

# Taxonomic Notes on Some Australian Ostracods with Description of New Species

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The following ostracods from Australian inland waters are described: *Limnocythere mowbrayensis* Chapman, 1914, *Limnocythere porphyretica* sp.n., *Zonocyprretta kalimna* gen. et sp.n., *Diacypris spinosa* sp.n., *D. dictyote* sp.n., *D. phoxe* sp.n. The taxonomic position of each of the genera mentioned above is discussed and all the Australian *Diacypris* species are reviewed. Ecological data for some of these species are also provided.

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## 1. Introduction

The state of knowledge of ostracods from inland waters in Australia is still poor compared to what is known of the European, North American and South African faunas. Yet, many of the Australian species already described show the endemicity of this group; this is particularly valid for the salt-water tolerant species grouped in the following genera: *Diacypris* Herbst, 1961, *Mytilocypris* McKenzie, 1966, *Australocypris* De Deckker, 1974, *Trigonocypris* De Deckker, 1976 and *Reticocypris* McKenzie, 1978. The temporary pool fauna, on the other hand, appear to consist of many cosmopolitan species such as *Eucypris virens* (Jurine, 1820), *Sarscypridopsis aculeata* (Costa, 1847), *Heterocypris incongruens* (Ramdohr, 1808) and *Heterocypris salina* (Brady, 1868).

Three new species of *Diacypris* (*D. spinosa*, *D. dictyote* and *D. phoxe*) which occur in saline lakes are described here and all the Australian species grouped within that genus will be reviewed. From temporary pools, two new species are described: *Zonocyprretta kalimna* gen. et sp.n. and *Limnocythere porphyretica* sp.n. For the first time, the soft parts of *Limnocythere mowbrayensis* Chapman, 1914, originally described from Pleistocene sediments, are illustrated. This species, previously known as fossil from Australia and New Zealand, has been found living in lakes in Australia.

All the specimens illustrated are deposited in the Australian Museum, Sydney.

## 2. Systematics

Superfamily CYTHERACEA Baird, 1850

Family LIMNOCYTHERIDAE Klie, 1938

Subfamily LIMNOCYTHERINAE Klie, 1938

*Limnocythere* Brady, 1868

*Limnocythere mowbrayensis* Chapman, 1914 (Figs. 1, 2)

*Limnocythere* (sic) *mowbrayensis* Chapman, 1914, p. 60, pl. 2, figs. 8a-c.

*Limnocythere* (sic) *sicula* Chapman, 1919, p. 29, pl. 4, figs. 10, 11.

*Limnocythere* (sic) *percivali* Brehm, 1939, p. 191, figs. 1a-c.

*Limnocythere* (sic) *mowbrayensis*; Hornibrook, 1955, p. 268, figs. 3, 4, 18, 30.

*Limnocythere mowbrayensis*; McKenzie, 1978, p. 181, figs. 5, 32.

*Lectotype*. National Museum of Victoria, Melbourne.

*Type locality*. Late Pleistocene deposit at Mowbray Swamp, N.E. Tasmania.

*Material examined*. Lectotype, Nat. Mus. Vict.; 20 adult males and 18 adult females, Little Fresh Dip and 12 adult males and 6 adult females, White Lagoon. Many specimens from other localities (see distribution section).

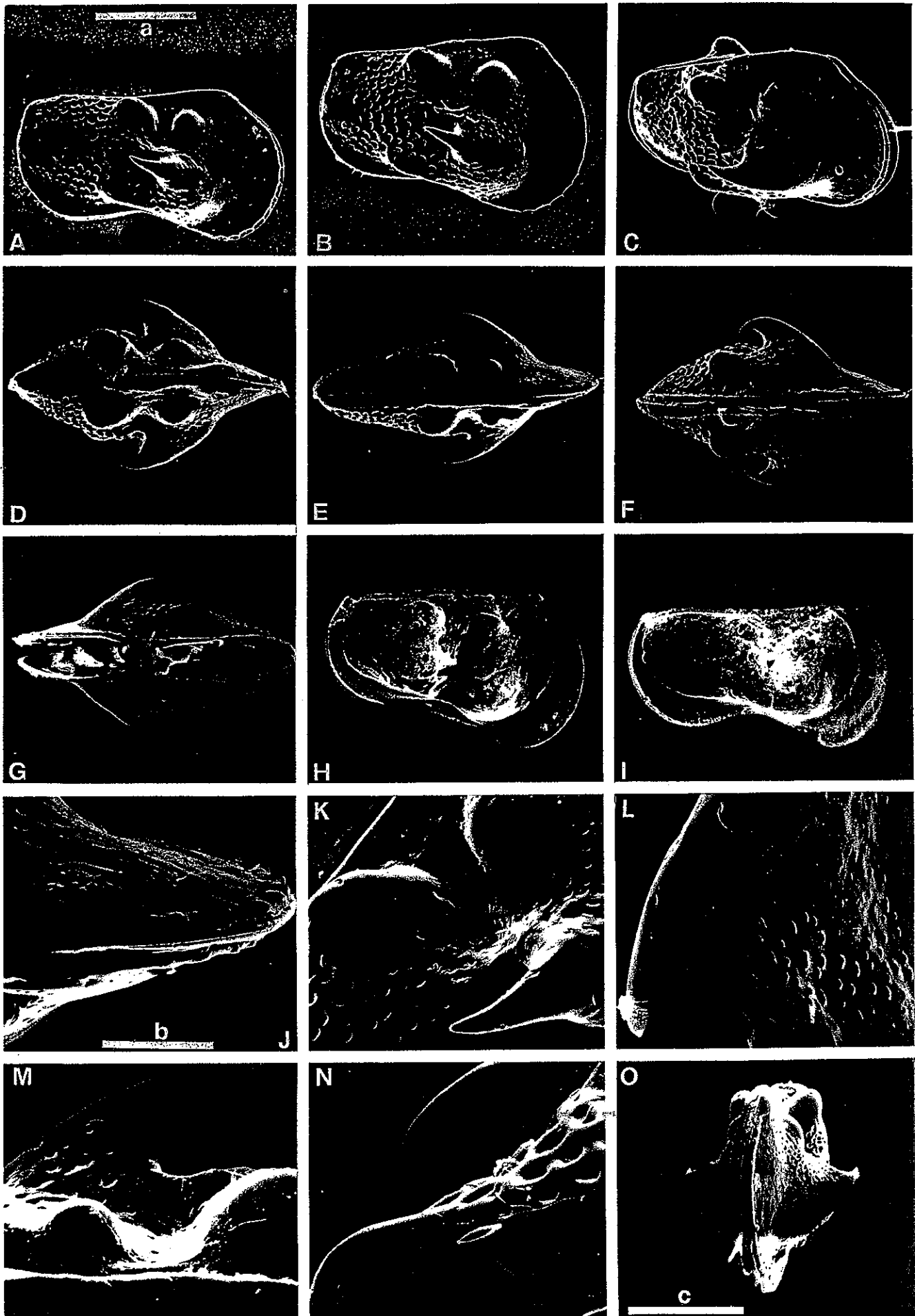
*Diagnosis*. On each adult valve, one sharp and recurved alar projection and two dorsolateral protuberances; anterior protuberance smaller and above base of ala; posterior one at level of tip of ala. Presence of a third protuberance ventrally just behind the ventral area.

*Dimensions*. Greatest length of carapace: ♂ 500-550 µm; ♀ 490-560 µm.

### Description

*Carapace*. Externally: Shell in lateral view rectangular with ventral margin strongly concave with both anterior and posterior ends rounded (Figs. 1H, I). Sexual dimorphism strong: ventrum almost in middle in some ♂ (Fig. 1I) but 2/3 from anterior in ♀ (Fig. 1H); dorsal margin almost straight in ♀ (Fig. 1H) and slightly concave in ♂ (Fig. 1I); height of anterior area compared to posterior greater in ♀ (Figs. 1B, 1H); in dorsal view ♂ (Fig. 1E) more compressed and posterior protuberance more prominent in ♀ (Fig. 1D) so the posteroventral protuberance can be seen in ♂ (Fig. 1E). On each valve presence of one sharp alar projection pointing posteriorly (Figs. 1A-G). Shell almost smooth in anterior area (Fig. 1J) and on most of the alae except near their base (Figs. 1K-M) and on protuberances (Figs. 1K, M, N); otherwise it is coarsely pitted. Setae and normal pores rare on shell but present even on alae (Figs. 1K-N) and protuberances (Figs. 1M, N).

Internally: Lophodont hinge with median element smooth with right valve slightly overlapping; calcified inner lamella broader anteriorly and broadest anteroventrally (Figs. 1H, I); radial pore canals common, single and almost all straight. Central muscle field consisting of a vertical row of 4 scars.



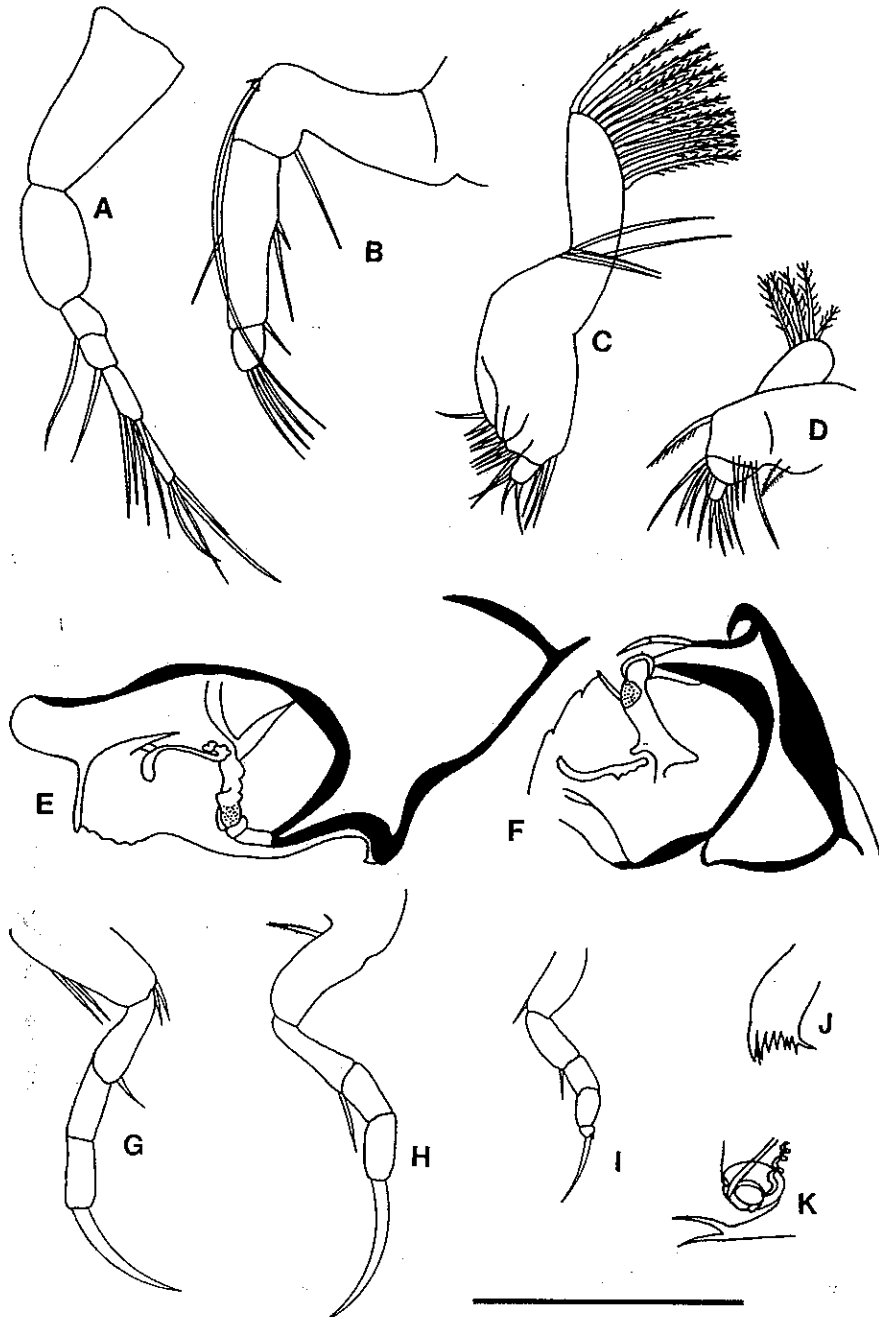


Fig. 2. *Limnocythere mowbrayensis* Chapman, 1914. (A-E, G-J: Little Fresh Dip Lake near Robe, South Australia. F: Six Miles Lagoon, Kangaroo Island, South Australia.) — A, ♂ antennula. — B, ♂ antenna. — C, ♀ maxillula. — D, ♂ mandibular palp. — E, ♂ hemipenis. — F, ♂ hemipenis. — G, ♂ maxilla. — H, ♂ thoracopod I. — I, ♂ thoracopod II. — J, ♂ mandibular coxale. — K, ♀ furca and genital lobe.  
Scale: 100 μm.

**Anatomy.** For details see Figs. 2A-K. Note the different features seen in the hemipenis in folded (Fig. 2F) and unfolded (Fig. 2E) position.

**Distribution and ecology.** Pleistocene: Mowbray Swamp, Tasmania (Chapman 1914; De Deckker in prep.), Boneo Swamp, Victoria (Chapman 1919), Pyramid Valley Swamp, New Zealand (Hornibrook 1955), Pulbeena Swamp, Tasmania: Last Interglacial (De

Deckker unpubl.). The facies in which these specimens have been found are typical of a freshwater swamp except for one subfossil occurrence in the Blue Lake, Mount Gambier, South Australia.

Recent: empty valves: Lake Coolongap, Western Australia (McKenzie 1978) and Lake Ada, Kangaroo Island (=K.I.), South Australia in lake sediments. With soft parts: Six Miles Lagoon, K. I., 9 Jan. 1976, pH: 7.5, 14.1‰ salinity; Little Fresh Dip near Robe, South Australia, 30 May 1978, 10 Dec. 1978, each time 3‰ salinity. In the last three cases, *L. mowbrayensis* was found crawling among filamentous algae. The valves were always white. This species has not been recorded in temporary pools.

Fig. 1. *Limnocythere mowbrayensis* Chapman, 1914. (Little Fresh Dip Lake near Robe, South Australia.) — A, ♂ RV, external lateral view. — B, ♀ RV, same view. — C, ♂, carapace oblique dorsal view. — D, ♀, carapace, dorsal view. — E, ♂, carapace, same view. — F, ♀, carapace, ventral view. — G, ♂, carapace, same view. — H, ♀ LV, internal lateral view. — I, ♂ LV, same view. — J, ♂, detail of E, anterior dorsal view. — K, ♂, detail of A, lateral view. — L, ♂, detail of E, lateral dorsal view. — M, ♂, detail of C, lateral dorsal view. — N, ♂, detail of C, same view. — O, ♀ carapace, oblique antero-dorsal view.

Scale a: 200 μm for A-I; b: 50 μm for J-N; c: 200 μm for O. (RV = right valve; LV = left valve.)

**Remarks.** Hornibrook (1955) synonymized *L. mowbrayensis*, *L. sicula* and *L. percivali* to the prior name *L. mowbrayensis* after examination of New Zealand and Australian Pleistocene material. McKenzie (1978) illustrated one empty valve of *L. mowbrayensis* but did not state whether he had found specimens with soft parts. The present paper contains therefore the first description of the anatomy of the species (Fig. 2). Note that no living specimen has been recorded in New Zealand. It is important to know that the extension of the alar

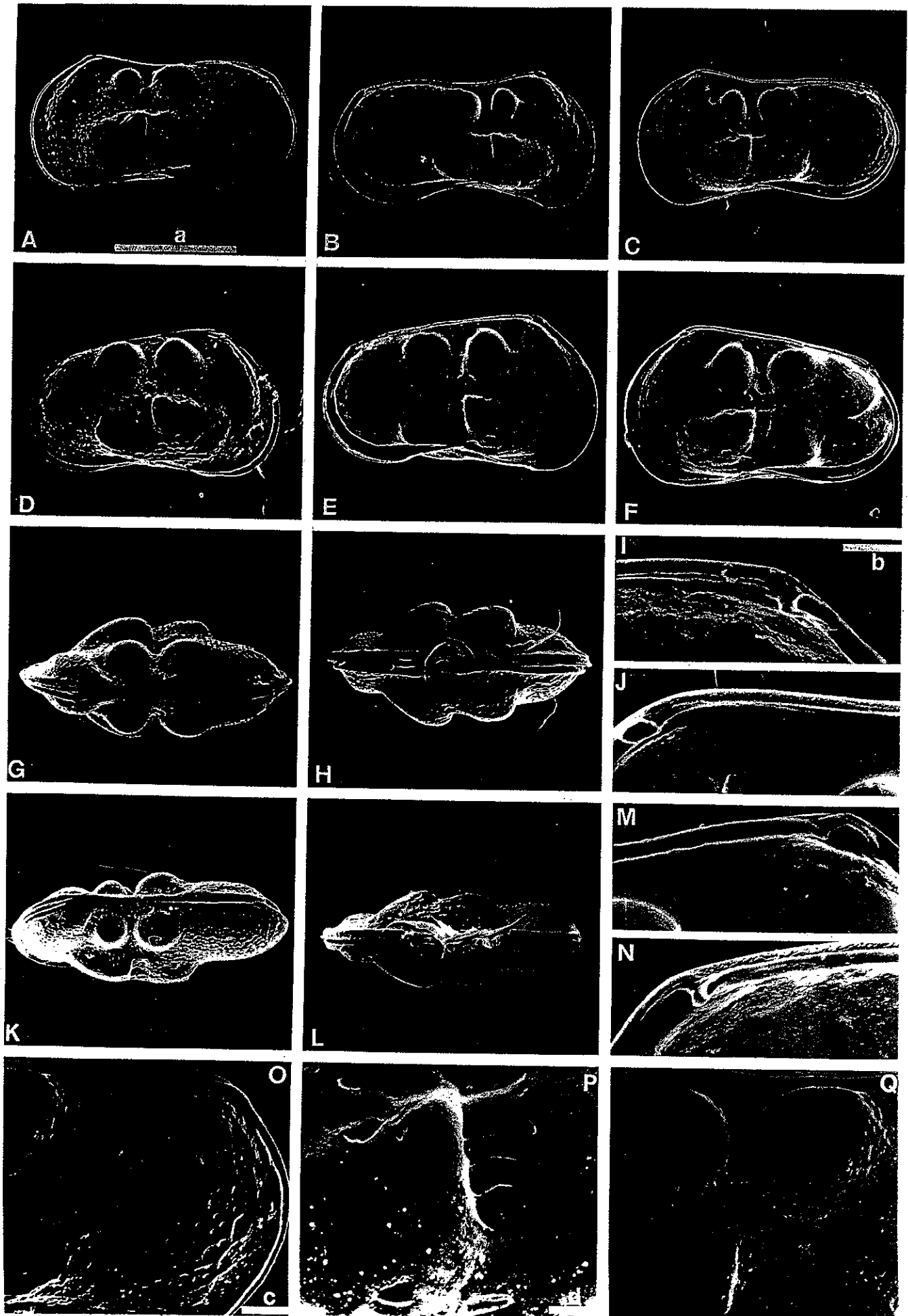




Fig. 3. *Limnocythere porphyretica* sp.n. (Roadside pool, 2.5 km west of Lake Grace Township, Western Australia.) — A, ♂ paratype carapace, external view showing LV. — B, ♂ holotype, LV, internal lateral view. — C, ♂ holotype, RV, internal lateral view. — D, ♀ paratype carapace, external view showing RV. — E, ♀ paratype, LV, internal lateral view. — F, ♀ paratype, RV, internal lateral view. — G, ♀ paratype carapace, oblique dorsal view. — H, ♀ paratype carapace, ventral view. — I, ♂ holotype, RV, detail of C to show posterior area of hinge. — J, ♂ holotype, RV, detail of C to show anterior area of hinge. — K, ♂ paratype carapace, oblique dorsal view. — L, ♂ paratype carapace, ventral view. — M, ♂ holotype, LV, detail of Fig. 3B to show posterior area of hinge. — N, ♂ holotype, LV, detail of Fig. 3B to show posterior area of hinge. — O, ♂ paratype, detail of Fig. 3A, posterior area. — P, ♂ holotype, detail of Fig. 3C, central muscle field. — Q, ♂ paratype, LV, central area in external lateral view to show protuberances.

Scale a: 200 μm for A–H, K–L; b: 20 μm for I–J, M–N; c: 50 μm for O, Q; d: 20 μm for P.

Fig. 4. *Limnocythere porphyretica* sp.n. (Roadside pool, 2.5 km west of Lake Grace Township, Western Australia.) Male holotype and female paratype. — A, ♂ antennula. — B, ♂ antenna. — C, ♀ maxillula. — D, ♂ hemipenis. — E, ♀ mandibular palp. — F, ♂ mandibula. — G, ♀ furca. — H, ♂ maxilla. — I, ♀ maxilla. — J, ♂ thoracopod I. — K, ♂ thoracopod II. — L, ♀ mandibular coxale; M, ♀ genital lobes. Scale: 100 μm.

projections on the shell of *L. mowbrayensis* can vary on some living specimens, as seen in late Pleistocene material from Pulbeena Swamp, N.W. Tasmania (De Deckker in prep.).

The only other *Limnocythere* species with, on each valve, a pointed ala recurved backward was described as *L. scutariense* by Petkovski (1961). It differs though from *L. mowbrayensis* in that the pointed ala is part of the posterior protuberance whereas in the latter species it is the opposite. Also *L. mowbrayensis* has a much narrower shell anteriorly when seen dorsally.

*Limnocythere porphyretica* sp.n. (Figs. 3, 4)

*Holotype.* Adult male, Australian Museum, Sydney.

*Type locality.* Roadside pool, 2.5 km west of Lake Grace township, Western Australia (118°25'24" E, 33°06'12" S).

*Material.* 20 adult males and 15 adult females.

*Derivation of name.* From the Latin purple-red: *porphyreticus* for the colour of the hemipenis.

**Diagnosis.** On each adult valve, two globular protuberances in dorsal area near hinge and below them two rounded alae in ventral area, one on either side of the ventrum. Anterior ala slightly larger.

**Dimensions.** Greatest length of carapace: ♂ 525–550 µm; ♀ 525–545 µm.

#### Description

**Carapace.** Externally: shell in lateral view rectangular with ventral margin concave and with anterior and posterior ends rounded (Figs. 3A, D); sexual dimorphism evident: dorsal margin slightly convex in ♂ (Fig. 3E) and obviously concave in ♀ (Fig. 3B); ♀ broader when seen in dorsal view. Greatest height in both sexes at about 1/5 from anterior (Figs. 3A–F). On each valve, presence of 2 smooth globular protuberances (smaller in ♂) in dorsal area (Figs. 3G, K) and between them of two rounded alae on either side of the central muscle field (extending slightly more outward than the globular protuberances); anterior ala being slightly larger and slightly higher than posterior one (Figs. 3G, H, K, L). Alae smooth dorsally (Figs. 3G, K) and coarsely pitted (Figs. 3H, L) as is the rest of the carapace (Fig. 3O). Left valve larger than right one anteriorly and posteriorly (Figs. 3H, L). Few normal pores occur on carapace and protuberance (Fig. 3Q).

**Internally:** Calcified inner lamella broader in left valve and broadest in anteroventral area (Figs. 3B, E). Hinge lophodont with posterior tooth broad, right valve crenulated (Fig. 3J) and posterior tooth in left valve bifid (Fig. 3N). Right valve superimposed over left one in hinge area (Figs. 3K, N). Central muscle field consisting of a vertical row of 4 scars (Fig. 3P) with 2 mandibular ones below and 3 antennal (?) scars above and in front with a 4th one below them at level of top scar from vertical row of 4 (Fig. 3P). Normal pore canals common and straight.

**Anatomy.** See Figs. 4A–M for details. Note the unusual sexual dimorphism of the maxillae (Figs. 4H, I): the terminal claw in ♂ being smaller, stouter and pectinate.

**Distribution.** So far this species is only known from the type locality. At the time of collecting (24 Aug. 1978), the water in the roadside pool was fresh. It is thought that this pool is subject to drying up.

**Remarks.** The following distinct differences between *Limnocythere porphyretica* and *L. mowbrayensis* occur:

**Carapace:** The pointed ala which is curved backward in *L. mowbrayensis* is very typical of that species whereas it is "rounded off" and not as extensive laterally, when viewed dorsally, in *L. porphyretica*. The sexual dimorphism of the curvature of the shell in the hinge area is more obvious in the latter species as is the less concave ventral area compared to *L. mowbrayensis*. The calcified inner lamella is much broader in *L. mowbrayensis* especially in the left valve.

**Soft parts:** The outline of both hemipenes (Fig. 2F, Fig. 4D) are very different and are good specific characters. The furca has smaller setae in *L. porphyretica*. There is obvious sexual dimorphism of the maxillae in the latter species but it is absent in *L. mowbrayensis*. The natatory setae of the antenna in *L. mowbrayensis* are much longer.

Petkovski (1961) in his revision of *Limnocythere* species of Yugoslavia illustrated two species *L. karamani* and *L. ohridense* which, in dorsal view, resemble *L. porphyretica* by possessing two globular protuberances above two wider alar ones on each valve. *L. porphyretica* differs from these two

species because both alae on each valve are of about the same width and the globular protuberances are also of the same size. In the two Yugoslav species, the anterior ala and globular protuberance are always the smallest. The compressed area in the anterior of the carapace, when seen dorsally, is much more extensive in *L. porphyretica*.

#### Superfamily CYPRIDACEA Baird, 1845

#### Family CYPRIDIDAE Baird, 1845

#### Subfamily CYPRETTINAE Hartmann, 1963

This subfamily is placed within the Cyprididae instead of the Cypridopsidae as done by Hartmann & Puri (1974) because it is thought that the reduction of the furca is not a sufficient character to require separation of this subfamily from the Cyprididae. The same applies to the Cypridopsinae. All the other features of the anatomy, as well as those of the shell, are typical of the Cyprididae. The reduction of the furca to a thin shaft and their claws (in Cyprettinae) or to a whip-like seta or setae (in Cypridopsinae) are phenomena which, it is suggested, have occurred through time, to various cypridid ostracods to allow them to become active swimmers as happened independently to the species of *Oncocypris* Müller, 1898 which belong to another family the Notodromadidae Kaufmann, 1900 (see De Deckker 1979a). The reduction of the furca in that ostracod genus is not a sufficient character to justify its inclusion in the Cypridopsinae as done by Hartmann & Puri (1974). The absence of pincers on the thoracopoda II and the presence of a fourth segment on that appendage is another anatomical feature typical of the Notodromadidae separating that family from the Cyprididae.

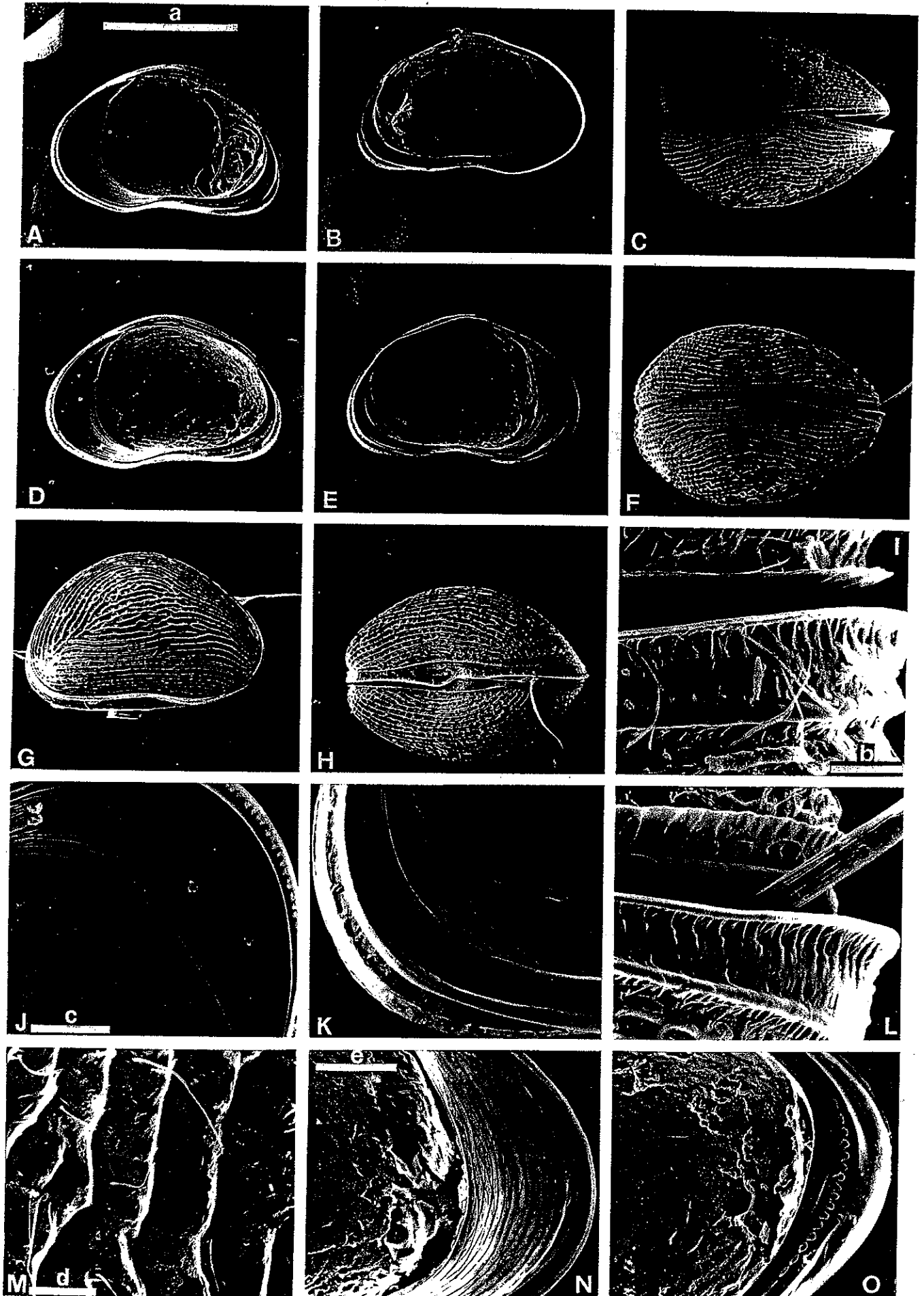
The subfamily Cyprettinae groups the following genera: *Cypretta* Vavra, 1895, *Neocypridella* Hartmann & Puri, 1974 (pro *Cypridella* Vavra, 1895), *Zonocyprretta* gen.n., *Paracyprretta* Sars, 1924 and *Bradycypris* Sars, 1924. The latter two genera are grouped in the tribe Bradycypridini McKenzie, 1971 (not Hartmann & Puri 1974) on the ground that they possess only one valve with internal septae in the anterior area of the right valve, whereas the others, which are assembled in the Cyprettini Hartmann, 1963 have both valves with radial septae.

#### *Zonocyprretta* gen.n.

**Diagnosis.** Shell sculptured with longitudinal lines all over; areas between these lines divided by small transverse ridges. Right valve slightly larger than left one and overlapping it most anteriorly and ventrally; posteroventral area of inside of right valve with a row of five denticles. Male maxilla palps asymmetrical. Furcae with fine claws of almost equal length and 2 fine setae at base of claws.

**Fig. 5.** *Zonocyprretta kalimna* gen. et sp. n. (Dam at Wasley Well, near Nallan, 21 km NNE of Cue, Western Australia.) — A. ♂ holotype, RV, internal lateral view. — B. ♂ holotype, LV, same view. — C. ♂ paratype, carapace in dorsal view. — D. ♀ paratype, LV, internal lateral view. — E. ♀ paratype, RV, same view. — F. ♀ paratype, carapace in dorsal view. — G. ♂ paratype, carapace in lateral view showing RV. — H. ♀ paratype, carapace in ventral view. — I. ♀ paratype, detail of H, posterior area. — J. ♀ paratype, detail of D, anterior area. — K. ♀ paratype, detail of E, posterior area. — L. ♀ paratype, detail of F, anterior area. — M. ♂ paratype, detail of G, lateral area. — N. ♀ paratype, detail of E, anterior area. — O. ♀ paratype, detail of D, posterior area.

Scale: a: 500 µm for A–H; b: 25 µm for I, L; c: 25 µm for J, K; d: 25 µm for M; e: 25 µm for N, O.



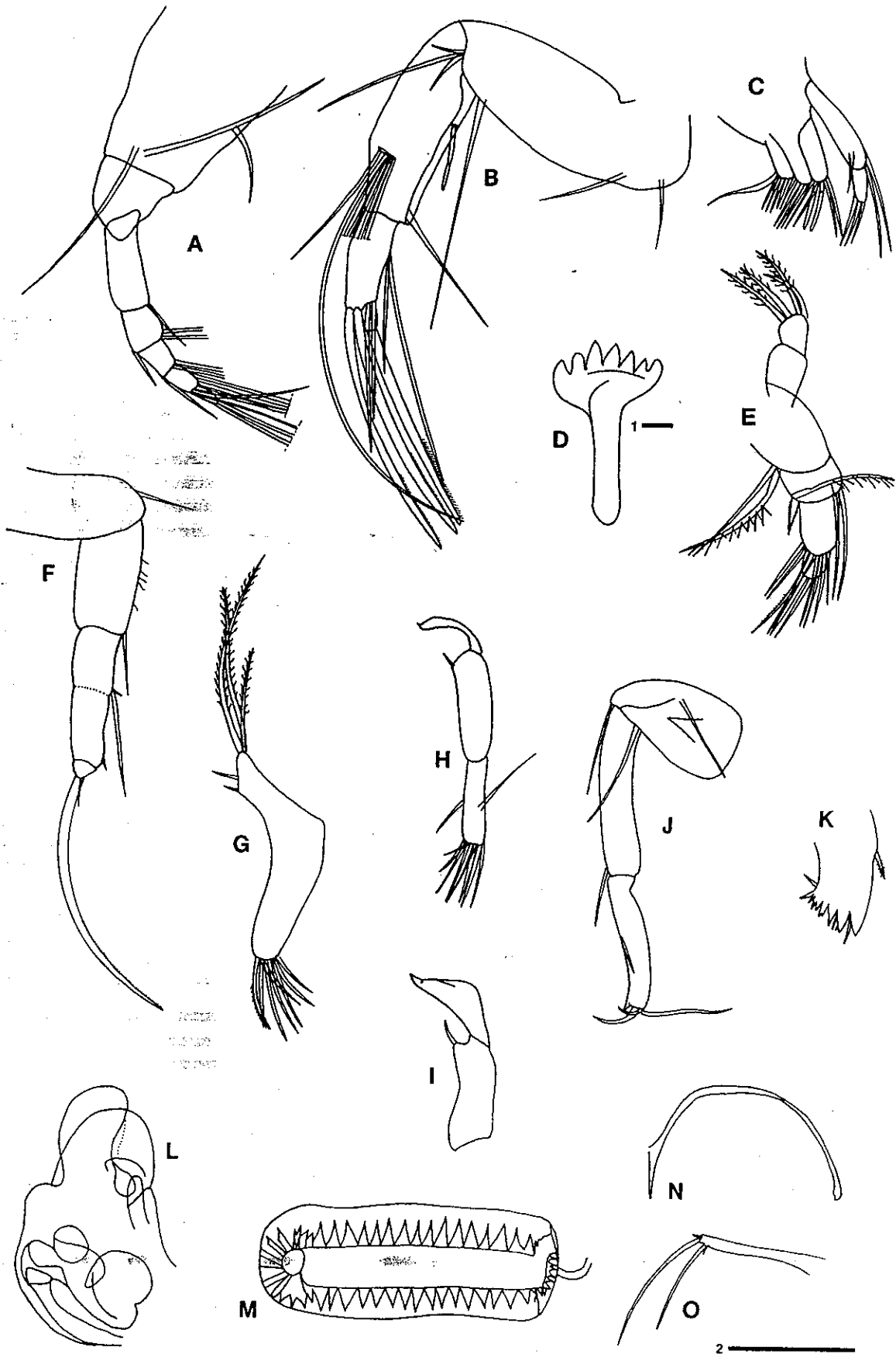


Fig. 6. *Zonocypretta kalimna* gen. et. sp.n. (Dam at Wasley Well, near Nallan, 21 km NNE of Cue, Western Australia.) Male holotype and female paratype. — A, ♂ antennula. — B, ♂ antenna. — C, ♂ maxillular masticatory processes and lobes. — D, ♂ rake-like organ. — E, ♂ mandibular palp. — F, ♂ thoracopod I. — G, ♀ part of

maxillar palp. — H, ♂ maxilla. — I, ♂ maxillar palp. — J, ♂ thoracopod II. — K, ♂ mandibular coxale. — L, ♂ hemipenis. — M, ♂ Zenker organ. — N, ♂ furcal attachment. — O, ♂ furca.

Scale 1: 10 µm for D only; 2: 100 µm.



*Remarks.* The shell of *Paracyprretta* which is sculptured with longitudinal ridges in the same way as *Zonocyprretta* differs from it by having very unequal valves: the left one extends much further away anteriorly than the right one and overlaps it; it also possesses septae in the right valve only. Both genera differ from *Bradycypris* which has a smooth shell.

Most species grouped in *Zonocypris* which have a shell covered with longitudinal ridges differ from *Zonocyprretta* by having the left valve overlapping the other and the peculiar two claws, although typical for the genus, on the female antenna of which the smaller is blade-like and has saw-like teeth. Septae are not present in the anterior area of *Zonocypris*. *Neozonocypris* Klie, 1944, also with a shell covered with longitudinal ridges, possesses similar claws on the female antenna as *Zonocypris* and also an overlapping left valve. *Neozonocypris* however is characterized by a circular tubercle in the ventral area of both valves; this feature is absent in all genera mentioned above. It is not yet understood if such a genus ought to be included in Cypridopsinae as suggested by many authors, among whom are Hartmann & Puri (1974), because the thoracopod II is 4-segmented and does not have pincers contrary to all other cypridid ostracods. Another ostracod genus bearing such unusual thoracopod II is *Neocypridopsis* Klie, 1940. Its taxonomic position also requires revision.

Type species: *Zonocyprretta kalimna* sp.n.

*Derivation of name.* From a combination of the two generic names *Zonocypris* and *Cyprretta* because it possesses characteristic features of the two genera (sculptured shell and anterior internal radial septae).

*Zonocyprretta kalimna* sp.n. (Figs. 5, 6)

*Holotype.* Adult male, Australian Museum, Sydney.

*Type locality.* Dam at Wasley Well, near Nallan, 21 km NNE of Cue, Western Australia (118°09'06" E, 27°16'54" S).

*Material.* 15 adult males and 15 ovigerous females.

*Derivation of name.* From *Kalimna* meaning beautiful in aboriginal language.

*Diagnosis.* Same as generic one plus outline of hemipenis as in Fig. 6L with lateral lobe tongue-like.

*Dimensions.* Length of carapace: ♂ 865 µm; ♀ 880 µm—height of carapace: ♂ 560 µm; ♀ 570 µm.

#### Description

*Carapace.* Externally: Suboval in lateral view with ventrum strongly concave (Figs. 5A, B, D, E), dorsal area broadly arched and greatest height at about middle (Fig. 5G). When viewed dorsally, it is egg-shaped (Fig. 5F). Shell sculptured with longitudinal ridges which follow outline of shell in dorsal area (Figs. 5C, F) and which are almost straight ventrally (Figs. 5G, H) and dividing laterally (Fig. 5G). At mid height, in anterior and posterior areas, most ridges coalesce (Fig. 5G); dorsally some are divided (Figs. 5C, F). Area between the longitudinal ridges partitioned by smaller, irregularly placed, transverse ridges (Figs. 5G, M). Simple-type normal pores common between these ridges (Fig. 5M). Right valve slightly larger and overlapping left one (Fig. 5F) especially in ventral area (Fig. 5H) and anteriorly (Figs. 5F, L). In ventral area, overlapping part of right valve not as broad anteriorly as it is posteriorly to the ventrum (Fig. 5H).

Internally: Hinge adont. Anterior calcified inner lamella very broad (Figs. 5A, B, D, E) and covered with fine striations running almost parallel to valve curvature (Figs. 5J, N).

Selvalge present posteriorly in both valves and most prominent anteriorly in the right valve where it is followed by an interior groove whereas it is very faint in the left valve where there is no groove. Posteriorly, calcified inner lamella broadest posteroventrally where a row of fine denticles is present in the right valve only (Fig. 5O). Radial septae are present in both valves anteriorly. Radial pore canals numerous (Fig. 5L) and straight. No pigmentation on shell was seen on living specimens.

*Anatomy.* See Figs. 6A–O. Note the asymmetrical male thoracopod palps (Figs. 6H, I) and the outline of the hemipenis (Fig. 6L).

*Distribution.* This species is only known from the type locality. The water at the time of collection (20 Aug. 1978) was fresh.

#### Subfamily DIACYPRIDINAE McKenzie, 1978

A typical feature of this subfamily is the very small length width ratios of the segments of the antennulae. Two genera *Diacypris* Herbst, 1961 and *Reticypris* McKenzie, 1978 are grouped in that subfamily. Four species of *Diacypris* were originally described by Herbst (1958) under the preoccupied generic name *Pseudocypris* Daday, 1910. These will be discussed here (chapter 3) with two *Diacypris* species recently described by McKenzie (1978) and another by Hartmann (1978). The New Zealand species *D. thomsoni* (Chapman, 1963) will not be studied here nor will the *Reticypris* species.

*Diacypris spinosa* sp.n. (Figs. 7, 8)

*Pontocypris attenuata* Brady; Ludbrook, 1955, p. 43, fig. 6 (non 5). Cyprinid, genus E: Bayly, 1970, p. 126.

*Diacypris* new: De Deckker, 1975, p. 423.

? *Diacypris* sp.: McKenzie, 1978, p. 188.

*Holotype.* Adult male, Australian Museum, Sydney.

*Type locality.* Small temporary pool, south of the Coorong Lagoon, South Australia (139°47'27" E, 36°26'45" S).

*Material examined.* *Pontocypris attenuata*: 1 specimen, S.A. Geol. Survey. Cyprinid genus E, 10 specimens (gift Bayly). *Diacypris* new: specimens Aust. Mus. 20 adult males and 20 adult females and juveniles from type locality and many specimens from all the other localities mentioned below.

*Derivation of name.* From Latin *spinus* meaning spiny for the spines on the shell.

*Diagnosis.* Carapace subtriangular to subrounded in lateral outline with dorsal "keel" protruding from the left valve; narrow in dorsal view. In both adult valves a row of spines or spinules occur posteroventrally along the margin; in the middle of the row one spine in each valve is longer than the others. Anteriorly a row of spinules occurs at the margin in

Fig. 7. *Diacypris spinosa* sp.n. (A–L, N–Q: Small pool, south of the Coorong Lagoon, South Australia. M: Salt Lake near Nammen Lake, Reagans Ford, Western Australia.) — A, ♂ paratype, carapace, lateral view to show LV. — B, ♂ holotype, RV, internal lateral view. — C, ♂ holotype, LV, same view. — D, ♀ paratype, carapace, lateral view to show LV. — E, ♀ paratype, RV, internal lateral view. — F, ♀ paratype, LV, same view. — G, juvenile paratype, carapace, lateral view to show RV. — H, ♂ paratype, carapace, oblique dorsal view. — I, ♂ paratype, carapace, oblique ventral view. — J, ♀ paratype, carapace, lateral view to show RV. — K, ♀ paratype, carapace, same view. — L, ♂ paratype, carapace, same view. — M, ♂ carapace, lateral view to show RV. — N, juvenile paratype, carapace, same view. — O, juvenile paratype, carapace, dorsal view. — P, juvenile paratype, carapace, same view (note artefact stuck to left valve). — Q, ♀ paratype, detail of K, posterior area. Scale a: 500 µm for A–P; b: 25 µm for Q.

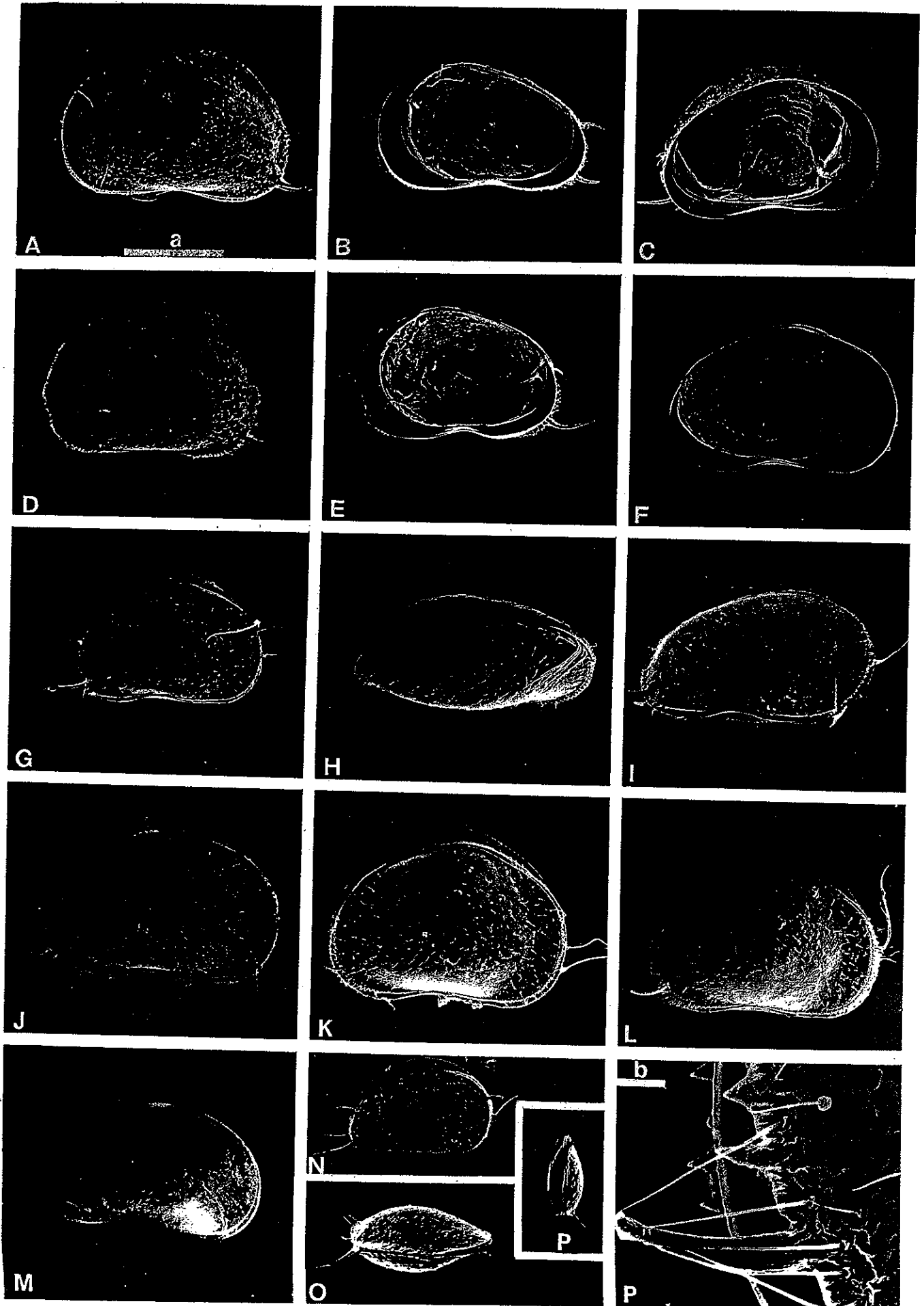
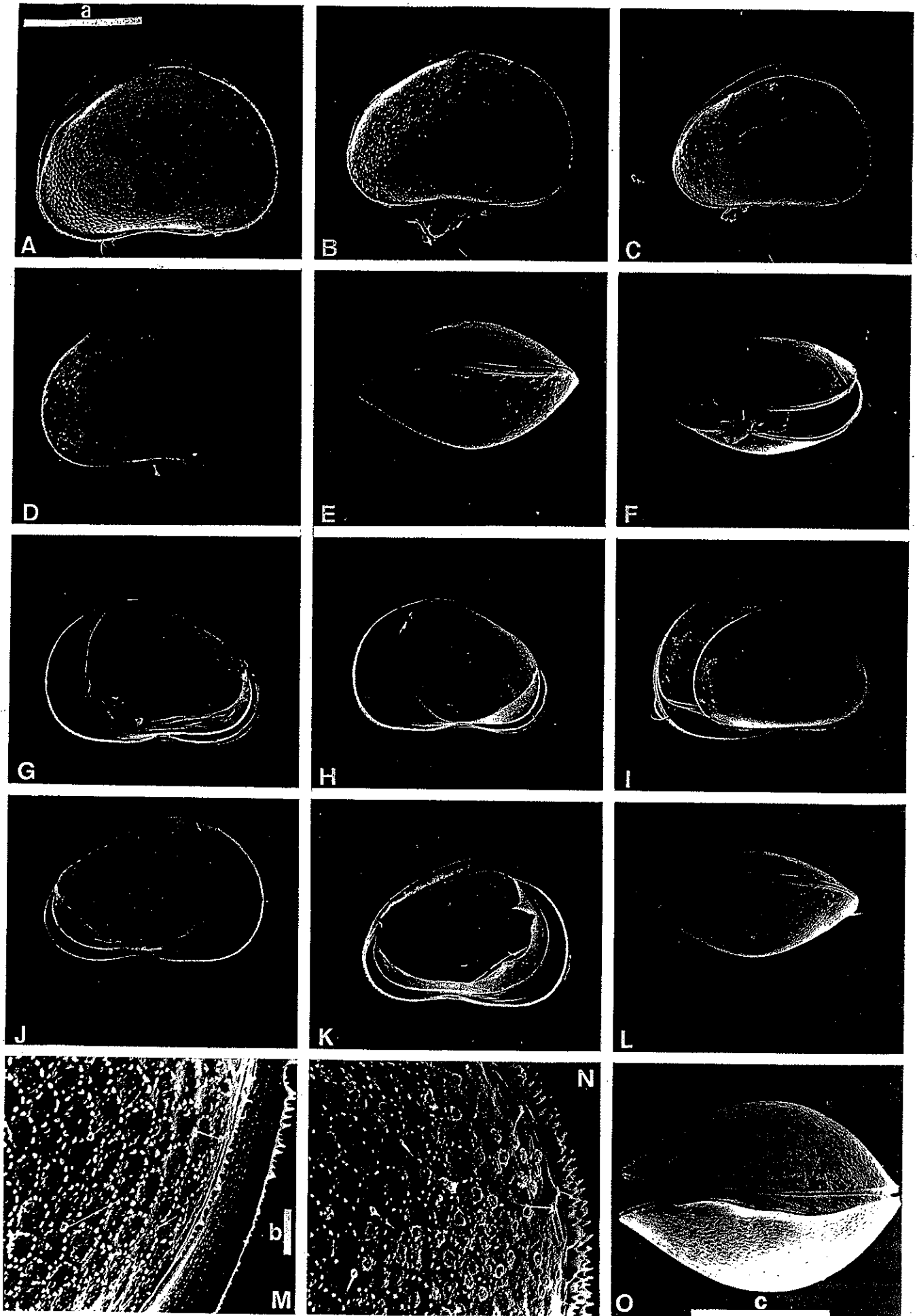




Fig. 8. *Diacypris spinosa* sp.n. (Small pool, south of the Coorong Lagoon, South Australia.) Male holotype and female paratype. — A, ♂ antennula. — B, ♂ antenna. — C, ♂ maxillular masticatory processes and lobes. — D, ♂ rake-like organ. — E, ♂ mandibular coxale. — F, ♂ thoracopod I. — G, ♂ maxilla. — H, ♂ maxillar

palp. — I, ♂ mandibular palp. — J, ♀ maxillar palp. — K, ♂ thoracopod II. — L, ♂ hemipenis. — M, ♂ furcal attachment. — N, ♂ furca. — O, ♂ Zenker organ.

Scale 1: 10  $\mu$ m for D only; 2: 100  $\mu$ m.



the right valve and near the top of the row one spinule is longer than the others. Outline of hemipenis as in Fig. 8L with outer lateral lobe crescent-shaped. Claws of furca unequal.

**Dimensions.** Greatest length of carapace measured without spines: ♂ 990–1 060 μm; ♀ 1 000–1 070 μm. Note great variation in height of left valve in both sexes.

#### Description

**Carapace.** Externally: Dorsally narrow and subrounded to subtriangular in lateral view. Ventrums concave (Figs. 7A–F). Shell pseudopunctate with common rimmed normal pores (Fig. 7Q). Left valve slightly larger than right one anteriorly and posteriorly and overlapping it dorsally and in the concave ventral area (Fig. 7I). Above dorsal overlap (=hinge area) the left valve often extends far above the right valve and forms a “keel” like feature whose height can vary tremendously between specimens (extremes: Figs. 7L, M). Anterior edge of left valve smooth and that of right valve spiny with one long spine near the top of the spinose row. Posterior edge of both valves spinose with the longest spine on the shell in the posteroventral area (Fig. 7Q). Another spine can occasionally be seen in the posterodorsal area at the top of the spinose row (Figs. 7B, C, E) and if present, it is about the same length as the anterior spine. In the smallest juveniles, spines, as long as those found in adults, can be seen in the same position as in adults (Figs. 7N, O, P), the longest spines being always in the posteroventral area. Colour of shell: green to occasionally bluish green.

Internally: Calcified inner lamella finely striated and broadest anteriorly (Figs. 7B, C, E, F). In left valve selvage prominent anteriorly and broadest posteroventrally (Figs. 7C, F); in that area, between selvage and edge of the valve transverse ridges can be seen (Figs. 7C, F). In right valve, selvage close to edge of valve anteriorly and is similarly placed in the left valve but is not as broad (Figs. 7B, E). Radial pore canals numerous and straight.

**Anatomy.** See Figs. 8A–O for details. The diagnostic feature is a broad crescent-shaped outer lateral lobe on the hemipenis and inner lobe digital and curved (Fig. 8L). Furca with anterior claw about twice the length of the posterior one and with both setae equal and about half the length of the posterior claw.

**Distribution and ecological data.** *Diacypriis spinosa* so far has been collected from the following localities: Western Australia: (valves only) in lake near Lort River (McKenzie 1978); Lake Beermullah approximately 18 km N of Gingin and salt lake near Nammon Lake,

Fig. 9. *Diacypriis dictyote* sp.n. (A, M: Swamp on edge of White Lagoon, Kangaroo Island, South Australia. B–L, N, O: Salt lake near Cantarra Homestead, south of the Coorong Lagoon, South Australia.)—A, ♀ carapace, lateral view to show RV. —B, ♀ paratype, carapace, same view. —C, ♂ paratype, same view. —D, ♂ paratype, carapace, lateral view to show LV. —E, ♀ paratype, carapace, dorsal view. —F, ♂ paratype, carapace, oblique ventral view. —G, ♀ paratype, RV, internal lateral view. —H, ♂ holotype, RV, same view. —I, ♀ paratype, carapace, lateral view to show RV (note valve from previous molt still attached). —J, ♀ paratype, LV, internal lateral view. —K, ♂ holotype, LV, same view. —L, juvenile, carapace, dorsal view. —M, ♀, detail of A, postero-dorsal area. —N, ♀ paratype, detail B, posterior area. —O, ♀ paratype, carapace, dorsal view.

Scale a: 500 μm for A–L; b: 25 μm for M–N; c: 500 μm for O.

Reagans Ford (30°51' S, 115°34' E). South Australia: type locality (139°47'27" E, 36°26'45" S); locality 15B near Robe (Bayly 1970); unnamed lagoon NE of Teatree Lagoon, Kangaroo Island (=K.I.); Greenfields Lagoon, K.I.; Birchmore Lagoon, K.I.; unnamed lagoon N of Eleanor River, K.I.; Murray Lagoon, K.I.; Lake Ada, K.I.; Lashmar Lagoon, K.I.; many lakes south of the Coorong Lagoon (De Deckker & Geddes in press). Victoria: Lake Bookar.

The salinity range of the waters in which this species is found is 4 to 52‰. Most commonly the salinity is far below 52‰. The type specimens were collected on 20 Sept. 1978 at 12‰.

#### *Diacypriis dictyote* sp.n. (Figs. 9, 10)

**Holotype.** Adult male, Australian Museum, Sydney.

**Type locality.** Salt lake, near Cantarra Homestead, south of the Coorong Lagoon, South Australia (139°44'48" E, 36°19'52" S).

**Material.** 40 adult males and 15 ovigerous females from type locality; many specimens from the other localities mentioned below.

**Derivation of name.** From Greek *diktyotos* meaning reticulate, for the ornamentation on the shell.

**Diagnosis.** In lateral view, carapace subtriangular in shape and in dorsal view broad (width >1/2 length) with anterior and posterior ends pointed. Shell finely reticulated at least anteriorly and posteriorly and with dorsal “keel” in dorsal area of left valve. Edge of both valves with very fine, small spines. Hemipenis with outer lateral lobe horse-shoe shaped and inner lateral lobe rectangular. Claws of furca unequal.

**Dimensions.** Greatest length of carapace: ♂ 780–810 μm; ♀ 840–940 μm.

#### Description

**Carapace.** Externally: Carapace subtriangular in lateral view (Figs. 9A–D) and ellipsoid in dorsal view with both ends pointed (Figs. 9E, L, O); greatest width of shell in middle and is more than half the length (Figs. 9E, O). Shell usually finely reticulated both anteriorly and posteriorly (Figs. 9B–D) but occasionally all over (Fig. 9A) except for the “keel” (Fig. 9M). Left valve slightly larger than right one except in the dorsal area where it is much taller; right valve inserted inside the left one below a “keel” which can vary in height (Figs. 9A, B for extremes). In dorsal view, this “keel” can be seen to be sinuated (Figs. 9E, O). Margin of valves finely denticulated (Fig. 9O), also at times on the edge of the “keel” (Fig. 9M).

Internally: Hinge adont; calcified inner lamella broadest anteriorly in both valves; selvage most prominent posteriorly in both valves whereas it is close to the edge of the right valve anteriorly (Figs. 9G, H) and further away from it in the left valve (Figs. 9J, K). Radial pore canals numerous and straight. Colour of shell: orangey-red.

**Anatomy.** See Figs. 10A–O for details of appendages; the outline of the hemipenis is characterized by a horse-shoe shaped outer lateral lobe and with a rectangular inner lateral lobe (Fig. 9L). Furcal claws unequal: anterior one more than half the length of the posterior one; anterior seta twice the length of the posterior one which is a third of the length of the posterior claw (Fig. 9N). Zenker organ with 19 rosettes (Fig. 9O).

**Distribution and ecological data.** So far *D. dictyote* has been recorded from salt lakes adjacent to the Coorong Lagoon in South Australia (De Deckker & Geddes in press) and from Kangaroo Island (swamp on edge of White Lagoon: 137°31'59" E, 35°37'39" S). *D. dictyote* has commonly been recorded from waters ranging between 12 and 69‰ salinities with 6 other records ranging up to 143‰. The data for the Kangaroo Island sample is temperature 27.5° and 21‰ salinity.

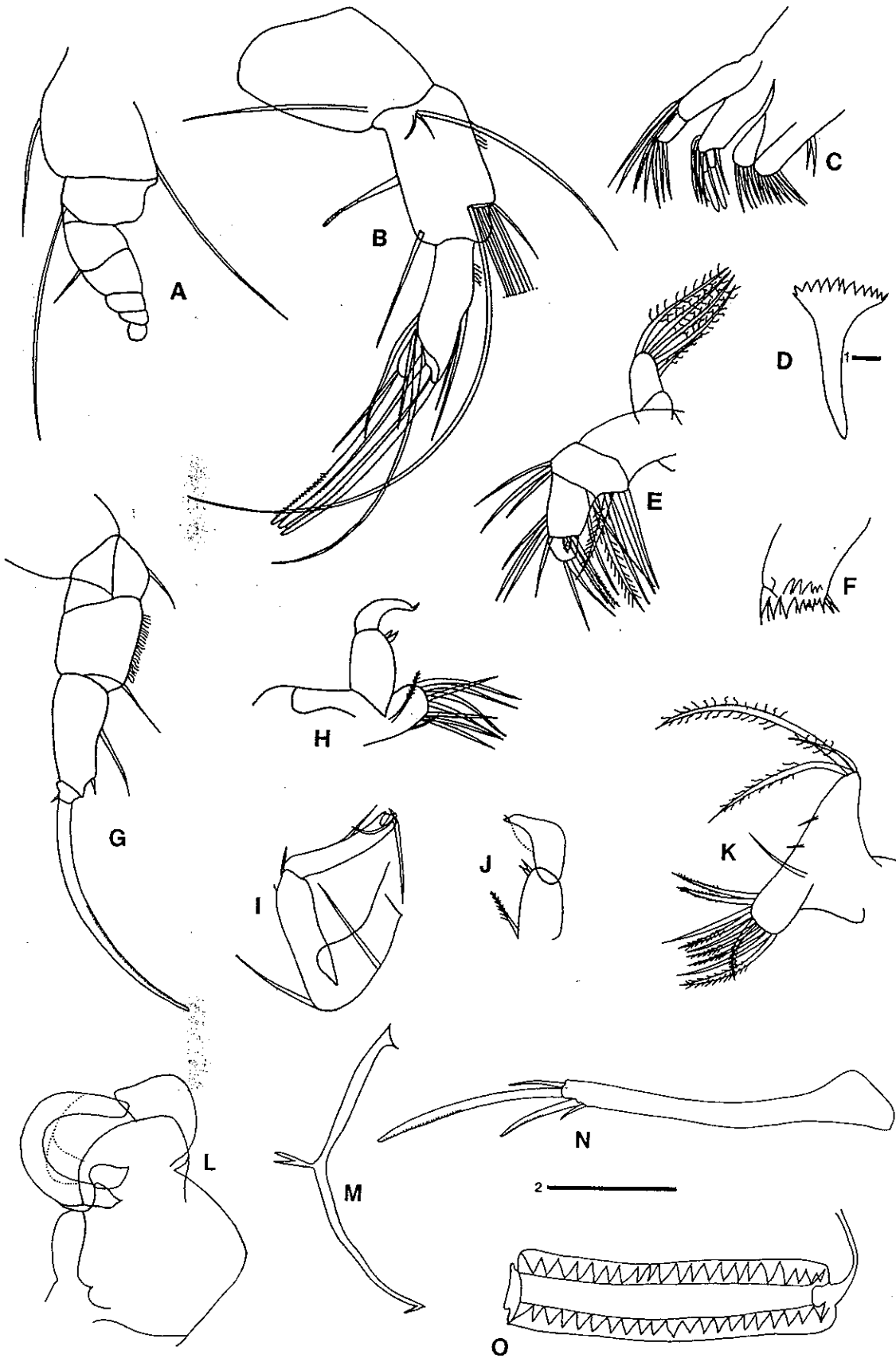


Fig. 10. *Diacypris dictyote* sp.n. (Salt lake near Cantarra Homestead, South of the Coorong Lagoon, South Australia.) Male holotype and female paratype. — A, ♂ antennula. — B, ♂ antenna. — C, ♂ maxillular masticatory processes and palp. — D, ♂ rake-like process. — E, ♂ mandibular palp. — F, ♂ mandibular coxale. — G, ♂ thor-

acopod I. — H, ♂ maxilla. — I, ♂ thoracopod II. — J, ♂ maxillar palp. — K, ♀ maxilla. — L, ♂ hemipenis. — M, ♂ furcal attachment. — N, ♀ furca. — O, ♂ Zenker organ.

Scale 1: 10 μm for D only; 2: 100 μm.

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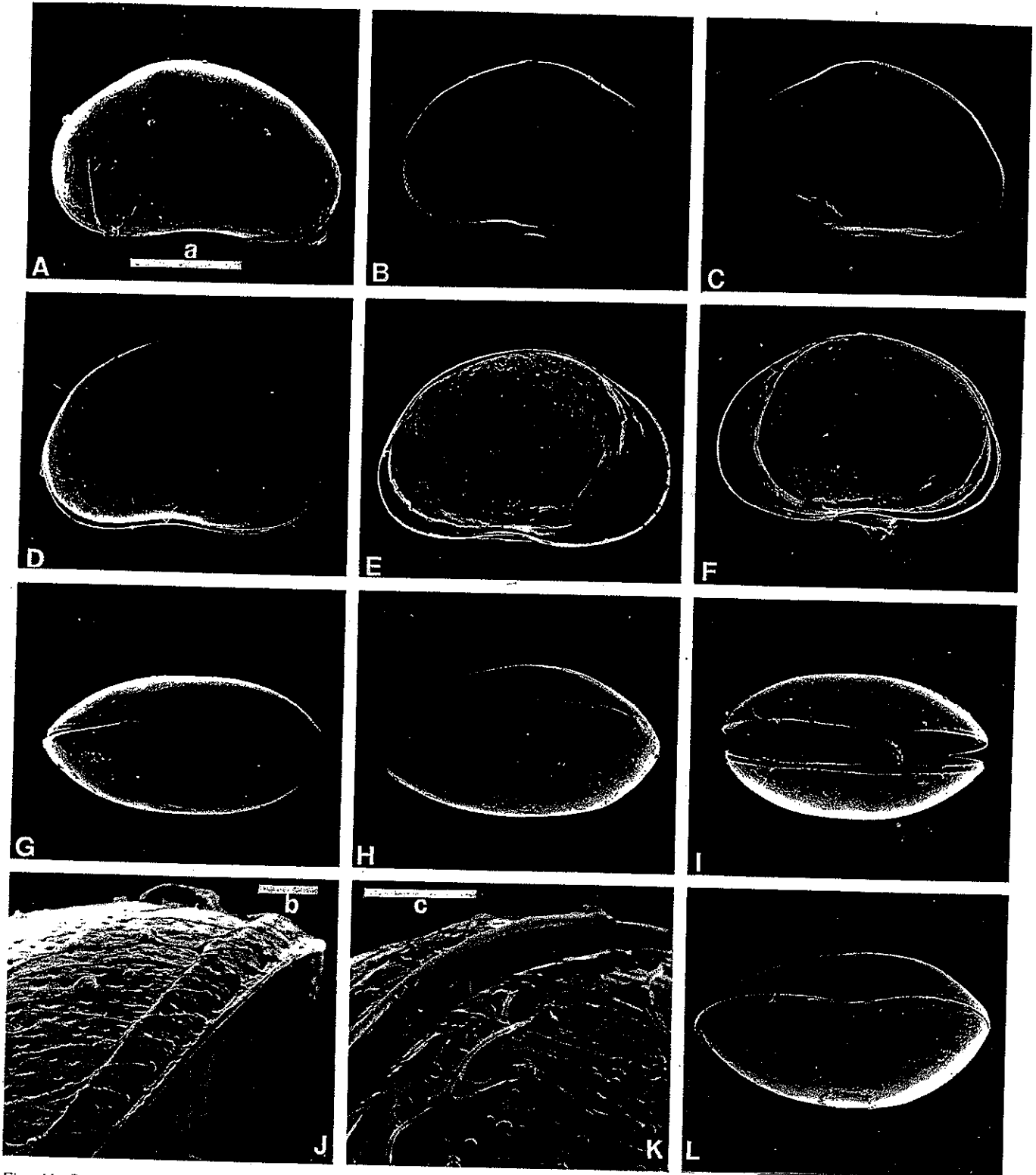


Fig. 11. *Diacypris phoxe* sp.n. (Small salt lake near Salt Works, North of Lake Alexandrina, South Australia.) — A. ♂ paratype, carapace, lateral view to show LV. — B. ♂ holotype, LV, internal lateral view. — C. ♂ holotype, RV, same view. — D. ♀ paratype, carapace, lateral view to show RV. — E. ♀ paratype, LV, internal lateral view. — F. ♀ paratype, RV, internal lateral view. — G. ♂

paratype, carapace, dorsal view. — H. ♀ paratype, carapace, dorsal view. — I. ♂ paratype, carapace, ventral view. — J. ♂ paratype, detail Fig. 11J, anterior area. — K. ♀ paratype, detail L, anterior area. — L. ♀ paratype, carapace, ventral view.

Scale a: 500 μm for A–I, L; b: 25 μm for J; c: 25 μm for K.

*Diacypris phoxe* sp.n. (Figs. 10, 11)

*Holotype.* Adult male. Australian Museum, Sydney.

*Type locality.* Small lake North of the salt works, North of Lake Alexandrina, South Australia (139°10'57" E, 35°15'13" S).

*Material.* 8 adult males and 13 ovigerous females from type locality.

*Derivation of name.* From Greek *phoxos* meaning pointed, for the characteristic pointed end of the outer lateral lobe on the hemipenis.

*Diagnosis.* Carapace almost round in lateral view with flattened ventral area and narrow in dorsal view (greatest width < 1/2 length). Depression in shell in anterodorsal area just before point of greatest height (= area where hinge starts). Dorsum, in hinge area, slightly inclined and on both sides the curvature of the shell is steeper especially in females. Shell pseudopunctate and with a few normal pores. Outline of

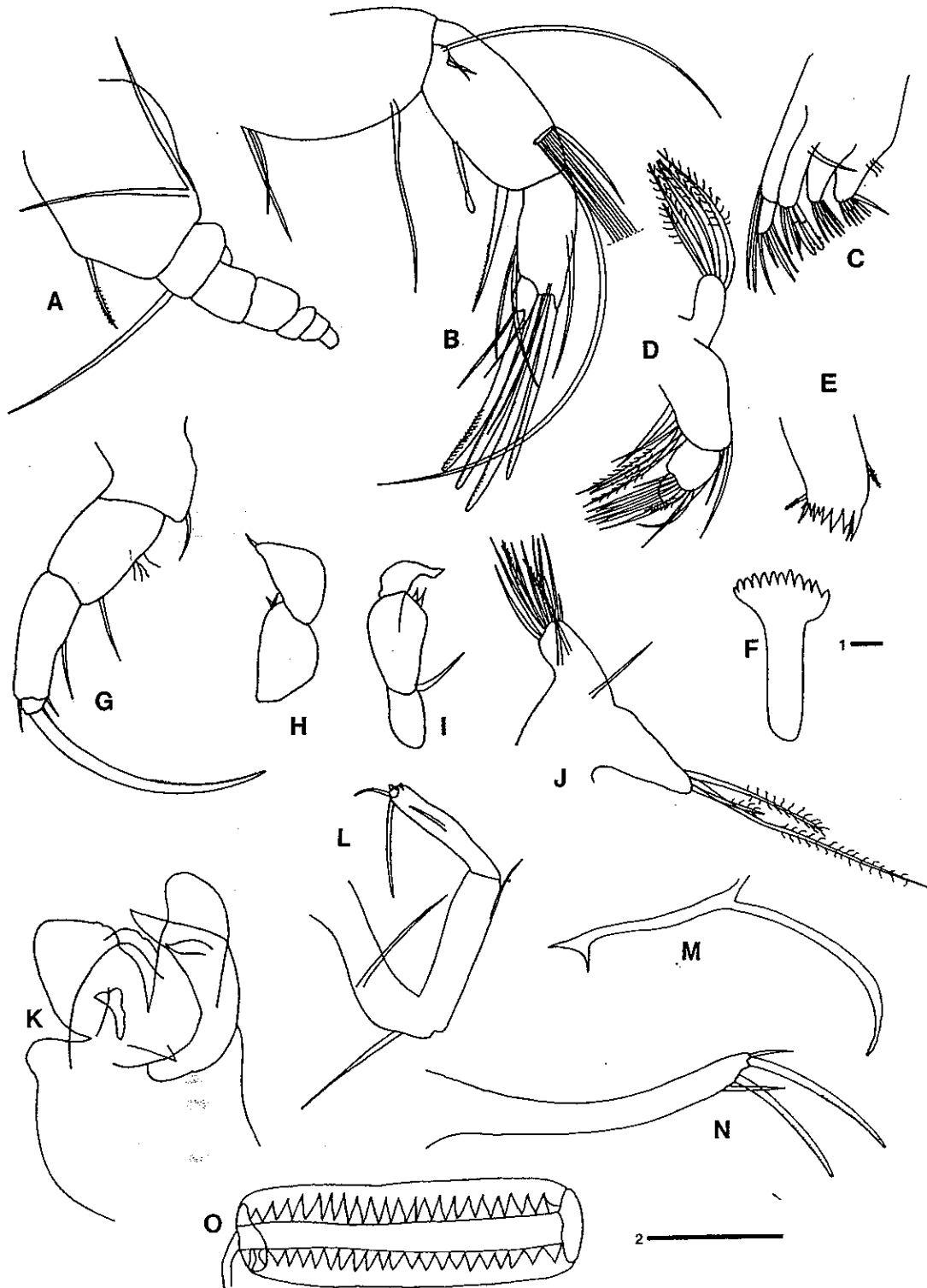


Fig. 12. *Diacypris phoxe* sp.n. (Small lake near Salt Works, north of Lake Alexandrina, South Australia.) Male holotype and female paratype. — A, ♂ antennula. — B, ♂ antenna. — C, ♂ maxillular masticatory processes and palp. — D, ♂ mandibular palp. — E, ♂ mandibular coxale. — F, ♀ rake-like organ. — G, ♂ thoracopod I. —

H-I, ♂ maxillar palps. — J, ♀ maxilla. — K, ♂ hemipenis. — L, ♂ thoracopod II. — M, ♂ furcal attachment. — N, ♂ furca. — O, ♂ Zenker organ.

Scale 1: 10  $\mu\text{m}$  for F only; 2: 100  $\mu\text{m}$ .

hemipenis with rectangular inner lateral lobe; crescent-shaped inner lateral lobe with outer end pointed and with broad digital lobe. Claws of furca almost equal in length.

*Dimensions.* Greatest length of carapace: ♂ 1000–1020  $\mu\text{m}$ ; ♀ 1090–1110  $\mu\text{m}$ .

#### Description

*Carapace.* Externally: Carapace almost round in lateral

view with a flattened ventral area which is concave in the mouth region (Figs. 11A, D); both ends of the shell rounded when viewed laterally. Dorsum in hinge area is slightly inclined and just in front it is slightly indented inwards (Figs. 11A–F); on both sides of the hinge the shell is slightly inclined especially in females (Figs. 11A, D). Left valve slightly larger and overlapping the right one all around its periphery (Figs. 11G–I, L). In dorsal view hinge straight with a little



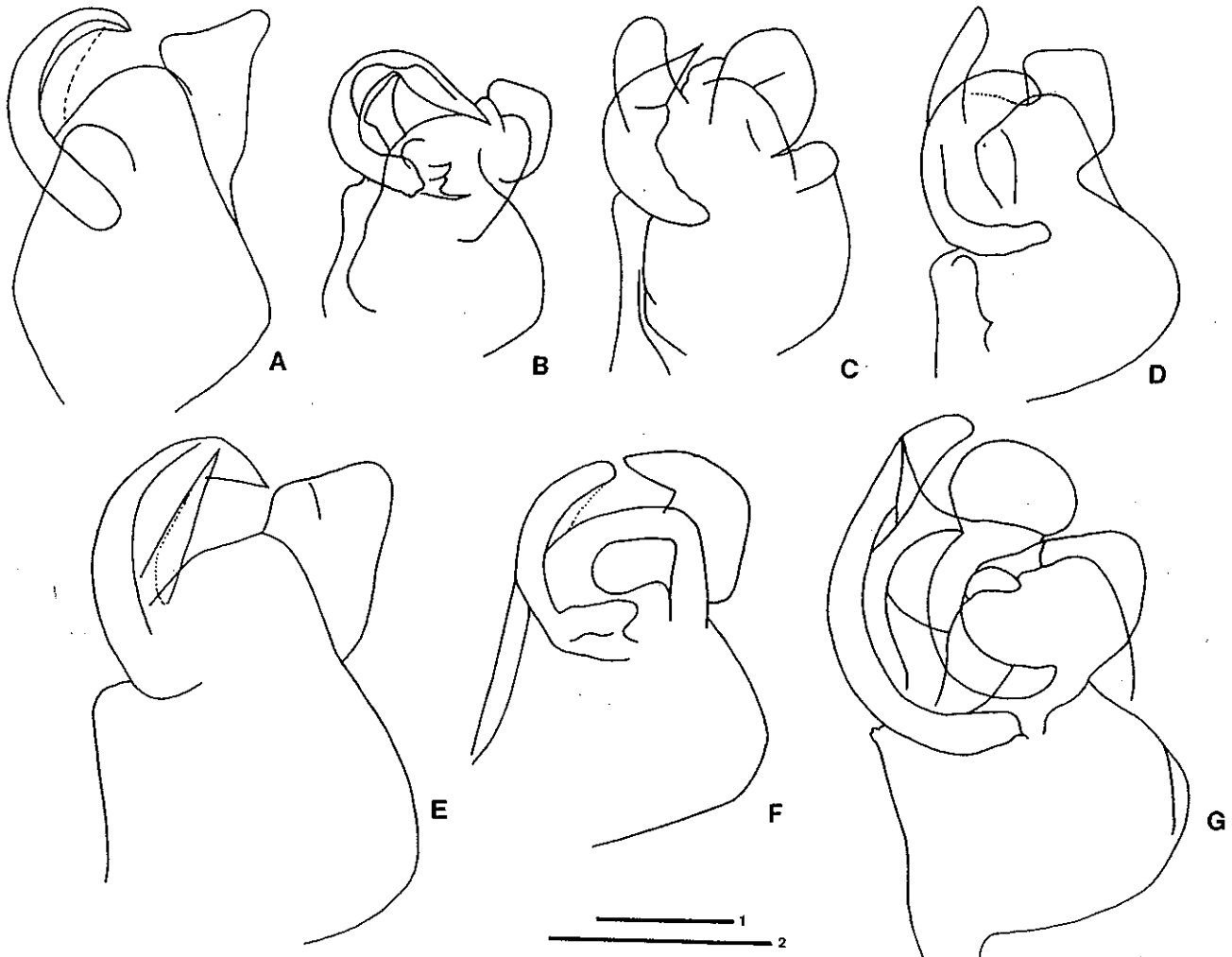


Fig. 13. Outline of hemipenis of *Diacypris* species. — A, *D. compacta*. — B, *D. dictyote*. — C, *D. phoxe*. — D, *D. whitei*. — E, *D.*

*dietzi*. — F, *D. spinosa*. — G, *D. fodiens*.  
Scale 1: 100  $\mu\text{m}$  for B-D, G; 2: 100  $\mu\text{m}$  for A, E, F.

overlap of the left valve at the anterior end of the hinge (Fig. 11G); carapace narrow and broadest in the middle. Both ends are slightly rounded (Figs. 11G-I, K). Shell pseudopunctate and with few normal pores (Figs. 11J, K); shell more pilose ventrally (Fig. 11I). Colour of shell: orange.

Internally: The calcified inner lamella broadest anteriorly in both valves (Figs. 11B, C, E, F) and smallest posteriorly in right one (Figs. 11C, F). Selvage prominent in both valves and closer to edge in the right valve (Figs. 11C, F, I). Hinge adont. Radial pore canals numerous and straight.

*Anatomy.* See Figs. 12A-O for details. The most characteristic features are: the shape of the hemipenis with the outer lateral lobe being crescent shaped and with its outer end pointed and the inner lateral lobe being rectangular (Fig. 12K); the almost equal furcal claws and setae.

*Distribution.* This ostracod so far has only been found from a few lakes around the type locality (Topping prep.). It has not been collected in the lakes adjacent to the Coorong Lagoon despite thorough monthly collecting during one year. The salinity of the water at the time of collection of the holotype was 18‰ on 12 July 78.

### 3. Remarks on all the Australian *Diacypris* species

Prior to the present paper, seven species of *Diacypris* from Australia were named and described. *D. compacta*, *D. dietzi*, *D. fodiens* and *D. whitei* were all described by Herbst (1958)

under the genus name *Pseudocypris* which was already pre-occupied. In 1961 the same author gave the new generic name of *Diacypris* to these four species. In 1978 McKenzie named two new species of *Diacypris*: *D. paracompacta* and *D. occidentalis*. In the same year Hartmann described a new species *D. parva*.

After examination of many specimens belonging to these species (except for *D. parva* for which only paratypes have been examined) mostly collected in salt lakes adjacent to the Coorong Lagoon in South Australia, close to which Herbst's species were collected, it was decided that the outline of the hemipenis was the most distinctive feature which could be used to identify the various *Diacypris* species despite features of the shell which were shown to vary a lot within one living population. The utility of this character has already been shown for other ostracod groups after comparison of many details of the shell and the anatomy (De Deckker 1978, 1979a). *Diacypris* species occur in saline water bodies which are characterized most often by highly varying water salinities as well as other physical parameters such a temperature and pH. It is thought that such constantly changing environmental factors can cause the great variations seen in the shell morphology of *Diacypris* species. For example the outline of the hemipenis was always similar for the species having different features of the shell as illustrated in Fig. 7 and grouped in *D. spinosa* sp.n., and in Fig. 9 for *D. dictyote*

sp.n. Variations in the shell of *D. compacta* were also noticed: in the hinge area, both valves can be of the same height whereas on some specimens in some populations, the left valve was seen to have developed a keel or a hump above the hinge area below which the right valve was interlocked. This feature was described by McKenzie (1978) for *D. paracompacta*. On the other hand, the outline of the hemipenis illustrated by that author is identical to the one given by Herbst (1958) for *D. compacta*. Because specimens have since been found in one population to represent the transitional forms between *D. compacta* and *D. paracompacta*, it has been decided to synonymize the two species. In fact, a dorsal rounded hump has been observed on paratypes of *D. compacta* deposited by Herbst in the British Museum.

The width of the carapace of *Diacypriis* species was also seen to vary as was the angle formed by the dorsal area with the ventral area: the dorsum is sometimes steeply inclined or well rounded, and transitional forms were noticed. Also, specimens collected in the same locality but at different times of the year and showing similar hemipenis outlines were considered to belong to the same species even if great differences existed in shell size. For these reasons, it was decided to synonymize *D. occidentalis* and *D. compacta* which have similar hemipenes. Contrarily, McKenzie (1978) separated the two on size and number of whorls in the Zenker organ. The latter character is known to show slight variations within one population representing one species and therefore is not accepted to be significant in specific taxonomy (De Deckker 1979a). Similarly, on the basis of variations of the shell size and shape, it is considered that *D. parva* ought to be synonymous with *D. compacta*. The outer lateral lobe of the hemipenis of *D. parva* as illustrated by Hartmann (1978, Fig. 673) with its outer extremity plotted in dotted lines is identical to the one illustrated by Herbst for *D. compacta* (Herbst 1958, Fig. 28).

With *D. paracompacta*, *D. occidentalis* and *D. parva* now synonymized to *D. compacta* only the four species of *Diacypriis* described by Herbst are recognized with the three others described in the present paper. Fig. 13 illustrates the outline of the hemipenis of each of the seven species. This should be useful in identifying the various species. Other characters of the shell can be used to distinguish the species but this needs to be done with caution bearing in mind the possible variations of the carapace and anatomy. The New Zealand species *Diacypriis thomsoni* (Chapman, 1963) emend. Chapman, 1977 could not be examined for the present paper. Chapman (1963), in her original description of the species, stated that it is characterized by fine knobs along both valves (in left valve along end of selvage, in right one knobs between selvage and valve border). This phenomenon was not seen in any of the Australian species. The hemipenis of *D. thomsoni* has never been illustrated.

Finally, fossil specimens of *Curvopsis curvata* (Lienenklaus, 1905) recently illustrated and described by Malz (1977) show strong resemblance to *Diacypriis compacta*. It is only known from Lower Miocene sediments in the Mainz Basin in Germany (Malz pers. comm.) and is thought to be restricted to brackish and freshwater environments (Malz 1977). The dorsal overlap and hump of the left valve and the interlocking right valve below the hump is typical of both species. The central muscle scars are identically placed and the position of the selvage in both valves is very similar for both species. A major difference however between *D. compacta* and *C. cur-*

*vata* is the indentation of the margin in the anteroventral area in the latter species especially in the right valve (Malz 1977 and pers. comm.). *D. compacta* is normally curved in that area. It is not considered justified to synonymize both genera at the present stage because a gap in the fossil record exists between their stratigraphic range. *Diacypriis* is only so far known to occur as living, and from late Quaternary sediments in Victoria and New South Wales (De Deckker, in prep.). The other *Curvopsis* species described by Malz as *D. propinqua* Malz, 1977 slightly resembles *Diacypriis fodiens* but no specimens have been compared. Malz's species however, shares similar characteristics of the shell such as position and type of selvage and ratio of valves (left one slightly larger than right and overlapping it along its periphery).

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