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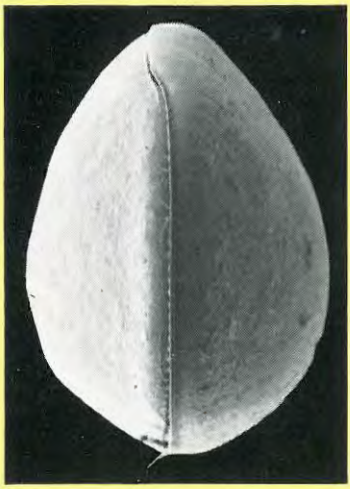

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OSTRACODA

Luxembourg, 1993

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Heterocypris salina (Brady, 1868), vue frontale de la carapace.

Trav. sci. Mus. nat. hist. nat. Luxemb. 19, 1993

Freshwater Ostracoda (Crustacea) collected by Prof. J.H. Stock on the Canary and Cape Verde islands. With an annotated checklist of the freshwater Ostracoda of the Azores, Madeira, the Canary, the Selvagens and Cape Verde islands

by

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Key-words: Freshwater Ostracoda, Macaronesia, salinity tolerance, ecology, biogeography, parthenogenetic reproduction.

Abstract: The authors report on freshwater Ostracoda collected by Prof. J.H. Stock from 1985 to 1988 on the Canary and Cabo Verde islands. A list of species and localities (mostly wells, several springs and other habitats) is provided. The collection includes 8 species, whieh, except for *Sarscypridopsis lanzarotensis* (Mallwitz, 1984) and *Pseudocandona albicans* (Brady, 1864), are all known from the nearby African continent. The small number of species collected is most certainly due to the ecological uniformity of the stations investigated. The taxonomy, ecology and geographie distribution of several species are discussed. *Plesiocypridopsis aldabrae* (G.W. Müller, 1898) is considered to be synonymous with *Plesiocypridopsis newtoni* (Brady & Robertson, 1870). An annotated checklist of the freshwater Ostracoda fauna of the Azores, Madeira, the Canary and Cape Verde islands is given, as well as a brief biogeographic discussion.

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Résumé: Les auteurs ont examiné l'ensemble des échantillons d'Ostracodes d'eau douce récoltés de 1985 à 1988 par le Professeur J.H. Stock sur les îles Canaries et les îles du Cap-Vert. Ils donnent une liste complète des espèces et des localités (il s'agit surtout de puits et de sources ainsi que de plusieurs autres habitats aquatiques). Le matériel examiné comprend 8 espèces qui toutes, à l'exception de *Sarscypridopsis lanzarotensis* (Mallwitz, 1984) et de *Pseudocandona albicans* (Brady, 1864), sont aussi connues du continent africain. Le petit nombre d'espèces récoltées est expliqué par l'uniformité écologique des biotopes prospectés (des puits surtout). La taxonomie, l'écologie et la distribution géographique de plusieurs espèces sont discutées. Les auteurs considèrent *Plesiocypridopsis aldabrae* (G.W. Müller, 1898) comme synonyme de *Plesiocypridopsis newtoni* (Brady & Robertson, 1870). Une liste annotée des Ostracodes d'eau douce trouvés jusqu'à cette date sur les Açores, Madère, les îles Canaries et du Cap Vert, ainsi qu'une brève discussion biogéographique sont données.

1. Introduction

Up to now only two papers deal with the ostracod fauna of the Canary islands. A first contribution was provided by Mallwitz (1984), who recorded *Cypridopsis lanzarotensis* (now ranked within the genus *Sarscypridopsis*, see below) of the island of Lanzarote. A second paper, published recently by the present authors (Meisch & Broodbakker 1990), reports on four species commonly occurring in samples collected by Prof. J.H. Stock on the Canary islands, i.e. *Cypridopsis vidua, Sarscypridopsis lanzarotensis, Plesiocypridopsis newtoni* and *Cypretta seurati*.

There is only one publication by Masi (1925) dealing with the freshwater Ostracoda of the Cape Verde islands with the description of a new species, *Cyprinotus hesperidum* (possibly synonymous with *Heterocypris symmetrica*, see below) from the island of Razo.

The present paper reports on the freshwater Ostracoda collected by Prof. J.H. Stock (Amsterdam, The Netherlands) from 1985 to 1988 on the Canary and Cape Verde islands in the Atlantic Ocean. A complete list of the samples, the species and the localities is given. Comments on the taxonomy and the ecology of the species are added. The study of Prof. Stock's most important collection allows us to provide the first thorough inside in the freshwater ostracod fauna of both groups of islands. We finally give an annotated check-list of the freshwater ostracod species hitherto known from the Mid-Atlantic islands commonly designated as the Macaronesian islands (the Azores, the Canary, Cape Verde and Selvagens islands) as well as a brief biogeographic discussion.

Prof. Stock's material from the Canary and Cabo Verde islands comprises ostracod samples from 60 freshwater localities including 8 species. Five more samples include pure marine species which will not be discussed here. Most of the samples were collected in wells, some in springs and a few in other aquatic habitats. The ecologic similarity of the waters sampled most probably explains why the number of species is relatively low. All samples are deposited at the Zoölogisch Museum Amsterdam.

Prof. Stock carefully recorded the electric conductivity of the water bodies

visited, thus providing important data on the salinity tolerance of the species collected.

The diagram of Hollwedel & Scharf (1988) (see table 1) was used to establish the approximate salinity and hence the salinity range(s) (from limnic to polyhaline) from the electric conductivity values indicated on Prof. Stock's labels. It should be noticed that the original diagram was drawn by Hollwedel & Scharf (1988) after measurements taken by Vesper (1972) in fresh and brackish waters at the North Sea coast of Germany at a temperature of 18° C. Prof. Stock's conductivity values are given for a temperature of 20° C: thus a slight correction is necessary to infer the salinity from table 1. Within the range considered here, a rise of 1° C results in an increase of 2 % of electric conductivity (Klee, 1990: 47).

The temperature of the wells and springs sampled on the Canary and Cape Verde islands ranges between 12° (in the highlands) and 23° C (in the lowlands).

The salinity ranges used in this paper are those of the widely accepted Venice System (see for instance Califano et al., 1958).

Abbreviations used in the text:

RV = right valve;
LV = left valve;
A2 = antenna;
Swset = swimming setae; natatory setae;
Mx1 = maxillula;
Mx2 = maxilla;
L = size of carapace (length);
spm = specimen;
Stn(s) = station(s);
EC = electric conductivity;
S = salt content;
p.p.t. = parts per thousand;
reg.n. = registration number;
BM (NH) = British Museum (Natural History), London, England;
MNHL = National Museum of Natural History of Luxembourg, Luxembourg;

RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium;
ZMA = Zoölogisch Museum of the University of Amsterdam, the Netherlands;
ZMH = Zoological Institute and Zoological Museum of the University of Hamburg, Germany.

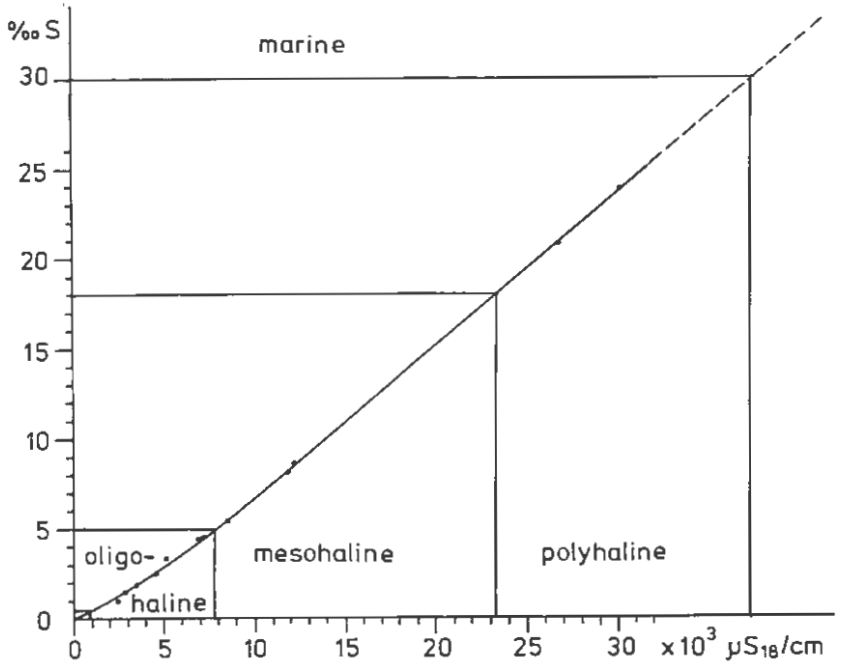

Table 1. - Electric conductivity at 18° C in relation with salt content of marine brackish waters. Data from Vesper (1972), diagram after Hollwedel & Scharf (1988), slightly modified.

2. List of the species collected by Prof. J.H. Stock on the Canary and Cape Verde islands

Phylum or subphylum	CRUSTACEA Pennant, 1777
Class	OSTRACODA Latreille, 1806
Subclass	PODOCOPA Müller, 1894
Order	PODOCOPIDA Sars, 1866

Superfamily CYPRIDOIDEA Baird, 1845

Family CANDONIDAE Kaufmann, 1900

Pseudocandona albicans (Brady, 1864)

Family CYPRIDIDAE Baird, 1845

Heterocypris salina (Brady, 1868)

Herpetocypris chevreuxi (Sars, 1896)

Cypretta seurati Gauthier, 1929

Cypridopsis vidua (O.F. Müller, 1776)

Plesiocypridopsis newtoni (Brady & Robertson, 1870)

Sarscypridopsis aculeata (Costa, 1847)

Sarscypridopsis lanzarotensis (Mallwitz, 1984).

Remark: In our recent paper (Meisch & Broodbakker, 1990), *Heterocypris incongruens* was erroneously reported from the Canary islands.

3. Notes on species

Remark: The 'Index and Bibliography of Nonmarine Ostracoda' published by Kempf (1980, 1991 and working copies provided by Prof Dr E.K. Kempf) was extensively used in the taxonomic part of the present paper.

Pseudocandona albicans (Brady, 1864)

(Fig. 1)

Syn.: *Candona parallela* G.W. Müller, 1900

The species occurs in 2 samples collected in a limnic spring on Tenerife and in an oligohaline spring (S = ca. 1 p.p.t.) on Gomera. Only females were found. Size: L = 0.68-0.84 mm.

P. albicans inhabits both permanent and temporary ponds. It is less frequently found in the shallow littoral zone of lakes. It is also known from springs, underground waters and slightly salty waters (for a review see Hiller, 1972). The finding of the species in an oligohaline spring on the island of Gomera confirms its tolerance to a slightly higher salinity.

P. albicans is distributed throughout Europe, North America and in (at least) the western part of Asia (Löffler & Danielopol, 1978). It has not been recorded on the African continent (Martens, 1984), where nevertheless its occurrence is expected. The males of *P. albicans* are very rare. Most of the populations hitherto found, including those examined here, reproduce parthenogenetically.

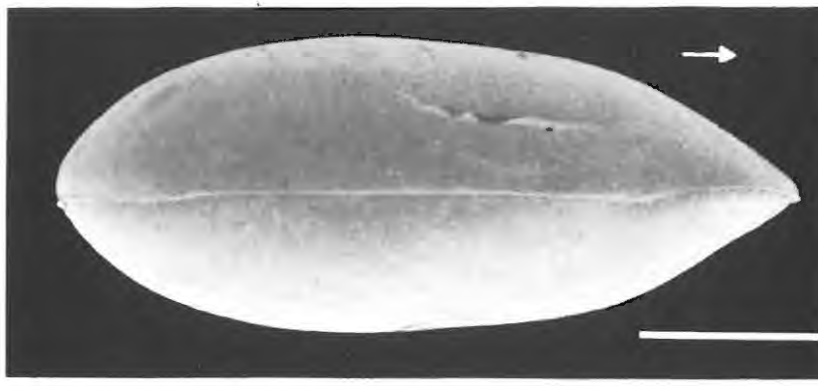

Fig. 1. - *Pseudocandona albicans*, female, Tenerife. Dorsal view of carapace. Scale bar: 0.20 mm.

Heterocypris salina (Brady, 1868)

(Figs 2 - 5)

Synonyms:
Cyprinotus salinus (Brady, 1868) Sars, 1890
Cyprinotus prasinus (Fischer, 1855) Brady & Norman, 1896
Heterocypris fretensis (Brady & Robertson, 1870) Klie, 1937

The species occurs in 12 samples collected on Gran Canaria (1 Stn), Tenerife (3 Stns), La Gomera (1 Stn), Sal (2 Stns), Santo Antão (3 Stns), Santiago (1 Stn) and São Vicente (1 Stn). Size: L = 0.81-1.21 mm. 10 out of the 12 stations are wells. The electric conductivity ranges from 0.36 to 6.13 mS/cm (inferred maximum salt content: ca. 4 p.p.t.), extending from the limnic to the upper limit of the oligohaline range.

H. salina is known to inhabit pure freshwater and slightly salty coastal and inland waters. It often occurs together (but not in the samples examined here) with other salt tolerant freshwater ostracods, such as *Herpetocypris chevreuxi* (Sars, 1896), *Sarscypridopsis aculeata* (Costa, 1847) and *Potamocypris unicaudata* Schäfer, 1943. Heuss (1966) collected the species in a river in Germany with a salinity of up to 7.1 p.p.t. (mesohaline range). Ganning (1967) sampled it in rockpools of the Swedish coast with a salinity of 4-8 p.p.t. The salinity range of the species extends from 1 to 20 p.p.t. (see Ganning 1967 and 1971), i.e. from the limnic to the polyhaline range.

Part of the specimens examined here still show remnants of the characteristic dark brown colour pattern of living specimens. Only females were found. Males are unknown.

Distribution: *H. salina* occurs throughout Europe, Asia and Africa. It seems to be rather common in North Africa, where its presence was repeatedly recorded (see Martens, 1984).

Taxonomy: the specimens examined differ markedly in carapace shape from those illustrated by G.W. Müller (1900) as reproduced in Klie's (1938) 'Fauna': In spite of a striking variability, our specimens are distinctly more elongate in lateral and, above all, in dorsal view (see Fig. 2A, C and compare with pl. 16: 1-2 in G.W. Müller 1900). The carapace shape of the specimens

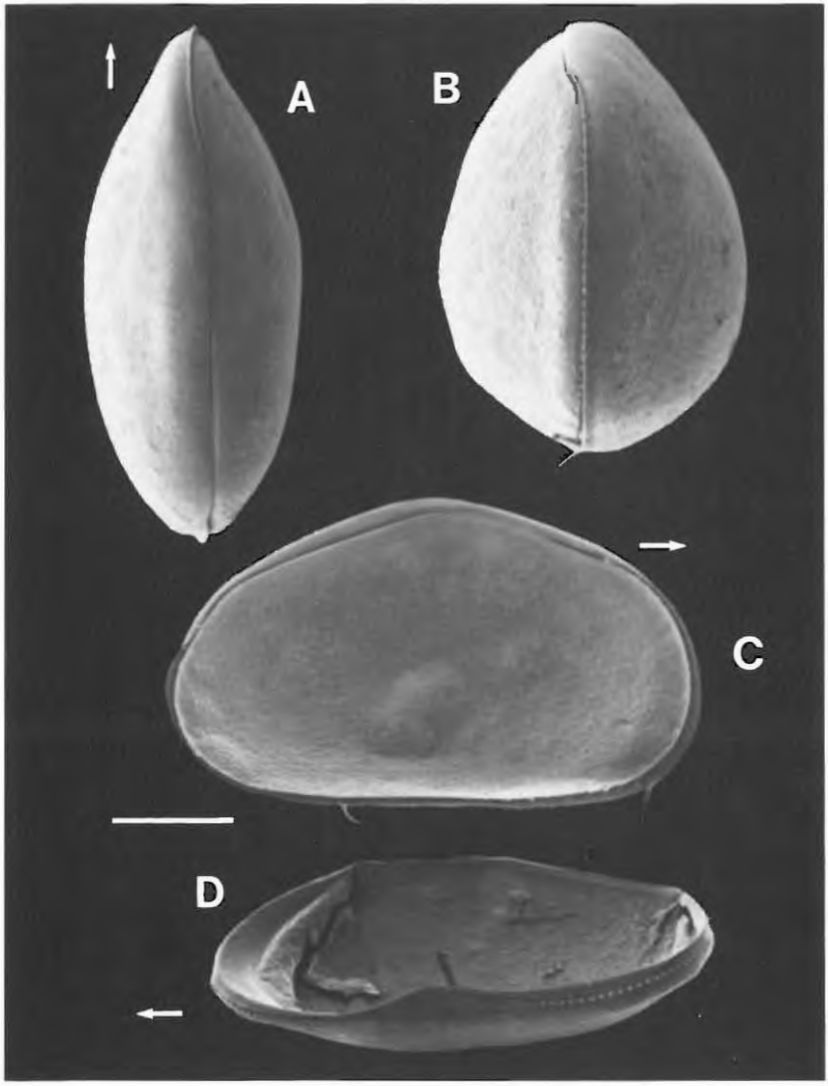

Fig. 2. - *Heterocypris salina*, females, island of Sal (Cape Verde).
A: carapace in dorsal view. B: carapace in frontal view. C: carapace in lateral view. D: RV, inner ventral view, inclined (see the pustules on the anterior and posterior ventral margin). Scale bar: 0.20 mm.

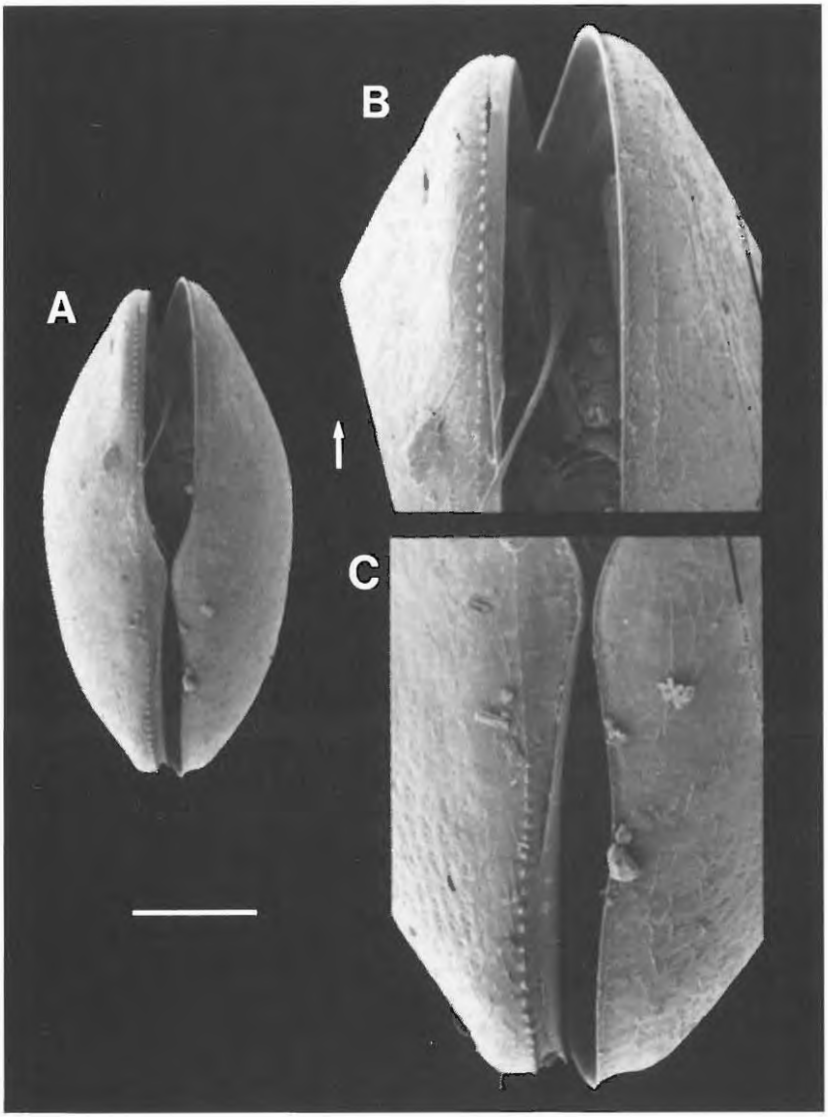

Fig. 3. - *Heterocypris salina*, female, island of Sal (Cape Verde).
A: carapace in ventral view. B: anterior detail of A. C: posterior detail of A.
Scale bar: 0.20 mm for A.

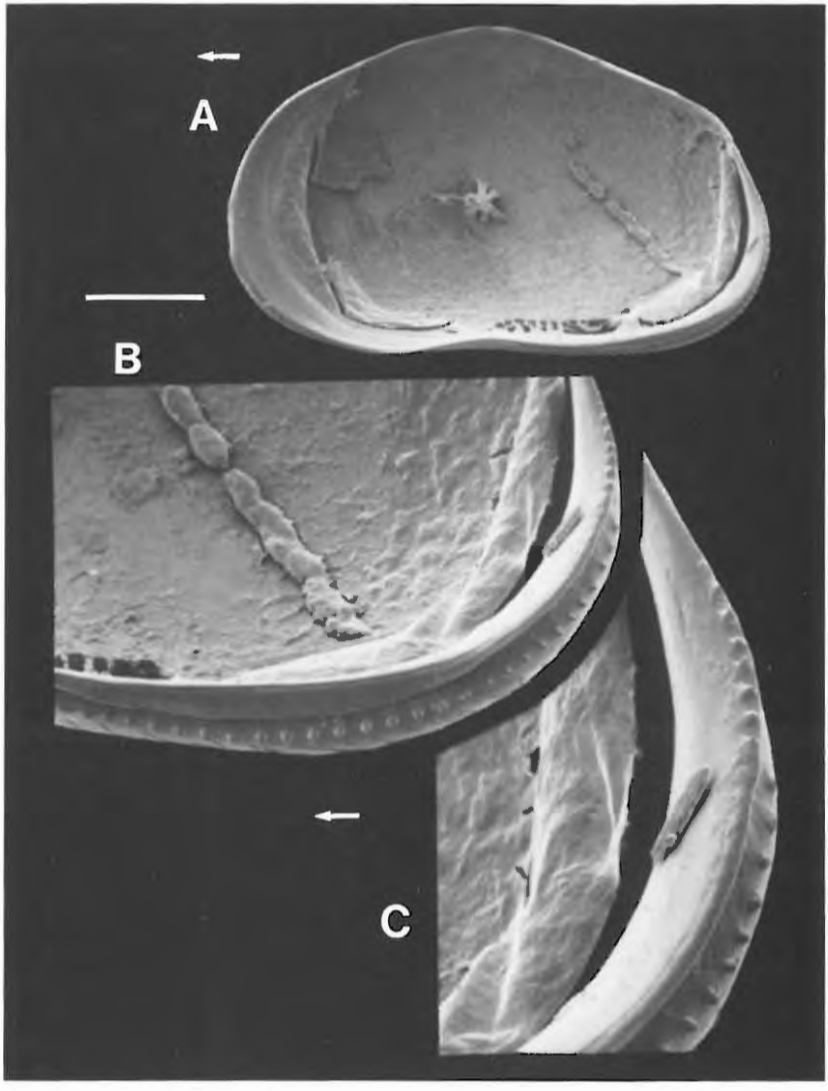

Fig. 4. - *Heterocypris salina*, female, island of Sal (Cape Verde).
A: RV, inner view. B: RV, postero-ventral detail of A, slightly inclined. C: RV, postero-ventral detail of B (see the rows of pustules on the outer list and on the selvage. Scale bar: 0.20 mm for A.

Fig. 5. - *Heterocypris salina*, females, island of Sal (Cape Verde).
A: LV, inner view. B: LV, anterior detail of A. C: LV, posterior detail of A.
D: carapace in ventral view (see the ventral overlapping of the RV by the LV).
Scale bar: 0.20 mm for A and D.

examined here more closely resembles, at least in dorsal view, that of specimens collected by Hollwedel & Scharf (1988, tables 2:10 and 3:1-7) on 2 islands of the German North Sea coast. Careful examination of carapace and soft part characters did not reveal any taxonomically significant differences with specimens of more compact carapace shape collected in Luxembourg.

The presence of small marginal tubercles on the RV is a characteristic feature of the genus *Heterocypris*. The RV of the specimens examined bears two rows of small tubercles all but a few placed on an outer list close to the antero-ventral and postero-ventral margins. At the posterior end of the RV, the row on the outer list ends at mid-height of the valve and is continued (with ca. 8 tubercles) on the selvage (see fig. 4 A-C). To our knowledge this feature was not yet recorded in the literature.

Herpetocypris chevreuxi (Sars, 1896)

(Figs 6 - 8)

Synonyms:
Herpetocypris helenae G.W. Müller, 1908
Herpetocypris agilis Rome, 1954
Herpetocypris caerulea Rome, 1954

The species was found in a spring and a stream on Tenerife. Empty carapaces most probably belonging to this species were found in a well on Gomera. All three stations have pure fresh water. Size: L = 1.92-1.99 mm (Tenerife).

Ecology: *H. chevreuxi* inhabits small ponds, the littoral zone of lakes, slowly flowing streams and swampy waters. It is known to occur in pure freswater as well as in slightly salty coastal and inland waters. The species has a holarctic distribution.

Taxonomy: *H. chevreuxi* is best characterized by the relative length of the A2 Swset which nearby extend to the tips of the terminal claws. The G2 claw of the antenna is distinctly smaller than the neighbouring G1 and G3 claws.

The LV is distinctly longer than the RV and ventrally overlaps the RV. The LV has a conspicuous lamella-like anterior and posterior inner list which is

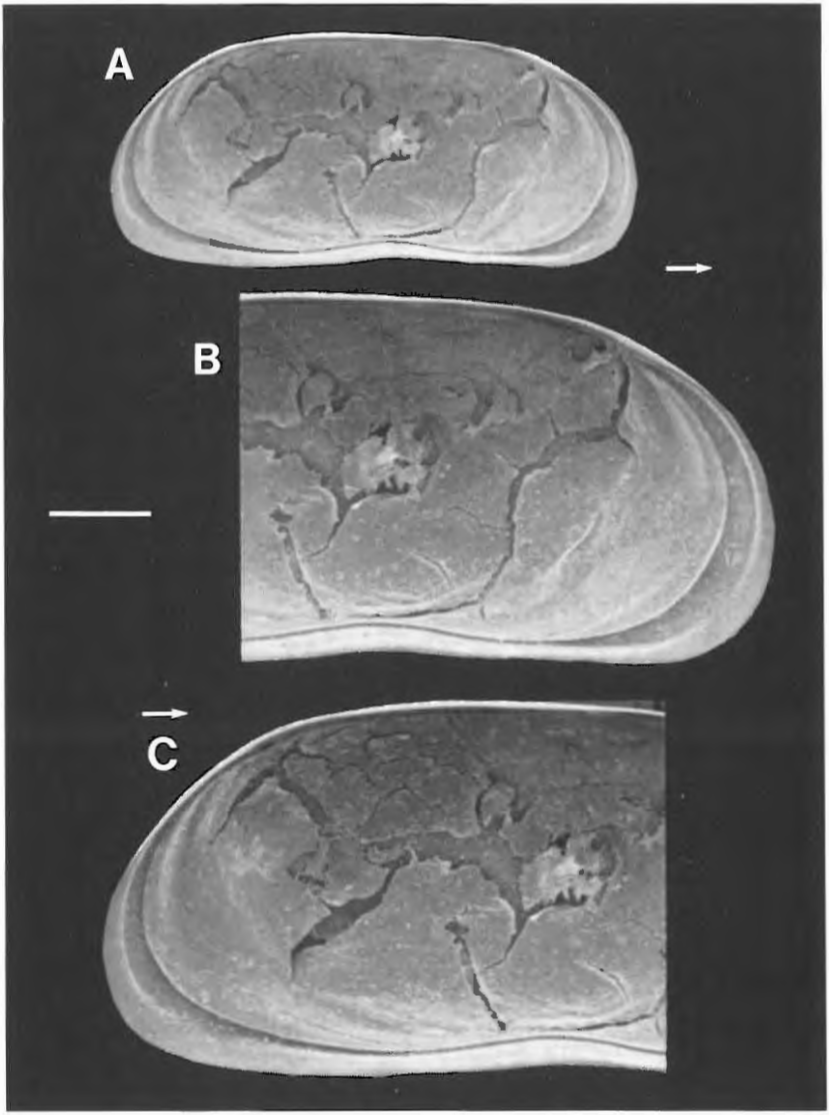

Fig. 6. - *Herpetocypris chevreuxi*, Tenerife (Canary islands).
A: LV, inner view. B: LV, anterior detail of A. C: LV, posterior detail of A.
Scale bar: 0.40 mm for A.

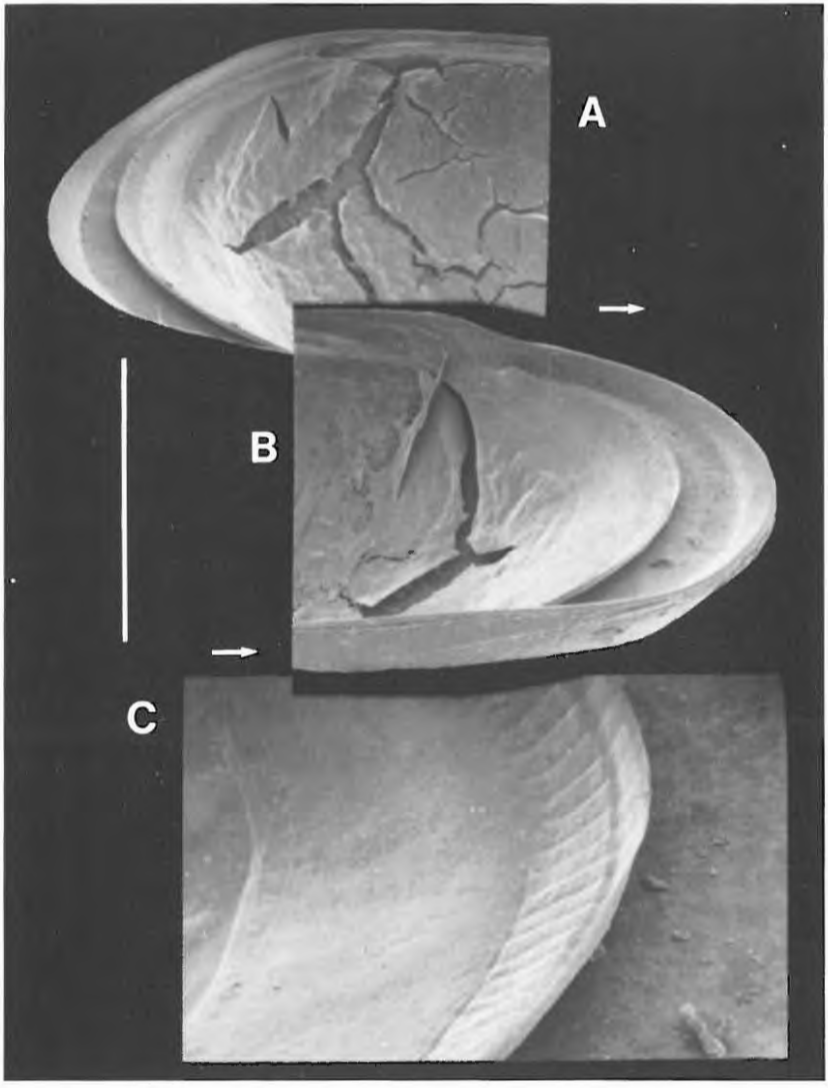

Fig. 7. - *Herpetocypris chevreuxi*, Tenerife (Canary islands).
A: LV, inner posterior marginal zone, inclined. B: LV, inner anterior marginal zone. C: LV, inner anterior marginal zone, detail of B, see the ripples on the lamella-like inner list. Scale bar: 0.40 mm for A and B.

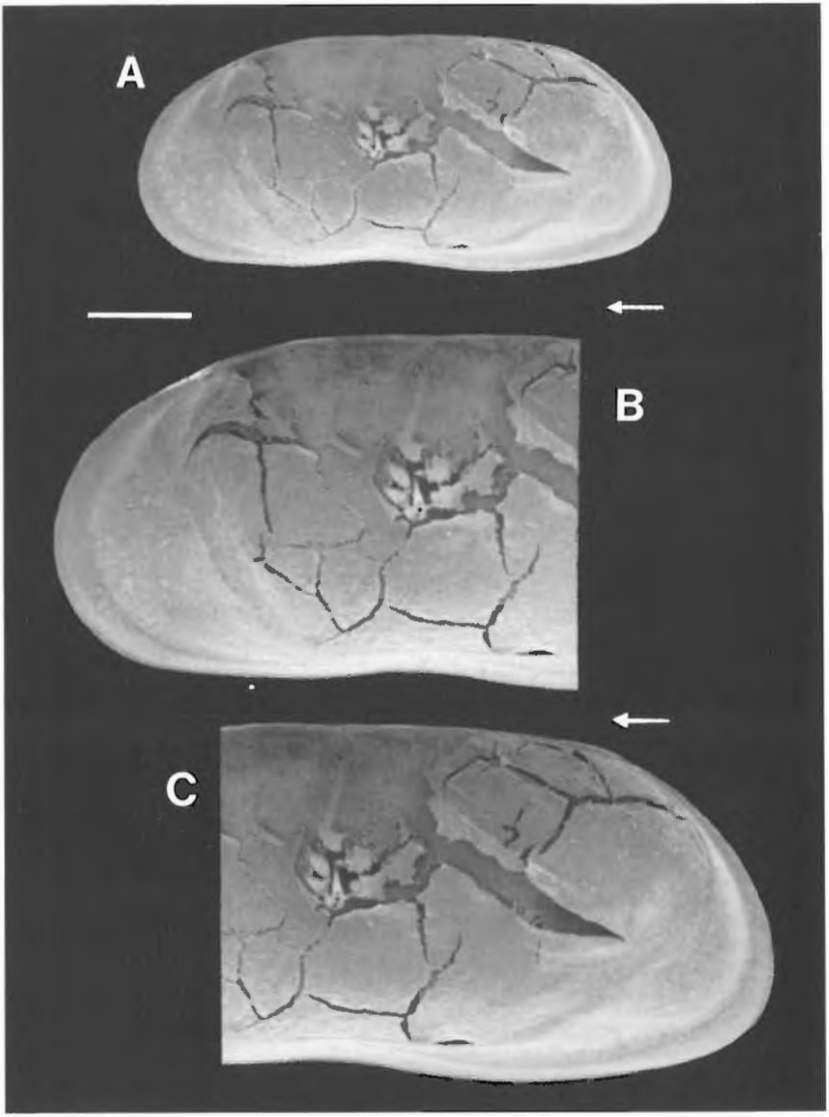

Fig. 8. - *Herpetocypris chevreuxi*, Tenerife (Canary islands).
A: RV, inner view. B: RV, inner anterior marginal zone, detail of A. C: RV, inner posterior marginal zone, detail of A. Scale bar: 0.40 mm for A.

markedly displaced inwards; ventrally the list runs close to the outer margin of the valve. The inner list is less strongly developed in the RV.

The specimens from Tenerife were carefully compared with specimens collected on the European continent (southwestern and eastern France and Luxembourg): The carapace and soft part features of all specimens studied are morphologically the same.

One might be tempted to assign Prof. Stock's specimens from the Canary islands to *H. helenae*, a species which hitherto was only recorded from the island of Saint Helena in the Atlantic Ocean (see G.W. Müller 1908 and McKenzie 1978). The original description of the species by G.W. Müller (1908) is very similar to that of *H. chevreuxi*. This led Sars (1924) to put *H. helenae* in synonymy with *H. chevreuxi*. More recently McKenzie (1978) 'tentatively' assigned one single juvenile *Herpetocypris* specimen collected in a spring of the 'High Central Ridge' on St Helena to *H. helenae*, thus maintaining *H. helenae* as a separate species. According to McKenzie (1978) *H. helenae* differs from *H. chevreuxi* by the following features:

(a) carapace shape in lateral view: the posterior margin slopes more steeply and the carapace is less elongate;

(b) the basal joint of the Mx1 palp bears several small spines.

(c) the slightly different structure of the distal part of the furcal rami.

The carapace shape, however, is highly variable in all species of the genus *Herpetocypris* as is the carapace size in *H. chevreuxi*: 1.83-2.40 mm (measurements taken from literature)! Moreover, examination of the Mx1 palp of European specimens undoubtedly belonging to *H. chevreuxi* proved that the small anterior (or dorsal) spines on the proximal joint of the Mx1 palp also exist in *H. chevreuxi*.

Unfortunately the type material of *H. helenae* is not present in the G.W. Müller collection at the Zoological Institute and Museum in Greifswald, Germany (pers. comm. of Dr G. Müller-Motzfeld). It is considered to be lost.

In our opinion, *H. helenae* is synonymous with *H. chevreuxi*.

Cypretta seurati Gauthier, 1929

The species was briefly discussed in our previous contribution (Meisch & Broodbakker 1990). *C. seurati* is found in 8 samples collected on the islands of Gomera (2 Stns), Sal (5 Stns), São Vicente (1 Stn). Six of these stations are wells, one is a spring and one a stream (interstitial underground water). Size: L=0.60-0.72 mm. *Cypretta seurati* was collected together with *Pseudocandona albicans* in an anchialine spring and with *Heterocypris salina* in a well. The electric conductivity ranged from 0.26 to 6.79 mS/cm: the inferred salinity extends from the limnic to the upper part of the oligohaline range.

Cypretta seurati is widely distributed throughout the tropical and subtropical regions. It was commonly found in wells, caves, springs and other habitats in the Caribbean islands (Broodbakker, 1984) and in Japan (Broodbakker, 1988, Broodbakker & Meisch, in prep.).

Cypridopsis vidua (O.F. Müller, 1776)

The species occurs in 15 samples collected on the islands of Fuerteventura (6 Stns), Gomera (6 Stns), Hierro (2 Stns) and La Palma (1 Stn). It was not found on the Cape Verde islands. Thirteen stations are wells, one is a cistern and one a slowly flowing pond.

C. vidua was collected together with *Sarscypridopsis aculeata* in 3 wells on Fuerteventura, with *Heterocypris chevreuxi* in 1 well on Gomera, with *Plesiocypridopsis newtoni* in 1 well and 1 cistern on Hierro.

In most wells less than 10 specimens, all females, were collected. The eye pigment is well developed in all specimens from these wells. Size: L = 0.52-0.63 mm.

Ecology: The conductivity values range from 0.23-7.41 mS/cm, extending from the limnic to the upper part of the oligohaline range (S max.: ca 4.5 p.p.t.).

C. vidua is a cosmopolitan species. In central and northern Europe it clearly shows a preference for ponds and the litoral zone of lakes with dense vegetation. The species is known to tolerate an increase in salt content. Males have never been found.

Plesiocypridopsis newtoni (Brady & Robertson, 1870)

(Figs 9 - 10)

Synonyms:
1870 *Cypridopsis newtoni* Brady & Robertson: 14
1898 *Cypridopsis aldabrae* G.W. Müller: 281
1965 *Cypridopsis (Plesiocypridopsis) newtoni* - Rome: 50.
1971 *Plesiocypridopsis newtoni* - McKenzie: 267.
1971 *Plesiocypridopsis aldabrae* - McKenzie: 267.

Material examined:

(1) Canary islands: 16 samples with males and fem., leg. Prof. J.H. Stock. See below.

(2) Corfu (Greece): 18 spms (males and fem.), leg. T. Stephanides, 1936, Klie collection, ZMH, reg.n. 1089.

(3) Belgium: 10 spms (fem. only), leg. K. Wouters, RBINS.

(4) France, Paris: 1 sample (fem. only), leg. C. Meisch, MNHL (see also Meisch, 1988).

(5) Luxembourg: 1 sample (fem. only), leg. C. Meisch, MNHL.

(6) Aldabra islands: 33 samples (several hundreds of males and fem.), leg. K.G. McKenzie, BM (NH), reg.n. 1969.6.9.624-656 (see McKenzie, 1978).

Part of the specimens from the Canary islands have already been studied and figures of the seminiferous tubules and the male prehensile organs of the maxilla are given (Meisch & Broodbakker 1990).

P. newtoni was found in 16 samples collected on the islands of Alegranza (1 Stn.), Fuerteventura (6 Stns.), Hierro (4 Stns.), Lanzarote 4 Stns.) and Tenerife (1 Stn.). Size: L fem. = 0.67-0.96 mm, L m. = 0.61-0.84 mm. Ten of the stations are wells. The species was found together with *Sarscypridopsis aculeata* in 2 wells on Fuerteventura and *Cypridopsis vidua* in 2 stations on Hierro. In 14 samples males and females are present (the remaining three contain less than 3 fem. specimens each). The species was not found in samples from the Cape Verde islands.

The electric conductivity of the stations ranges from 0.71 to 33.2 mS/cm. The inferred salt content covers the limnic (2 Stns), oligohaline (9 Stns), mesohaline (1 Stn) and even the polyhaline (3 Stns) ranges. The inferred maximum salinity is about 25 p.p.t.!

Distribution: *P. newtoni* is widely distributed throughout Europe, Asia and Africa. In North Africa it is commonly found in muddy and slightly salty swamps, in man-made reservoirs and wells (Gauthier, 1931). Bisexual populations are common in the southern part of the distribution area, while only parthenogenetic populations occur in the northern part. In Europe, males have been recorded from Spain, Portugal, Corfu, Bulgaria, Hungary and also from Turkey.

Taxonomy: In the sample from Stn 85/569 of Lanzarote some of the females as well as males were found to have 3 instead of 2 branchial filaments on the maxilla (Mx2). *P. newtoni* is considered to have only 2 such filaments (see for instance Gauthier, 1934, who examined specimens from Madagascar). Careful examinations of the specimens with 3 Mx2 filaments showed that they do not differ by any other character from those having only 2 filaments.

As a control we tried to check the number of branchial filaments in 52 specimens of *P. newtoni* collected in Corfu, France, Belgium, Luxembourg and the Canary islands. The number could be checked in only 24 out of 52 dissected specimens due to the difficult dissection and preparation of the very delicate Mx2 respiratory plate. All these specimens proved to have 2 branchial filaments. This combined with the fact that the number of filaments of the branchial plate was found to be constant within the species belonging to the genus *Potamocypris* (also Cypridopsinae) in Europe (Meisch, 1984, 1985) made us consider the possibility that the specimens with 3 filaments belong to a different species. A likely candidate could be *Plesiocypridopsis aldabrae* (G.W. Müller, 1898) from the Aldabra islands in the Indian Ocean. This species is at least very closely related to *P. newtoni*. According to G.W. Müller (1898), in *P. aldabrae* the female has 3 filaments while the male has only 2, which is also shown in his figures (pl. 18: 13-14).

Although the Mx2 of all Cyprididae (including the Cypridopsinae) shows considerable sexual dimorphism - the male maxillar palp being transformed into a clasping organ used by the male during copulation - the Mx2 respiratory

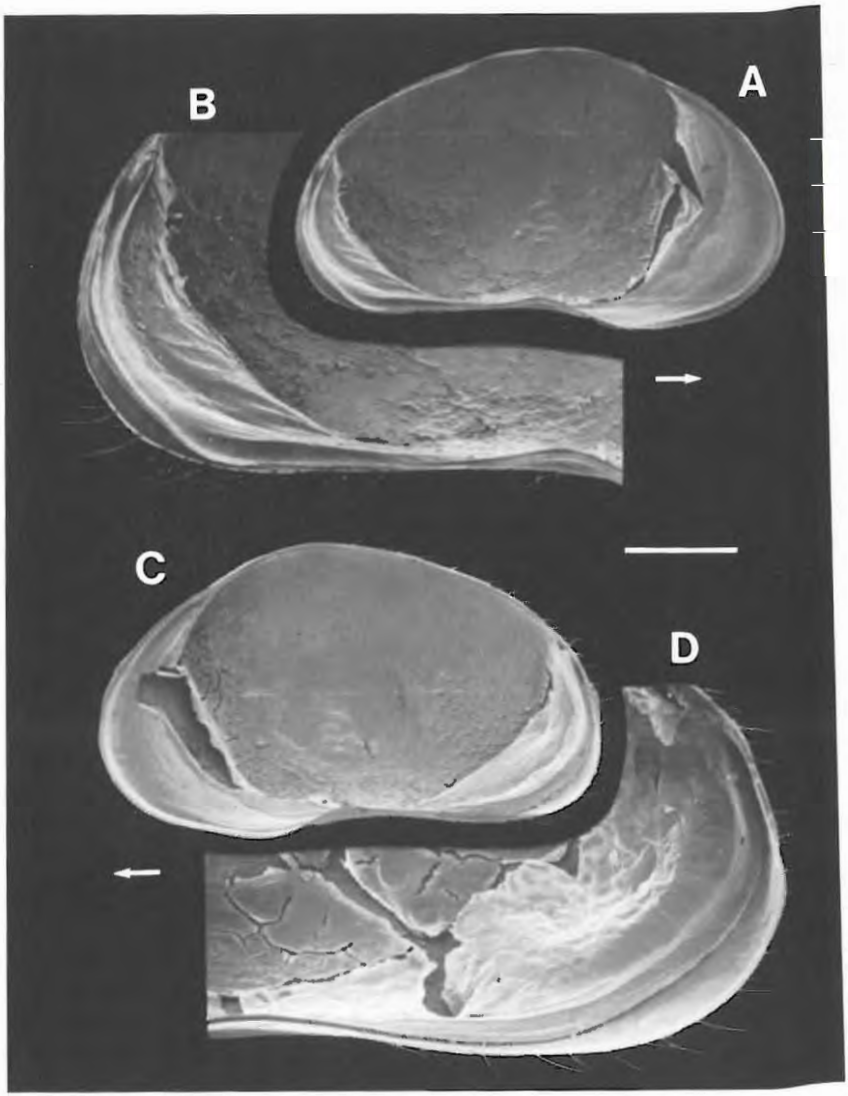

Fig. 9. - *Plesiocypridopsis newtoni*, female, Lanzarote (Canary islands). A: LV, inner view. B: LV, posterior inner marginal zone, detail of A. C: RV, inner view. D: RV, inner posterior marginal zone, this photo from a specimen different from C. Scale bar: 0.20 mm for A and C.

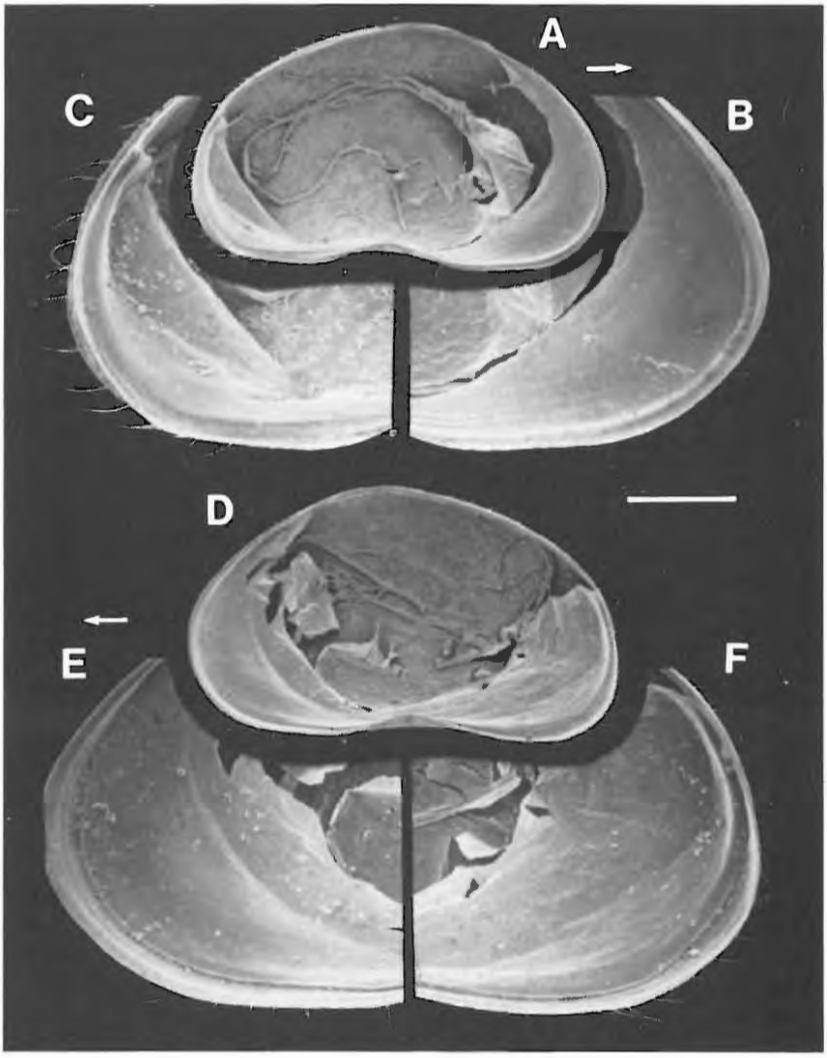

Fig. 10. - *Plesiocypridopsis newtoni*, male, Lanzarote (Canary islands). A: LV, inner view. B: LV, anterior inner marginal zone, detail of A. C: LV, posterior inner marginal zone, detail of A. D: RV, inner view. E: anterior inner marginal zone, detail of D. F: inner posterior marginal zone, detail of D. Scale bar: 0.20 mm for A and D.

plate and hence the number of branchial filaments is usually identical in both sexes.

It is possible that G.W. Müller's (1898) specimens actually belong to two different species, i.e. *P. newtoni*, with 2 Mx2 branchial filaments, and a new species, i.e. his *P. aldabrae*, with 3 maxillar filaments. It is noteworthy that G.W. Müller later (1912) put *P. aldabrae* in synonymy with *P. newtoni*, a synonymy accepted by Bronstein (1947). Unfortunately the type specimens of *P. aldabrae* are considered to be lost: they are not at the Zoological Museum of the University of Greifswald (Germany), where the large G.W. Müller collection is deposited (pers. comm. of Dr G. Müller-Motzman, university of Greifswald).

McKenzie (1971) collected specimens of *P. aldabrae* in 1967 and 1968 on the Aldabra atoll (deposited at the British Natural History Museum), which can be considered as topotypic material: Re-examination of these specimens revealed that male and female specimens were present with 2 as well as 3 Mx2 branchial filaments, which are identical in all other morphological features. The Aldabra specimens are also morphologically the same as the *P. newtoni* specimens discussed earlier, differing only in one character of the hemipenis: the 'knob' on the inner side of the distal process, which is distinctly less developed in the specimens from Aldabra than in those from the Canary islands and Greece (the remaining samples only contain females). At present we do not consider this character difference of the hemipenis and the number of branchial filaments being 2 or 3 to be sufficient to warrant the erection of a new species. This does mean that this is the first record of variability within a species of the number of filaments on the branchial plate of the Mx2 (in species with less than 4 filaments).

Our conclusion is that the specimens from Aldabra and Lanzarote with 3 filaments fall within the variability range of *P. newtoni* and that *P. aldabrae* has to be considered to be synonymous with *P. newtoni*, the latter having nomenclatural priority.

Sarscypridopsis aculeata (Costa, 1847)

The species occurs in 11 samples all collected in wells on the island of Fuerteventura (Canary islands). It was not collected on the Cape Verde islands. It was found together with *Cypridopsis vidua* in 4 wells, in 2 others with *Plesiocypridopsis newtoni*. Size: L = 0.57-0.67 mm.

The electric conductivity of the habitats ranges from 2.08 to 9.73 mS/cm (inferred salt range: ca. 1-6 p.p.t.), thus covering the oligohaline and the lower part of the mesohaline ranges. Part of the specimens examined still show remnants of the green colouration of living specimens.

S. aculeata commonly occurs in slightly salty coastal and inland waters. It is only rarely found in pure fresh water. Ganning (1971) collected the species in rockpools on the Swedish coast at a maximum salt content of 17.2 p.p.t.. *S. aculeata* is a cosmopolitan species. The males are unknown.

Taxonomy: The valves of all specimens examined are densely covered with deep pits. Between the pits stiff setae and, in some of the specimens, short spines are found. The Mx2 respiratory plate bears 4 filaments.

Sarscypridopsis lanzarotensis (Mallwitz, 1984)

Syn.: *Cypridopsis lanzarotensis* Mallwitz, 1984

This species was recently transferred by Meisch & Broodbakker (1990) from the genus *Cypridopsis* to the genus *Sarscypridopsis* McKenzie, 1977 and SEM figures of the valves were provided.

The species was found in 7 samples collected on Gomera (1 Stn), Hierro (1 Stn), La Palma (2 Stns) and Tenerife (3 Stns). It was not collected on the Cape Verde islands. Two samples were collected in springs, 2 in wells and 2 in a cave. In the fountain ponds on La Palma the species was found together with *Cypridopsis vidua*, on Tenerife it was collected together with *Heterocypris salina*. Size: L = 0.56-0.76 mm.

The electric conductivity ranges from 0.97 to 15.4 mS/cm (inferred salt content: ca. 0.5-11 p.p.t.), thus covering the oligohaline and the lower half of the mesohaline ranges.

Up to now *S. lanzarotensis* is only known from the Canary islands.

4. List of localities and species

Remarks: (1) All samples are preserved in alcohol and are deposited at the Institute of Taxonomic Zoology of the University of Amsterdam (The Netherlands).

(2) Names of localities and other data were copied from the labels included in Prof. Stock's tubes. Part of the information on the localities was completed by Prof. Stock (pers. comm.). For each sample we add the number of specimens, the carapace size (only adult specimens were considered) and the number of dissections we made. All electric conductivity values were converted into mS/cm.

4.1. Canary islands

Island of Alegranza

85/583 South side of the island, large concrete basin filled with rainwater in dry riverbed, depth: 2 m, EC= 2.38 mS/cm, 8 Jan. 1986 (Plancius exp.):
Plesiocypridopsis newtoni (11 f. and 5 m.).

Island of Fuerteventura

87/58 Betancuria, open well just north of the locality, EC = 2.08 mS/cm, 4 May 1987:
Cypridopsis vidua (17 f., L = 0.54-0.61 mm),
Sarscypridopsis aculeata (9 f., L = 0.61-0.63 mm).

87/59 Betancuria, open well south of the 16th century church, EC = 4.09 mS/cm, 4.5.1987:

Cypridopsis vidua (15 f., L = 0.56-0.60 mm)
Sarscypridopsis aculeata (4 f., L = 0.62-0.63 mm).

87/60 Betancuria, closed well south of the 16th century church, EC = 7.41 mS/cm, 4 May 1987:

Cypridopsis vidua (28 f., L = 0.57-0.58 mm)
Sarscypridopsis aculeata (15 f., L = 0.63-0.66 mm).

87/61 Betancuria, well, 0.8 km south of the locality at km sign 37, EC = 5.13 mS/cm, 4 May 1987:

Cypridopsis vidua (5 f., L = 0.54-0.60 mm)
Sarscypridopsis aculeata (7 f., L = 0.63-0.66 mm, 1 diss.).

87/74 Totó, well, EC = 4.39 mS/cm, 5 May 1987:

Plesiocypridopsis newtoni (30 f. and 25 m.) (1 diss.).

87/75 Ca. 1 km north of Gran Tarajal, open well, EC = 7.95 mS/cm, 6 May 1987:

Plesiocypridopsis newtoni (about 20 f. and 3 m.) (1 diss.).

87/76 Las Playitas, closed well ca. 300 m from the sea, EC = 7.27 mS/cm, 6 May 1987:

Plesiocypridopsis newtoni (6 f. and 4 m.) (1 diss.).

87/77 Las Playitas, well, ca. 400 m from the sea, EC = 10.81 mS/cm, 6 May 1987:

Plesiocypridopsis newtoni (1 m. and 1 juv.) (1 diss.).

87/84 Partly open well along the road GC 640, at km. sign 1, EC = 4.72 mS/cm, 6 May 1987:

Sarscypridopsis aculeata (21 f., L = 0.60-0.62 mm).

87/85 Antigua (Villa Nueva), open well, EC = 9.56 mS/cm, 6 May 1987:

Sarscypridopsis aculeata (29 f., L = 0.57-0.62 mm).

87/86 Antigua (Villa Nueva), partly open well, EC = 9.73 mS/cm, 6 May 1987:

Sarscypridopsis aculeata (8 f., L = 0.60-0.61 mm).

87/87 Antigua (Villa Nueva), open well, 30 m south of Stn 87/86, EC = 8.38 mS/cm, 6 May 1987:

Sarscypridopsis aculeata (10 f., L = 0.60 mm, only 2 spms measured).

87/93 Antigua, zona Carbon, closed well, EC = 1.49 mS/cm, 7 May 1987:

Cypridopsis vidua (3 f., L = 0.58-0.61 mm).

87/100 Barranco del Garabato, open well, Agua de Buyes, EC = 3.38 mS/cm, 7 May 1987:

Cypridopsis vidua (11 f., L = 0.55-0.63 mm).

87/109 Barranco de la Solapa, open well in upper cours of the locality, west of Pajara, EC = 5.09 mS/cm, 8 May 1987:

Sarscypridopsis aculeata (39 f., L = 0.59-0.63 mm).

87/110 Alto de Aguaje, new well, EC = 7.35 mS/cm, 8 May 1987:

Plesiocypridopsis newtoni (5 f. and 3 m.) (1 diss.),
Sarscypridopsis aculeata (ca. 30 f., L = 0.61-0.67 mm).

87/111 Barranco de Machin, closed well, EC = 4.88 mS/cm, 8 May 1987:

Plesiocypridopsis newtoni (2 f.) (1 diss.),
Sarscypridopsis aculeata (17 f., L = 0.61-0.67 mm).

Island of Gran Canaria

88/01 small springs in cliff of Playa del Inglés (urbanización California), EC = 6.13 mS/cm, 7 Feb. 1988:

Heterocypris salina (34 f., L = 0.96-1.21 mm) (1 diss.).

Island of La Gomera

86/564 Hamlet of Palmarejo, pozo (= well) del Sindicato Regantes, EC = 1.35 mS/cm, 26 Nov. 1986:

Cypridopsis vidua (1 f., L = 0.59 mm).

86/566 Playa de Vallehermosa, well in Barranco del Valle, EC = 0.23 mS/cm, 27 Nov. 1986:

Herpetocypris cf. *chevreuxi* (3 ad. empty carapaces),
Cypridopsis vidua (1 empty carapace, L = 0.63 mm),
Cypridopsinae sp. (1 empty carapace),
Cyprididae sp. (1 empty carapace).

86/572 Santiago, barranco La Junta, open well, ca. 1 km from the sea, EC = 1.33 mS/cm, 28 Nov. 1986:

Cypridopsis vidua (72 f., L = 0.55-0.63 mm).

86/574 Barranco de Santiago, open well near mouth, EC = 0.68 mS/cm, 28 Nov. 1986:

Cypridopsis vidua (1 f., L = 0.54-0.59 mm).

86/576 Barranco de Erque, spring, alt. ca. 970 m, EC = 0.45 mS/cm, 28 Nov. 1986:

Sarscypridopsis lanzarotensis (ca. 30 f., L = 0.56-0.66) (1 diss.).

86/581 Castillio Torre del Conde at San Sebastian, open well, EC = 1.84 mS/cm, 29 Nov. 1986:

Cypretta seurati (2 f., L = 0.69 mm).

86/583 Mouth of Barranco del Rincón (= Playa de Avalo), anchialine spring, EC = 1.87 mS/cm, 29 Nov. 1986:

Pseudocandona albicans (1 ad. f., L = 0.78 mm) (1 diss.),
Cypretta seurati (1 f.) (1 diss.).

86/584 Barranco Hondo, closed well at Playa de San Sebastian, EC = 0.63 mS/cm, 29 Nov. 1986:

Cypridopsis vidua (1 f., L = 0.58 mm).

86/586 San Sebastian, open well on beach of Castillio Torre del Conde, EC = 2.14 mS/cm, 29 Nov. 1986:

Cypridopsis vidua (1 f., L = 0.57 mm).

87/25 San Sebastian, Barranco Hondo, open well, EC = 6.09 mS/cm, 21 Apr. 1987:

Heterocypris salina (1 f., L = 1.03 mm).

Island of El Hierro

87/39 Pozo (open well) La Bonanza, EC = 6.86 mS/cm, 27 Apr. 1987:

Cypridopsis vidua (1 f., L = 0.60 mm),
Plesiocypridopsis newtoni (1 f. and 1 smashed spmn) (1 diss.).

87/42 Pozo (open well) de Hoya del Verodal, EC = 3.24 mS/cm, 8 Apr. 1987:

Plesiocypridopsis newtoni (1 f.) (1 diss.).

87/43 Small well Poyat, 100 m east of La Salud, ca. 9 m from the sea, EC = 11.52 mS/cm, 29 Apr. 1987:

Sarscypridopsis lanzarotensis (8 f., L = 0.62, 1 spmn measured) (1 diss.).

87/45 Ajibe (=cistern) Verodal Playa, EC = 2.36 mS/cm, 29 Apr. 1987:

Plesiocypridopsis newtoni (21 f. and 19 m.) (1 diss.).

87/46 Ajibe (=cistern) de la Punta, EC = 0.77 mS/cm, 29 Apr. 1987:

Cypridopsis vidua (4 f., L = 0.57-0.60 mm),
Plesiocypridopsis newtoni (10 f. and 2 m.) (1 diss.).

Island of Lanzarote

85/569 Arrecife, reservoir (well) close to the salt ponds (salinas) at the head of Puerto de Naos (fishery harbour), EC = 29.4 mS/cm, 5 Jan. 1986:

Plesiocypridopsis newtoni (16 f. and 11 m.) (8 diss.).

85/574 Playa de las Coloradas, small covered well on natural rock, watertable + depth: 5+0.5 m, 23° C, EC = 3.12 mS/cm, 6 Jan. 1986 (Plancius exp.):
Plesiocypridopsis newtoni (1 m.) (1 diss.).

85/575 El Golfo, north-end, seaside of beach wall, in volcanic black sand and earth, ca. 0.5 m above low water line EC = 32 mS/cm, 6 Jan. 1986 (Plancius exp.):
Plesiocypridopsis newtoni (44 f. and 22 m.) (1 diss.).

85/579 Punto de Mujeres, large open well with mill near a salt-pan, EC = 33.2 mS/cm, 7 Jan. 1986:
Plesiocypridopsis newtoni (2 ad. m.) (1 diss.).

Island of La Palma

86/541 Fuente (=fountain) de San Juan, slowly running ponds, 7 Nov. 1986:
Cypridopsis vidua (6 f., L = 0.52-0.58 mm) (1 diss.),
Sarscypridopsis lanzarotensis (7 f., L = 0.61-0.68 mm, 1 diss.).

86/544 San Andres, well, EC = 0.98 mS/cm, 17 Nov. 1986:
Sarscypridopsis lanzarotensis (2 f., L = 0.67-0.68 mm).

Island of Tenerife

86/518 Montes de las Mercedes, spring E of Pico del Inglés, alt. ca. 850 m, EC = 0.22 mS/cm, 4 Nov. 1986:
Herpetocypris chevreuxi (7 ad. f. and 2 valves; L = 1.92-1.99 mm).

86/524 Along the road from Tamaimo to Los Gigantes, cemented trough, EC = 2.32 mS/cm, 9 Nov. 1986:
Heterocypris salina (20 f., L = 1.05-1.15 mm).

86/525 Playa a Paraíso, junction of conducciones (=pipelines), EC = 0.97 mS/cm, 9 Nov. 1986:

Plesiocypridopsis newtoni (13 f. and 10 m.) (2 diss.),
Herpetocypris chevreuxi (1 ad. f.),
Heterocypris cf. *salina* (1 f.).

86/527 Barranco de Pedro Alvarez, small spring, alt. ca. 650 m, EC = 0.29 mS/cm12 Nov. 1986:

Pseudocandona albicans (16 f., L = 0.68-0.84 mm) (1 diss.)

86/528 Punta del Hidalgo, well La Fajama II-03, EC = 1.34 mS/cm, 12 Nov. 1986:

1 smashed specimen, not identified.

87/33 La Rajeta (Pta. del Hidalgo), small spring in beach cliff, EC = 3.51 mS/cm, 25 Apr. 1987:

Sarscypridopsis lanzarotensis (21 f., L = 0.67-0.73 mm) (2 diss.),
Heterocypris salina (22 f., L = 1.22-1.29 mm).

87/124 Cueva del Agua (near El Balayo), dimmed light, uppermost cave basin, gravel, sand, EC = 1.49 mS/cm, 14 May 1987:

Sarscypridopsis lanzarotensis (several 1000 f., L = 0.66-0.72 mm) (3 diss.).

87/127 Cueva del Agua (near El Balayo), small rimmed gulley near the entrance, EC = 15.40 mS/cm, 14 May 1987:

Sarscypridopsis lanzarotensis (ca. 50 f., L = 0.72-0.76 mm) (1 diss.).

4.2. Cape Verde islands

Island of Sal

86/52 Algodocira, open well, watertable + depth: 8 + 0.4 m, UTM coord. 9398 4040, Cvetkov net, EC = 0.26 mS/cm, 19 Jan. 1986 (Plancius exp.):

Cypretta seurati (about 550 f., L = 0.63-0.69 mm, 4 diss.).

86/55 Porto de Palmira (Vile Verde), open well just E of the locality, watertable + depth = 8 + 0.5 m, EC = 0.36 mS/cm, 19 Jan. 1986 (Plancius Exp.):

Heterocypris salina (3 f., L = 0.84 mm).

86/71 Fijoal, open well, EC = 2.36 mS/cm, 20 Jan. 1986 (Plancius exp.):

Heterocypris salina (ca. 2000 f., L = 0.84-0.92 mm) (1 diss.),

Cypretta seurati (ca. 30 f.).

86/73 Curral do Dadó, well, EC = 6.79 mS/cm, 23 Jan. 1986 (Plancius exp.):

Cypretta seurati (ca. 60 f., L = 0.69-0.72 mm).

86/74 Mouth of Ribeira de Madama, method Karaman-Chappuis in interstitial water of dry bed; coarse sand and gravel, 24 Jan. 1986 (Plancius exp.):

Cypretta seurati (4 f., L = 0.73 mm).

86/75 Jardim, well with windpump, EC = 4.45 mS/cm, 26 Jan. 1986 (Plancius exp.):

Cypretta seurati (ca. 100 f., L = 0.69-0.72 mm).

Island of Santiago

86/34 Mouth of Ribeira Brava, closed well, watertable + depth: 6.5+0.5 m, EC = 0.70 mS/cm, UTM coord. TS 1691 8507, Cvetkov net, 16 Jan. 1986. Other fauna: Planaria, Hydrobiidae (Plancius exp.):

Heterocypris salina (1 f.) (1 diss.).

Island of São Vicente

86/02 Monte da Ribeira Juliao, north side, open well, watertable + depth: 1.5 + 16 m, 16°52'N 25°W, Cvetkov net, EC = 3.4 mS/cm, 13 Jan. 1986 (Plancius exp.):

Cypretta seurati (2 f., L = 0.60-0.67 mm).

86/11 Ribeira de Calhan, well, EC = 4.05 mS/cm, 13 Jan. 1986:
Heterocypris salina (22 f., L = 0.96-1.12 mm) (1 diss.).

Island of Santo Antão

86/101 Ribeira de Kuruginhas at Port Noeff, well, 23 Jan. 1986, EC = 1.59 mS/cm (Plancius exp.):
Heterocypris salina (20 f., L = 0.81-0.89 mm).

86-101 Ribeira Grande, Pozo (=well) Acao, EC = 1.08 mS/cm, 23 Jan. 1986 (Plancius exp.):
Heterocypris salina (2 f., L = 0.90 mm).

86/104 Pozo Acao, well named 'Picoter', EC = 1.04 mS/cm, 23 Jan. 1986 (Plancius exp.):
Heterocypris salina (1 juv. f.).

5. Annotated check-list of freshwater Ostracoda of the Azores, the island of Madeira, the Canary, Selvagens and Cape Verde islands

The Azores, the island of Madeira, the Canary and the Selvagens islands form the so-called Macaronesian biogeographic region. Strictly speaking, the Cape Verde islands do not belong to Macaronesia. They will nevertheless be considered here.

5.1. The Azores

The ostracod fauna of the Azores was studied by De Guerne (1887a,b, 1888), Moniez (1888), Barrois (1896), Richard (1896), Petkovski (1963) and Paulo & Moutinho (1983).

De Guerne (1887a,b, 1888) recorded 2 species: *Cypris virens* (= *Eucypris virens*) which is included in the list below and *Cypris moniezi* n.sp. Unfortunately, the original description of *Cypris moniezi* is so poor that it cannot be identified at present (see also G.W. Müller, 1912) and we therefore do not consider it herein.

The same is true for 7 of the 11 species recorded by Moniez (1888): These are *Cypris moniezi* De Guerne, *Cypris nitens* Fischer, *Cypris tessellata* Fischer, *Cypris trigonella* Brady, and three species which the author described as new from the Azores: *Cypris elegans*, *Cypridopsis lunata* (possibly synonymous with *Plesiocypridopsis newtoni*, see G.W. Müller 1912: 208) and *Cypridopsis chavesi*. The four remaining species recorded by Moniez (1888) are listed below.

Barrois (1896) mentioned 13 species, among which 5 cannot be identified at present (*Cypris nitens* Fischer, *Cypris elegans* Moniez, *Cypris moniezi* De Guerne, *Cypris tessellata* Fischer and *Cypris trigonella* Brady). The remaining 8 species are included in the list below.

Richard (1896) recorded 7 species and Petkovski (1963) 13 species, all of which, except for *Potamocypris smaragdina* (Vavra, 1891), are included in the list below. According to Dr Petkovski (pers. comm.), the *P. smaragdina* specimens from the Azores actually belong to *P. arcuata* (see also Meisch, 1985: 40). Finally, Paulo & Moutinho (1983) recorded 4 species.

The authors' names are added in parenthesises: Barr. = Barrois (1896), De G. = De Guerne (1888), Mon. = Moniez (1888), P.&M. = Paulo & Moutinho (1983), Rich. = Richard (1896), Petk. = Petkovski (1963).

Pseudocandona stagnalis (Sars, 1890):
São Miguel (Petk., mentioned as uncertain).

Cyclocypris ovum (Jurine, 1820):
São Miguel (Barr., mentioned as doubtful), (Mon.).

Cypris bispinosa Lucas, 1849:
Santa Maria (Barr.), (Petk., fem. only), (P.& M.).

Eucypris virens (Jurine, 1820):
Faial (De G.), Graciosa (Barr.), (Mon.), São Jorge (Barr.), (Mon.), São Miguel (Barr.), (Mon.), Terceira (Barr.), (Mon.).

Heterocypris incongruens (Ramdohr, 1808):
Corvo (Rich.), Faial (Rich.), (Petk.), Flores (Rich.), Graciosa (Rich.), Santa Maria (Rich.), São Miguel (Barr.), (Rich.), (Petk.), Terceira (Barr.), (Rich.), (Petk.).

Heterocypris salina (Brady, 1868):
São Miguel (RICH, as *Cyprinotus prasinus* = *Cypris salina*), Terceira (Petk.)

Herpetocypris chevreuxi (Sars, 1896):
São Miguel (Petk.), Santa Maria (Petk.), (P.&M.).

Herpetocypris reptans (Baird, 1835):
Corvo (Rich.), Flores (Rich.), Graciosa (Rich.), São Miguel (Rich.).

Strandesia (Neocypris) obliqua (Brady, 1868):
Faial (Petk.), Flores (Petk.), São Miguel (Barr.), (Mon.).

Cypridopsis lusatica Schäfer, 1943 = *C. brincki* Petkovski, 1963:
Santa Maria (Petk.). São Miguel (Petk.).

Cypridopsis obesa (Brady & Robertson, 1869):
Santa Maria (Petk.).

Cypridopsis vidua (O.F. Müller, 1776):
Faial (Rich.), Flores (Petk.), Graciosa (Rich.), São Jorge (Barr.), (Mon.), Santa Maria (RICH, as *C. picta*), São Miguel (Barr.), (Mon.), (Rich.), (Petk.), Terceira (Barr.), (Mon.), (Rich.).

Sarscypridopsis aculeata (Costa, 1847):
Santa Maria (Rich.), (Petk.), (P.&M.), São Miguel (Petk.), Terceira (Petk.).

Potamocypris arcuata (Sars, 1903):
Santa Maria (Petk.), São Miguel (Petk.).

Potamocypris villosa (Jurine, 1820):

Corvo (Rich.), Faial (Barr.), (Rich.), Santa Maria (Barr.), (Rich.,), (Petk. as *P. v. crassipes*), (P.&M., as id.), São Miguel (Barr.), (Rich.), (Petk. as *P. v. crassipes*), Terceira (Barr.), (Rich.).

5.2. The island of Madeira

The freshwater ostracod fauna of Madeira was studied by Fischer (1855), Schodduyn (1927), Stauder (1990, 1992) and Stauder & Meisch (in press).

According to Stauder & Meisch (in press), who critically review the species recorded by Fischer (1855) and Schodduyn (1927), none of the seven species listed by these two early authors can be identified unequivocally at present (for details see the paper mentioned). Stauder & Meisch (in press) also report on the collection of three species in a stream (the Ribeira das Cales) near Funchal:

Strandesia (Neocypris) obliqua (Brady, 1868),

Cypridopsis lusatica Schäfer, 1942
(= *Cypridopsis brincki* Petkovski, 1963, = *Cypridopsis bamberi* Henderson, 1986).

Potamocypris pallida Alm, 1915.

Remark: for details on the synonymy of *Cypridopsis lusatica* with *Cypridopsis brincki*, see Petkovski et al. (1993).

5.3. Canary islands

As stated in the introduction, there are only two papers dealing with the ostracod fauna of the Canary islands, i.e. the papers by Mallwitz (1984) and Meisch & Broodbakker (1990).

Mallwitz (1984) recorded *Cypridopsis lanzarotensis* n.sp. on the island of Lanzarote. It was transferred into the genus *Sarscypridopsis* by Meisch & Broodbakker (1990).

(MALLW.) = Mallwitz, 1984; the other localities are those reported herein.

Pseudocandona albicans (Brady, 1864):
La Gomera, Tenerife.

Herpetocypris chevreuxi (Sars, 1896):
La Gomera, Tenerife.

Heterocypris salina (Brady, 1868):
Gran Canaria, La Gomera, Tenerife.

Cypretta seurati Gauthier, 1929:
La Gomera.

Cypridopsis vidua (O.F. Müller, 1776):
Fuerteventura, La Gomera, El Hierro, La Palma.

Plesiocypridopsis newtoni (Br. & Rob., 1870):
Alegranza, Fuerteventura, El Hierro, Lanzarote, Tenerife.

Sarscypridopsis aculeata (Costa, 1847):
Fuerteventura.

Sarscypridopsis lanzarotensis (Mallwitz, 1984):
La Gomera, El Hierro, Lanzarote (MALLW.), La Palma, Tenerife.

5.4. Selvagens islands

No data are available on the freshwater ostracod fauna of the Selvagens islands.

5.5. Cape Verde islands

There is only one paper dealing with freshwater Ostracoda of the Cape Verde islands. Masi (1925) recorded the finding of a new species, *Cyprinotus hesperidum*, from the island of Razo. This species is considered to be most probably synonymous with *Heterocypris symmetrica* G.W. Müller (see Martens & Meisch, in prep.).

(MASI) = Masi (1925); the localities without specification are those mentioned herein.

Heterocypris salina (Brady, 1868):
Sal, Santiago, São Vicente, Santo Antão.

Heterocypris symmetrica (G.W. Müller, 1898) = *Cyprinotus hesperidum* Masi, 1925:
Razo (MASI, 1925).

Cypretta seurati Gauthier, 1929:
Sal, São Vicente.

6. Notes on biogeography

The freshwater ostracod fauna of the Macaronesian s.l. biogeographic area remains poorly known: Thus far only 20 species are recorded. For this reason, we believe it to be too early to give an extensive discussion on the biogeography of the freshwater ostracod fauna of the area. Nevertheless we would like to make the following remarks:

(1) Except for *Sarscypridopsis lanzarotensis*, all the Macaronesian species listed above are also known from outside the area. We believe *S. lanzarotensis*, which up to now was only found on some of the Canary islands (La Gomera, El Hierro, Lanzarote, La Palma, Tenerife) not to be endemic to the area and think it will in future be found on the African continent as well.

(2) All the remaining species also occur on the European and, except for *Pseudocandona albicans*, also on the African continent. The presence of *P. albicans* in Africa is highly probable.

(3) Only two of the 20 species recorded, i.e. *Pseudocandona stagnalis* and *Plesiocypridopsis newtoni*, reproduce bisexually. The remaining species all reproduce parthenogenetically in the area. The colonization of new aquatic habitats is facilitated by the parthenogenetic reproduction mode: one single specimen can give rise to a new population.

(4) Many ostracod species have been shown to survive the transport on the feet and the plumage of birds. At least some can survive the passage through the gut of birds and even freeze-drying (see for instance Löffler, 1964). Freshwater Ostracoda have obviously arrived by passive transport onto the Atlantic islands. Most likely the transport was ensured by migratory birds, and maybe also by man.

7. Acknowledgments

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Remark: the Klie-collection at the Zoologic Institute and Zoologic Museum of the University of Hamburg (Germany) is on permanent loan from the Zoologic Institute of the University of Kiel (Germany).

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Taxonomic revision of the freshwater Ostracoda species *Cypridopsis lusatica* Schäfer, 1943 (Crustacea)

by

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Abstract: The Recent freshwater ostracod species *Cypridopsis lusatica* Schäfer, 1943 belonging to the Podocopida-Cypridoidea-Cyprididae is redescribed and its taxonomic status is revised. *Cypridopsis brincki* Petkovski, 1963 and *Cypridopsis bamberi* Henderson, 1986 are shown to be junior synonyms of *Cypridopsis lusatica*. The taxonomic relations with *Cypridopsis brevisetosa* Klie, 1943 are discussed. It is suggested that *Cypridopsis lusatica* is presently undergoing an evolutionary process of reduction of the swimming setae of the antennae, a process which results from the passage of a swimming to a crawling mode of life. At present, the species is known from eastern Germany, northern France, England, Portugal, Spain, Italy, Macedonia (former Yugoslavia), the Azores and Madeira. *Cypridopsis lusatica* is herein first recorded from France and Italy.

Résumé: Les auteurs présentent une révision taxonomique de *Cypridopsis lusatica* Schäfer, 1943, un ostracode actuel d'eau douce appartenant aux Podocopida-Cypridoidea-Cyprididae. *Cypridopsis brincki* Petkovski, 1963 et *Cypridopsis bamberi* Henderson, 1986 sont mises en synonymie avec *Cypridopsis lusatica*. Les auteurs émettent l'hypothèse que l'espèce est engagée dans un processus évolutif conduisant à la réduction progressive des

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soies natatoires de l'antenne. A cette date, l'espèce est connue d'Allemagne orientale, du nord de la France, de l'Angleterre, du Portugal, de l'Espagne, d'Italie, de Macédoine, des Açores et de Madère. Les relations taxonomiques avec *Cypridopsis brevisetosa* Klie, 1943 sont discutées. *Cypridopsis lusatica* est nouvelle pour la faune de la France et de l'Italie.

Introduction

The genus *Cypridopsis* s.l. Brady, 1867 belongs to the Cypridopsinae which is considered a subfamily of the Cyprididae by recent authors (McKenzie, 1971, De Deckker, 1979, Martens, 1985). A list of the genera of the Cypridopsinae was given by Marmonier et al. (1989) and completed by Meisch (1991). The latter publication also comprises a key for the identification of the European genera of the Cypridopsinae.

Since about 1965 the genus *Cypridopsis* s.l. was recognised to include several phyletic lineages best classified as separate genera. As a result, *Plesiocypridopsis* Rome, 1965; *Sarscypridopsis* McKenzie, 1977; *Cavernocypris* Hartmann, 1964; and *Klieopsis* Martens et al. (1991) have been removed from *Cypridopsis* s.l., a splitting process which most probably is not yet finished.

Cypridopsis lusatica belongs to *Cypridopsis* s.str., as it has (a) a left valve ventrally overlapping the margin of the RV, (b) a conspicuous double folded oblique inner list on the left valve, (c) furcal rami with a triangular (not cylindrical) trunk.

Like *Cypridopsis vidua*, the type-species of the genus, most of the *Cypridopsis* s.str. species have natatory setae which distinctly extend beyond the tips of the terminal claws of the antennae and hence are good swimmers. At present only a few non-swimming *Cypridopsis* species, i.e. species with strongly reduced natatory setae, are known (see below). *Cypridopsis lusatica* has natatory setae of intermediate length and hence most probably has only a reduced swimming ability. The tips of the setae are very delicate, a feature which probably indicates that the seate are undergoing an evolutionary reduction process (see below).

Remark: when working on the taxonomic part of the present paper, the 'Index and Bibliography of Nonmarine Ostracoda' by Kempf (1980, 1991) was extensively used.

Abbreviations used in text:
ad. = adult specimen(s):
a.s.l. = above sea level;
A1 = antennule (first antenna);
A2 = antenna (second antenna);
Mx1 = maxillula;
Mx2 = maxilla;
T1 = first thoracopod (walking leg);
T2 = second thoracopod (cleaning leg);
fem. = female(s);
reg. n. = registration number;
RBINS = Royal Belgian Institute of Natural Sciences (Brussels).

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

Subfamily CYPRIDOPSINAE Kaufmann, 1900

Cypridopsis lusatica Schäfer, 1943

1943 *Cypridopsis lusatica* Schäfer: 210.
1948 *Cypridopsis lauta* Margalef: 184.
1958 *Cypridopsis lusatica* Schäfer (= *C. lauta* Margalef) - Margalef: 55.
1963 *Cypridopsis brincki* Petkovski: 56.
1986 *Cypridopsis bamberi* Henderson: 1.
1993 *Cypridopsis brincki* - Stauder & Meisch (in press).

Type material: 2 syntype specimens preserved in alcohol, deposited at the Zoological Institute and Zoological Museum of the University of Hamburg (Klie-collection, reg. n. 1134). These 2 specimens obviously have been sent by H.W. Schäfer to W. Klie. The remaining type-specimens do not exist at the museum in Berlin (comm. of Dr E. Pietrzeniuk) nor in Görlitz (comm. of Prof W. Dunger), which are the towns where Schäfer worked and hence are considered lost.

Material examined

1. Germany, Oberlausitz, near Görlitz, near the village of Gruna, a ditch, probably fed by a spring, in a meadow: 2 ad. fem., leg. H.W. Schäfer, 14 May 1933. (Type material).

2. Macedonia, near Skopje, above the village of Aracinovo, spring: several ad. fem., leg. T.K. Petkovski. Collected together with *Heterocypris limbata* Masi, *Heterocypris inaequivalvis* Bronstein and *Herpetocypris brevicaudata* s.l. Kaufmann.

3. Macedonia, near Valandovo (southern Macedonia), a pond fed by a spring ('Tatarli'): numerous fem., leg. T.K. Petkovski, 15 July 1987. Collected together with *Cypridopsis vidua* (O.F. Müller), *Herpetocypris intermedia* s.l. Kaufmann and *Psychrodromus fontinalis* (Wolf).

4. Macedonia, beside the road from Strip to Radovis (eastern Macedonia), a helocrenic spring: numerous fem., 23 April 1968, leg. T.K. Petkovski. Collected together with *Candona fasciolata* Petkovski and *Cypridopsis vidua* (O.F. Müller).

5. France, Pas-de-Calais, Ambleteuse, swampy environment of a spring in a meadow in the ancient dunes: 11 August 1981 (5 ad., 1 juv.), 11 Nov. 1981, 7 August 1982 (3 ad.), 6 August 1986 (2 ad., 1 juv.). Leg. K. Wouters, RBINS, reg.n. IG 26 305, 26 481 and IG 27 084.

6. Italy, Bolsena (about 70 km north of Rome), a ditch, probably flowing from a spring, in a garden: 1 fem., 23 August 1984, leg. C. Meisch.

7. Spain, northwest, Asturias, near the village of Molena, water flowing from a spring in a meadow: 48 fem., L = 0.61-0.65 mm, 11 August 1988, leg. C. Meisch.

8. Island of Madeira (Portugal), near Funchal, Ribeira das Cales (mountain stream, spring at about 1500 m above sea level), 820 m and 980 m a.s.l., March and April 1989, leg A. Stauder (see also Stauder & Meisch, in press, under *Cypridopsis brincki*).

9. Great Britain, England, 6 fem. syntype specimens, British Museum (Natural History), North Cornwall, near Camelford, small spring in a pasture land, leg. P. A. Henderson, 4.9.1983, reg. n. 1985.66-71.

Differential diagnosis

A species of the genus *Cypridopsis* s.str. with the following features: Surface of valves smooth, carapace yellowish green to yellowish brown. A2 natatory setae of variable length, reaching from the middle of the terminal claws to slightly beyond the tips of the claws. Distal joint of the maxillular palp cylindrical, about twice as long as broad; 3rd masticatory lobe with 2 serrate teeth bristles. Respiratory plate of the maxilla (Mx2) with one filament. Walking leg (T1) short and stout, with a strong distal claw. Furcal rami strongly reduced, of triangular shape.

Additional description (females)

Carapace moderately elongate, subovoid in lateral view. In dorsal view, the LV slightly reaching beyond the RV at both the anterior and posterior ends.

LV slightly larger than RV. Ventrally the LV overlaps (embraces) the margin of the RV when the carapace closes. Surface of valves smooth, with sparse setae. Selvage of both valves situated on the valve margin. Inner marginal zones of the LV posteriorly with an oblique double folded inner list, becoming a single folded, lamella-like list at the middle and the anterior end of the valve; anteriorly this list moderately displaced inwards (fig. 1 A, 3 A, B). Marginal zones of RV: posterior double folded list and anterior inner list very weakly developed, running close to the outer valve margin (fig. 1 B, 3 C, D).

Size: 0.60-0.75 mm. Colour: yellowish green to yellowish brown.

Forehead, upper lip, hypostome and rake-like organs as in fig. 4 A, B.

Antennule (A1) 7-jointed, the 2 proximal joints slightly longer than the combined length of the 5 distal joints (fig. 4 C); 2nd joint much wider than long, the posterior margin very prominent. Rome organ weakly developed. Relative lengths of the distal 5 joints about 11:9:7:6:8. Distal joint ca. 3.6 as long as broad. Aesthetasc y_a only 2.1 x the length of the the distal joint.

Antenna (A2) relatively stout (fig. 5 A). Length ratios of the 3 distal joints and the longest claw of the penultimate joint about 60:31:10:53. Natatory setae thin, of variable length, reaching to the tips of the apical claws in the type specimens (the distal parts of the setae are still more fine and delicate than the basal parts in these specimens), only extending to about the middle of the apical claws in the other specimens examined; sensitive seta (sometimes designated as the 6th seta, *Tastborste*) extending to the middle of the next joint. Aesthetasc Y well developed, the apical part distinctly widened. Three z-setae present, z_1 distinctly longer than z_2 and z_3. t-setae of unequal length. Apical claws G_1, G_2 and G_3 strongly developed; G_M-claw distinctly shorter than the neighbouring G_M-claw.

Mandibula with 6 or 7 teeth, 4 of them bifurcated, with spine-like setae between them (fig. 5 B). Mandibular palp 4-jointed; alpha-seta short and pointed, smooth; beta-seta thickened but not noticeably short; gamma-seta long and set with setulae (barbs) on the top third of its length; apical joint with 5 setae, the 2 medial setae distally set barbs.

Apical joint of the maxillular (Mx1) palp cylindrical, about twice as long as

broad, with 4 distal setae of unequal length (fig. 6 A); 3rd masticatory lobe with 2 serrate teeth bristles *(Zahnborsten)*.

Respiratory plate of the maxilla (Mx2) with 1 long filament (fig.6 B).

First thoracopod (T1, walking leg) 5-jointed, the apical claw distinctly longer than the 3 distal joints (relative lengths ca. 100:80). Basal joint only 1.5 x as long as wide (2.1 x in the related *Cypridopsis brevisetosa*).

Second thoracopod (T2, cleaning leg) 4-jointed (fig. 6 D).

Genital fold and furcal rami as in fig. 6 E. Furcal trunk thick, of triangular shape; flagellum distinctly separated from the trunk, ca. 3x as long as the anterior margin of the trunk.

Males are unknown.

Taxonomic discussion

Cypridopsis lusatica Schäfer, 1943 was described from south-eastern Germany, near the village of Gruna in the environs of Görlitz (region of Oberlausitz, former GDR). Only 2 of the numerous type specimens collected by H.W. Schäfer still exist (see above).

C. brincki Petkovski, 1963 was described from the islands of São Miguel and Santa Maria in the Azores. According to the original description, it differs from *C. lusatica* mainly by the following features (a) the A2 swimming setae extend to about the middle of the terminal claws (these slightly extend beyond the tips of terminal claws in *C. lusatica*); (b) the teeth bristles of the 3rd masticatory lobe of the maxillula (Mx1) are serrate (these teeth are smooth in *C. lusatica*).

Dissection and examination of one type specimen of *C. lusatica* by one of us (C.M.), showed that the A2 swimming setae actually reach very slightly beyond the tips of the terminal claws, the apical third part of the setae being strikingly delicate and thin. Contrary to Schäfer's (1943) remark, however, the teeth bristles of the 3rd masticatory process of the maxillula are distinctly

serrate (barbed). The latter feature is only seen under high magnification power (at least 400X). No other taxonomically important difference was found between *C. lusatica* and *C. brincki*.

In conclusion, we consider *C. brincki* Petkovski, 1963 to be synonymous with *C. lusatica* Schäfer, 1943.

Cypridopsis lauta Margalef, 1948 was originally described from two localities in the Spanish Pyrenees. The species was later synonymised with *C. lusatica* by Margalef (1958).

C. lusatica is closely related to *Cypridopsis brevisetosa* Klie, 1943 and *Cypridopsis bamberi* Henderson, 1986, both having reduced A2 natatory setae.

C. brevisetosa Klie, 1943, which at present is only known from springs in Morocco, differs from *C. lusatica* by (a) the presence of pits on the surface of the valves, (b) the very strongly reduced natatory setae which scarcely extend beyond the proximal margin of the next A2 segment, and (c) a conspicuously long and slender apical T1 claw. These three characters clearly form an adaptation to a creeping and/or digging mode of live. *C. brevisetosa* obviously is more adapted than *C. lusatica* to a non-swimming life.

C. bamberi Henderson, 1986, which is known from one locality in Cornwall (U.K.), differs from *C. lusatica* by (a) a slightly larger size (L=0.75 mm), and (b) the absence of any branchial filament on the Mx2. However, examination of the type-specimens of *C. bamberi* and dissection of one of these specimens by one of us (C. M.) showed that, contrary to Henderson's (1986) statement, the Mx2 bears one branchial filament. The 6 adult paratype-specimens examined have a carapace length of 0,66 - 0,69 mm. Furthermore, no taxonomically significant difference with *C. lusatica* was found. We thus consider C. *bamberi* a junior sysnonym of *C. lusatica*.

Reduction of the A2 natatory setae: an ongoing evolutionary process in *Cypridopsis lusatica*

Among the specimens examined, those from Germany display the longest A2 natatory setae, the distal parts of these setae being extremely thin and delicate. Obviously, a very slight genetic change would be sufficient to reduce the length of these setae. Without their thin distal third, the setae extend about to the middle of the claws, as in the specimens from other localities.

Because of the reduced length of the natatory setae, *C. lusatica* most certainly is devoid of any swimming ability. Furthermore, the species seems to be engaged in an evolutionary process of progressive reduction of the natatory setae. Not all populations have reached the same evolutionary stage, as shown by examination of the specimens from Germany. Natural selection most probably favours specimens having still more reduced setae. Indeed, repetitive development of these setae - during each moulting process - at least requires nutrient supplies without any benefit for the individuals. It should be noted that the known populations of *C. lusatica* reproduce parthenogenetically. We do not know, at present, if the reduction of the natatory setae took place entirely or partly in the bisexually reproducing ancestral populations of the species, or if the parthenogenetic populations are able to continue the process. A distinctly more stable evolutionary stage will be reached in future when probably the setae will scarcely extend beyond the base of the next A2 joint, a condition already reached in *C. brevisetosa*.

Ecology and life-history

Schäfer (1943) collected the species in a small ditch in a meadow, where it dwelled with *Potamocypris villosa* (Jur.), *Cryptocandona vavrai* (Kaufm.) and *Pseudocandona albicans* (Brady). As already stated by Schäfer (1943), the accompanying species provide evidence that the ditch is fed by a spring. In northwestern France the species was found together with *Candona candida, Cyria ophthalmica, Herpetocypris reptans* and *Potamocypris villosa*. All known populations of the species have been found in springs or waters flowing from springs. Thus, waters running in open fields (pastures) appear to be the favourite habitat of the species.

C. lusatica has been found from March (Madeira) to the end of August (Italy). At present, the life-history of the species remains unknown.

Distribution

At present, *C. lusatica* is known from 12 localities situated in south-eastern Germany (1 loc.), north-eastern France (1 loc.), south-western England (1 loc.), eastern and southern Macedonia (former Yugoslavia) (3 loc.), central Italy (1 loc.), north-western Spain (1 loc.), north-eastern Spain (2 loc.), Portugal (1 loc., Petkovski, 1963) and the Azores (islands of São Miguel and Santa Maria). These records seem to indicate that the species has a southern distribution. It can be expected to be widely distributed in the circummediterranean area. *C. lusatica* has not yet been been found in Africa, where its presence nevertheless is expected.

The rare occurrence of the species in central and western Europe (Germany, France and England) could be explained by an occasional introduction by migrating birds: at least some species of ostracods are known to survive the transport on the legs and the plumage of birds (e.g. Löffler 1964). However, the species most probably is incapable of spreading in northern regions.

Acknowlegments

We thank Prof Dr Gerd Hartmann (University of Hamburg) for the loan of the type specimens of *Cypridopsis lusatica* from the Klie-collection and Dr G.A. Boxshall (British Museum, Natural History, London) for the loan of the type-material of *Cypridopsis bamberi*. The Klie-collection of the Zoological Institute and Zoological Museum of the University of Hamburg is on permanent loan from the Zoologic Institute of the University of Kiel, Germany. We also thank S. De Grave, M. Sc., for critically reading the manuscript.

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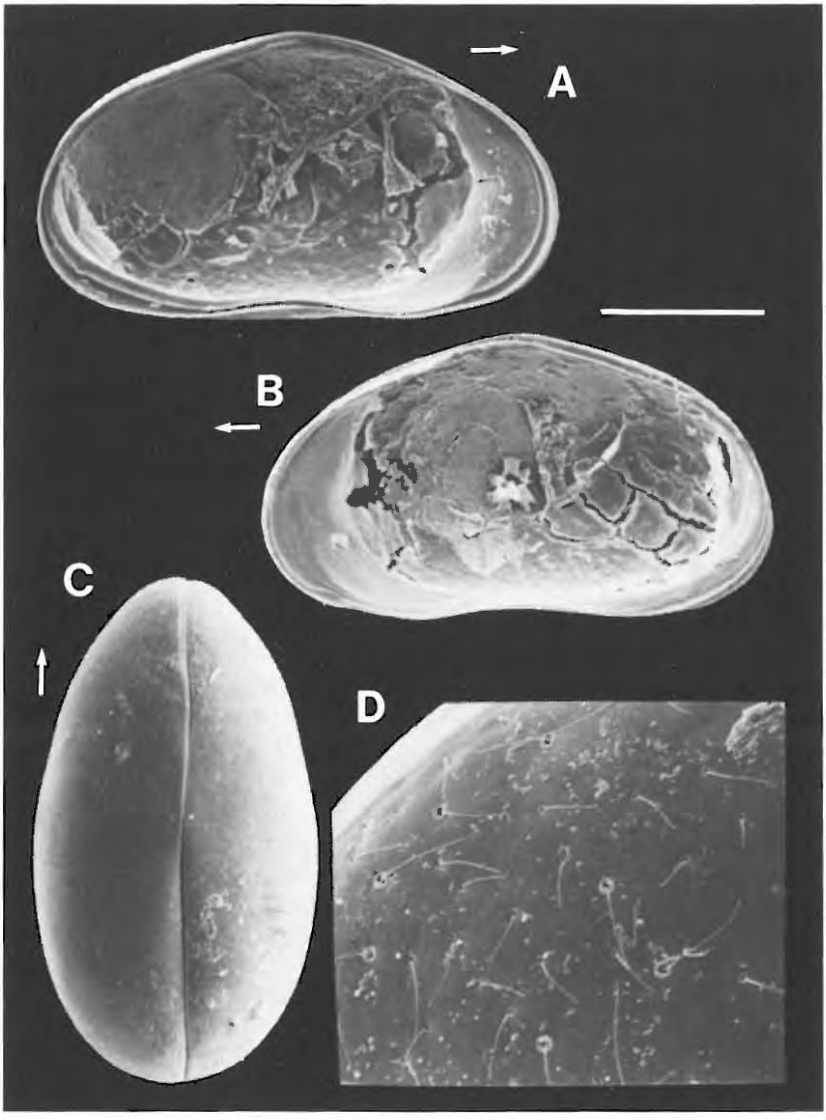

Fig. 1. - *Cypridopsis lusatica*, female, northwestern Spain.
A: LV, internal. B: RV, internal. C: carapace in dorsal view. D: surface of valves. Scale bar: 0.20 mm for A-C.

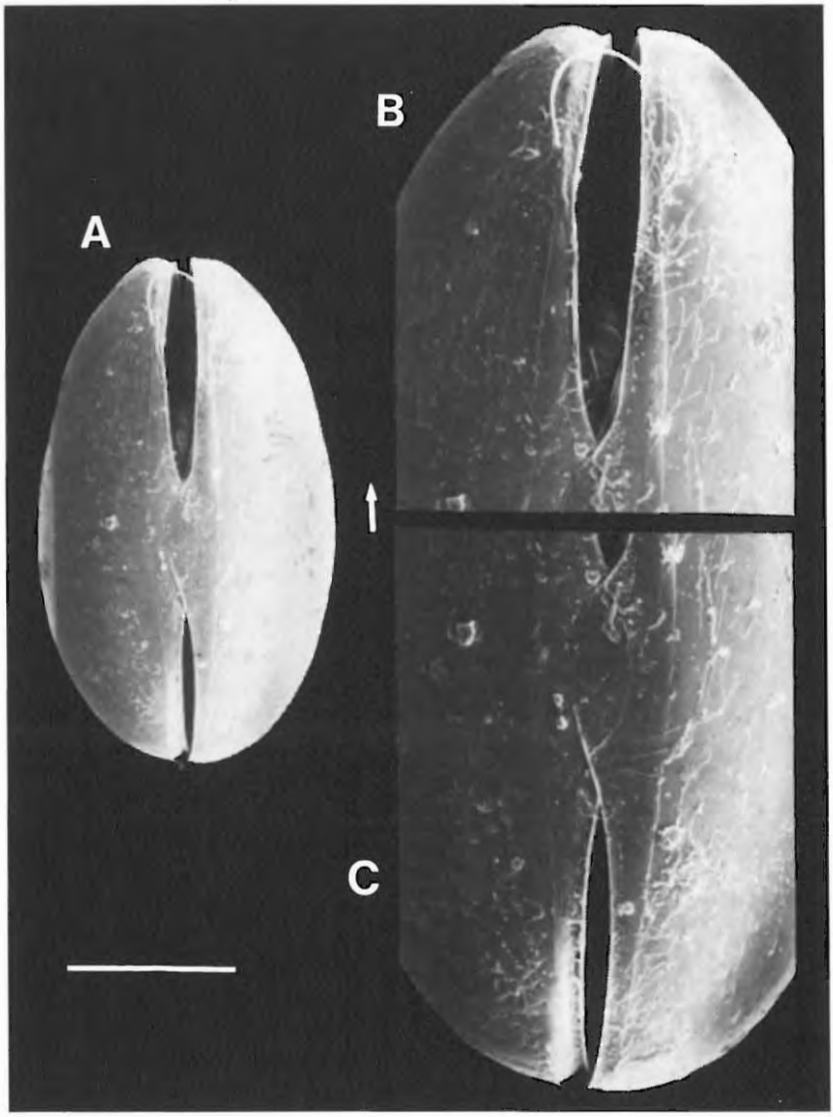

Fig. 2. - *Cypridopsis lusatica*, female, northwestern Spain.
A: carapace in ventral view. B: anterior detail of A. C: posterior detail of A.
Scale bar: 0.20 mm for A.

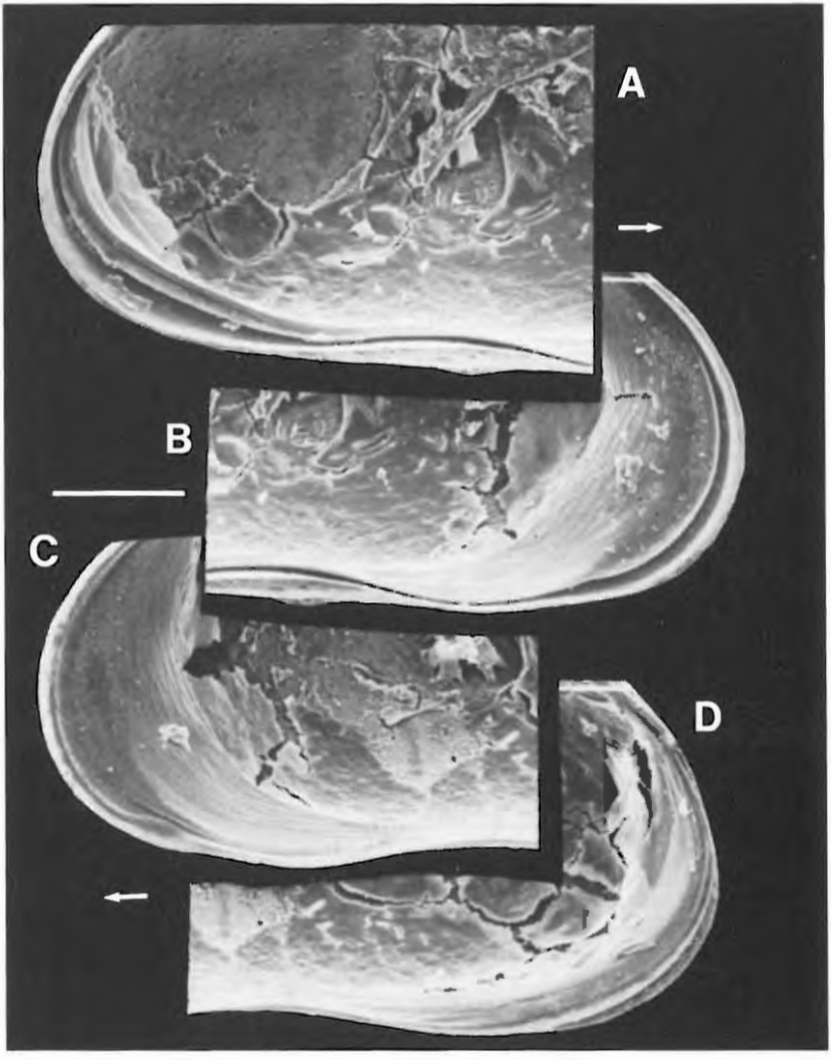

Fig. 3. - *Cypridopsis lusatica*, female, northwestern Spain,
A: LV, inner posterior marginal zone. B: LV, inner anterior marginal zone (A and B: details of fig. 1 A). C: RV, inner anterior marginal zone. D: RV, inner posterior marginal zone (C and D: details of fig. 1 B). Scale bar: 0.40 mm for all.

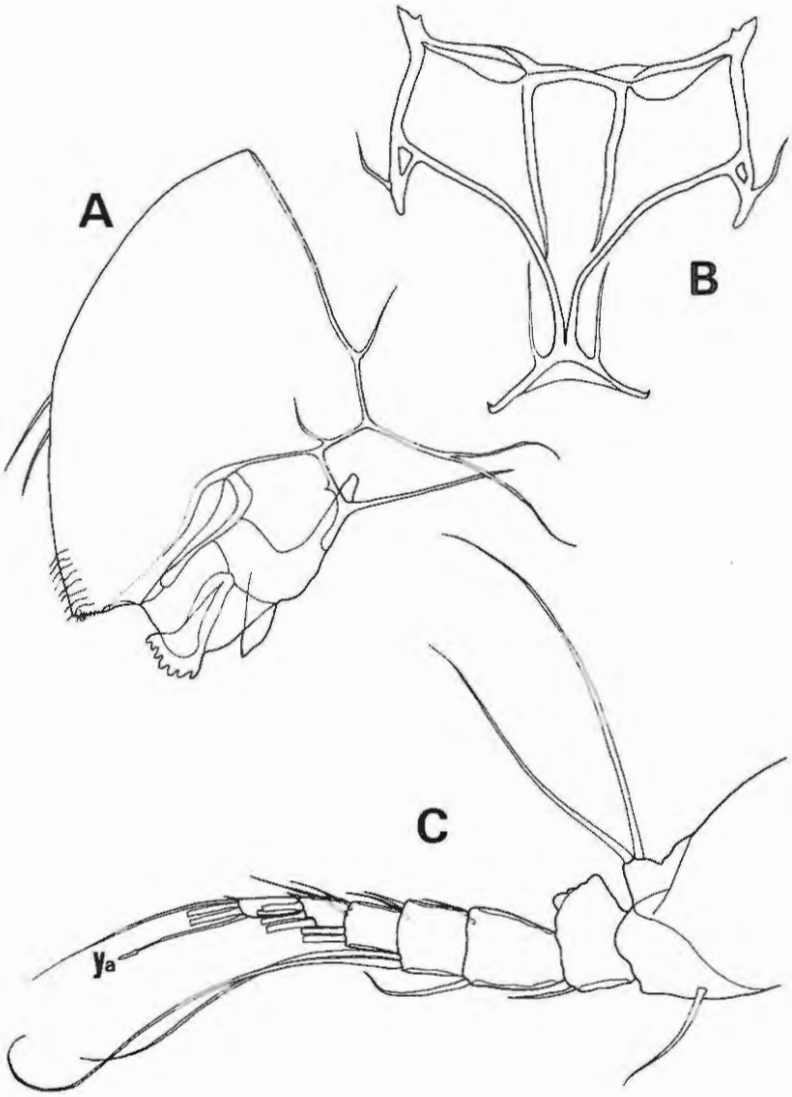

Fig. 4. - *Cypridopsis lusatica*, female, Macedonia (former YU).
A: forehead and upper lip. B: hypostome. C: antennula (A1).

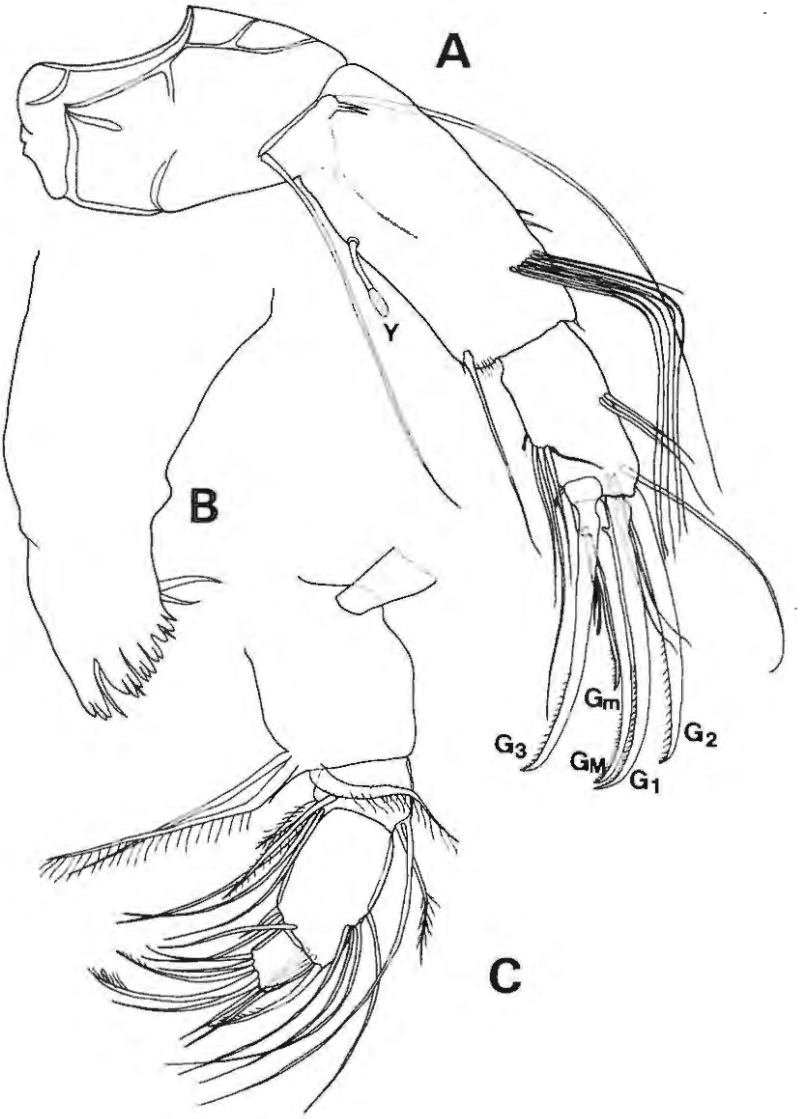

Fig. 5. - *Cypridopsis lusatica*, female, Macedonia (former YU).
A: antenna (A2). B: mandible. C: mandibular palp.

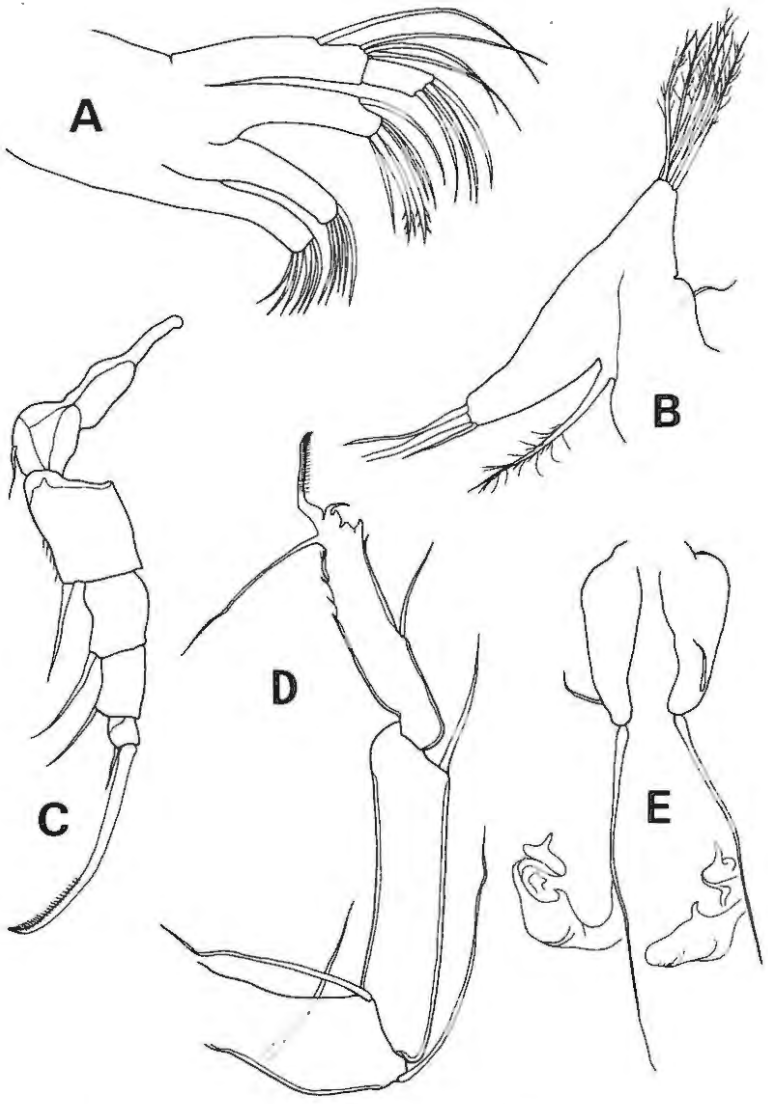

Fig. 6. - *Cypridopsis lusatica*, female, Macedonia (former YU).
A: maxillula (Mx1). B: maxilla (Mx2). C: first thoracopod (T1, walking leg).
D: second thoracopod (T2, cleaning leg). E: furca and genital fold.

Trav. sci. Mus. nat. hist. nat. Luxemb. 19, 1993

The ostracod fauna of the old Lake Hula (Israel) (Crustacea, Ostracoda)

by

Koen MARTENS [1)]

Summary

The old collections of the Lake Hula region, taken immediately before (1933-1945) and immediately after (1962-1968) the drainage of the lake, provide a relatively rich ostracod fauna and the preliminary identifications of these specimens are here reported. Twenty species are found: six genera and eight species are new to the fauna of Israel. None of the species are particularly rare except perhaps *Stenocypris werneri* DADAY, originally described from pools near the River Nile, which is here transferred to the genus *Parastenocypris*. Relying on the present data, it does not appear that any endemic ostracod species occurred in the old Lake Hula.

Introduction

The nothernmost part of the Jordan Rift Valley (in itself part of the northern extension of the great Afro-Syrian Rift) used to contain a lake, best known as Lake Hula or Huleh. According to POR (1989), this lake was formed in the early Pleistocene. At that stage, however, it was little more than a large and shallow swamp. The formation of the actual deep lake itself did not occur until

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the late Pleistocene (c. 30,000 BP - Cowgill, 1969). During the first half of the present century, the lake occupied an area of 13-14 km^2 and the surrounding swamps covered an additional 37-49 km^2 (Por, loc. cit.). Shortly after World War II, however, a large drainage project was initiated. These works were finished around 1951, leaving only a small part of the original swamp and lake as a Nature Reserve. This reserve exists to date, but its environment bears little resemblance to the pre-drainage situation, mainly because of a drastic decrease in the quality of the water.

The old Hula lake supposedly held a number of endemic (sub-) species, which might have become extinct as a consequence of the drainage of the lake (see Por 1989 and Dimentman et al. 1992 for a summary of the taxonomic groups with presumed endemics) The best known example is that of the frog *Discoglossus nigriventer*, endemic to the predrainage lake Hula and not reported from the area since 1955.

Nothing is known with regard to the ostracod fauna of the old lake. Barrois (1894) reported on various crustacean groups, but did not identify ostracods. Substantial collections (benthos, plankton, etc) of the pre-drainage lake still exist to date, and the sorted ostracod of these samples were kindly sent to me by Dr Ch. Dimentman and Dr H. Bromley (The Hebrew University, Jerusalem). They are gratefully acknowledged for allowing me to study this material.

I here report on the preliminary identifications of this unique material, which is extremely valuable, both for the reconstruction of the environment of the old lake and for comparisons with the present day conditions. Descriptions of the recent fauna of the Hula Valley (including the Nature Reserve and the many surrounding springs) will be published elsewhere. At that stage, a more elaborate discussion on taxonomy and ecology of the ostracod fauna of this region will be given. The old collections contained nearly exclusively decalcified and damaged specimens, which in most cases still allowed identification, but which prevented illustration and description of the valves. Both soft part and valves descriptions will therefore be given at a later stage with recent material.

Twenty species could be identified. Six genera and eight species are new to the fauna of Israel (Table 2). This illustrates the poor state of our knowledge

of the non-marine ostracod fauna of this country (Martens et al. in press). Including the above taxa, there are now 33 Recent non-marine ostracod species reported from Israel.

Notes on selected species (see Tables 1 and 2)

Pseudocandona spec., *Candona* cf. *neglecta*, *C.* cf. *angulata*

These three species cannot be identified with certainty, due to the decalcification of the carapaces. However, good specimens are available in recent collections from the area (Martens, unpublished) and these taxa will be described elsewhere.

Ilyocypris spec.

Only two specimens were present and they did not allow a positive identification. The species appears related to *I. divisa* Klie, 1926, yet differs from it at least in the dorsal aspect of the carapace and in the shape of the hemipenis.

Heterocypris salina (Brady, 1868)

Both the saline and the freshwater form (*H. fretensis*) of this species were present, showing that at least some localities must have had a saline influence. The same is shown by the presence of *Sarscypridopsis aculeata* (Costa, 1847).

Hemicypris reticulata (Klie, 1930)

The species was first described from Paraguay (Klie, 1930), but was subsequently reported from northern Africa (Mauritania, Tchad and Senegal in Gauthier 1938, 1939, 1951 resp.). It thus appears to be quite common in northern Africa and as such its presence in Israel is no surprise.

'*Stenocypris*' *subterranea* Hartmann, 1964

The species was originally described from Afghanistan (Hartmann, 1964), but is not uncommon in the Mediterranean (Martens, unpublished). The Hula

collections provided a number of bisexual populations; the male morphology will be extensively described elsewhere (see above).

This species does not belong to *Stenocypris* s.s., because it lacks the radial septa in the valves. Its marginal pore canals are furthermore branched, which would refer it to *Parastenocypris* (*Chrissia* has straight, unbranched marginal pore canals). However, other aspects of its morphology indicate that this taxon, together with a number of other species, requires the erection of a new genus. *Stenocypris subterranea* is typical of springs and caves.

Parastenocypris werneri (Daday, 1910) comb. nov.

Stenocypris werneri was described from pools near Gizeh, at the edge of the Egyptian part of the Nile (Daday, 1910). The present locality is only the second record for this species. Again, radial septa are missing so this is not a genuine *Stenocypris*. The species is here referred to *Parastenocypris*.

Cypridopsis hartwigi G.W. Müller, 1990

Meisch (1991) recently revised the taxonomy of the *C. hartwigi- C. elongata* complex and offered excellent illustrations. Our specimens are slightly more elongated than the ones from western Europe, but all anatomical details are identical. Meisch (loc. cit.) also cited the distribution of *C. hartwigi* and concluded that, although the species is known from both western and central Europe, it is still to all probability more common in southern Europe. It has also been reported from northern Africa (see Martens, 1984) so that, again, its presence in Israel was to be expected.

Conclusions

The main aim of the present note was to make the identifications of the Lake Hula ostracods available to the scientific community. A thorough discussion of this fauna can only be useful in comparison with the present day fauna of this area, and can therefore not be presented here. Nevertheless, a number of observations are immediately obvious when simply assessing the present species list.

It appears, for example, that the majority of the fauna of the old Lake Hula has a purely Palaearctic origin. Only *Hemicypris reticulata*, *Stenocypris subterranea* and perhaps *Parastenocypris werneri* are restricted to nothern Africa (not counting the South American localities of *H. reticulata*) or the Middle East. Other species like *Heterocypris incongruens* and *Darwinula stevensoni* are cosmopolitan or nearly so.

Most of the old collections were probably taken from the litoral of the old lake itself, not so much from the surrounding springs. Of the species here recorded, only *Stenocypris subterranea* is typical of springs and caves. One can nevertheless accept that these biota must have had a much more diverse fauna, as the present day ostracod communities of these springs and rivers consists of various typical (and sometimes endemic) species (Martens, unpublished). It would seem logical that these faunas were already present in isolated springs, not covered by the lake, in the predrainage conditions.

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Table 1: List of stations

A. Before the drainage

new code	old code	date	locality
01	006	24.03.1933	Lake Hula
02	024	26.03.1933	
03	027	07.04.1935	
04	028	07.04.1935	
05	067	23.03.1940	
06	151	10.06.1940	
07	212	27.10.1940	
08	235	12.03.1941	
09	244	13.03.1941	
10	268	14.03.1941	
11	284	15.03.1941	
12	303	16.04.1941	
13	338	05.09.1941	
14	345	06.09.1941	
15	351	07.09.1941	
16	354	07.09.1941	
17	375	09.09.1941	
18	468	05.05.1943	
19	488	06.05.1943	
20	501	08.05.1943	
21	'E'	??.09.1945	

Table 1: List of stations (continued)

B. After the drainage

new code	old code	date	locality
22	HUJ-E6	28.12.1962	HULA RESERVE
23	HUJ-S8	12.03.1965	
24	HUJ-V8	12.03.1964	
25	HUJ-Z8	12.03.1964	
26	HUJ-B10	23.03.1965	
27	HUJ-C12	10.03.1966	
28	CR 295	10.09.1966	EN TEO
29	HUJ-F12	19.03.1968	HULA RESERVE
30	HUJ-G12	19.03.1968	
31	HUJ-X5	16.10.1962	HULA VALLEY
32	HUJ-W5	16.10.1962	HULA VALLEY
33	HUJ-C6	28.12.1962	HULA VALLEY
34	HUJ-G7	16.10.1962	EN TEO
35	HUJ-U8	12.03.1964	HULA RESERVE
36	HUJ-I12	24.08.1965	EN TEO

Table 2: list of species in samples collected before (c. 1940) and after (c. 1966) the drainage of the old Lake Hula.

(***)= genus and species new to the fauna of Israel;

(*) = species new to the fauna of Israel.

	species	stations before c. 1940	after c. 1966
***	*Pseudocandona* spec.	1	-
	Candona cf. *neglecta*	8	25/26/27/ 29/30/35
	Candona cf. *angulata*	-	27/29/35
***	*Candonopsis kingsleyi*	-	25/26/34/ 35/36
**	*Cypria ophthalmica*	20	26/27/32
	Ilyocypris spec.	-	30
	Heterocypris salina	8	30
	Heterocypris incongruens	12/18	-
***	*Hemicypris reticulata*	-	32
	Herpetocypris spec.	8	-
***	*'Stenocypris' subterranea*	16	34
***	*Parastenocypris werneri*	15	22/31/32
	Eucypris virens	-	22/33
*	*Cypris bispinosa*	4	-
	Cypris pubera	-	23
	Cypridopsis vidua	2/14/17/19/21	26/29
*	*Cypridopsis hartwigi*	4	23/35
	Sarscypridopsis aculeata	4	-
	Potamocypris arcuata	-	30
	Darwinula stevensoni	-	26

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II Nouvelles études paléontologiques et biostratigraphiques sur les Ammonites du Grand-Duché de Luxembourg et de la région Lorraine attentante. Pierre L. MAUBEUGE, 1984.

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2. Quelques espèces peu connues, rares ou inattendues. Léopold REICHLING, 1985.

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XVI Atlas des lichens épiphytiques et de leurs champignons lichénicoles (macrolichens exceptés) du Luxembourg. Paul DIEDERICH, 1990.

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