

Three further new species of the *Cyprideis* species flock (Crustacea, Ostracoda) from Lake Tanganyika (East Africa)

by Karel WOUTERS & Koen MARTENS

Abstract

Three further new species, belonging to three genera, of ostracods from Lake Tanganyika are described: *Tanganyikacythere rotunda* sp. nov., *Cyprideis romei* sp. nov. and *Romecytheridea concurrens* sp. nov. The species primarily differ in shape of the valves, structure of the hinge and structure of the hemipenis.

The *Cyprideis* species flock of Tanganyika now consists of 23 formally described species (all endemic) in 6 genera (5 endemic). Again, these discoveries constitute mounting evidence that there might be higher numbers of cryptic species in this flock than was previously assumed. The genera *Romecytheridea* (derived) and *Cyprideis* (ancestral) are still the most speciose.

Key words: taxonomy, morphology, ancient lakes, speciation, *Cyprideis*, species flock, Ostracoda.

INTRODUCTION

The concepts of cryptic species and speciation are becoming an important issue in studies on animal and plant biodiversity in general, and in aquatic sciences in particular (GOMEZ *et al.*, 2002, BALIAN *et al.*, 2008). Especially in ancient lakes, traditional Linnean species turn out to be in fact species complexes. These species complexes can be either monophyletic or paraphyletic. In the first type, all cryptic species are in fact sister species and their origin lies in mechanisms of diversification through natural or sexual selection or through neutral processes, but all the time keeping morphological stasis. In most cases, sympatric sister species will become morphologically very different through processes such as reinforcement and character displacement, but in other cases emerging reproductive isolation is not accompanied by obvious morphological diversification. VÄINÖLÄ & KAMALTYNOV (1999)

found that many amphipods in Lake Baikal comprised such cryptic species, and they estimated that the real amphipod diversity in this ancient lake might be close to 1000 species, three times the number of species presently described and recognised.

The second type of cryptic species are those which appear scattered through molecular phylogenies. These species, with high morphological similarity, are no sister species and their similar morphologies have originated through parallel evolution. Such cryptic species have been found in the *Cytherissa* species flock in Lake Baikal (SCHÖN & MARTENS, unpubl.). Here, we report on three cryptic species, most likely belonging to type 1 species complexes, in 3 different genera.

The *Cyprideis* species flock is the most intensively studied ostracod radiation in the ancient Lake Tanganyika (ROME 1962, KISS 1959, WOUTERS 1979, 1988a, b, WOUTERS & MARTENS 1992, 1994, 1999, 2001, 2007, DUCASSE & CARBONEL 1993, 1994). The 3 new species described here bring the total number of formally described species to 23 (all endemic) in 6 genera (5 endemic).

Both past and recent expeditions to Lake Tanganyika have yielded dozens of thus far unexplored samples, from wide ranges of depth and latitude. It is therefore to be expected that further new taxa within the *Cyprideis* species flock will be discovered.

TERMINOLOGY AND ABBREVIATIONS

The morphology of the copulatory organ of *Cyprideis* and related genera is complex and sometimes difficult to interpret with light microscopy. Therefore, some descriptive terms for parts of the hemipenis anatomy, important for taxonomic discrimination, were introduced by WOUTERS & MARTENS (1994, 1999,

2001, 2007). These are again used here. The distal part of the hemipenis consists of two lobes, a larger one, the distal shield (DS) and a smaller one, the distal lobe (DL). The central part of the hemipenis is very complex, and has, among other structures, a ventrally oriented lobe, here called the central lobe (CL), which can be hook-like, club-like or hammer-like in appearance. The fourth structure is the actual copulatory process (cp). As maxillule and mandible appear to have no specific features in the present species flock (see descriptions in WOUTERS & MARTENS, 1994, 1999), they are not described, nor illustrated for the new species described herein. Line drawings of the hinge of the valves, finally, illustrate the negative parts (the sockets) in black, the positive parts (the teeth) in white.

The studied material is deposited in the Ostracod Collection (O.C.) of the Royal Belgian Institute of Natural Sciences, Brussels (Belgium).

TAXONOMIC DESCRIPTIONS

Subclass Ostracoda LATREILLE, 1806

Order Podocopida G.W. MÜLLER, 1894

Suborder Podocopina G.W. MÜLLER, 1894

Infraorder Cytherocopina GRÜNDEL, 1967

Superfamily Cytheroidea BAIRD, 1850

Family Cytherideidae SARS, 1925

Subfamily Cytherideinae SARS, 1925

Tribe Cyprideidini KOLLMANN, 1960

Genus *Tanganyikacythere* DUCASSE & CARBONEL, 1993

Tanganyikacythere rotunda sp. nov.

(Pl. 1, Figs 1-11, Pl. 4, Figs 1-11)

DERIVATION OF NAME

Latin: *rotundus*, *-a*, *-um* = rounded, because of the rounded shape of the valves.

TYPE LOCALITY

Lake Tanganyika, Zambia, Toby's Lodge, Isanga Bay, 8° 37' 30" S, 31° 12' 04" E, depth 1.5 m, sand with stands of *Elodea*, leg.: K. MARTENS, 24 September 2006 (Station Tang. 06/11).

TYPE MATERIAL

Holotype: A male with valves stored dry (O.C. 3031a)

and dissected limbs preserved in a sealed glycerine preparation (O.C. 3031b).

Allotype: A female with valves stored dry (O.C. 3032a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3032b).

Paratypes: six dissected males and four dissected females (O.C. 3033-3042) and one male and one female empty carapace (O.C. 3043 and 3044).

OTHER MATERIAL

A male with valves stored dry (O.C. 3045a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3045b), from Lake Tanganyika, Tanzania, Kipili Islands, Mpimbwe Cape, 7° 08' 15" S, 30° 30' 34" E, depth 2-3 m, coarse gravel; leg.: K. MARTENS, 28 September 2007 (station Tang. 07/08).

A male with valves stored dry (O.C. 3046a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3046b), from Lake Tanganyika, Zambia, Kipembe, 8° 20' 24" S, 30° 30' 25" E, depth 10 m, sand with shell debris amongst rocks; leg.: K. MARTENS, 26 September 2006 (Station Tang. 06/19).

DIAGNOSIS

Large and smooth valves; female left valve with very rounded appearance; hinge completely negative in the left valve and positive in the right one; first right leg in the male only weakly developed as a clasping organ; hemipenis with a narrow, curved triangular distal shield; long and club-shaped central lobe.

DESCRIPTION

Large, thick and heavily calcified carapaces; general appearance rounded and slightly elongate; right valves lower than left ones, especially in females. Valves smooth.

Female valves (Pl. 1, Fig. 2, Pl. 4, Figs 3-4, 6-7): dorsal margin weakly convex, especially in the right valve; anterior and posterior margins broadly rounded, with no marked transition between the dorsal and ventral margins in the left valve; right valve with indistinct posterior cardinal angle; ventral margin nearly straight to weakly convex in the right valve; ventral margin convex in the left valve, giving this valve a very rounded appearance; dorsal and ventral margins nearly parallel in the right valve; carapace in dorsal view with indented anterior and broadly rounded posterior extremity; lateral margins nearly parallel in the middle; largest width situated near the middle of the

carapace.

Male valves (Pl. 1, fig. 1, Pl. 4, Figs 1-2, 5) more elongate, i.e. less high, than females; dorsal margin weakly convex, ventral margin straight; margins distinctly tapering towards the posterior; carapace in dorsal view spindle-shaped, with blunt anterior and posterior extremities; lateral margins convex; largest width situated near the middle.

Inner lamella moderately wide in both sexes, wider in males than in females; numerous straight, sometimes bifurcated marginal pore canals (Pl. 1, Figs 1, 2); very shallow anterior and posterior vestibula in the female; no vestibula seen in the males.

Muscle scar pattern consisting of a row of four rounded adductor scars, a rounded U-shaped frontal scar and a small fulcral point.

Hinge strongly developed (Pl. 1, Figs 1, 2, Pl. 4, Figs 10, 11), tripartite and completely positive in the right valve and negative in the left one; hinge of the right valve consisting of ca 11 anterior elongate and obliquely oriented toothlets, a median element with ca 20 small toothlets and a posterior element with 6 large, obliquely oriented toothlets. The median element is not divided.

Antennule (Pl. 1, Fig. 3) five-segmented; first segment stout, dorso-distally set with a row of fine setules; second segment elongate and hirsute, with long ventro-distal seta, reaching beyond the terminal segment; third and fourth segment short, with three strong claw-like setae and two long curved setae; fourth segment with very short medial seta; fifth segment long and slender with a slender claw, and a short aesthetasc, fused at its base with a curved seta.

Antenna (Pl. 1, Fig. 4) four-segmented with two-segmented exopodite; terminal segment small with two stout claws.

First leg only slightly dimorphic in the male: left leg (Pl. 1, Fig. 5) as in the female, with slender segments and stout terminal claw; right leg (Pl. 1, Fig. 6), only weakly developed as a clasping organ, with wider segments and with longer terminal claw.

Second leg strongly dimorphic in the male: left leg (Pl. 1, Fig. 7) as in the female, elongate and with slender curved terminal claw; right leg (Pl. 1, Fig. 9) strongly reduced and weakly sclerotised.

Third leg (Pl. 1, Fig. 8) not dimorphic, long and hirsute; anterior margin of second segment set with numerous setules; terminal segment with slender and long claw.

Hemipenis (Pl. 1, Fig. 11) with a narrow, curved triangular distal shield (DS); distal lobe (DL) narrow and curved; copulatory process (cp) rounded; central

lobe (CL) long and club-shaped, attached to the hemipenis with a broad rounded proximal part.

Abdominal extremity in the female (Pl. 1, Fig. 10) a wedge-shaped curved process, ventrally set with fine setules; furcae very small.

MEASUREMENTS

Holotype (male)

Left valve: L 0.76 mm, H 0.46 mm

Right valve: L 0.75 mm, H 0.42 mm

Allotype (female)

Left valve: L 0.77 mm, H 0.51 mm

Right valve: L 0.76 mm, H 0.47 mm

Paratypes, males

L 0.71-0.77 mm, H 0.40-0.46 mm

Paratypes, females

L 0.76-0.79 mm, H 0.48-0.53 mm

REMARKS

The present species is a brooder. In four of the dissected females the postero-dorsal pouch contained: 6 eggs and 3 nauplii (O.C. 3039), 4 eggs and 3 nauplii (O.C. 3040), 10 eggs and 5 nauplii (O.C. 3041), 12 eggs and 2 nauplii (O.C. 3042).

OCCURRENCE

Tanganyikacythere rotunda sp. nov. is known from the type locality, namely Toby's Lodge, Isanga Bay (Zambia), 8° 37' 30" S, 31° 12' 04" E, depth 1.5 m, sand with stands of *Elodea*, but also from two other localities, namely the Kipili Islands, Kipembe (Zambia), 8° 20' 24" S, 30° 30' 25" E, depth 10 m, sand with shell debris amongst rocks and Mpimbwe Cape (Tanzania), 7° 08' 15" S, 30° 30' 34" E, depth 2-3 m, coarse gravel.

DISCUSSION

Three other species of the genus *Tanganyikacythere* have thus far been described from Lake Tanganyika: *T. burtonensis* DUCASSE & CARBONEL, 1993, *T. caljoni* WOUTERS & MARTENS, 1994 and *T. fulgens* WOUTERS & MARTENS, 2007. The valves of *T. fulgens* are larger (L 0.75-0.81 mm) than those of *T. rotunda* sp. nov. (L 0.71-0.69 mm) and *T. burtonensis* (L 0.68-0.80 mm). *T. caljoni*, is the smallest species of the four (L 0.62-0.69 mm). In *T. caljoni* the short median element of the hinge is divided in an antero-median element and a postero-median element. The antero-median element consists of a few toothlets in the left valve and sockets in the right

one. In the three other species the median element is undivided, and the hinge is completely positive in the right valve and negative in the left one. *T. burtonensis* has much thicker valves, is more spherical in dorsal view and has more elongate hinge toothlets.

The appendages of *T. burtonensis* and *T. fulgens* and *T. rotunda* sp. nov. show a number of similarities. The right first leg is developed as a clasping organ in both species; the shape of their distal shields is quite similar, although narrower and less curved in *T. rotunda* sp. nov. The central lobe, however, is markedly different: very elongate and club-shaped in *T. rotunda*, hook-like in *T. burtonensis* and suboval and slightly curved in *T. fulgens*. The similarities between the three species most likely reflect their close relationship.

Genus *Cyprideis* JONES, 1857

Cyprideis romei sp. nov.
(Pl. 2, Figs 1-11, Pl. 5, Figs 1-11)

DERIVATION OF NAME

Named after DOM Remacle Joseph ROME (1893-1974), who published an important monograph on Tanganyikan ostracods (1962), and who was mentor of one of us (KW) from 1966 to 1970. After so many years, KW still remembers this fine and erudite gentleman with gratitude and pride.

TYPE LOCALITY

Lake Tanganyika, Zambia, Chimba, W. of Sumbu, 8° 25' 29" S, 30° 27' 27" E, depth 9 m, coarse sand, collected by SCUBA with handnet, leg.: K. MARTENS, 25 September 2006 (Station Tang.06/14).

TYPE MATERIAL

Holotype: a male with valves stored dry (O.C. 3047a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3047b).

Allotype: a female with valves stored dry (O.C. 3048a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3048b).

Paratypes: six dissected males and five dissected females (O.C. 3049-3059) and one female and one male empty carapace (O.C. 3060 and 3061).

DIAGNOSIS

Medium-sized valves, with six lateral nodes; lateral nodes hardly visible in dorsal view; valve surface with a fine reticulation pattern with rounded to polygonal meshes; micro-ornamentation consisting of an indistinct network of inter-tangled needle-like structures; hemipenis with broad, flame-shaped (rounded triangular) distal shield; central lobe large, consisting of a horizontal curved connection to the hemipenis and a perpendicularly downward oriented blunt process.

DESCRIPTION

Medium-sized elongate suboval valves; male valves only little lower than females. Valves in both sexes with six relatively small nodes: a small antero-dorsal one and an elongate medio-dorsal one, with a shallow sulcus between the two nodes; third node small, situated postero-dorsally, fourth node is the subcentral tubercle, fifth node elongate, situated medio-ventrally and finally a postero-ventral node, being larger and more ventrally situated in females than in males. Valve surface covered with a fine reticulation pattern, consisting of polygonal to rounded meshes; muri set with very fine micro-ornamentation, consisting of an indistinct network of inter-tangled needle-like structures.

Female valves (Pl. 2, Fig. 2, Pl. 5, Figs 3, 4): dorsal margin nearly straight, but with postero-dorsal brood pouch slightly protruding over the (straight) hinge line; anterior margin broadly rounded; posterior margin truncate; ventral margin nearly straight; maximum height in the posterior tenth of the valves; carapace (Pl. 5, Fig. 8) in dorsal view wedge-shaped, with blunt anterior and narrowly rounded posterior extremity; lateral margins somewhat irregular; lateral nodes hardly visible in dorsal view.

Male valves (Pl. 2, Fig. 1, Pl. 5, Figs 1, 2) more elongate, i.e. less high than females; dorsal margin nearly straight; ventral margin weakly convex; anterior margin broadly rounded; posterior margin evenly rounded; dorsal and ventral margins tapering towards the posterior. Carapace (Pl. 5, Fig. 9) narrow, with nearly parallel margins; lateral margins somewhat irregular mainly caused by the protruding medio-dorsal node; anterior extremity pointed, posterior extremity triangular.

Anterior inner lamella rather narrow, posterior one narrow; numerous straight, rarely bifurcated marginal pore canals (Pl. 2, Figs 1-2); very shallow anterior vestibula; no posterior vestibula; muscle scar pattern consisting of a row of four oval adductor scars, a

rounded U-shaped frontal scar and a small fulcral point.

Hinge (Pl. 2, Figs 1-2, Pl. 5, Figs 5, 6, 7, 10) consisting of three elements: anterior element, median element (divided in antero-median and postero-median element) and posterior element; right valve hinge: anterior element positive, consisting of 10 small toothlets; antero-median element negative, a crenulated groove; postero-median element, a crenulated bar, with indistinct toothlets; posterior element positive, consisting of ca 6 toothlets. Hinge of the left valve complementary with a comparable number of teeth, toothlets and sockets.

Antennule (Pl. 2, Fig. 3) five-segmented; first segment stout; second segment elongate, with long ventro-distal seta, reaching to the tip of the terminal aesthesc; third and fourth segments short, with three relatively short and stout claws and two curved setae; fourth segment with short medial seta; fifth segment long and narrow, with long and slender curved seta, and a long aesthesc, fused at its base with a long and slender, nearly straight seta of the same length.

Antenna (Pl. 2, Fig. 4) four-segmented with two-segmented exopodite; third segment with one long and one short antero-median seta, and two short claw-like setae and a long and slender curved seta; distal claw stout; terminal segment very small with two large claws.

First leg dimorphic in the male: left leg (Pl. 2, Fig. 6) as in the female, with slender segments; right leg (Pl. 2, Fig. 5) developed as a clasping organ, with a wide terminal segment and a strong claw.

Second leg strongly dimorphic in the male: left leg (Pl. 2, Fig. 8) as in the female, with slender and curved terminal claw; right leg (Pl. 2, Fig. 9) strongly reduced, indistinctly segmented and weakly sclerotised.

Third leg (Pl. 2, Fig. 7) not dimorphic, long and very hirsute; anterior margin of second segment set with bundles of setules; terminal segment with long and narrow claw.

Hemipenis (Pl. 2, Fig. 11) with broad, flame-shaped (rounded triangular) distal shield (DS); distal lobe (DL) narrow and weakly curved; copulatory process (cp) rounded; central lobe (CL) large, consisting of horizontal curved connection to hemipenis and perpendicularly downward oriented blunt process.

Abdominal extremity in the female (Pl. 2, Fig. 10) a slightly curved narrow wedge-shaped pointed process; furcae small.

MEASUREMENTS

Holotype (male)

Left valve: L 0.68 mm, H 0.36 mm

Right valve: L 0.66 mm, H 0.34 mm

Allotype (female)

Left valve: L 0.73 mm, H 0.40 mm

Right valve: L 0.71 mm, H 0.38 mm

Paratypes, males

L 0.65-0.71 mm, H 0.34-0.40 mm

Paratypes, females

L 0.70-0.74 mm, H 0.38-0.41 mm

REMARKS

The present species is a brooder. In three of the dissected females the postero-dorsal pouch contained: 11 eggs and 5 nauplii (O.C. 3055), 8 eggs and 7 nauplii (O.C. 3056), 2 eggs (O.C. 3057).

OCCURRENCE

Cyprideis romei sp. nov. is only known from the type locality, namely Chimba, W. of Sumbu (Zambia), 8° 25' 29" S, 30° 27' 27" E, depth 9 m, coarse sand.

DISCUSSION

Six other species of the genus *Cyprideis* have thus far been described from Lake Tanganyika, namely *C. loricata* WOUTERS & MARTENS, 2001, *C. mastai* WOUTERS & MARTENS, 1994, *C. profunda* WOUTERS & MARTENS, 1999, *C. rumongensis* WOUTERS & MARTENS, 1994, *C. spatula* WOUTERS & MARTENS, 1999 and *C. aciculata* WOUTERS & MARTENS, 2007. Only two of these six species, *C. loricata* and *C. aciculata* have strongly ornamented valves, the others have smooth or more or less pitted valves. *C. loricata* is a larger species (L 0.93-1.01 mm), with heavily calcified valves. *C. aciculata* (L. 0.70-0.80 mm) and *C. romei* sp. nov. (L 0.65-0.74 mm) are much smaller and less calcified. *C. aciculata* and *C. romei* resemble each other closely. *C. aciculata*, however, has less elongated valves (*C. aciculata*: height/length LV male holotype: 0.58; LV female allotype: 0.59 versus *C. romei*: height/length LV male holotype: 0.53; LV female allotype: 0.55). The hinge of *C. aciculata* is much stronger developed, with larger teeth and toothlets. In *C. romei* the lateral nodes are hardly visible in dorsal view, whereas in *C. aciculata* they are very prominent. Furthermore, the micro-ornamentation in *C. aciculata* consists of very fine needle-like spines, whereas in *C.*

romei the micro-ornamentation is an indistinct network of inter-tangled needle-like structures. The most striking difference between *C. aciculata* and *C. romei* sp. nov. is in the morphology of the hemipenis. In *C. romei* the dorsal shield is broad, flame-shaped (rounded triangular), versus narrow and apically truncate in *C. aciculata*. The central lobe in *C. romei* consists of a horizontal curved connection to the hemipenis and a perpendicularly downward oriented blunt process, whereas in *C. aciculata* the central lobe consists of a horizontal straight connection to the hemipenis, a perpendicularly downward oriented hook-like process and a short and blunt upward oriented process.

Genus *Romecytheridea* WOUTERS, 1988

Romecytheridea concurrens sp. nov.
(Plate 3, Figs 1-11, Plate 6, Figs 1-11)

DERIVATION OF NAME

Latin: present participle of *concurrere* = to taper; because of the tapering dorsal and ventral margins, especially in the male valves.

TYPE LOCALITY

Lake Tanganyika, Zambia, Kipembe, 8° 20' 24" S, 30° 30' 25" E, depth 10 m, sand with shell debris amongst rocks, collected by SCUBA with hand net, leg.: K. MARTENS, 26 September 2006 (Station Tang. 06/19).

TYPE MATERIAL

Holotype: a male with valves stored dry (O.C. 3062a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3062b).

Allotype: a female with valves stored dry (O.C. 3063a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 3063b).

Paratypes: one dissected male and two dissected females (O.C. 3064-3066).

DIAGNOSIS

Valves medium-sized, regularly reticulated; dorsal and ventral margins tapering, especially in the males; anterior margin very broadly rounded; nodes absent; eye tubercle weakly developed; strongly developed selvage; third and fourth segments of male right first leg fused, with vague remnants of a suture; distal shield

of hemipenis (DS) wide, with convex posterior margin and anterior margin with convexity in the middle and sharp indentation distally; central lobe consisting of a horizontal straight connection to the hemipenis, and a downward oriented long and pointed hook-like process and an upward oriented semicircular widening.

DESCRIPTION

Small, elongate valves with tapering dorsal and ventral margins; strong anterior marginal rim; valve surface reticulated; zone behind anterior rim smooth; valves without nodes or ridges; surface reticulated; reticulation absent in a wide zone behind the anterior marginal rim; muri set with delicate micro-ornamentation (Pl. 6, Fig. 1) consisting of minute pustules. Inner lamella in both sexes wide, with numerous mostly branched marginal pore canals (Pl. 3, Figs 1-2); anterior vestibulum shallow, posterior vestibulum small and very shallow; strongly developed selvage in both sexes. Hinge tripartite and consisting of anterior, median and posterior elements; median element bipartite. Hinge of right valve (Pl. 3, Fig. 1): anterior element with 10-11 small toothlets; antero-median element with numerous (ca 10) very small sockets; postero-median element a bar-like crenulated structure with a large number of small toothlets; posterior element consisting of about six small toothlets. Left valve hinge complementary (Pl. 3, Fig. 2)

Male valves (Pl. 3, Fig. 1, Pl. 6, Fig. 1-2) with nearly straight dorsal margin; anterior broadly rounded; posterior margin narrowly rounded, with a blunt triangular appearance; ventral margin straight, with antero-ventral concavity; dorsal and ventral margins distinctly tapering; male carapace (Pl. 6, fig. 9) in dorsal view very narrow, with nearly parallel lateral margins, with truncate anterior extremity, marked by the presence of a marginal rim; posterior extremity truncate; lateral margins convex in the middle.

Female valves (Pl. 3, Fig. 2, Pl. 6, Figs 3-4) large and higher than males; dorsal and ventral margins tapering, but less so than in males; anterior margin long and broadly rounded, posterior margin truncate; micro-ornamentation as in males; female carapace (Pl. 6, Fig. 8) with anterior extremity truncate by the presence of a marginal rim; posterior extremity truncate; lateral margins nearly straight with a convexity in the middle; maximum height posteriorly situated at 4/5 of the length.

Antennule (Pl. 3, Fig. 3) five-segmented; first segment short and broad; second segment about twice as long as wide; third segment very short, fourth segment slightly more elongated; fifth segment twice as long as

wide; antero-distal seta of second segment reaching beyond the tip of the fifth segment; third segment with a distal claw, and fourth segment with one stout and one long and slender curved seta; medial seta of fourth segment moderately long; fifth segment slender with a rather thin claw-like seta, and a long aesthetasc, fused at the base with a curved long seta.

Antenna (Pl. 3, Fig. 4) four-segmented, with three-segmented exopodite; third segment with three medially inserted relatively short posterior setae; narrow distal posterior claw-like seta and one long and one short curved anterior seta; claws of terminal segment moderately long.

First leg only slightly dimorphic in the male: left leg (Pl. 3, Fig. 6) slender, as in the female; right leg (Pl. 3, Fig. 5), developed as a clasping apparatus; with broad third and fourth segments; third and fourth segments fused, with an incomplete and indistinct suture in the middle; distal claw not centrally, but ventrally inserted.

Second leg dimorphic in the male; right leg (Pl. 3, Fig. 9) strongly reduced and weakly sclerotised; left leg (Pl. 3, Fig. 8) as in the female, slender, with short terminal claw.

Third leg (Pl. 3, Fig. 7) not dimorphic, but long and slender, hairy, with bundles of setulae, and with long and slender weakly curved terminal claw.

Hemipenis (Pl. 3, Fig. 11): distal shield (DS) broad, slightly curved and overall triangular in shape, with convex posterior margin and anterior margin with convexity in the middle and sharp indentation distally; distal lobe (DL) shorter than distal shield, slightly curved, with parallel margins; copulatory process (cp) large and rounded lobe; central lobe (CL) somewhat S-shaped, consisting of a horizontal straight connection to the hemipenis, and a downward oriented long and pointed hook-like process and an upward oriented semicircular widening.

Female abdominal extremity (Pl. 3, Fig. 10) a long and narrow, curved process with irregular lateral margins; genital lobe with rounded anterior and triangular posterior margin (as in other *Romecytheridea*-species); furcae small.

MEASUREMENTS

Holotype (male):

Left valve: L 0.60 mm, H 0.31 mm

Right valve: L 0.59 mm H 0.29 mm

Allotype (female):

Left valve: L 0.70 mm, H 0.22 mm

Right valve: L 0.68 mm H 0.34 mm

Paratypes: L 0.59-0.68 mm, H 0.28-0.36 mm

REMARKS

The present species is a brooder. In the three dissected females the postero-dorsal pouch contained: 14 nauplii (O.C. 3063), 9 eggs and 3 nauplii (O.C. 3065), 6 eggs and 6 nauplii (O.C. 3066).

OCCURRENCE

Romecytheridea concurrens sp. nov. is only known from the type locality namely Kipembe (Zambia), 8° 20' 24" S, 30° 30' 25" E, depth 10 m, sand with shell debris amongst rocks.

DISCUSSION

Six other species of the genus *Romecytheridea* have thus far been described from Lake Tanganyika, namely *R. ampla* WOUTERS, 1988, *R. bacata* WOUTERS & MARTENS, 2007, *R. belone*, WOUTERS & MARTENS, 2001, *R. longior* WOUTERS & MARTENS, 1999, *R. plegma* WOUTERS & MARTENS, 2001 and *R. tenuisculpta* (ROME, 1962). *R. longior* lacks the anterior marginal rim, present in *R. concurrens*, and in the other known *Romecytheridea*-species. *R. belone* differs by its strongly branched anterior marginal pore canals, and by the very different morphology of the hemipenis, with a distally pointed triangular distal shield and a large club-shaped central lobe. *R. concurrens* sp. nov. is characterised by the fusion of the third and fourth segments of the male right first leg. This feature is only seen in two other *Romecytheridea* species, namely *R. plegma* and *R. tenuisculpta*. The valves of both species show an overall similarity with *R. concurrens*. The latter differs, however, by the strongly tapering dorsal and ventral margins, especially in the males. Furthermore, the central lobe of the hemipenis of *R. plegma* is spoon-shaped. From all *Romecytheridea*-species, *R. concurrens* sp. nov. is most closely related to *R. tenuisculpta*. Both species have large valves, with a strongly developed selvage. The valves of *R. tenuisculpta* have nearly parallel dorsal and ventral margins, a stronger developed eye tubercle, and a medium-sized postero-ventral node. The central lobe of *R. tenuisculpta* is very long, narrow, and distally strongly curved and needle-like (based on ROME, 1962, and on specimens in the collections of the RBINS, O.C. 3067-3070). In *R. concurrens* this lobe consists of a horizontal straight connection to the hemipenis, and a downward oriented long and pointed hook-like process and an upward oriented semicircular widening.

Table 1. List of the actually known species of the *Cyprideis* species flock of Lake Tanganyika (in alphabetical order).

Genus *Archeocyprideis* DUCASSE & CARBONEL, 1994

1. *A. tuberculata* DUCASSE & CARBONEL, 1994

Genus *Cyprideis* JONES, 1857

2. *C. aciculata* WOUTERS & MARTENS, 2007
3. *C. loricata* WOUTERS & MARTENS, 2001
4. *C. mastai* WOUTERS & MARTENS, 1994
5. *C. profunda* WOUTERS & MARTENS, 1999
6. *C. romei* sp. nov. (this paper)
7. *C. rumongensis* WOUTERS & MARTENS, 1994
8. *C. spatula* WOUTERS & MARTENS, 1999

Genus *Kavalacythereis* WOUTERS, 1979

9. *K. braconensis* WOUTERS, 1979

Genus *Mesocyprideis* WOUTERS & MARTENS, 1992

10. *M. irsacae* (KISS, 1959)
11. *M. nitida* WOUTERS & MARTENS, 2001
12. *M. pila* WOUTERS & MARTENS, 1999

Genus *Romecytheridea* WOUTERS, 1988

13. *R. ampla* WOUTERS, 1988
14. *R. bacata* WOUTERS & MARTENS, 2007
15. *R. belone* WOUTERS & MARTENS, 2001
16. *R. concurrens* sp. nov. (this paper)
17. *R. longior* WOUTERS & MARTENS, 1999
18. *R. plegma* WOUTERS & MARTENS, 2001
19. *R. tenuisculpta* (ROME, 1962)

Genus *Tanganyikacythere* DUCASSE & CARBONEL, 1993

20. *T. burtonensis* DUCASSE & CARBONEL, 1993
21. *T. caljoni* WOUTERS & MARTENS, 1994
22. *T. fulgens* WOUTERS & MARTENS, 2007
23. *T. rotunda* sp. nov. (this paper)

GENERAL DISCUSSION

The present material was collected in the framework of the ESF Eurocore-project MOLARCH, which searches for fingerprints of past climatic events (i.e. lake level fluctuations) in extant populations of several model groups of ancient lake organisms, including the *Cyprideis* species flock. Both intra- and interspecific molecular phylogenies of the *Cyprideis* species flock will be built, and these trees will falsify the hypothesis that the present cryptic species belong to monophyletic clusters (Type 1).

The cryptic species from the same genus seem to differ mainly in the shape and structure of the male copulatory appendages. Other, but less pronounced, differences are in the shape and number of segments of sex-specific limbs (first right limbs in males, developed into clasping organs), the shape of the valves and the development of the hinge.

The first two sets of characters, hemipenes and first limbs, are all used by males to stimulate females into accepting them as mates for reproduction (DANIELOPOL *et al.*, 1990). The relative morphological stasis in other morphological modules of these species complexes seems to indicate that especially sexual, and not natural, selection has been the driving force in this cryptic speciation.

At present, the Tanganyikan *Cyprideis* species flock comprises 23 species in 6 genera (see Table 1)

ACKNOWLEDGEMENTS

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Karel WOUTERS

Department of Invertebrates
Royal Belgian Institute of Natural Sciences
Vautierstraat 29
B-1000 Brussels, Belgium
(Karel.Wouters@naturalsciences.be)

Koen MARTENS

Freshwater Biology
Royal Belgian Institute of Natural Sciences
Vautierstraat 29
B-1000 Brussels, Belgium
(Koen.Martens@naturalsciences.be)

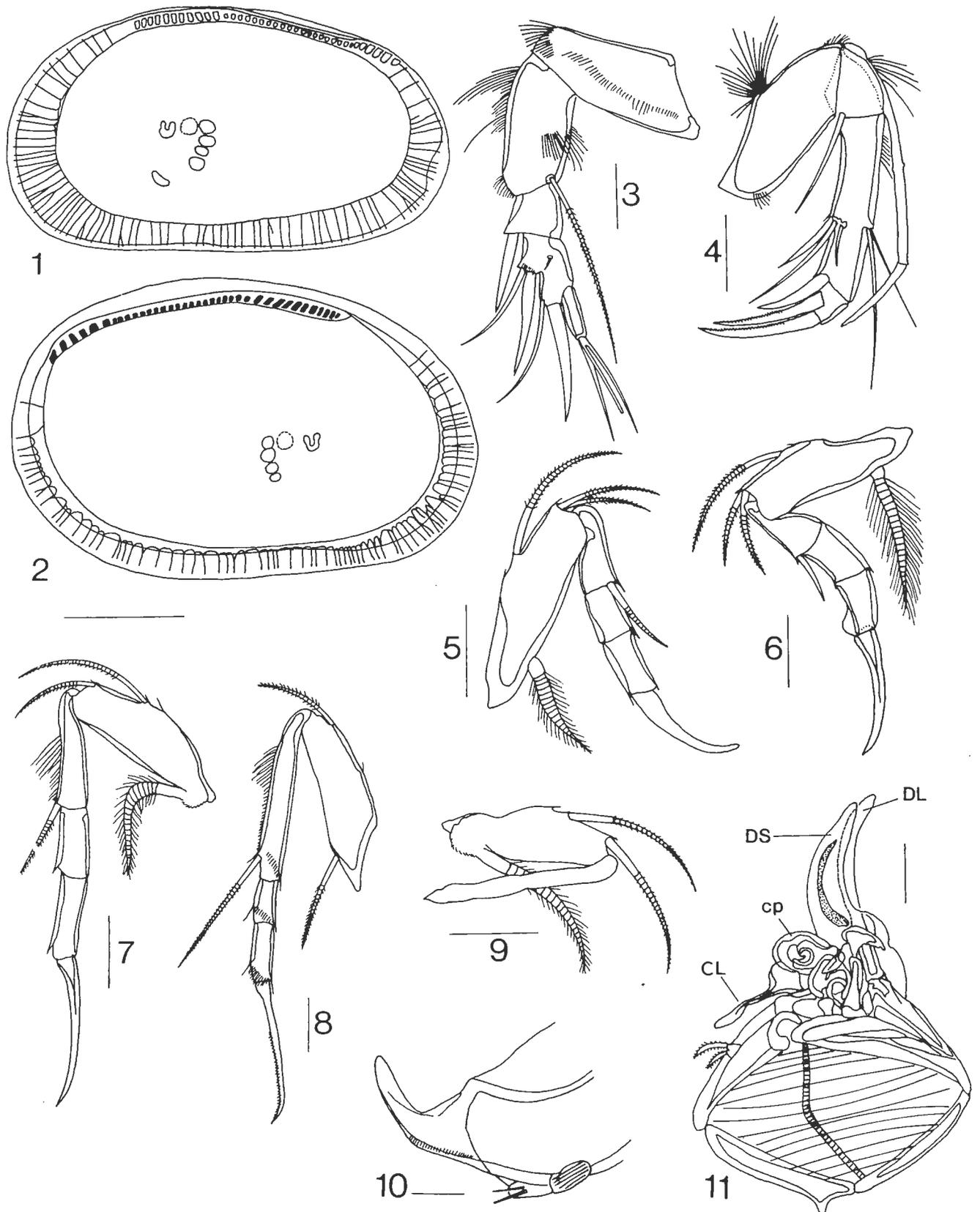


Plate 1. *Tanganyikacythere rotunda* sp. nov., Lake Tanganyika, Zambia, Toby's Lodge, Isanga Bay. Fig. 1. Right valve, male, holotype, internal view (O.C. 3031). Fig. 2. Left valve, female, allotype, internal view (O.C. 3032). Fig. 3. Antennule, male, holotype. Fig. 4. Antenna, male, holotype. Fig. 5. Left first leg, male, holotype. Fig. 6. Right first leg, male, holotype. Fig. 7. Left second leg, male, holotype. Fig. 8. Third leg, male, holotype. Fig. 9. Second right leg, male, holotype. Fig. 10. Abdominal extremity, female, paratype (O.C. 3042). Fig. 11. Hemipenis, holotype. Scales: Figs 1-2: 200 μ m; Figs 3-11: 50 μ m.

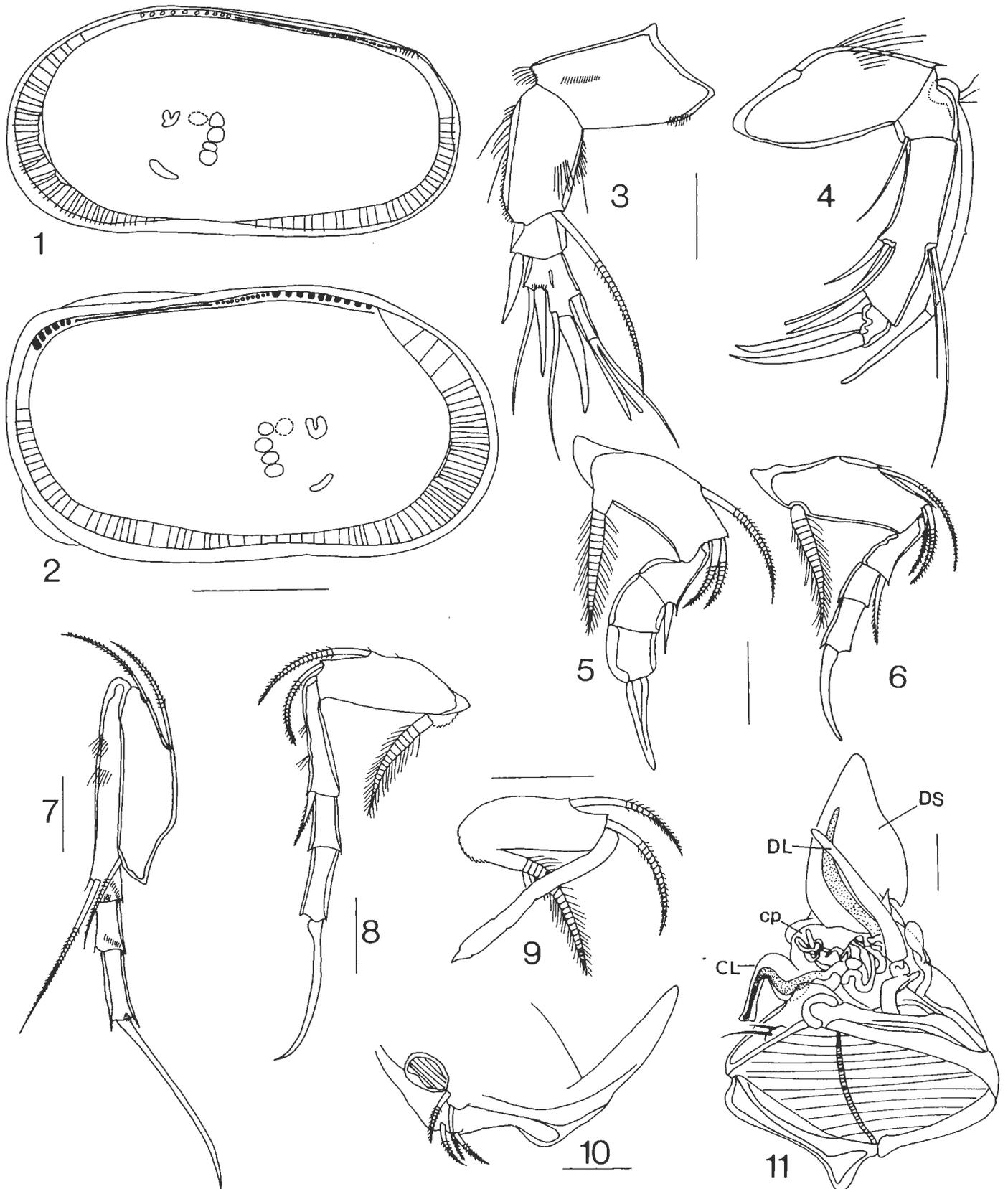


Plate 2. *Cyprideis romei* sp. nov., Lake Tanganyika, Zambia, Chimba. Fig. 1. Right valve, male, holotype, internal view (O.C. 3047). Fig. 2. Left valve, female, allotype, internal view (O.C. 3048). Fig. 3. Antennule, male, holotype. Fig. 4. Antenna, male, holotype. Fig. 5. Right first leg, male, holotype. Fig. 6. Left first leg, male, holotype. Fig. 7. Third leg, male, holotype. Fig. 8. Left second leg, male, holotype. Fig. 9. Right second leg, male, holotype. Fig. 10. Abdominal extremity, female, paratype (O.C. 3056). Fig. 11. Hemipenis, holotype. Scales: Figs 1-2: 200 μ m; Figs 3-11: 50 μ m.

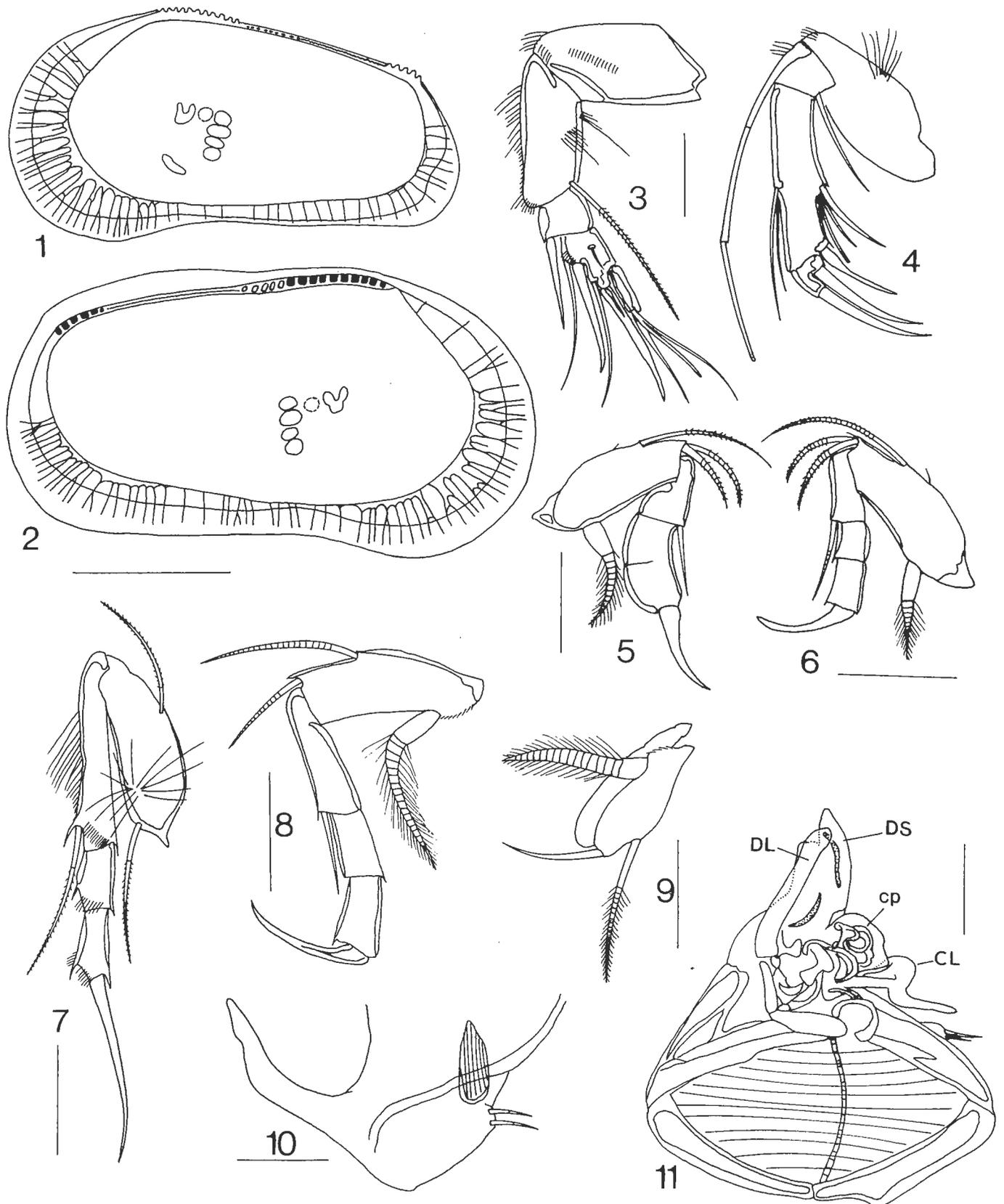


Plate 3. *Romecytheridea concurrens* sp. nov., Lake Tanganyika, Zambia, Kipembe. Fig. 1. Right valve, male, holotype, internal view (O.C. 3062). Fig. 2. Left valve, female, allotype, internal view (O.C. 3063). Fig. 3. Antennule, male, holotype. Fig. 4. Antenna, male, holotype. Fig. 5. Right first leg, male, holotype. Fig. 6. Left first leg, male, holotype. Fig. 7. Third leg, male, holotype. Fig. 8. Left second leg, male, holotype. Fig. 9. Right second leg, male, holotype. Fig. 10. Abdominal extremity, female, allotype. Fig. 11. Hemipenis, holotype. Scales: Figs 1-2: 200 μ m; Figs 3-11: 50 μ m.

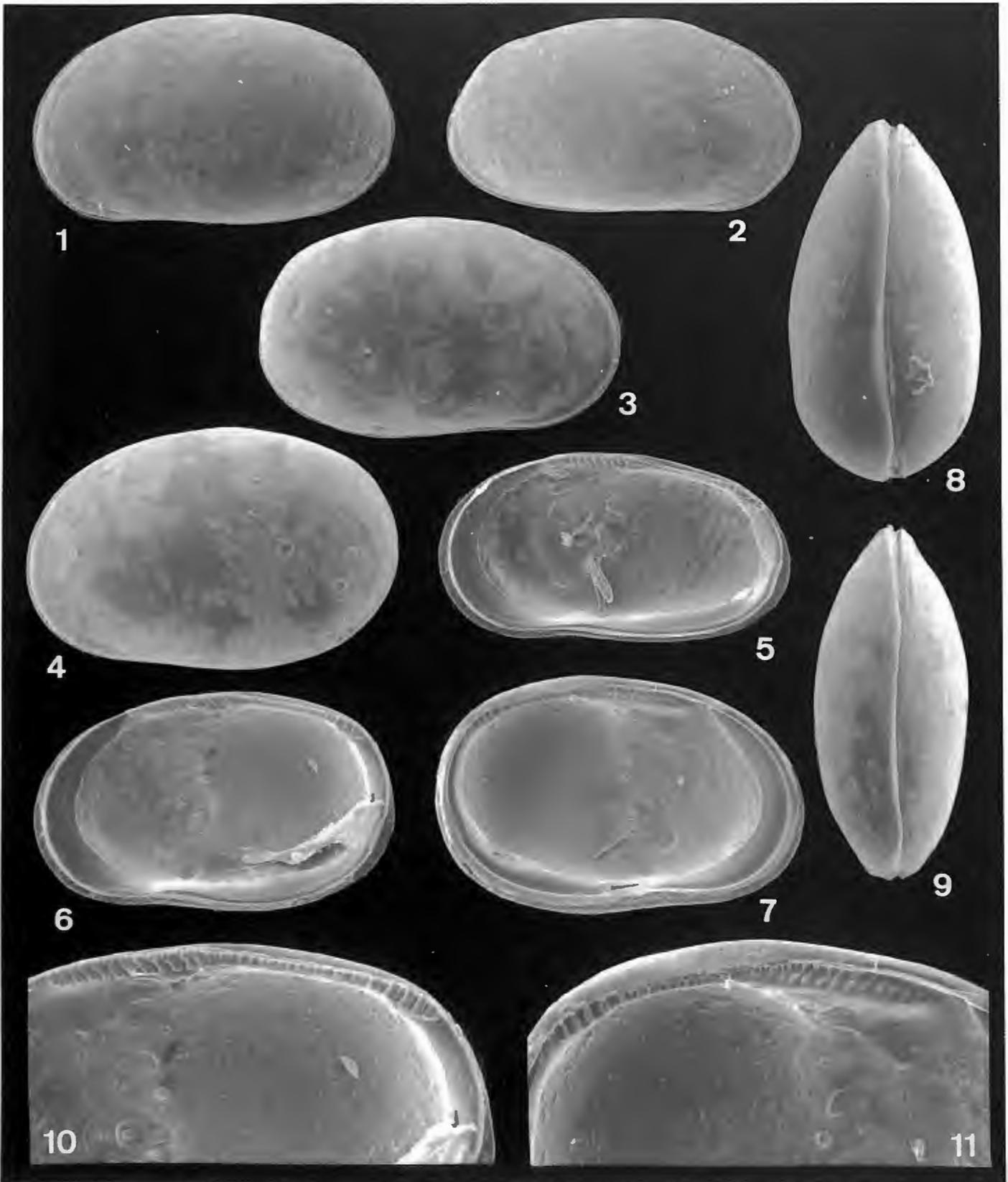


Plate 4. *Tanganyikacythere rotunda* sp. nov., Lake Tanganyika, Zambia, Toby's Lodge, Isanga Bay. Fig. 1. Left valve, male, lateral view, paratype (O.C. 3037). Fig. 2. Right valve, male, lateral view, paratype (O.C. 3037). Fig. 3. Right valve, female, lateral view, paratype (O.C. 3041). Fig. 4. Left valve, female, lateral view, paratype (O.C. 3041). Fig. 5. Right valve, male, internal view, paratype (O.C. 3033). Fig. 6. Right valve, female, internal view, paratype (O.C. 3039). Fig. 7. Left valve, female, internal view, paratype (O.C. 3039). Fig. 8. Carapace, female, dorsal view, paratype (O.C. 3043). Fig. 9. Carapace, male, dorsal view, paratype (O.C. 3044). Fig. 10. Right valve, female, hinge, paratype (O.C. 3039). Fig. 11. Left valve, female, hinge, paratype, (O.C. 3039). Magnifications: Figs 1-9: 80 x; Figs 10-11: 140 x.

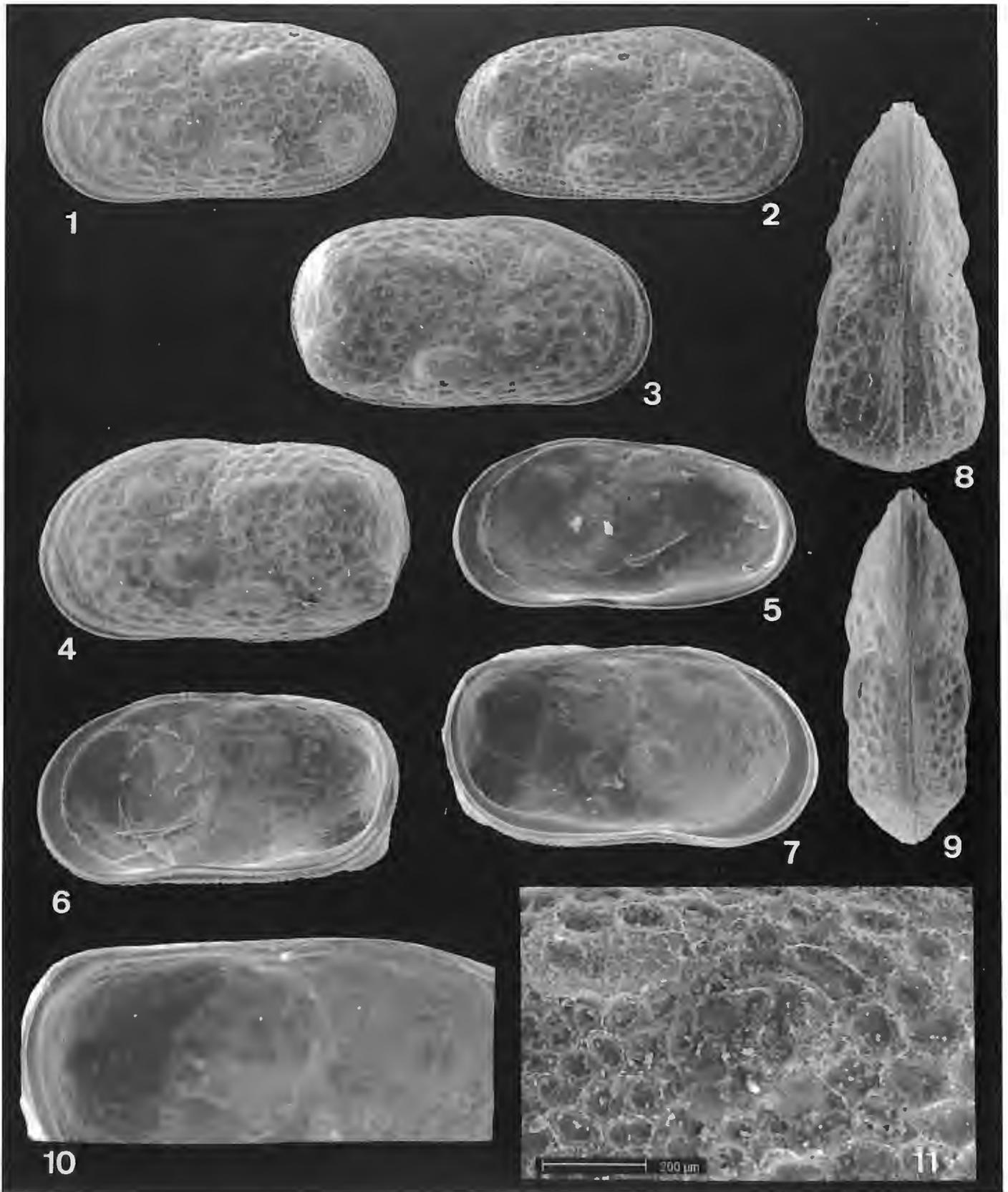


Plate 5. *Cyprideis romei* sp. nov., Lake Tanganyika, Zambia, Chimba. Fig. 1. Left valve, male, lateral view, paratype (O.C. 3052). Right valve, male, lateral view, paratype (O.C. 3052). Fig. 3. Right valve, female, lateral view, paratype (O.C. 3055). Fig. 4. Left valve, female, lateral view, paratype (O.C. 3055). Fig. 5. Right valve, male, internal view, paratype (O.C. 3053). Fig. 6. Right valve, female, internal view, paratype (O.C. 3056). Fig. 7. Left valve, female, internal view, paratype (O.C. 3056). Fig. 8. Carapace, female, dorsal view, paratype (O.C. 3060). Fig. 9. Carapace, male, dorsal view, paratype (O.C. 3061). Fig. 10. Left valve, female, hinge, paratype (O.C. 3056). Fig. 11. Left valve, male, central area, ornamentation (O.C. 3052). Magnifications: Figs 1-9: 140 x; Fig. 10: 130 x.

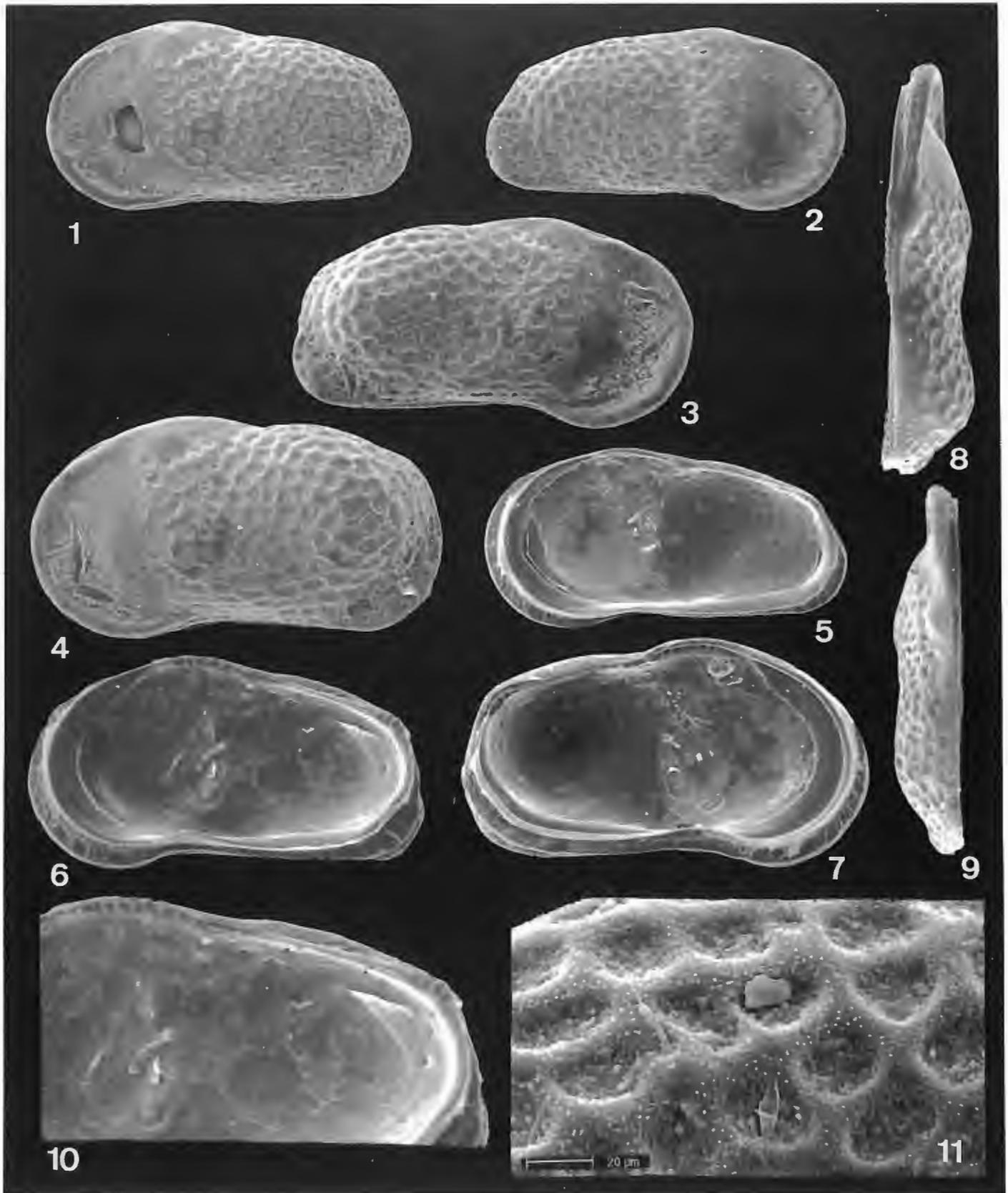


Plate 6. *Romecytheridea concurrens* sp. nov., Lake Tanganyika, Zambia, Kipembe. Fig. 1. Left valve, male, lateral view, paratype (O.C. 3064). Right valve, male, lateral view, holotype (O.C. 3062). Fig. 3. Right valve, female, lateral view, paratype (O.C. 3065). Fig. 4. Left valve, female, lateral view, paratype (O.C. 3065). Fig. 5. Right valve, male, internal view, paratype (O.C. 3064). Fig. 6. Right valve, female, internal view, paratype (O.C. 3066). Fig. 7. Left valve, female, internal view, paratype (O.C. 3066). Fig. 8. Right valve, female, dorsal view, allotype (O.C. 3063). Fig. 9. Left valve, male, dorsal view, holotype (O.C. 3062). Fig. 10. Right valve, female, hinge, paratype (O.C. 3066). Fig. 11. Right valve, female, postero-dorsal area, ornamentation, paratype (O.C. 3065). Magnifications: Figs 1-9: 95 x; Fig. 10: 140 x. Fig. 11: scale 20 µm.