

Freshwater Ostracoda (Crustacea) collected in Tenerife, Canary Islands

CLAUDE MEISCH, BJÖRN MALMQVIST and ANDERS N. NILSSON

ABSTRACT: The authors report on the finding of seven species of freshwater Ostracoda on the isle of Tenerife (Canary Islands). Three species, i.e. *Cypris pubera* O.F. MÜLLER, 1776, *Strandesia (Neocypris) obliqua* (BRADY, 1868) and *Trajancypris clavata* (BAIRD, 1838) are new to the fauna of Tenerife and also to the Canary Islands. Notes on the ecology and geographical distribution of the species are given. The structure of the very peculiar surface pores found on the anterior part of the valves of *Trajancypris clavata* and *Heterocypris incongruens* is described and illustrated by scanning electron micrographs. An updated checklist of freshwater Ostracoda occurring in Tenerife and a short zoogeographical discussion are given.

KEYWORDS: Crustacea, Ostracoda, Canary Islands. Tenerife, parthenogenesis, zoogeography.

Introduction

The first contribution to the freshwater ostracod fauna of the Canary Islands was published by MALLWITZ (1984), who recorded a new species, i.e. *Cypridopsis lanzarotensis* MALLWITZ, 1984, now placed within *Sarscypridopsis* MCKENZIE, 1977, from the island of Lanzarote. More recent records were provided by MEISCH & BROODBAKKER (1990, 1993), BALTANAS & GARCIA-AVILES (1993) and BEYER & MEISCH (1995). According to the checklist published by the last authors, at present 16 freshwater Ostracoda species are known to occur on the Canary Islands.

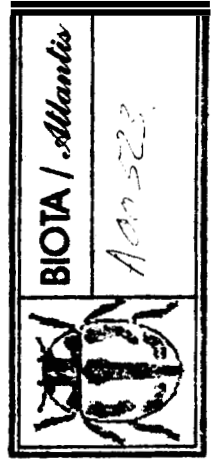
To date, 9 species of freshwater Ostracoda have been recorded from Tenerife (see the list below).

In February and March 1993, two of us (B. MALMQVIST AND A. N. NILSSON) extensively collected the freshwater invertebrates of Tenerife, mostly from streams. We hereinafter report on the Ostracoda recovered during that survey.

A total of 20 samples with Ostracoda were collected from 18 localities. Seven species of Ostracoda were found. A detailed list of localities and species is given below. Three species, i.e. *Cypris pubera* O.F. MÜLLER, 1776, *Strandesia (Neocypris) obliqua* (BRADY, 1868) and *Trajancypris clavata* (BAIRD, 1838) are new to the fauna of Tenerife and also to the Canary Islands. Notes on the species collected, an updated checklist of the freshwater Ostracoda of the island of Tenerife and a brief zoogeographical discussion are provided.

Furthermore, we describe and illustrate the tiny surface structures surrounding the openings of part of the surface pore canals in *Trajancypris clavata* and *Heterocypris incongruens*. These structures have not yet been described in the literature.

The widely used Venice system is used for indications on the tolerance (limnic to polyhaline) to salt content (see also the diagram in MEISCH & BROODBAKKER 1993).



ABBREVIATIONS used in text and figures:

spm(s)	=specimen(s);	juv.	=juv. specimens;
L	= carapace length of adult specimens;	m.	= male;
RV	= right valve; LV = left valve;	alt.	= altitude in meters above sea-level;
ad(s)	= adult(s);	p.m.	= parts per mille (salinity);
fem.	= female;	SEM	= scanning electron microscope.

List of species found:

Cypris pubera O.F. MÜLLER, 1776;
Trajancypris clavata (BAIRD, 1838);
Heterocypris incongruens (RAMDOHR, 1808);
Heterocypris salina (BRADY, 1868);
Herpetocypris chevreuxi (SARS, 1896);
Strandesia (Neocypris) obliqua (BRADY, 1868);
Sarsocypridopsis lanzarotensis (MALLWITZ, 1984).

Systematics

Phylum or subphylum CRUSTACEA PENNANT, 1777

Class OSTRACODA LATREILLE, 1806

Subclass PODOCOPA MÜLLER, 1894

Order PODOCOPIDA SARS, 1866

Superfamily CYPRIDOIDEA BAIRD, 1845

Family CYPRIDIDAE BAIRD, 1845

Family Cyprididae BAIRD, 1845

Subfamily Cypridinae BAIRD, 1845

Cypris pubera O.F. MÜLLER, 1776

Material examined. The species occurs at 3 stations, at all reservoirs: Bufadero (1); Tahodio (10); Los Campitos (26 specimens). All collected individuals were females.

Size of adults: L = 2.09-2.45 mm.

Remarks. It occurs throughout Europe, Asia and North America (holartic distribution). It is new to the Canary Islands. It has not been reported from the Azores, Madeira, Cape Verde and Selvagens Islands (MEISCH & BROODBAKKER 1993).

C. pubera inhabits permanent and temporary water bodies such as ponds, pools, ditches, slow flowing rivers and the littoral zone of lakes. *C. pubera* reproduces parthenogenetically throughout nearly the whole part of its distribution area. Males are only known from one locality in Turkey (SCHÄFER 1952).

Most of the specimens collected in early March in Tenerife are adt. This is in agreement with the findings of STEPHANIDES (1948) on the island of Corfu (Greece), where a maximum development of adults was observed in February. In central and northern Europe, on the contrary, the maximum occurrence of adults is seen in May and June and the populations disappear in July. *C. pubera* is a mesothermophile, oligorheophile, titanoeuryplastic (HILLER 1972, HARTMANN & HILLER 1977) and oligohalophile species (maximum salt content reported in the literature: 27 p.m.)

Subfamily Eucypridinae BRONSTEIN, 1947

Trajancypris clavata (BAIRD, 1838)

(Figs 1-3)

Material examined. The species occurs in the sample from Los Campitos (5 adult females).

Size: L = 2.18-2.47 mm.

Remarks. *T. clavata* inhabits small, shallow, clayey temporary and, more rarely, permanent water bodies. The species, which is new to the Canary Islands and also to the Macaronesian region, occurs throughout Europe and Asia. It is widely distributed in the circum-Mediterranean regions and in the Middle East. It is very rare in northern and central Europe, where most probably it is only occasionally introduced by migrating birds.

The valves of Ostracoda are more or less densely covered with pore canals, called normal pore canals in opposition to the marginal pore canals, which extend perpendicularly to the valve surface. In the Darwinulacea, Cypridacea, Bairdiacea and some Cytheracea, the opening of those pore canals very characteristically is surrounded by a thin and evenly thickened 'neck' (see PURI 1974, HARTMANN 1966, KEYSER 1980).

The surface of the valves of *T. clavata* appears smooth under the stereomicroscope. Under the SEM, however, small and irregularly distributed 'knobs' can be seen near the anterior margin of each valve (figs 1D and 2A-C). At higher magnification, the knobs appear to be formed by the transformed neck surrounding the opening of the pore canals. Fig. 2A shows an untransformed pore and a knob-like pore side by side. The structure of the knob-like pore is best seen in lateral view (fig. 2C): the anterior half of the neck is markedly thickened compared to that of a 'normal' pore canal; the posterior half of the neck is even thicker and protrudes distinctly. Seven and eight knobs respectively have been found on the 2 valves examined (1 LV and 1 RV). Up to now, this character has not been mentioned in the literature. Very similar surface pore canals with transformed necks are found in *Eucypris virens*, another eucypridid species. In *E. virens*, however, the peculiar necks are situated on wart-like elevations ('Porenwarzen') and hence are clearly visible in the stereomicroscope. Most probably, those peculiar surface pore canals on the anterior end of the valves are a characteristic taxonomic feature of at least part of the Eucypridinae. The function of the knob-like pore canals is not known, but probably it is sensorial.

T. clavata is closely related to *T. laevis* (G.W.MÜLLER), from which it differs by the absence of a conspicuous inner list on the anterior marginal zone of the RV (fig. 1D,E). *T. serrata* (G.W.MÜLLER) is another closely related species. The latter is best distinguished by the marginal denticles on the posterior end of both valves (see MARTENS 1989).

Subfamily Cyprinotinae BRONSTEIN, 1947

Heterocypris incongruens (RAMDOHR, 1808)

(Figs 4-5)

Material examined. The species occurs in 5 stations: Punta de Hidalgo. 2 samples (8 adults); Tejina (12 adults and subadults); Erjos (3 adults); La Laguna (5 adults). All collected animals were females.

Size of adults: L = 1.29-1.65 mm.

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Remarks. The samples from Tenerife, all collected in early March, include adult and subadult specimens. In Europe, larvae appear in March, the maximum development of adults occurs from May till autumn and the populations disappear in November.

H. incongruens presents a most interesting case of geographical parthenogenesis: asexual populations (females only) occur nearly world-wide. Males have up to now only been found in eastern Europe (eastern Germany, the Czech Republic, eastern Austria and Hungary). *H. incongruens* is known to occur on the Azores, but has not been reported from the Cape Verde and Selvagens Islands (MEISCH & BROODBAKKER 1993).

H. incongruens is a mesothermophile, mesohalophile, titanoeuryplastic (HARTMANN & HILLER 1977) and oligohalophile species.

Some of the specimens from Tenerife possess a slightly beak-shaped, laterally compressed anterior end of the carapace (fig. 4A). The feature is best seen in dorsal view. In European specimens, the anterior end of the carapace most often appears broadly pointed rather than beak-shaped. However, HOLLWEDEL & SCHARF (1988, table 2, fig 5) present a dorsal view of a specimen from the island of Mellum in the North Sea, which shows a carapace similar to that of fig. 4A from Tenerife.

The anterior parts of the valves of *H. incongruens* are known to bear minuscule 'spines', which are barely visible in the stereomicroscope as well as at low magnification in the SEM (see fig. 4 A,B). The structure of those spines, which hitherto has not been described in the literature, is described and illustrated below. Under higher magnification, the spines appear to be directed towards the rear end of the carapace (fig. 4 C,D). Each small spine is shown to be formed by the transformed 'neck' which surrounds the opening of a pore canal.

In the 'spine-bearing' pore canals (fig. 5 A-C), the anterior half of the neck is distinctly thickened and the posterior half is conspicuously protruded towards the posterior end of the valve (fig. 5 B-C). We tentatively assign a tactile sensitive function to those structures. Similar but slightly differently shaped spines are found on the valves of *Trajancypris clavara* (see above).

Heterocypris salina (BRADY, 1868)

Material examined. The species occurs in 2 samples collected in early March in a canal at Chigurgue (7 adult females). The characteristic dark brown pattern of the carapace is still recognizable on the preserved specimens.

Size: L = 1.15-1.22 mm.

Remarks. *H. salina* is commonly found in slightly salty waters of the oligo- and mesohaline ranges. It is more rarely collected in pure freshwater. The site in Tenerife was characterized by a remarkably high conductivity - 251 mS/m, which corresponds to a salinity of about 20 p.p.m., higher than any other site investigated. In Europe, the animals disappear in late autumn (GANNING 1971). In southern areas, as in Tenerife the populations persist throughout the year.

The species is distributed throughout the Holarctic region, where it occurs mainly in the coastal regions. It is also known from the Azores and Cape Verde Islands.

Subfamily Herpetocypridinae KAUFMANN, 1900

Herpetocypris chevreui (SARS, 1896)

Material examined. "The species occurs at 12 stations, most of which are streams.

All 44 (adults and subadults) were females.

Size of adults: L = 1.95-2.35 mm.

Remarks. *H. chevreui* is best characterized by the length of the natatory setae, which approximately extend to the tips of the terminal claws of the antennae.

The species inhabits ponds, the litoral zone of lakes, swampy habitats and slow flowing streams. It is found in slightly salty waters of the oligohaline range as well as in freshwater. The species is distributed throughout North Africa, Europe and Asia. It is also known from South Africa, South America and the Azores.

H. chevreui is closely similar to *H. helenae* G.W.MÜLLER, 1908 described from the island of Saint Helena in the Atlantic Ocean. MEISCH & BROODBAKKER (1993), taking into account the taxonomic differences stressed by MCKENZIE (1978), concluded that the two species are synonymous. However, BALTANAS & GARCIA-AVILES (1993) recently assigned specimens from the islands of La Gomera and Fuerteventura (Canary Islands) to *H. cf. helenae*. According to those authors, *H. cf. helenae* is smaller and, moreover, differs by the pattern of furcal spines, the relative length of the posterior furcal claw and the relative lengths of the distal setae on the maxillar palp. One of us (C.M.) rather believes that those characters fit within the variability range of *H. chevreui*. There is a need for a systematic investigation of the geographical variability of the species within the genus *Herpetocypris*.

Subfamily Cypricerinae MCKENZIE, 1971

Strandesia (Neocypris) obliqua (BRADY, 1868)

Material examined. The species occurs in the sample from Agua Garcia (7 adult females).

Size: L = 1.22-1.29 mm.

Remarks. *S. obliqua* inhabits small permanent and temporary water bodies and the litoral zone of lakes. Males are only known from North Africa and Croatia.

The species is new to the Canary Islands. It is distributed throughout Europe and North Africa. It is also known from the Azores, Madeira and North America. Up to now it has not been recorded in Sub-Saharan in Africa (MARTENS 1984).

Subfamily Cypridopsinae KAUFMANN, 1900

Sarscypridopsis lanzaroremis (MALLWITZ, 1984)

Material examined. "The species occurs in 2 stations (1 adult and 3 juv.). All specimens (1 adult and 3 juv.) were females.

Size of adults: L = 0.78 mm.

Remarks. *S. lanzaroremis* hitherto has been found in springs, in wells and in cave waters. The two stations in Tenerife reported here are pools with connection to streams. The species was first described from the island of Lanzarote and to date is only known from the Canary Islands (La Gomera, El Hierro, La Palma, Tenerife and Lanzarote). Males are unknown.

Check-list of the freshwater Ostracoda of Tenerife

The list is based on contributions published by MEISCH & BROODBAKKER (1990, 1993), BALTANAS & GARCIA-AVILES (1993) and BEYER & MEISCH (1995) as well as on the records provided here.

- Pseudocandona albicans* BRADY, 1864; *Herpetocypris chevreuxi* (SARS, 1896);
Cypris pubera O.F. MÜLLER, 1776; *Platycypridopsis newtoni* (BRADY & R. BERTSON, 1877);
Trajanocypris clavata (BAIRD, 1838) *Sarscypridopsis lanzarotensis* (MALLWITZ, 1984);
Heterocypris incongruens (RAMDOHR, 1808); *Strandesia (Neocypris) obliqua* (BRADY, 1868).
Heterocypris salina (BRADY, 1868);

Detailed list of localities and species

1. Ijuana, stream, 770 m, 6 March 1993. *Herpetocypris chevreuxi*: 1 ad. fem.
2. Chamorga, stream, ca 380 m, 6 March 1993. *Herpetocypris chevreuxi*: 3 ad. fem.
3. Rio, stream, 1555 m, 27 February 1993. *Herpetocypris chevreuxi*: 5 ad. fem.
4. Barranco del Rio, man-made channel, slow flow, 900 m, 26 February 1993. *Herpetocypris chevreuxi*: 1 ad. fem.
5. Barranco Anesma, stream, 6 March 1993. *Herpetocypris chevreuxi*: 5 ad. fem. and 7 juv.
6. Chiguergue (2 samples), man-made channel, ca. 5 l/s, lime deposits, alt. 840 m, 3 March 1993. *Heterocypris salina*: 4 and 3 ad. fem.
7. Los Silos, man-made channel, 160 m, 2-3 l/s, 2 March 1993. *Heterocypris chevreuxi*: 2 ad. fem.
8. Punta de Hidalgo, 2 samples: a deep pool and a pool in a dry stream bed, 20 m, 25 February 1993. *Heterocypris incongruens*: 8 ad. fem.
Herpetocypris chevreuxi: 1 ad. fem.
Sarscypridopsis lanzarotensis: 3 juv.
9. Tejina, leakage from a reservoir, rich vegetation, ca 160 m, 25 February 1993. *Heterocypris incongruens*: 12 subad. and ad. fem.
Sarscypridopsis lanzarotensis: 1 fem.
Strandesia (Neocypris) obliqua: 7 ad. fem.
10. Agua Garcia, seeping water with iron deposits in a dried up stream bed, 880 m, 24 February 1992. *Herpetocypris chevreuxi*: 12 subad. and ad. fem.
11. El Rio, pools in a dry stream bed, 680 m, 26 February 1993. *Herpetocypris chevreuxi*: 2 ad. fem.
12. Punta del Teno, several pools in a dry stream bed with dessiccated algae, alt. 130 m, 2 March 1993. *Heterocypris incongruens*: 3 ad. fem.
13. Erjos, several large ponds, 1035 m, 2 March 1993. *Cypris pubera*: 1 ad. fem.
14. Bufadero (Charca del Cuchillo), reservoir with fish, alt. 80 m, 1 March 1993. *Cypris pubera*: 10 ad. fem.
15. Embalse de Tahodio, reservoir with fish, 250 m, 1 March 1993. *Cypris pubera*: 17 ad. and 9 juv. fem.
16. Los Campitos, reservoir, alt. 330 m, 1 March 1993. *Trajanocypris clavata*: 6 ad. fem.
17. La Hidalga, reservoir, 180 m, 25 February 1993. *Herpetocypris chevreuxi*: 1 im. fem.
Herpetocypris chevreuxi: 1 empty ad. carapace.
18. La Laguna, man-made channel, 550 m, 6 March 1993. *Heterocypris incongruens*: 5 ad. fem.
Herpetocypris chevreuxi: 3 ad. fem.

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Discussion

Eight of the nine ostracod species hitherto recorded in Tenerife also occur on the European and/or African continents. *Sarscypridopsis lanzarotensis* is only known from Tenerife and from 4 of the remaining islands of the Canary archipelago (see above). In spite of this fact, we do not believe the species to be endemic to the Canary Islands. It most probably also occurs on the African continent, the ostracod fauna of which remains rather poorly known.

Strikingly, all the species hitherto found on Tenerife, except for *Plesiocypridopsis newtoni*, reproduce parthenogenetically on the island. Parthenogenesis obviously favours the colonization of new and far-off localities. Ostracods are known to be passively transported on the plumage and body parts of migrating birds. The eggs of at least some species, e.g. of *Cypris pubera* and *Hererocypris incongruens*, pass unharmed through the gut of ducks (LÖFFLER 1964, PROCTOR 1964).

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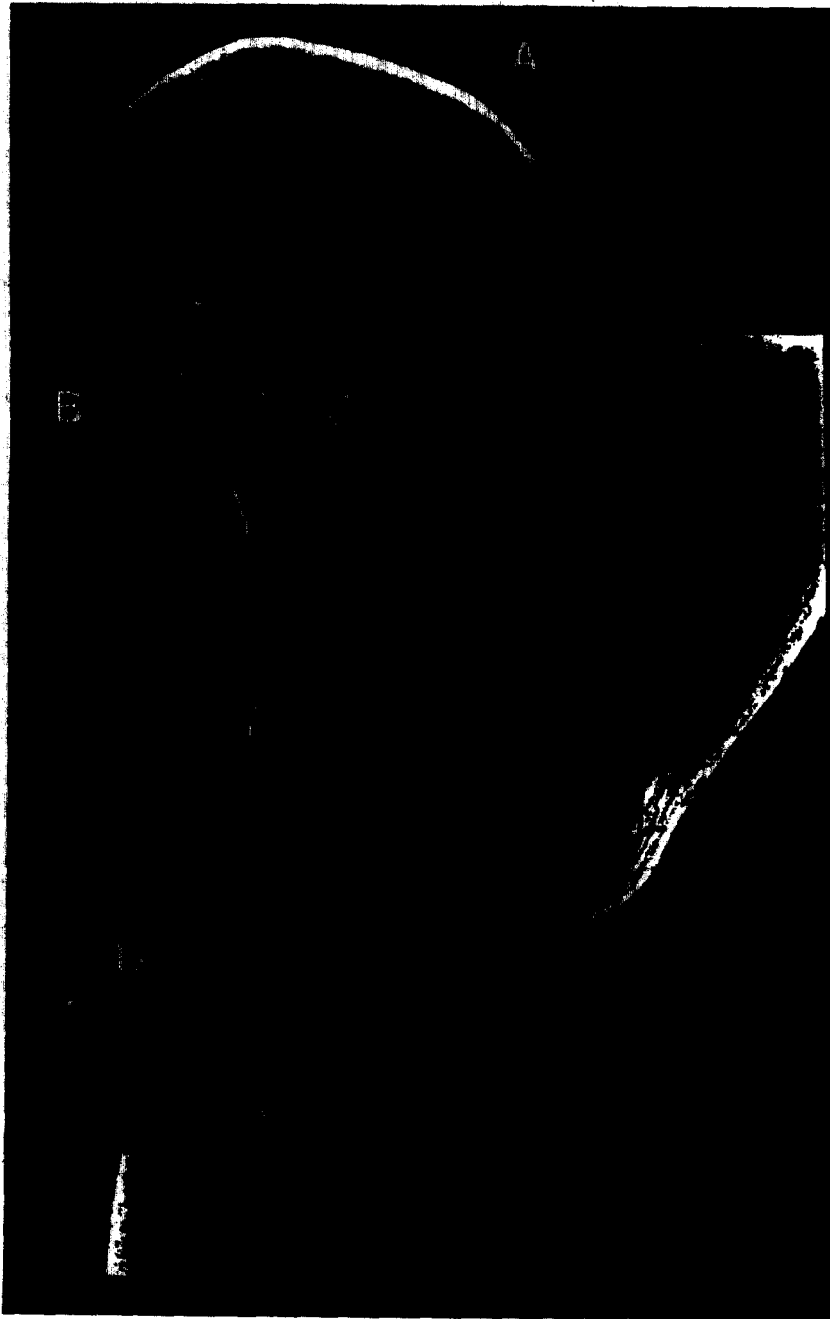


Fig. 1. *Trajancypris clavata* (BAIRD, 1838); female. A: Carapace in lateral view, LV. B: Carapace in dorsal view. C: Posterior detail of B. D: Anterior part of the surface of LV; the arrows point to some of the tiny knob-like structures surrounding the openings of pore canals. - Scale bar: 1 mm for A and B.

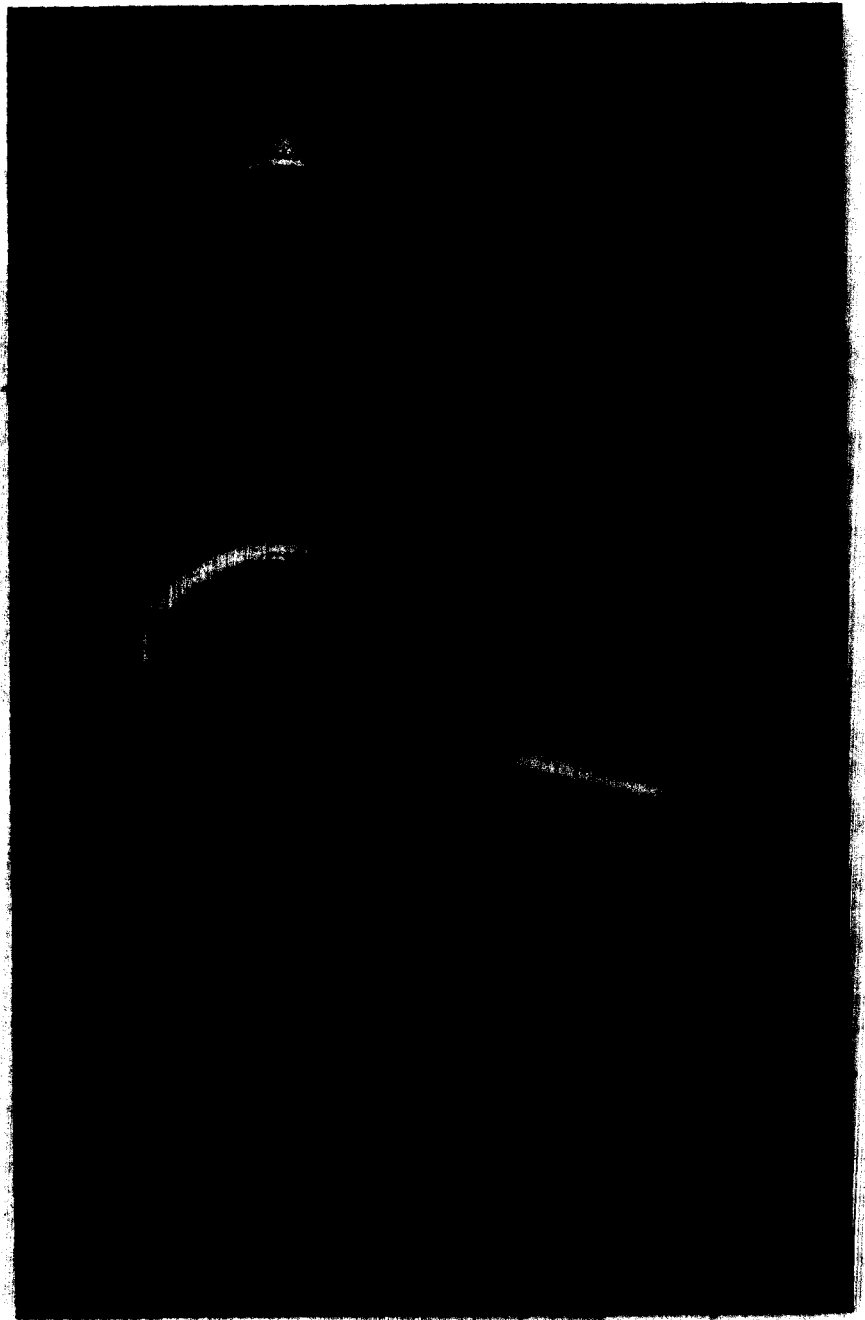


Fig. 2. *Trajancypis clavata* (BAIRD, 1838); female. Untransformed and knob-like pores near the anterior margin of the valves. A: see an untransformed pore at the right and a transformed, knob-like pore at the left. B: Knob-like pore seen from above. C knob-like pore in lateral view. See text for explanations. - Scale bar: 10 μm for C; 13.5 μm for B; 163 μm for A.

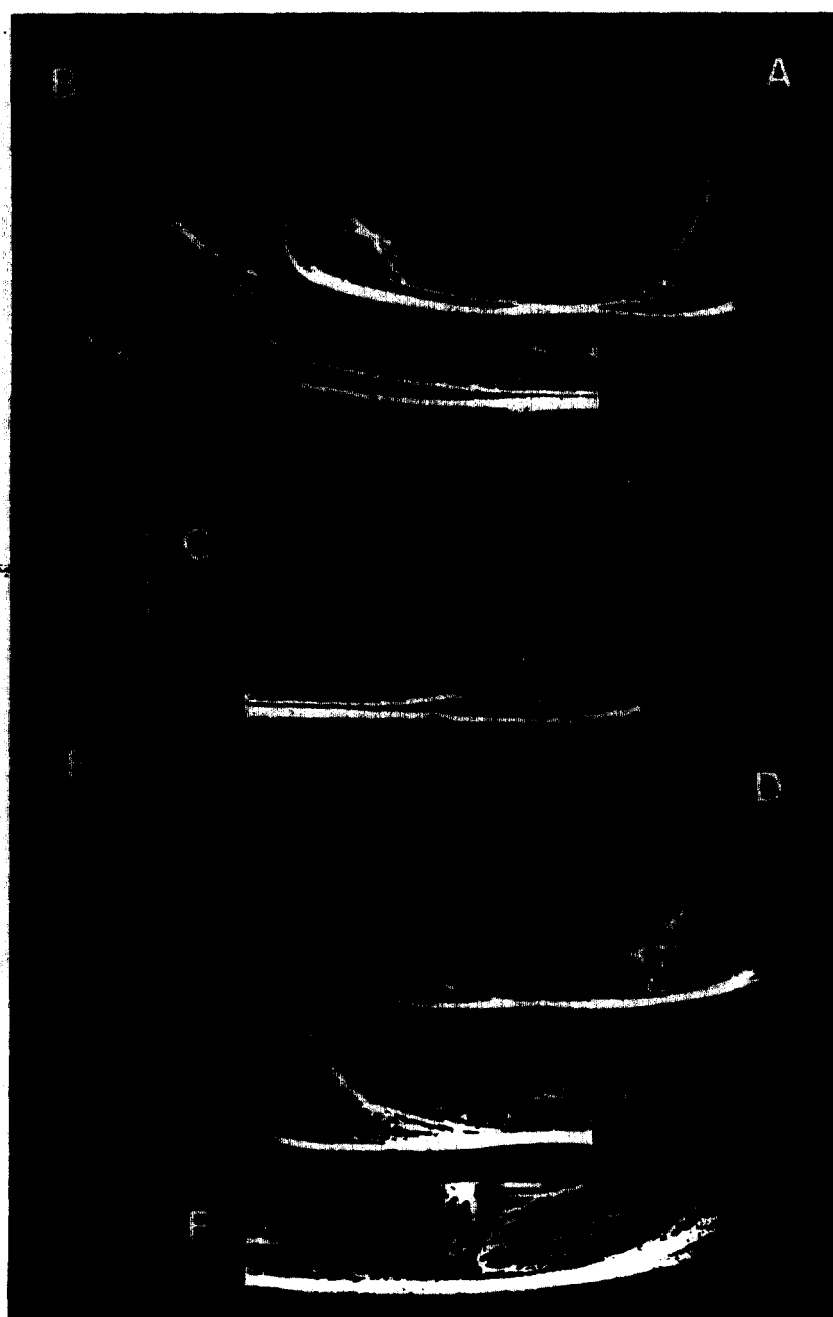


Fig. 3. *Trajancypris clavata* (BAIRD, 1838);, female. A: LV. inner view. B: Posterior detail of A. C: Anterior detail of A. D: RV, inner view. E: Anterior detail of D. F: Posterior detail of D. - Scale bar: 1 mm for A and D.

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Fig. 4. *Heterocypris incongruens* (RAMDOHR, 1808): female. A and B: Two carapaces in dorsal view; see the anterior end of the carapace at left, which is slightly beak-shaped. C: Anterior detail of A, see the spinules. D Detail of C. - Scale bar: 0.50 mm for A and B.

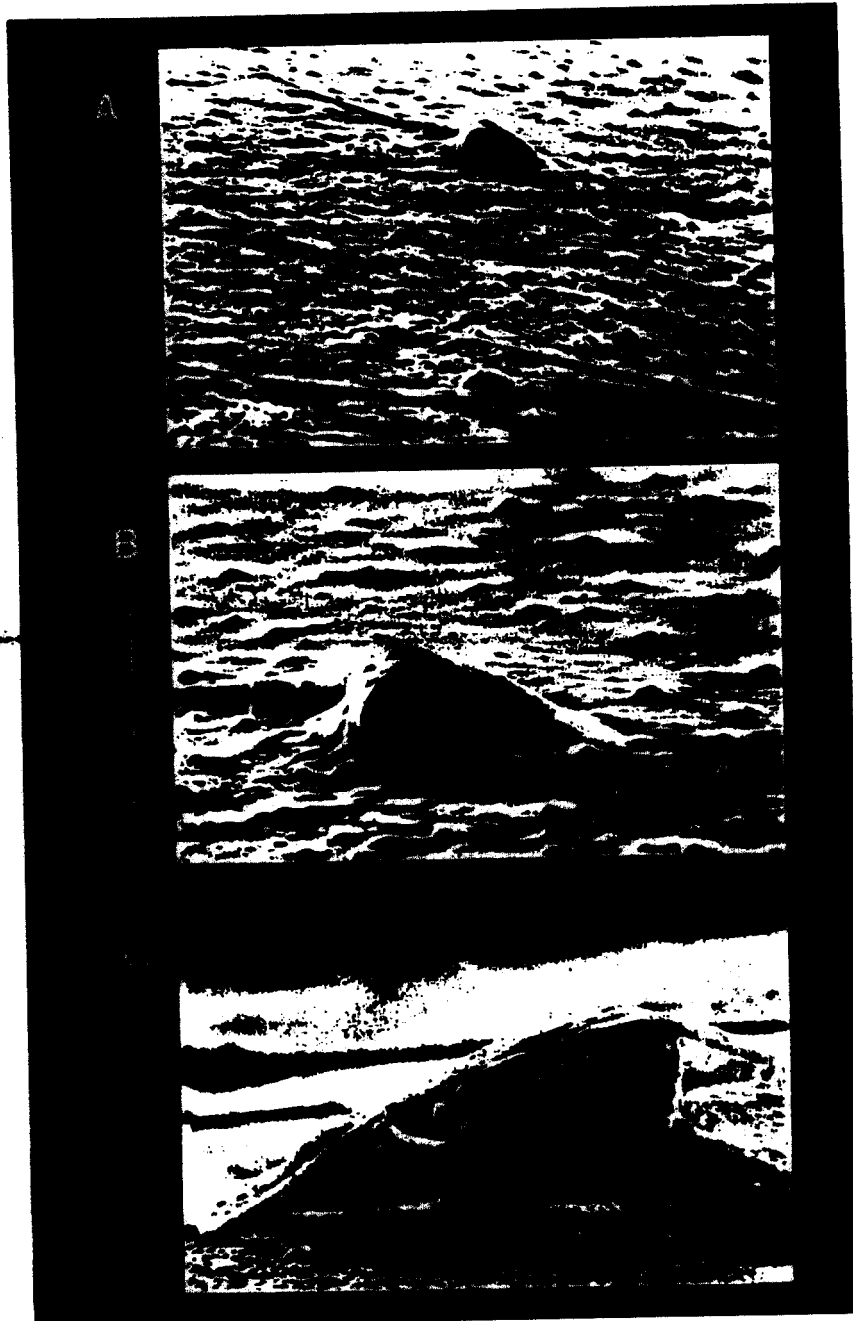


Fig. 5. *Heterocypris incongruens* (RAMDOHR, 1808); female. A: Nearly untransformed (bottom) and distinctly transformed (= spinous) pore (top). B and C: Transformed (spinous) pores. B (detail of A) and C show two different pores at the same magnification. The protruding part is directed towards the rear of the carapace. See text for explanations. -Scale bars: 10 μm for B and C; 25.4 μm for A.