, it is much straighter.

Cancrocaeca, however, is clearly distinct from *Amarinus*, viz. the complete absence of eyes or orbits; complete absence of a rostrum; rectangular form and approximately horizontal positioning of the antennal fossa; and absence of intercalated plates at the edges of the fifth and sixth male abdominal segments. The generic classification of the Hymenosomatidae is still less than ideal in many respects (see Ng, 1988c). The value of the G1 in defining generic limits has yet to be determined. For example, while the G1s of *Cancrocaeca xenomorpha* and *Amarinus laevis* are generally similar; both differ from those of other *Amarinus* species in the form of the distal parts and tips.

Two other characters, the form of the posterior margin of the epistome and structure of the G2, may prove useful in hymenosomatid classification. These, however, have generally been ignored and no broad comparisons are possible. In *Cancrocaeca*, the posterior margin of the epistome has a broad truncate median lobe without a median cleft. In the few species for which this character has been figured (e.g. see Holthuis, 1968 for *A. angelicus* and *A. pilosus*), the median lobe is approximately triangular and appears bifurcated as a result of the deep clefting. The G2 is generally not figured or described.

The degree of ocular degeneration far in *Cancrocaeca* is more extreme than for any known brachyuran crab. The loss of eyes in crabs has been discussed by Guinot (1988a, b, 1989, 1990); and she draws interesting parallels between troglobitic and deep-sea crabs. A third group, not previously discussed, which has many species having reduced eyes or cornea are the luteophilous crabs, i.e. those inhabiting soft sublittoral mud (see Ng, 1987). Taxa like *Caecopilumnus* Borradaile, 1903 are probably blind, with a very reduced cornea and only a very small amount of pigment (see Borradaile, 1903).

In freshwater crabs, the most extreme cases known are in *Cerberusa caeca* Holthuis, 1979 (Potamidae) from Borneo, *Typhlopseudothelphusa juberthiei* Delamare Debouteville, 1976 (Pseudothelphusidae) and *Rodriguezia mensabak* (Cottarelli & Argano, 1977) (Trichodactylidae) from Central America, and *Chaceus caecus* Rodriguez & Bosque, 1990 (Pseudothelphusidae) from South America (see Holthuis, 1979, 1986; Guinot, 1988a; Rodriguez & Bosque, 1990). In these species, the corneas are absent and the eyestalks have degenerated into small

stumps. The unfilled orbits remain visible and well formed. In other true troglobites, the corneas have simply lost all pigmentation, with the eyestalks at very stages of degeneration, e.g. *Trogloplax joliveti* Guinot, 1986 (Trogloplacidae) and *Holthuisana alba* Holthuis, 1980 (Sundathelphusidae) (see Guinot, 1986, 1987, 1988a).

In deep-sea crabs, the genus *Austinograea* Hessler and Martin, 1989 (Bythograeidae) shows the most drastic condition of eye degeneration. In the type species, *A. williamsi* Hessler & Martin, 1989, the eyes bear no cornea or pigment, the eyestalk having degenerated so much that it is no longer moveable and is fused to the surrounding orbital region (Hessler & Martin, 1989). A second species described by Guinot (1990), *A. alayseae*, had the same features. Until the present discovery of *Cancrocaeca*, the ocular degeneration of *Austinograea* is the most severe known for any brachyuran crab.

Stebbing (1923), in describing a new dromiid species, *Cryptodromia oktahedros* from Durban (Natal, South Africa), noted that for this species, "The eyes I have been unable to distinguish" (p. 4). He however did not elaborate on this most peculiar feature. His figures of *C. oktahedros* (his Pl. 12) are very sketchy and do not show the orbits clearly. The species was again only dealt with briefly (without mention of the blind feature) in Barnard's (1950) monograph of the South African crabs. The whereabouts of the only known specimen, a female, is not known, and whether the lack of eyes in this species is natural or due to damage cannot be ascertained (C. L. McLay, pers. comm.).

Cancrocaeca xenomorpha, new species

(Figs. 1-7)

Materials examined. - Holotype - male (4.7 by 4.1 mm) (ZRC 1990.11971) Lubang Batu Neraka, Kappang, Maros, Sulawesi (Celebes), Indonesia, leg. P. Leclerc, 4.viii.1990.

Paratypes. - 1 male (4.6 by 3.9 mm) (MNHN-B 24450); 1 female (ovigerous with ca. 30 eggs) (6.2 by 5.6 mm) (ZRC 1990.11972); 1 female (ovigerous with 23 eggs) (5.7 by 4.9 mm) (ZRC 1990.11973); 1 young female (5.3 by 4.5 mm) (MNHN-B 24450), same data as holotype. — 1 male (4.0 by 3.6 mm) (ZRC 1990.484), Gua Tanette, Kappang, Maros, Sulawesi (Celebes), Indonesia, leg. P. Leclerc, 18.vii.1989.

Description. - Male holotype. - Carapace rounded, slightly broader than long, dorsal surface smooth. Cervical, thoracic and gastrocardiac grooves deep, very distinct; cervical groove long, converging towards frontal region; thoracic diverging towards but not reaching edge of posterolateral margin. Gastric region strongly raised; anterior part of cardiac region raised, posterior part distinctly depressed. Rostrum not discernible; edges of frontal, anterolateral, midlateral and posterolateral margins not clearly demarcated, being almost confluent with each other. Frontal and anterolateral margins cristate, lined with numerous short upcurved hairs. No trace of eye or eyestalks; two oval shallow depressions below front may represent vestigial orbits. Epistome broad, well developed, sloping gradually into buccal cavity. Branchial regions laterally swollen; Milne Edwards openings at base of chelipeds. Antennal fossae almost rectangular, not demarcated by distinct ridges, upper external angle of each fossa with small but distinct rounded tubercle; fossae almost horizontal in position, not excavated, well developed antennae not retractable; very distinct short laterally flattened spine between two antennae. Base of antennules at lower external edge of antennular fossae, basal segment fused

with carapace. Epistome about one third width of carapace; posterior margin cristate, with broad, truncate median lobe without any median cleft, lateral margins gently concave.

Ischium of third maxilliped without sulcus, merus almost twice length of ischium along outer lateral edge; inner lateral margins not meeting when closed; both maxillipeds concealing about half of mouth field; palp formed by carpus, propodus and dactylus longer than merus. Exopod longer than and reaching upper outer edge of merus, with blunt subdistal tooth on inner margin; flagellum well developed, basal segment with 4 setose aesthetascs and one short simple subterminal seta.

Chelipeds equal, surfaces smooth, edges lined with numerous simple hairs and short hooked hairs. Ischio-basis fused, immovable, elongate, basis still discernible but short. Merus with short submedian dorsal tooth; carpus smooth. Fingers slightly longer than palm; slightly flattened, cutting edges with numerous blunt teeth, tips distinctly hooked and curved inwards.

Ambulatory legs very long, second pair longest, 3.7 times width of carapace. Ischio-basis elongate, fused, but suture still distinct. Dorsal and ventral edges lined with numerous simple hairs and shorter hooked hairs. Tip of dactylus corneous, hooked, distal margins without any ventral teeth on any leg.

Abdomen 6-segmented, segment 6 (telson) widest, outer edge strongly convex, all intersegmental sutures distinct, articulating; segment 1 reaching to coxae of last ambulatory legs. Gonopore sternal, adjacent (but not in contact) to last ambulatory coxa.

G1 stout, appears twisted inwards; distal two thirds straight, inner margin lined with numerous long hairs distal part very complex, with 3 pronounced processes; surfaces of median process covered with small spines, with large, strong pectinate projection at edge. Groove for G2 pronounced, opening between 3 processes. G2 subequal to half length of G1, twisted at base, distal two thirds straight, cup-like structure well developed, distal part dilated to form flap, not elongated.

Male paratypes. - Larger than holotype male but agree in most major aspects. The G1 of the smallest paratype male is generally similar to that of the holotype except that the broader lateral lobes have a slightly different form. The differences do not appear to be significant.

Female paratypes. - Non-sexual features essentially similar to that of males. Abdomen 6-segmented, broad, covering entire sternum, reaching to base of legs, dome-shaped, forming pronounced brood cavity; sutures between segments distinct; segments 1-3 articulating, segments 3-5 with very limited movement; segment 5 and 6 articulating; segment 6 strongly convex on outer margin. Four pairs of biramous setose pleopods; appressed against inner surfaces of abdomen; exopod two segmented; first pair with long terminal 9-10 setae on second segment; endopod 1-segmented, about 0.7 times length of exopod, with numerous scattered long hairs on surfaces. Eggs, when present, large, evenly rounded, diameter ca. 0.6 mm; kept in centre of abdominal concavity. Female gonopores very large, elevated; sternal in position; diameter of each between 0.15 to 0.25 times width of sternum; outer lateral margin almost straight, inner lateral margin strongly convex.

Etymology. - The specific name is derived from the Greek "xenos" for strange and "morphos" for morphology; alluding to the unusual features of the crab.

Remarks. - The present discovery of *Cancrocaeca xenomorpha* is the first record of a freshwater hymenosomatid from Sulawesi. Previously, seven true freshwater hymenosomatid species have been reported (see Holthuis, 1968; Lucas, 1980; Abele, 1972) -

Elamenopsis kempi (Chopra & Das, 1930) - Iraq (introduced to Panama)
Elamenopsis introversa (Kemp, 1917) - China
Elamenopsis inermis (Takeda & Miyake, 1971) - Palau Islands
Amarinus pilosus (A. Milne Edwards, 1973) - New Caledonia
Amarinus lacustris (Chilton, 1882) - Australia
Amarinus angelicus (Holthuis, 1968) - Papua-New Guinea
Amarinus wolterecki (Balss, 1934) - Philippines

An eighth undescribed freshwater species (an *Elamenopsis*) has been collected from water hyacinths (*Eichhornia crassipes*) in Thailand (Ng and Phaibul Naiyanetr, unpublished data). The record of the euryhaline *Hymenosoma orbiculare* Desmarest, 1825 from a south Africa lake (Allanson *et al.*, 1966; Boltt, 1969) needs to be checked to determine if the specimens from marine and freshwater habitats are indeed conspecific.

The holotype male and the two male and three female paratypes of *C. xenomorpha* were collected during two separate trips from two parts of the cave system (Karenta Park). While one paratype male was obtained from Gua Tanette; the holotype and other paratypes were "... sampled from a new cave: Lubang Batu Neraka (Cave of Evil Rocks), the river which passes through probably arising from the upper parts of Gua Tanette Cave's river. Nevertheless, it seems to me that the biotopes of the two stations are somewhat different. The river of the Batu Neraka Cave contains many big pieces of wood and other organic matter. Four of the specimens stood under a single piece of submerged wood along the side of the river, while the fifth was collected under a small rock also along the side of the river. Quite in contrast, there are very few pieces of wood in the Gua Tanette Cave river. Maybe one of the siphons which cut the stream between the two caves (we still have a hiatus of more than 1 km in direct distance between the two caves) acts as a filter. This year, I have spent three days in Gua Tanette, and I have turned over a great many rocks and look at many pools, searching unsuccessfully for the crabs, and I now believe that the specimen found last year [paratype male] had been flooded out of its natural habitat during the rainy season (it had been discovered in a small rockpool about two meters above the main river level) and thus was not in its specific biotope. Another difference stands in the fact that most of the stones are calcified and strongly attached to the the substratum in Gua Tanette river while these are free in Batu Neraka Cave river which allow to the crabs to hide under. Otherwise temperatures are identical: 25.8°C" (adapted from letter by P. Leclerc, 23.viii.1990).

Dr. Leclerc was also kind enough to send me some photographs of the live animals taken by Didier Rigal (Fig. 1). The larger females were a light brown whereas the small female and males white. The brown colour was caused by mud particles attached to the carapace surface and hairs. On cleaning, the larger females were also found to be devoid of pigment.

Little else is known about the biology of *C. xenomorpha*. All three males are fully mature. The smallest female, measuring 5.3 by 4.5 mm, appears to be still immature. Although its abdomen is already quite broad, it is still relatively flat and not distinctly domed as in the two ovigerous females. The pleopods are also less setose.

The small number of large spherical eggs (diameter ca. 0.6 mm) present in ovigerous *Cancrocaeca xenomorpha* also suggests that its larval development is probably also of the abbreviated type. Lucas (1980: 153, 185, 216) noted that hymenosomatid species (*Amarinus lacustris*; *Elamenopsis kempi*; *Elamenopsis bovis* (Barnard, 1946; *Halicarcinus afecundus* Lucas, 1980) with large eggs (about 0.7 mm diameter) and small brood sizes (24 to 35 eggs) had suppressed larval development. Species with large egg numbers and egg sizes of 0.35 mm and less however, had normal larval development (see also Abele, 1972; Lucas, 1971, 1980). Interestingly, two of the species known or believed to have abbreviated development are marine or euryhaline - *H. afecundus* and *E. bovis*. In *E. bovis*, 13 one mm juveniles have been found in the brood cavity (Barnard, 1950). In the freshwater species, *A. lacustris* and *A. angelicus*, Lucas (1971, 1980: 153) recorded no free-swimming larval stages.

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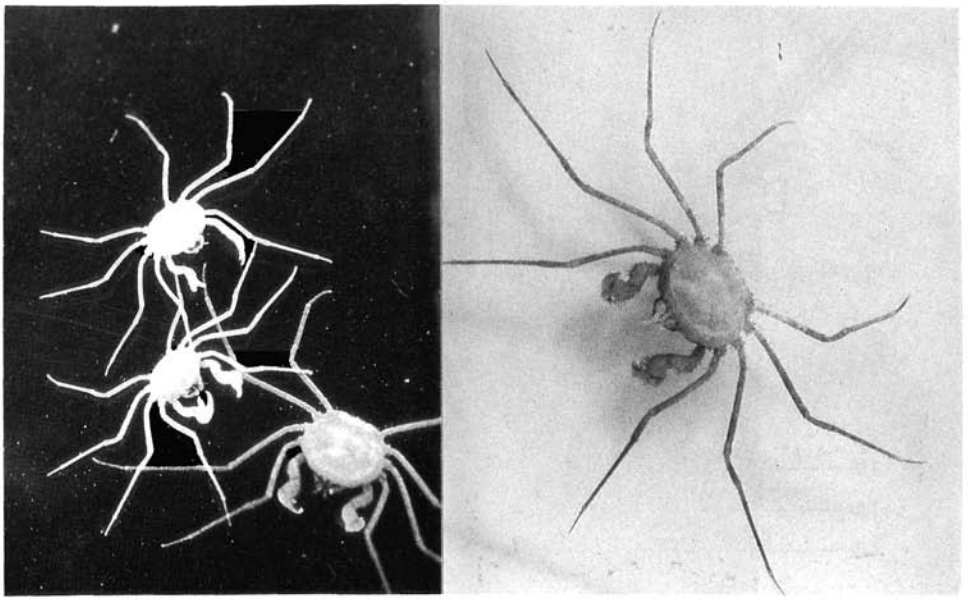

Fig. 1. Live *Cancrocaeca xenomorpha*, new genus, new species, from Lubang Batu Neraka, Kappang, Maros, Sulawesi. The smaller males are white; the larger females are covered with silt and appear brown. The natural colour of both sexes is white. Photographs by Didier Rigal, courtesy of Philippe Leclerc.

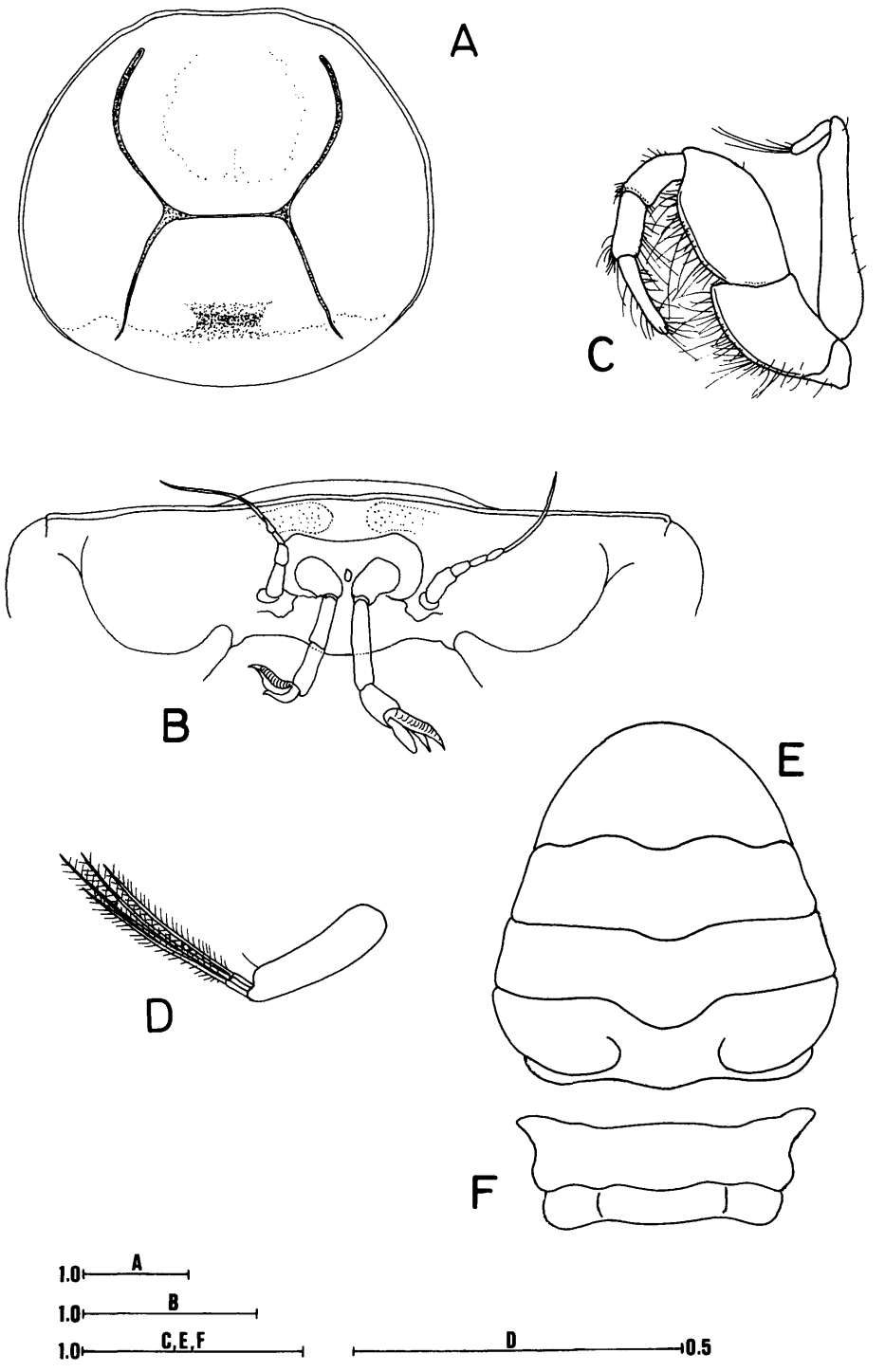

Fig. 2. *Cancrocaeca xenomorpha*, new genus, new species. Paratype male (4.0 by 3.6 mm) (ZRC 1990.484). A, dorsal surface of carapace (denuded); B, frontal view of carapace (denuded); C, left third maxilliped; D, flagellum of left third maxilliped exopod; E, third to sixth male abdominal segments; F, first and second male abdominal segments.

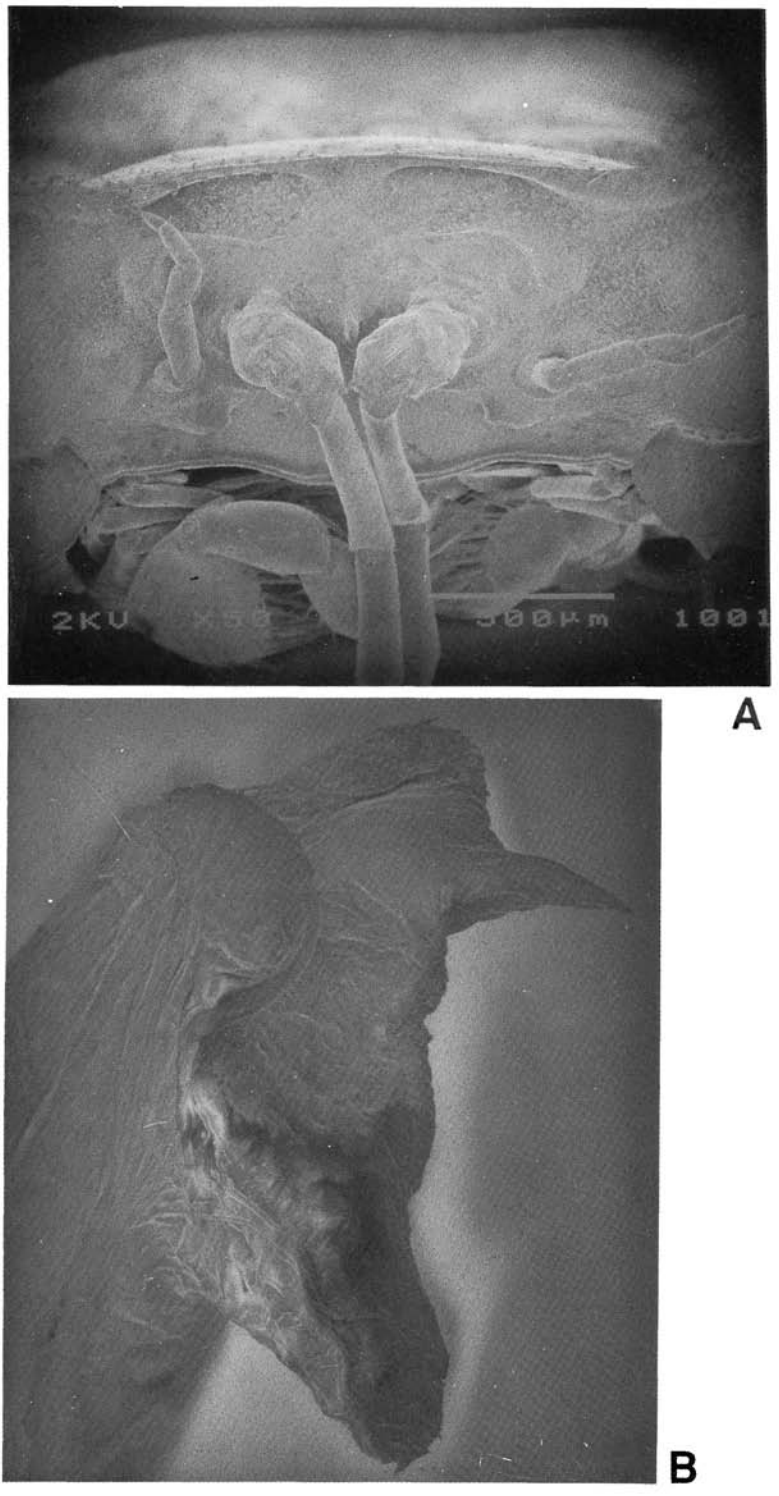

Fig. 3. *Cancrocaeca xenomorpha*, new genus, new species. Paratype male (4.0 by 3.6 mm) (ZRC 1990.484). A, SEM photograph of face. Note complete absence of eyes. B, SEM photograph of distal part of left G1.

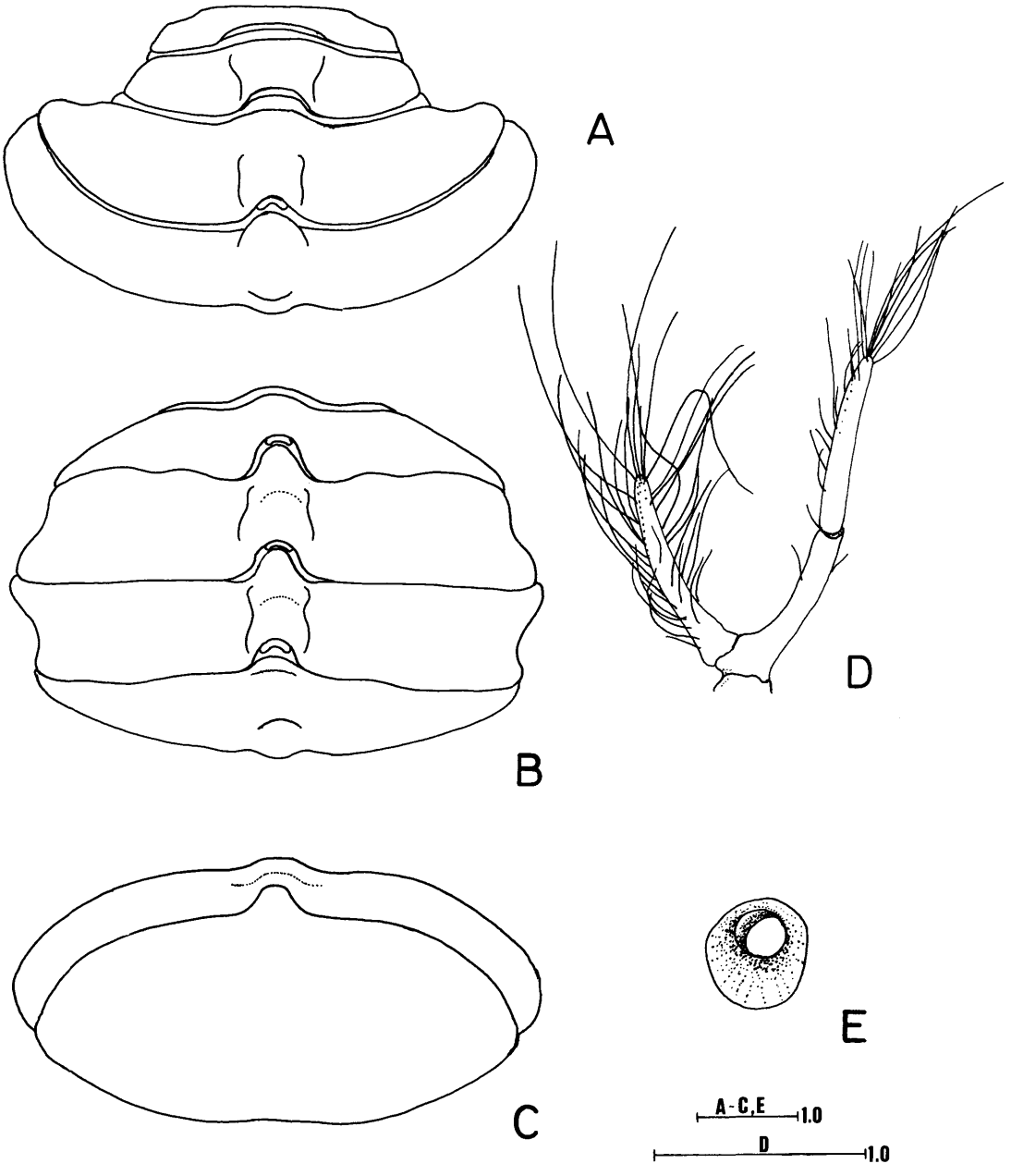

Fig. 4. *Cancrocaeca xenomorpha*, new genus, new species. Paratype female (5.7 by 4.9 mm) (ZRC 1990.11973). A, first to fourth female abdominal segments; B, third to sixth female abdominal segments; C, fifth and sixth female abdominal segments; D, female left first pleopod; E, right female gonopore (convex surface facing centre of sternum).

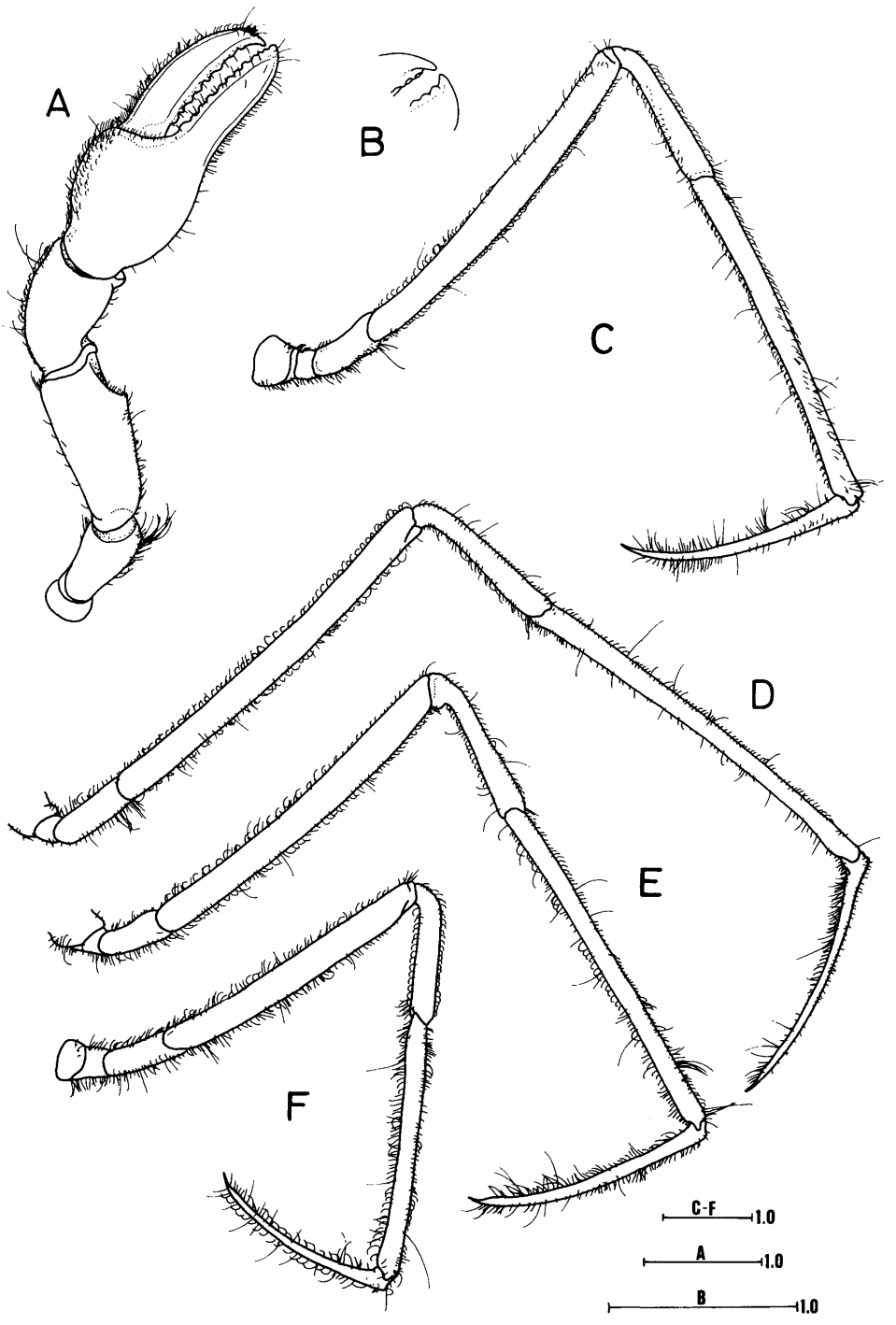

Fig. 5. *Cancrocaeca xenomorpha*, new genus, new species. Paratype male (4.0 by 3.6 mm) (ZRC 1990.484). A, right cheliped; B, tip of cheliped fingers; C-F, first to fourth right ambulatory legs respectively.

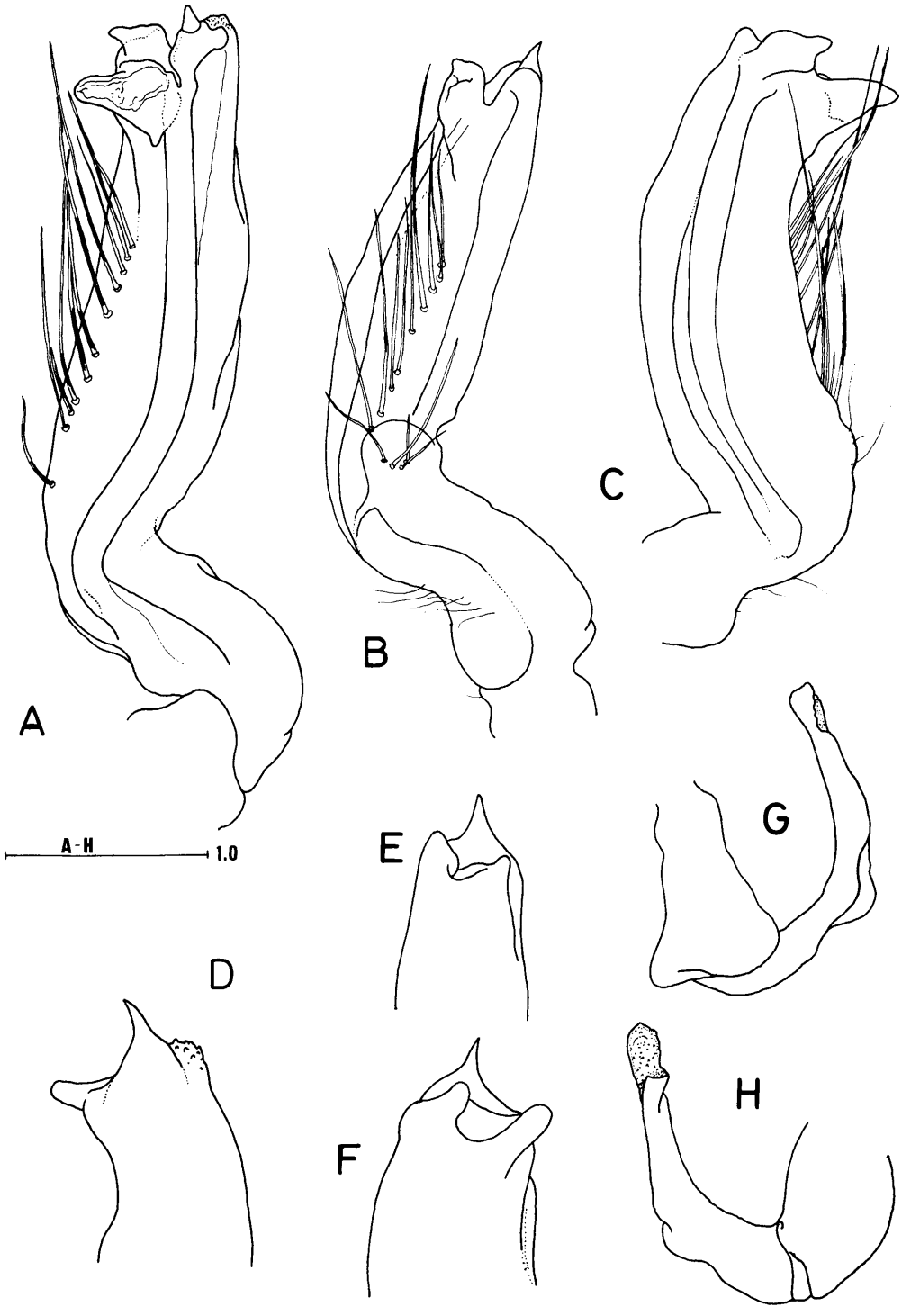

Fig. 6. *Cancrocaeca xenomorpha*, new genus, new species. Paratype male (4.0 by 3.6 mm) (ZRC 1990.484). A-C, Left G1 from various angles (A, ventral view); D-F, distal part of left G1 from various angles; G, H, two views of left G2.

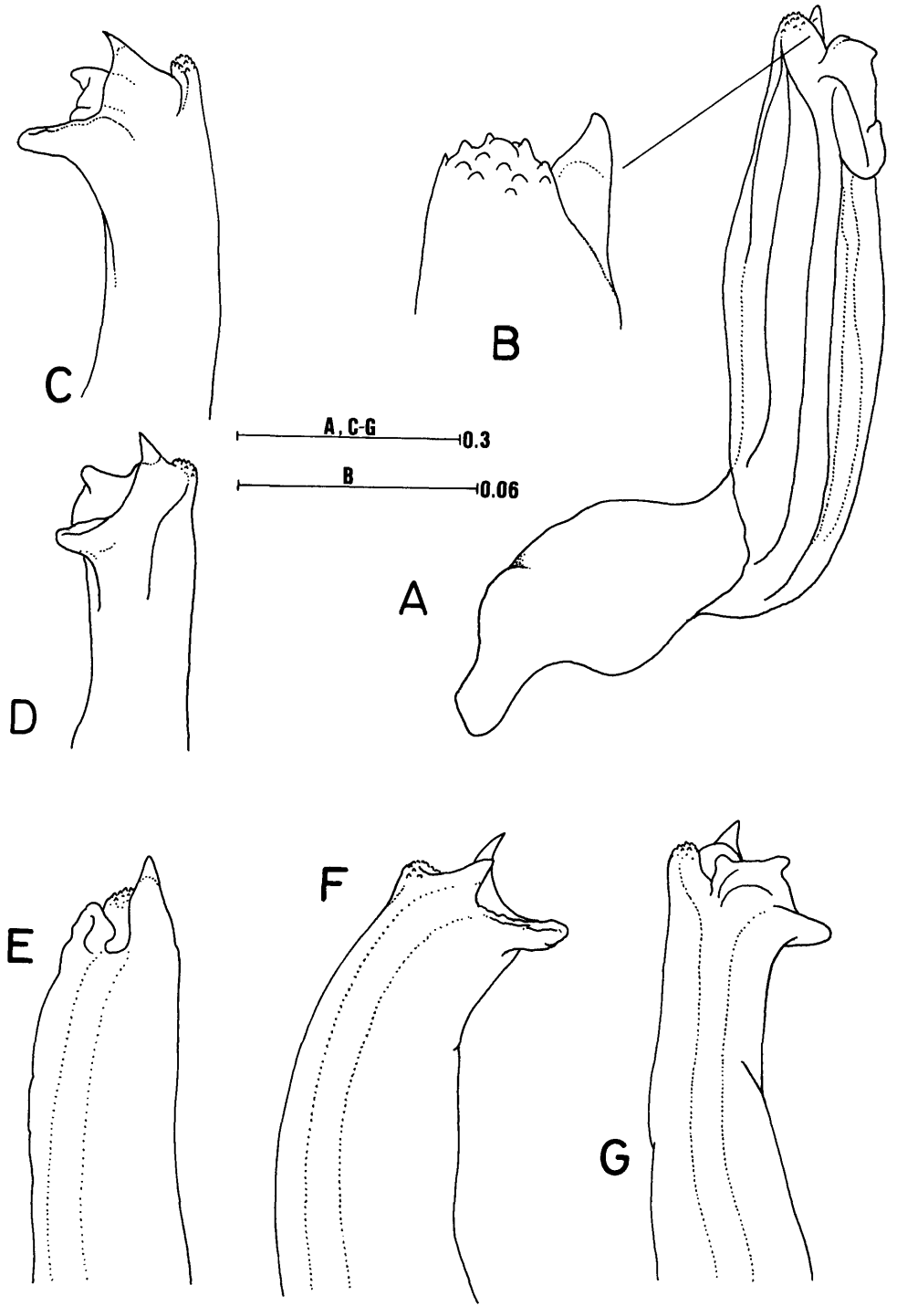

Fig. 7. *Cancrocaeca xenomorpha*, new genus, new species. Holotype male (4.7 by 4.1 mm) (ZRC 1990.11971). A, left G1 (hairs omitted); B, enlarged toothed process of distal part of G1; C-G, distal part of G1 from various angles.

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