

TRAVAUX SCIENTIFIQUES
DU MUSÉE D'HISTOIRE NATURELLE DE LUXEMBOURG



VI

**REVISION OF THE RECENT
WEST EUROPEAN SPECIES
OF THE GENUS POTAMOCYPRIS
(Crustacea, Ostracoda)**

PART II

SPECIES WITH LONG SWIMMING SETAE
ON THE SECOND ANTENNAE

by
Claude MEISCH

1985

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La photo de la page de couverture montre la carapace de *Potamocypris unicaudata* au microscope électronique à balayage.

Longueur: 0,75 mm

Date de la parution: mars 1985.

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Part II: Species with long swimming setae on the second antennae.

by Claude MEISCH¹⁾

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Abstract: The recent West European species of the genus *Potamocypris* with long swimming setae on the second antennae are revised. Among the 17 nominal species described in the literature, 9 existing species are recognized. A key to the species is proposed. Diagnosis, complements of description, taxonomic history and discussion, data on ecology and geographic distribution are given for each species. The carapace of each species (except for *P. rullieri*) is shown on scanning electron micrographs. Tables allowing direct comparison between related species are given.

I. SYSTEMATIC POSITION OF THE GENUS POTAMOCYPRIS

Classification according to HARTMANN & PURI (1974):

Class: Crustacea;
Subclass: Ostracoda;
Order: Podocopida;
Superfamily: Cypridoidea;
Family: Cypridopsidae KAUFMANN, 1900;
Subfamily: Cypridopsinae BRONSTEIN, 1947.

Remark: The superfamily-ending -ACEA commonly used by Ostracodologists is changed here in -OIDEA in agreement with a recommendation of the ICZN. CYPRIDACEA thus becomes CYPRIDOIDEA (see also BOWMAN & ABELE, 1982).

II. ACKNOWLEDGMENTS

For the loan of type-material and/or other material studied in the present part of the revision I thank:

Prof. Gerd HARTMANN, University of Hamburg, Germany: for the whole *Potamocypris*-material deposited by W. KLIE and also the Asian material studied by Prof. HARTMANN (1964) himself. This material includes the types of *P. steueri*, *P. unicaudata*, *P. almasyi caspica* and *P. almasyi minor*;

Dr G.A. BOXSHALL, British Museum (Natural History), London: for the types of *P. variegata*, *P. diana* and material of *P. maculata* (FOX collection);

Dr M.E. CHRISTIANSEN, Zoological Museum of the University of Oslo, Norway: for type-specimens of *P. arcuata* and *P. humilis* and material of *P. villosa* (SARS collection);

- Dr. P.S. DAVIS, the Hancock Museum, Newcastle-upon-Tyne, GB: for the types of *P. variegata* and *P. reniformis*;
- Dr. L. FORRÓ, Hungarian Natural History Museum, Budapest: for 13 spirit tubes labeled *P. villosa* and *P. ophthalmica* (DADAY collection);
- Dr. A. FRANZÉN, Natural History Museum in Stockholm, Sweden: for the type-specimens of *P. maculata*;
- Dr D. HILLER, Hamburg, Germany: for material of *P. smaragdina*. (I obtained these specimens through Dr B. SCHARF);
- Dr K. MARTENS, University of Ghent, Belgium: for material of *P. arcuata* (from Algeria and Belgium), *P. smaragdina* and *P. unicaudata* (from Belgium);
- Dr H. NÜCHTERLEIN, Germany: for material of *P. smaragdina*;
- Dr T. PETKOVSKI, Natural History Museum in Skopje, Yugoslavia: for specimens of *P. steueri*, *P. producta* and *P. smaragdina*;
- Dr O.A. SCARLATO, Zoological Institute of the Academy of Sciences in Leningrad, Soviet Union: for the type-specimens of *P. arcuata*;
- Dr B. SCHARF, Mainz, Germany: for specimens of *P. smaragdina*;
- Mrs M.G. van der MERVE, South African Museum, Cape Town, South Africa: for type-specimens of *P. humilis*.
- Dr K. WOUTERS, Royal Institute of Natural History in Brussels: for material of *P. villosa* and *P. unicaudata*.

For this second part I am again much indebted to Dr Karel WOUTERS (Brussels): I thank him for critically reading the manuscript; furthermore, all the SEM photos of this work are the result of our joint work on the scanning electron microscope at the Institut Royal des Sciences Naturelles de Belgique.

The discussions with K. WOUTERS, K. MARTENS, B. SCHARF and my correspondence with Dr T. PETKOVSKI had an influence on several taxonomic decisions taken in this work.

I am grateful to the European colleagues who responded to my request for information on ostracod collections deposited at their institutes. They are quoted in the text.

The acknowledgments expressed to Prof. J. HOFFMANN, N. STOMP and P. KREMER in part I of the revision are also valid for the present part. Finally I would like to thank Jean-Marie BODÉ who helped me by improving the English manuscript.

III. INTRODUCTION

I would like to complete the introduction given in the first part of the revision by the following data:

1. Species belonging to the genus *Potamocypris* have been found on all the continents, except the Antarctic and Australia. The records of *Potamocypris*-species from Australia are all based on errors of determi-

nation (communication of Dr Patrick DE DECKKER, Canberra, Australia). A plausible explanation for this absence may be that the genus only differentiated after Australia had broken off from the Gondwana continent.

According to VAN MORKHOVEN (1963) the oldest fossil which undoubtedly belongs to the genus *Potamocypris* is *P. gracilis* (SIEBER 1905) from the Upper Miocene of Steinheim (Germany).

2. Neither *Potamocypris intermedia* DADAY, 1900 (described from Hungary) nor *Cypridopsella nicki* LINDNER, 1920 (recorded from Poland; *Cypridopsella* is partially synonymous to *Potamocypris*) belong to the genus *Potamocypris*. The original descriptions of both species show a Mx1 - palp with a cylindrical terminal joint. This single character is sufficient to remove both species from the genus *Potamocypris*: they rank in one of the three genera *Cypridopsis*, *Plesiocypridopsis* or *Sarsocypridopsis*. The original descriptions of the two species do not allow to make a choice among these three genera. (See also the short discussion given in the introduction to part I of the present revision, MEISCH, 1984:8).

3. Number of species.

The zoological literature mentions seventeen nominal *Potamocypris*-species with long A2 Swset occurring in West Europe. I have been able to examine the type-material of eight of these species. The types of eight of the remaining species have to be considered as lost. The types of one species (*P. vanoyei*) still exist, but I was unsuccessful in my request to get them on loan (fortunately the status of this species is not problematic; see under *P. unicaudata*).

The systematic revision of the seventeen nominal species allows to recognize nine actually existing species. Of each of these nine species (except *P. rullieri*) I was able to examine a rather important material, including at least several samples collected in geographical regions distant from each other in Europe or in extra-European regions. (See the detailed list of the material examined in the appendix).

I have not been able to clarify the taxonomic status of one species, namely *P. rullieri*: the type-specimens of this species are lost and the locality where the types were collected in 1966 no longer exists (I visited this locality in 1983).

Remark: Two European *Potamocypris*-species with long swimming setae are recorded from Eastern Europe only: *P. almasyi* DADAY, 1904 and *P. longisetosa* BRONSTEIN, 1928. These species are not revised here because I was not able to locate the institute where the type-material is deposited (the types of *P. almasyi* are most probably lost). The taxonomic status of both species will nevertheless be discussed.

4. For the diagnosis of the genus *Potamocypris* and a discussion on the taxonomic features at specific level, see the first part of the revision (MEISCH, 1984).

5. I would like to come back to the status of the genus *Cyprilla* SARS, 1924, which has been put in synonymy with *Potamocypris* by GAUTHIER (1939 b). I adopt GAUTHIER's point of view in spite of the fact that McKENZIE (1971) and GHETTI & McKENZIE (1981) recently maintained *Cyprilla* as a distinct genus. Hereafter I would like to give additional and, as I believe, decisive information in favour of the synonymy of *Cyprilla* with *Potamocypris*.

Following SARS (1924), McKENZIE (1971) and GHETTI & McKENZIE (1981: in the key to the genera, p.21) state that the genera *Cyprilla* and *Potamocypris* differ by the relative position of the valves: in *Cyprilla*, the l.v. embraces («abbraccia» in italian) the r.v. on both the anterior and the posterior end of the carapace. In *Potamocypris*, the opposite relation may be seen: the r.v. embraces the l.v.

Remark: the verb «embrace» obviously is used by GHETTI & McKENZIE as synonymous to «overlap» or «extend beyond» and not in the sense given by GAUTHIER. (See the discussion in MEISCH, 1984).

My own observations show that in some species the relative position of the valves at the anterior and posterior end of the carapace actually is constant. This is the case in *P. producta*, *P. pallida* etc. But in other species, such as for instance in *P. villosa*, the relative position of the valves is variable; in most *P. villosa*-specimens the r.v. extends beyond the l.v. in front, but specimens in which both valves extend to equal height are not rare and in some specimens the l.v. even overlaps the r.v. in front (see Fig. 15-c,d,e). A similar variability is seen in at least

some other species as in *P. zschokkei* (a true *Potamocypris*-species) and also in *P. arcuata* (belonging to the genus *Cyprilla* according to SARS and MCKENZIE).

According to GHETTI & MCKENZIE a second diagnostic feature, i.e. the carapace size, should separate the two genera: the size should be about 0.50 mm in *Cyprilla* and about 0.70 mm in *Potamocypris*. But in at least some of the species considered here, the carapace length shows striking variability. Thus, for instance, in *Potamocypris* (= *Cyprilla*) *arcuata* and in *Potamocypris villosa*, the size ranges from about 0.55 to about 0.70 mm.

I would like to conclude that in my opinion the observations described above, clearly show that the maintenance of *Cyprilla* as a genus distinct from *Potamocypris* (or even as a subgenus of *Potamocypris*) is no longer justified.

IV. ABBREVIATIONS USED IN THE TEXT

The following abbreviations will be used:

A1 = antennule; A2 = antenna; Swset = swimming setae; Mx 1 = maxillule; Mx 2 = maxilla; T1 and T2 = thoracopods 1 and 2 (walking leg and cleaning leg); Fu = furcal ramus; l.v. and r.v. = left valve and right valve; l.v. > r.v. = the left valve overlaps the right valve (anteriorly or/and posteriorly); selv. = selvage (Saum, lamelle hyaline); SEM = scanning electron microscope; PVLP = polyvinylactophenol for the mounting of dissected specimens; ICZN = International Code of Zoological Nomenclature;

BMNH = British Museum (Natural History), London, Great Britain;
HMNT = Hancock Museum, Newcastle upon Tyne, Great Britain;
HNHM = Hungarian Natural History Museum, Budapest, Hungary;
IRSNB = Institut Royal des Sciences Naturelles de Belgique, Brussels;
MHNG = Natural History Museum of Geneva, Switzerland;
NHML = Natural History Museum of Luxembourg, Luxembourg;
NHMS = Natural History Museum of Stockholm, Sweden;
SAM = South African Museum, Cape Town, South Africa;
ZIL = Zoological Institute of the Academy of Sciences in Leningrad, Soviet Union;
ZMH = Zoological Museum and Zoological Institute of the University of Hamburg, Germany;
ZMO = Zoological Museum and Zoological Institute of the University of Oslo, Norway.

V. KEY TO THE SPECIES

Preliminary remarks: 1. In the key, the surface of the valves is described as it can be seen under the stereomicroscope (40 - 80X).

2. *P. rullieri* is not included in the key: the specific status of this species, which has only been found once (ANICHINI, 1968), appears to be uncertain. See the diagnosis and discussion on page 79.

- 1a. Terminal joint of the Mx1 - palp with 4 distal spines (Fig. 5-c,d). Colour of carapace: 2 or 4 transverse green bands (Fig. 6) (except for *P. unicaudata* which is uniformly green) 2
- 1b. Terminal joint of the Mx1 - palp with 5 distal spines (Fig. 17-c). Colour: without 2 or 4 dark green transverse bands 5
- 2a. Terminal joint of the Mx1 - palp distally only slightly enlarged (Fig. 1-d). Carapace distinctly ovate in dorsal view. In marine brackish waters *P. steueri*
- 2b. Terminal joint of the Mx1 - palp distally distinctly enlarged (Fig. 5-c). Carapace slender (not distinctly ovate) in dorsal view. In fresh water or slightly salty inland waters 3
- 3a. Mx2 - respiratory plate with 2 branchial filaments (Fig. 5-e). Size: 0.46 - 0.56 mm *P. variegata*
- 3b. Mx2 - respiratory plate with 1 branchial filament (Fig. 9-d). Size equal or superior to 0.60 mm 4
- 4a. Carapace in dorsal view: anteriorly the r.v. overlaps the l.v. (Fig. 10-c). Colour: more or less uniformly green *P. unicaudata*
- 4b. Carapace in dorsal view: anteriorly the l.v. overlaps the r.v. (Fig. 12-c). Colour: with 2 dark green transverse bands (Fig. 6-e,f) *P. smaragdina*
- 5a. Carapace in lateral view with nearly a straight postero-dorsal margin (Fig. 26-a). In Europe hitherto only reported from isles of the Gulf of Finland *P. humilis*
- 5b. Carapace shape in lateral view different, with a distinctly arched postero-dorsal margin 6
- 6a. Carapace in lateral view: l.v. anteriorly and posteriorly with lobe-like excrescences (= lobe-like flanges) (Fig. 23-a) *P. producta*
- 6b. Carapace in lateral view different, without lobe-like excrescences on the l.v. 7
- 7a. Valves smooth (min. 40X), with numerous long and stiff setae (Fig. 15-a) *P. villosa*
- 7b. Valves with distinct pits (min. 40X) (Fig. 19-a). *P. arcuata*

VI. SYSTEMATIC PART

1. POTAMOCYPRIS STEUERI KLIE, 1935

(Figs 1 - 4)

Potamocypris steueri KLIE, 1935 a: 3-7, figs 1-7;

Potamocypris tetrataeniata ANICHINI, 1967: 206-215, figs 7-8.

TYPE-MATERIAL: 13 type-specimens deposited by KLIE (ZMH, 1175). A holotype was not designated.

DESIGNATION OF LECTOTYPE: One of the female type-specimens which I dissected is designated as the lectotype: 2 slides, soft parts in PVLVP, valves in Euparal, deposited in ZMH.

TYPE-LOCALITY: Lake Maryut («Mariotissee») in Egypt, where the type-specimens come from is designated as the type-locality.

MATERIAL EXAMINED: The syntypes deposited by KLIE and 3 samples coming from Algeria (coll. GAUTHIER), Italy and Yugoslavia (coll. PETKOSKI). See also the detailed list in the appendix.

IMPORTANT LITERATURE: GAUTHIER, 1937: colour of the carapace, variability of the carapace shape in a population, detailed redescription of the male.
GAUTHIER, 1939 b: structure of the carapace.

DIAGNOSIS

CARAPACE. Lateral view as in Fig. 2. Surface of the valves smooth under the stereomicroscope (40-80X), with shallow pits under the SEM.

Dorsal view: the r.v. slightly overlapping the l.v. anteriorly and posteriorly.

Marginal zones of the l.v.: selvage peripheral along the whole margin of the valve (anterior and posterior flanges absent).

Colour: pale green with 4 dark green transverse bands.

Size: 0.55-0.68 mm.

APPENDAGES. Swset A2 extending beyond the tips of the terminal claws by 20-35% of their total length.

Mx1 - palp: terminal joint distally only slightly enlarged, bearing 4 spines; third masticatory process with 2 faintly barbed teeth. (In all the other known *Potamocypris*-species these teeth are smooth).

Mx2 - respiratory plate with 1 branchial filament.

All the hitherto known populations with males and females.

The species occurs in marine brackish waters.

COMPLEMENTS OF DESCRIPTION

1. GAUTHIER (1937) gives detailed figures of the carapace colour. I did not see myself any living specimen of this species.

2. The carapace of *P. steueri* shows two characters which set this species somewhat apart from the remaining species of the genus:

a) on the l.v. the selvage is not displaced inwards from the outer margin of the valve: there is neither an anterior nor a posterior flange¹⁾. (It should be recalled that a more or less developed flange is observed on the l.v. of all the other known *Potamocypris*-species).

b) The l.v. lacks the medio-ventral extern list which is present in the other species of the genus: see Fig. 3-b for *P. steueri* and compare with Fig. 16-a for instance (*P. villosa*), on which this list is best seen.

It is important to note that these 2 features of the adult *P. steueri* carapace characterize the juvenile carapaces of all the *Potamocypris*-species.

Thus it has to be concluded that in the adult stage, *P. steueri* retains a carapace whose structure is similar to that found in the juvenile stage. The significance of this observation will be discussed briefly in the next chapter.

¹⁾ The flange was called «outer extension of the valve» in part I of the revision.

Remark: the presence of the medio-ventral list on the l.v. may be checked under the stereomicroscope (ventral view of a partially opened carapace) at a minimum magnifying power of 60X. But the observation is somewhat difficult. On the contrary, the SEM allows easy verification of this feature.

To my knowledge the absence of the medio-ventral list on the l.v. in *P. steueri* has not yet been reported in the literature. GAUTHIER (1939 b) gives an excellent and detailed description of the carapace of *P. steueri* and of several related species: but the author does not mention the list considered here. This may be explained by the fact that the methods used by GAUTHIER for the study of the carapaces (cutting after decalcification) does not allow observation of this feature.

3. *P. steueri* shows a slight sexual dimorphism: the female carapace is generally larger and more egg-shaped in dorsal view (Fig. 2-a,b,c,d). GAUTHIER (1937) took the following measures on his specimens from Algeria: 0.62-0.64 mm for the males, 0.66-0.68 mm for the females. The second antennae too differ in males and females; the terminal A2 claws of the male are armed with strong spines, while the antennal claws of the female show distinctly weaker spines.

4. The seminiferous tubules of the male are spirally enrolled in the anterior part of the carapace (Fig. 4-d). For the description and the figures of the prehensile Mx1 - palp and also the copulatory organ of the male, see KLIE (1935) and GAUTHIER (1937).

5. KLIE (1935 a: 4) writes that the 3rd masticatory process on the Mx1 bears 2 smooth teeth. But this observation is erroneous: on all the specimens I have dissected (among these are 2 syntype-specimens deposited by KLIE) those teeth show the characteristic barbs (Fig. 1-c,e). This observation is in agreement with that of GAUTHIER (1937) and ANICHINI (1967, under *P. tetrataeniata*).

6. On his Fig. 2-D, GAUTHIER (1937:151) shows a T2 (cleaning leg) with a strikingly developed hook on the terminal «pincer-claw». This feature might have been a valuable diagnostic character of the species. But I have found out that on the specimens I have dissected (among them are two specimens collected and studied by GAUTHIER; ZMH 1174), the T2 pincer-claw is distally only slightly hooked (see Fig. 1-g).

IS *P. STEUERI* A NEOTENIC OR AN ANCESTRAL SPECIES?

In the adult *Potamocypris*-specimens, the carapace is characteristically formed by two distinctly asymmetrical valves: the r.v. is higher than the l.v.; the l.v. anteriorly and posteriorly bears a flange and medio-ventrally it shows a folded list. (The two latter features are always missing on the r.v.).

In juvenile specimens of all *Potamocypris*-species, on the contrary, the valves are of equal or subequal shape and structure: the flanges and the medio-ventral list are missing on the l.v.; the r.v. is barely higher than the l.v.

In the preceding chapter I was able to show that the adult *P. steueri*-specimens have a carapace that does not differ in structure from that of the juveniles: the adult *P. steueri* valves are indeed of subequal structure. One might object that possibly all the specimens hitherto examined had not yet reached the adult stage and that a last moulting would make the characteristic asymmetrical carapace of the adult stage to appear. In my opinion this hypothesis is not correct. Indeed some of the specimens I have examined are females bearing well-developed eggs and spermatozoa; some of the males bear well-developed copulatory organs. This proves that these specimens had attained the reproductive stage.

The persistence of juvenile characters in the reproductive stage may be interpreted in two ways:

- a) The species reaches sexual maturity before attaining the adult stage: it would be neotenic. To my knowledge this would be the first case of true neoteny described in an ostracod.
- b) The species retained primitive (= plesiomorphic) characters during its phylogenetic history. Thus the species may closely resemble the true ancestral species which was at the basis of the phylogenetic lineage considered here.

P. steueri shows several other features which may be considered as being primitive:

(a) the carapace is distinctly egg-shaped in dorsal view; none of the remaining *Potamocypris*-species has such a broad shell (this broad form may be connected with the fact that the carapace lacks a distinct dorsal hump on the r.v.; see Fig. 2-a,b);

(b) the terminal joint of the Mx1 - palp distally is only slightly enlarged.

A last character has to be considered: *P. steueri* inhabits brackish marine waters. This feature may be seen as being primitive (in this case *P. steueri* inherited it from an ancestral species) or, on the contrary, as being derived (in this latter case the ancestor was already a freshwater species and *P. steueri* secondarily returned to the brackish water).

One should avoid regarding *P. steueri* as a true ancestral species (if the hypothesis under b above should turn out to be correct). Indeed, ancestral species too, if they survive the speciation events, evolve by acquiring derived characters which make them different from the original stem-form.

I am not able to choose between the hypotheses stated above. Moreover, the detailed discussion of phylogenetic problems goes beyond the scope of this work. But I thought it interesting to draw the attention to some of the questions that arose during the study of this species.

RELATIONS

P. steueri is easily delimited by its diagnostic features: it cannot be confused with any of the other known *Potamocypris*-species.

TAXONOMIC DISCUSSION

1. *P. tetrataeniata* ANICHINI, 1967 was described from marine brackish waters in Sardinia. ANICHINI (1967:215) writes that she deposited a holotype at the Zoological Institute of the University in Cagliari, Sardinia. (Mrs ANICHINI died in 1981). No type-material of any of ANICHINI's species is presently deposited at the Zoological Institute in Cagliari

(communication of Prof. Renzo STEFANI). I made further efforts to find the missing types, but was unsuccessful. This material has to be considered as having been lost. Fortunately the excellent and detailed description given by ANICHINI easily allows to conclude that *P. tetrataeniata* almost certainly is identical with *P. steueri*: indeed all the taxonomic characters, of the carapace as well as of the soft parts, are in perfect agreement. ANICHINI (1967) compares *P. tetrataeniata* with several other *Potamocypris*-species, except with *P. steueri*. The author obviously was aware neither of the work of KLIE (1935 a) nor of that of GAUTHIER (1937) in both of which *P. steueri* was described.

2. GAUTHIER (1937:152) put forward the hypothesis that *P. variegata* is the parthenogenetic form of *P. steueri*. KLIE (1938) takes up this hypothesis without comment. This hypothesis is rejected here. In spite of some resemblance (see the size and the sculpture of the carapace and also the length of the A2 Swset), the two «forms» clearly belong to distinct species. The differences in the structure and colour of the carapace and the Mx2 - respiratory plate allow easy distinction between both species (see the figures showing *P. steueri* and *P. variegata*).

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. steueri is a characteristic inhabitant of marine brackish waters in regions with a moderately warm climate. The optimum total salinity is about 10‰. The species may be collected in estuaries, in ponds situated near the sea shore and in other localities where sea water mingles with fresh water.

P. steueri has been found in Egypt (Lake Maryut, near Alexandria, KLIE 1935 a) in Algeria (Oued Hamiz, bay of Algiers, GAUTHIER 1937), in Italy (Lake Patria, see the appendix to this work), in Yugoslavia (PETKOVSKI 1964), in Bulgaria (regions around the Black Sea, KLIE 1937 a) and in the Soviet Union (regions of the Caspian Sea, BRONSTEIN 1947 and ZWETKOV 1959).

P. steueri probably has a wide circum-mediterranean distribution.

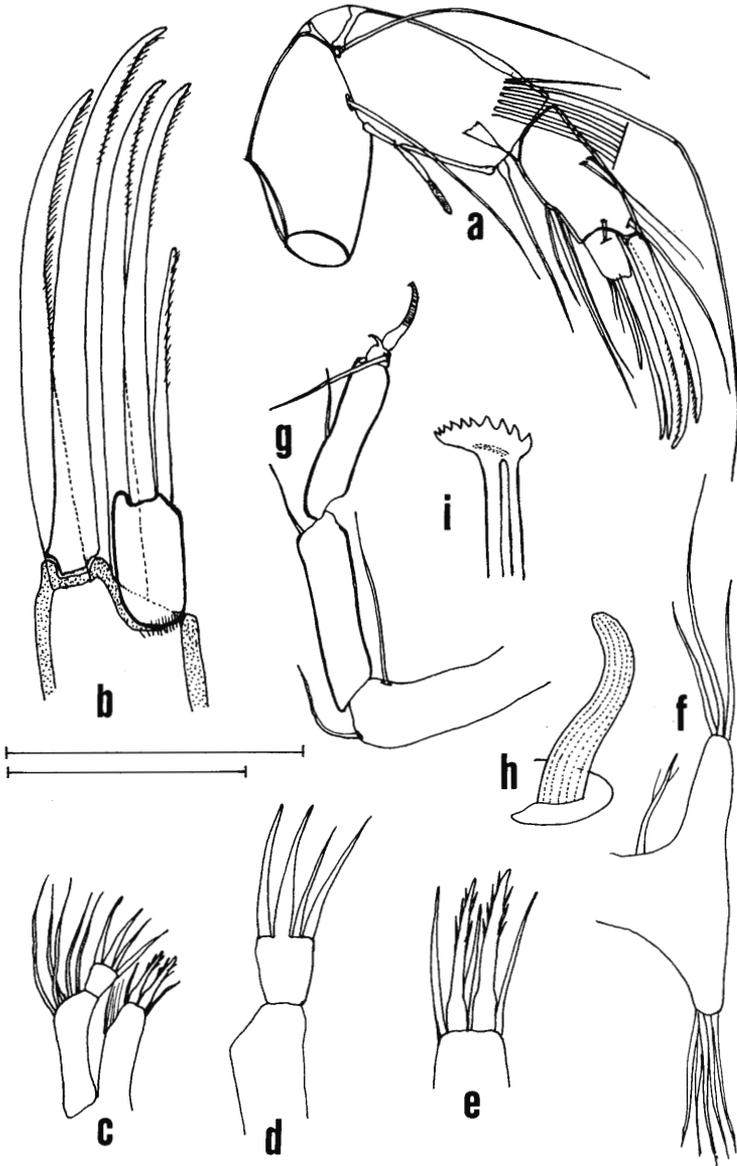


Fig. 1. - *Potamocypris steueri*.

a: Antenna (A2); b: Distal claws of the antenna; c: Palp and 3rd masticatory process of the maxillule (Mx1); d: Terminal joint of the Mx1-palp; e: Barbed teeth of the 3rd Mx1-process; f: Maxilla (Mx2); g: Thoracopod T2; h: Genital hook; i: Rake-like organ. (All these appendages belonging to a female specimen). Small scale = 100 μm for a, c, f, g; = 50 μm for d, e, i, h. Large scale = 50 μm for b.

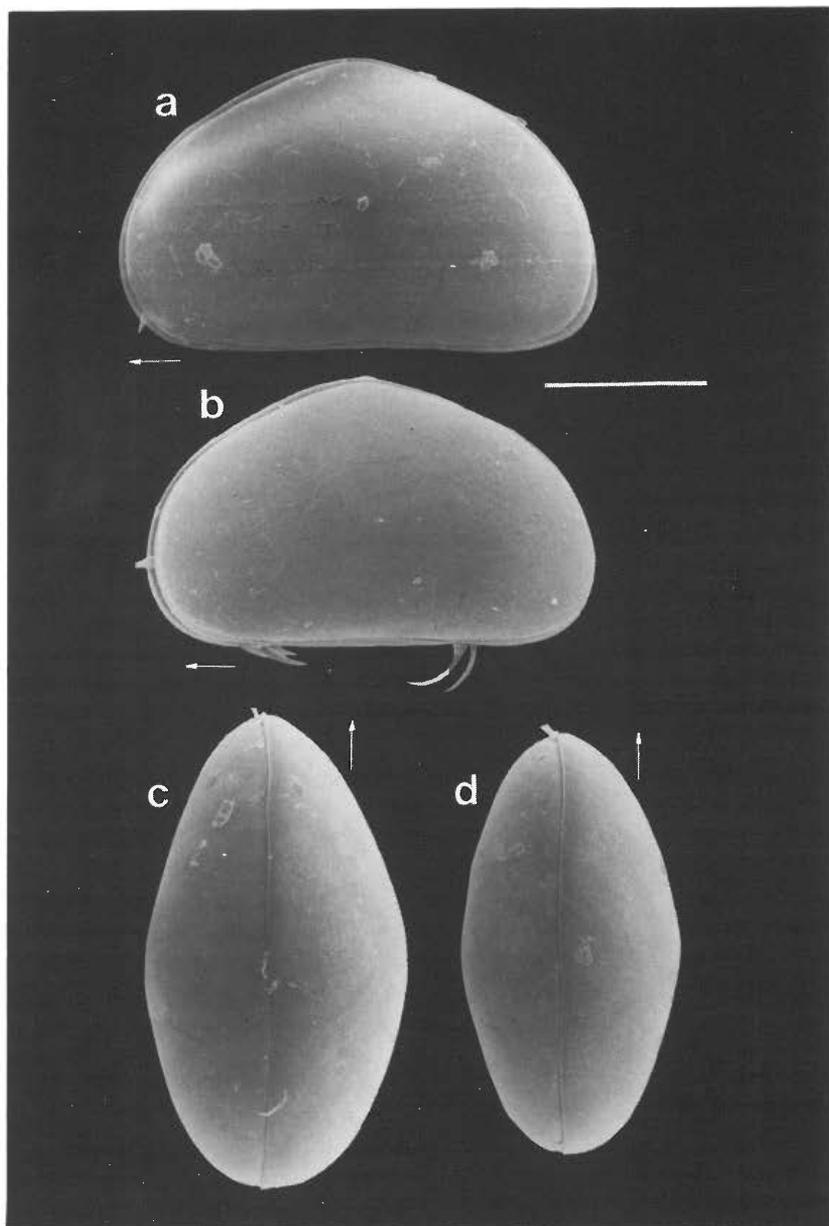


Fig. 2. - *Potamocypris steueri*.

a: Female carapace in lateral view; b: Male carapace in lateral view; c: Female carapace in dorsal view; d: Male carapace in dorsal view. Scale = 0.20 mm for all. All the specimens of Figs 2-4 from Yugoslavia (coll. PETKOVSKI).

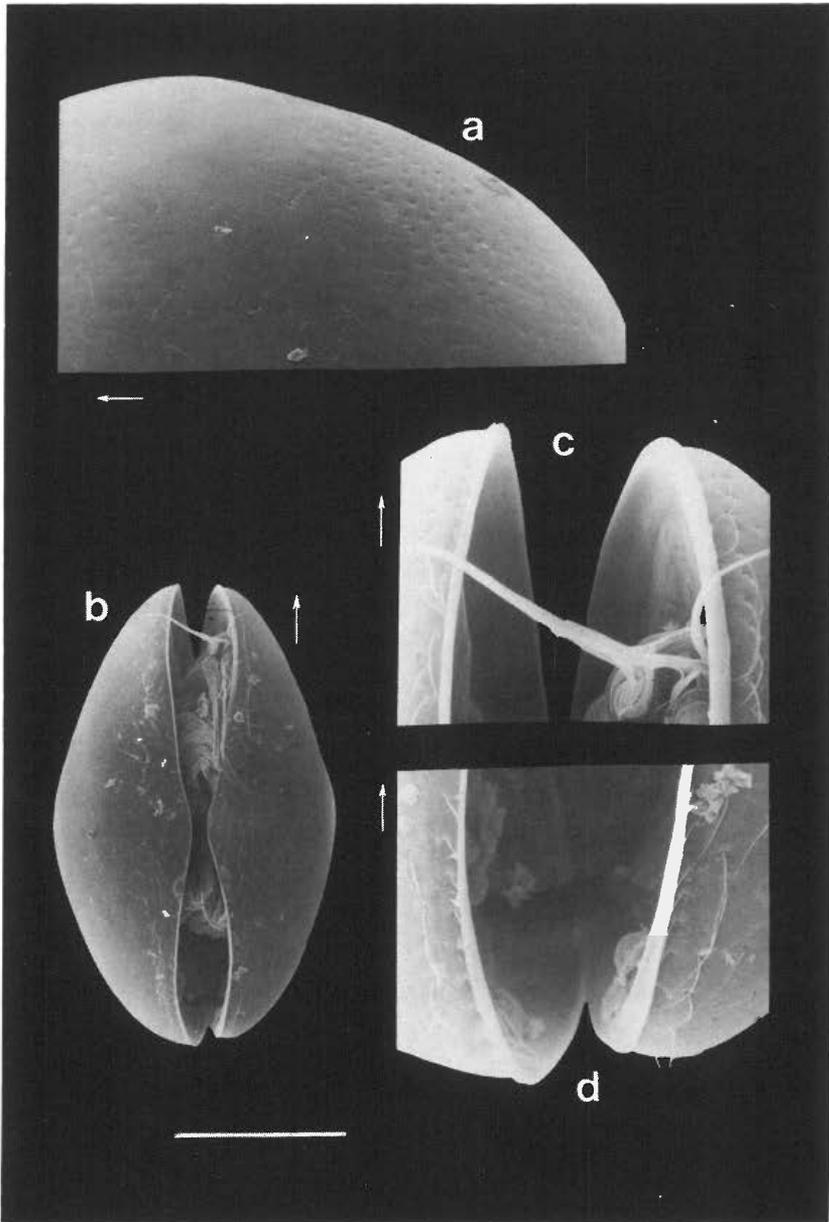


Fig. 3. - *Potamocypris steueri*.

a: Surface ornamentation of the carapace; b: Ventral view of the carapace; c: Anterior detail of b; d: Posterior detail of b. (Female specimens). Scale = 0.20 mm for b; = 0.10 mm for a; = 50 μ m for c and d.

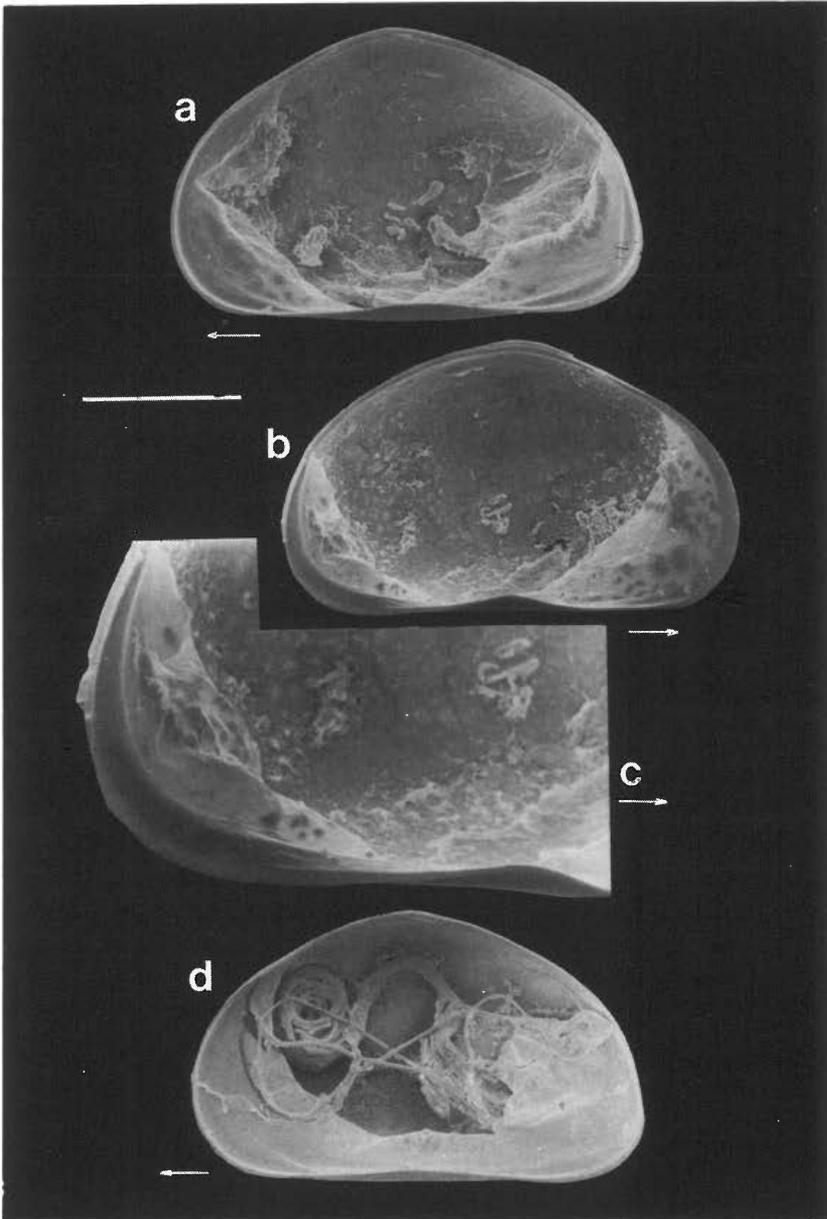


Fig. 4. - *Potamocypris steueri*.

a: Right valve, internal; b: Left valve, internal; c: Posterior marginal zone of the left valve (detail of b); d: Male right valve, internal (see the spirally enroled seminiferous tubules); a-c: Female sex. Scale = 0.20 mm for a, b and d; = 0.10 mm for c.

2. POTAMOCYPRIS VARIEGATA (BRADY & NORMAN, 1889)
(Figs 5 - 8)

Cypridopsis variegata BRADY & NORMAN, 1889: 91, pl. VIII figs 20-21;
Potamocypris variegata DADAY 1900: 193;
Cypridopsis variegata MÜLLER 1900: 84-85, pl. 18 figs 3-4 and 15-17;
non *Paracypridopsis variegata* (BRADY & NORMAN) sensu KAUFMANN
1900: 316-317, pl. 19 figs 16-17 and pl. 22 figs 24-25.

TYPE-MATERIAL: 1 spirit tube labelled «*Cypridopsis variegata*, Lough Neagh, Ireland» deposited in BMNH, NORMAN collection 1900.3.29.135). This tube includes specimens of *P. variegata* and *P. similis*. A holotype was not designated.

H.M. FOX dissected 4 specimens from this tube, namely 1 *P. similis* and 3 *P. variegata* specimens. He mounted these 4 dissections on one microscopic slide. I was able to examine both the tube deposited by NORMAN and the slide mounted by FOX.

I dissected 3 specimens from the NORMAN tube, namely 1 *P. similis* and 2 *P. variegata* specimens. Each of these specimens is mounted on a separate slide. The 3 slides are deposited in BMNH.

DESIGNATION OF LECTOTYPE: One of the 2 syntype-specimens which I have dissected is designated as the lectotype: soft parts on a slide in PVLP, valves in a micropalaeontological slide. Both slides are deposited in BMNH.

TYPE-LOCALITY: «Side of Lough Neagh», Ireland, where the type-material comes from.

MATERIAL EXAMINED: The syntypes of the species and 6 samples coming from France, Germany, Italy and Luxembourg. (See the detailed list in the appendix).

IMPORTANT LITERATURE: MÜLLER, 1900: redescription of the species;

WOHLGEMUTH, 1914: life - history and ecology;

NÜCHTERLEIN, 1969 and HILLER, 1972: ecology;

FOX, 1965: taxonomy.

DIAGNOSIS

CARAPACE. Shape in lateral view as shown on Figs 6-a, 7-a,b. Surface of the valves with irregular, shallow pits, barely visible under the stereomicroscope (40-80X).

In dorsal view: the l.v. slightly overlapping the r.v. both in front and behind.

Marginal zones of the l.v.: anteriorly and posteriorly with a well-marked flange (selvage distinctly displaced inwards).

Size: 0.46-0.56 mm. Colour: yellowish green with 2 dark green transverse bands.

APPENDAGES. Swset A2 extending beyond the tips of the claws by 20-37%, more rarely by 40-45% of their total length.

Mx1 - palp: terminal joint with 4 distal spines.

Mx2 - respiratory plate with 2 branchial filaments.

Males unknown.

COMPLEMENTS OF DESCRIPTION

The SEM shows that the adult valves are covered with shallow pits of irregular shape, principally located in the central regions of the valves: the pits progressively vanish towards the peripheral regions of the valves (Fig. 7-a,b). These pits often are barely visible under the stereomicroscope.

On juvenile specimens, the pits are distinctly more numerous and cover the whole surface of the valves. In the peripheral regions, however, (the regions which are practically smooth in the adults), the pits are distinctly smaller and less shallow than in the more central areas of the valves. The juvenile valves are smooth under the stereomicroscope.

Indications on the exact length of the A2 Swset are rather rare in the literature. According to KLIE (1938) the Swset barely extend beyond the tips of the claws. On the type-specimens which I have dissected, they overlap by 20-25% of their total length. SCHARF (1980: 197) gives the following values for his measurements: 21% of overlapping in a first sample (coming probably from the neighbourhood of Hamburg) and 33%-37% of overlapping in two samples from the Rhine valley. In 2 samples which I collected myself in the Moselle valley (Remerschen and Nennig, see the appendix), I measured 30-37% of overlapping. But in two samples which I collected in France (in the Sologne and in the Loire

valley; the two localities are about 30 km distant from each other) the Swset extend beyond the claws by 40-45% of their total length. These specimens do not differ by any other taxonomic feature and there may not be any doubt on their belonging to *P. variegata*. As a conclusion I want to point out that the variability of the length of the Swset is larger than it was believed till now. (But this remark also applies to the other species revised here).

RELATIONS

1. *P. variegata* and *P. similis*.

Preliminary remark on *P. similis*: in part I of the revision, I had not noted that in one sample of *P. similis* which I have examined (the sample from Angers, western France), the A2 Swset are distinctly longer than in the remaining samples. In the specimens from Angers, the Swset extend beyond the basis of the A2 claws; they reach the middle of the claws. I would like to recall that in the type-specimens as well as in the remaining *P. similis* specimens which I had at my disposal, the Swset characteristically extend to the basis of the A2 claws. The finding of *P. similis* specimens showing such long Swset had not yet been reported in the literature. This preliminary remark is of some importance for the taxonomy of *P. similis* and *P. variegata*.

Both species, indeed, are closely allied. They share the following features: small carapace (0.46-0.56 mm), with the same colour pattern (2 dark green transverse bands), valves with pits, marginal zones of the l.v. with identical structure, Mx1 - palp with 4 distal spines, Mx2 with 2 branchial filaments.

In fact, the soft parts of both species only differ by the length of the Swset. The valves can only be distinguished by the ornamentation. The table below resumes the differences:

P. variegata

A2 Swset long, extending beyond the tips of the claws on at least 20% of their length;

P. similis

Swset A2 reduced, characteristically reaching the basis of the terminal claws (Fig. 14-b in MEISCH, 1984), rarely reaching the middle of the claws;

valves with irregular shallow pits, valves with numerous deep pits,
missing on the peripheral regions distinctly visible under the stereo-
of the valves, barely visible under microscope.
the stereomicroscope.

Furthermore, in the samples which I examined, the carapace of *P. variegata* is more pointed in front (dorsal view); the carapace of *P. similis*, on the contrary, is often more egg-shaped anteriorly. But this character is not reliable, because there is an overlapping variability.

Serious doubt may arise on the necessity of specific separation of *P. variegata* and *P. similis*. This doubt is strengthened by the examination of the above mentioned specimens of *P. similis* from Angers, in which the Swset show intermediate length. (I ranked those specimens from Angers in *P. similis* because of the deep, well marked pits on the valves). It may not be excluded that populations with Swset showing all the different intermediate lengths will be found later on. In the case where the ornamentation of the valves is revealed to show a similar variability, then *P. variegata* and *P. similis* probably will have to be considered as being the extreme forms of a single variable species (a species possibly engaged in a speciation event).

But for the moment I believe it more prudent to maintain the specific separation. Both forms occupy separate ecological niches: *P. similis*, because of its short Swset, is strictly linked to the bottom mud, while *P. variegata* is capable of active swimming. Moreover, the provisional maintenance of two specific names has the advantage to draw the attention to this taxonomic problem.

As a conclusion, future investigators should pay particular attention to the checking of the above mentioned taxonomic features in *P. variegata* and *P. similis*.

2. *P. variegata* and *P. arcuata*. Both species share the following features: valves with pits, marginal zones of the l.v. of similar structure (Figs 7-f, 8-d, e and 20-a,b), Mx2 with 2 branchial filaments. The two species, however, can easily be distinguished by the following features:

P. variegata

carapace with 2 dark green transverse bands;

valves with normal (number and length) setae;

A2 Swset relatively short, characteristically overlapping by 20-37%, rarely 45%;

Mx1 - palp: 4 distal spines;

P. arcuata

carapace uniformly green or with a dark green dorsal blob;

valves with numerous long setae;

Swset very long, overlapping by 37-55% of their length;

this palp with 5 distal spines.

TAXONOMIC DISCUSSION

1. The type-material studied by BRADY and NORMAN is deposited in HMNT and BMNH. This material includes specimens of *P. variegata* and *P. similis*. The authors obviously did not distinguish between these closely related species.

The material in HMNT (BRADY collection) includes 3 micropalaeontological slides labelled *Cypridopsis variegata*. But the three slides contain carapaces and valves of *P. similis*. None of the specimens belongs to *P. variegata*. The slides are registered as follows: (a) slide 1.51.08 («river Nene at Peterborough»); 2 valves and 1 carapace of *P. similis*; (b) slide 1.51.09 («Isle of Skye»); 2 carapaces of *P. similis*; (c) slide 2.11.47 («Dykes on the site of Whittlesea Mere»); numerous valves and carapaces belonging to different genera, among them 1 carapace of *P. similis*. So these 3 slides do not contain any specimen of *P. variegata*.

The type-material in BMNH (NORMAN collection) includes 1 spirit tube labelled «*Cypridopsis variegata*, Lough Neagh Ireland» and registered as 1900.3.29.135. In this tube I found 2 specimens of *P. similis* and 8 specimens of *P. variegata*. The lectotype has been chosen among the latter specimens.

2. The original description of *P. variegata* by BRADY & NORMAN (1889) is limited to the description of the carapace and does not give any indication on the appendages. As the original description is somewhat concise, it is not possible at present to find out to which species (*P. variegata* or *P. similis*) it applies.

In 1900, two separate redescriptions of *P. variegata* were published. The first, given by KAUFMANN (1900:316) under the name *Paracypridopsis variegata*, shows a species with reduced Swset. The second redescription is due to MÜLLER (1900:84) under the name *Cypridopsis variegata*. MÜLLER fails to indicate the length of the Swset.

In 1912, MÜLLER states that his specimens bear long Swset and he decides that «his» species is identical to *P. variegata* as it was described by BRADY & NORMAN. As a conclusion, MÜLLER renames the species described by KAUFMANN (1900), the new name being *P. similis*. (The name should draw attention to the close relationship with *P. variegata*).

MÜLLER's (1912) proposition was later accepted by all ostracod workers. As the type-material of *P. variegata* includes specimens of *P. variegata* and also of *P. similis*, I choose the lectotype of each of these two species in agreement with MÜLLER's (1912) indications: the stabilization of the nomenclature will thus be guaranteed.

3. GAUTHIER's (1937) hypothesis that *P. variegata* is possibly the parthenogenetic form of *P. steueri* was taken up without comment by KLIE (1938). This hypothesis, however, is not correct: see the taxonomic discussion under *P. steueri*.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. variegata is reported to be relatively rare: this accounts for the fact that its ecology is poorly known. The species inhabits stagnant and running waters. I collected it myself in six localities in Luxembourg and in France (see the appendix): all these localities are ponds with rich aquatic vegetation. The adults are only found during the summer months (July to September). In my opinion the species is less rare than reported in the literature.

P. variegata has been found in Great Britain (FOX, 1965), in Ireland (BRADY & NORMAN, 1889), in Eastern and in Western Germany (MÜLLER, 1900; NÜCHTERLEIN, 1969; HILLER, 1972; SCHARF, 1976; MEISCH, unpublished, see the appendix), in the Netherlands (REDEKE & DEN DULK, 1940), in Italy (MASI, 1905), in France (PARIS, 1920; MEISCH, several localities, see the appendix) in Czechoslovakia (WOHLGEMUTH, 1914), in Yugoslavia (PETKOVSKI, 1961), in Hungary (KLIE, 1939 and FARKAS, 1958), in Poland (SYWULA, 1974) and in the Soviet Union (KLIE, 1923, 1927; BRONSTEIN, 1947 in the rivers Volga and Orka).

I found the species in Luxembourg, near Remerschen, in a gravel pit located in the Moselle valley.

The species is also recorded from the USA (FURTOS, 1933; TRESSLER, 1947, 1959).

Remark: KLIE (1941: 233-234) reports the finding of *P. variegata* in Macedonia at Privata and Sedes. I was able to examine the sample from Sedes (ZMH, 1168): these specimens actually belong to *P. arcuata*. *P. variegata* has to be excluded with certainty: the Mx1 - palp of these specimens bears 5 distal spines, and not 4 as in *P. variegata*. This erroneous identification by one of the most famous European ostracodologists clearly shows the taxonomic difficulties presented by these related species.

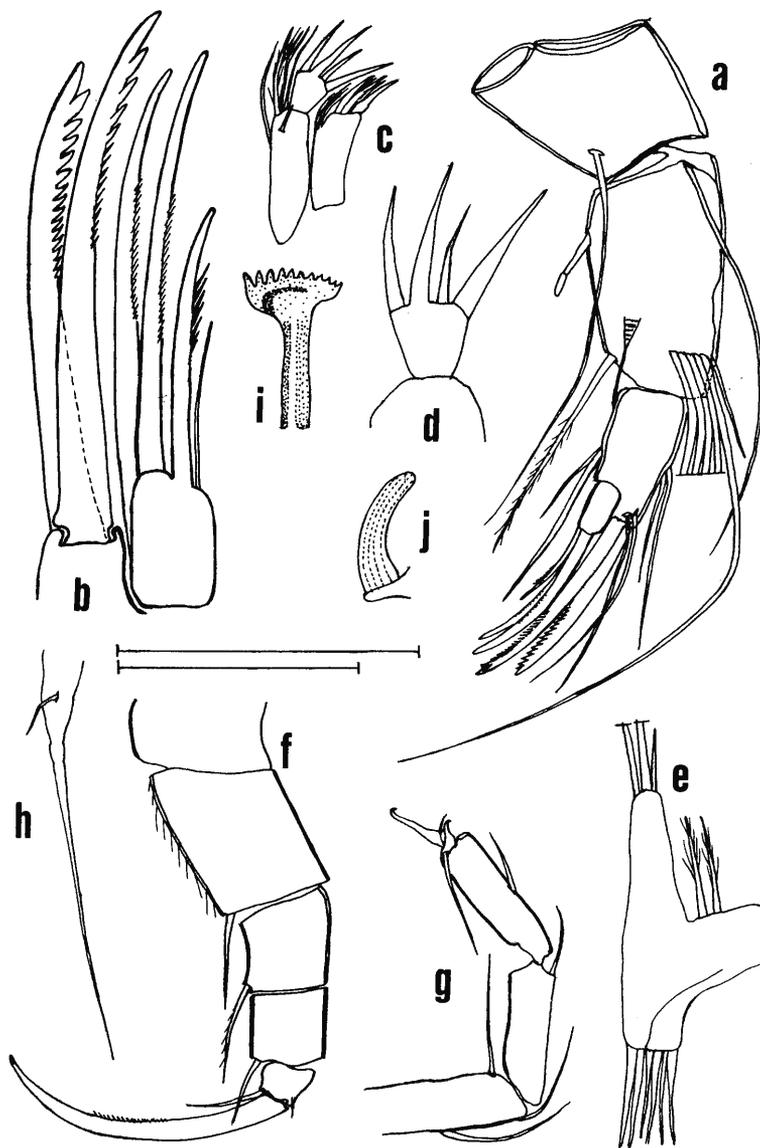


Fig. 5. - *Potamocypris variegata*.

a: Antenna (A2); b: Distal claws of the antenna; c: Palp and 3rd masticatory process of the maxillule (Mx1); d: Terminal joint of the Mx1 - palp; e: Maxilla (Mx2); f: Thoracopod T1; g: Thoracopod T2; h: Furcal ramus; i: Rake-like organ; j: Genital hook. Small scale = 100 μm for a, c, e, f, g, h; = 50 μm for d, i, j. Large scale = 50 μm for b; a-j: Luxembourg, near Remerschen.

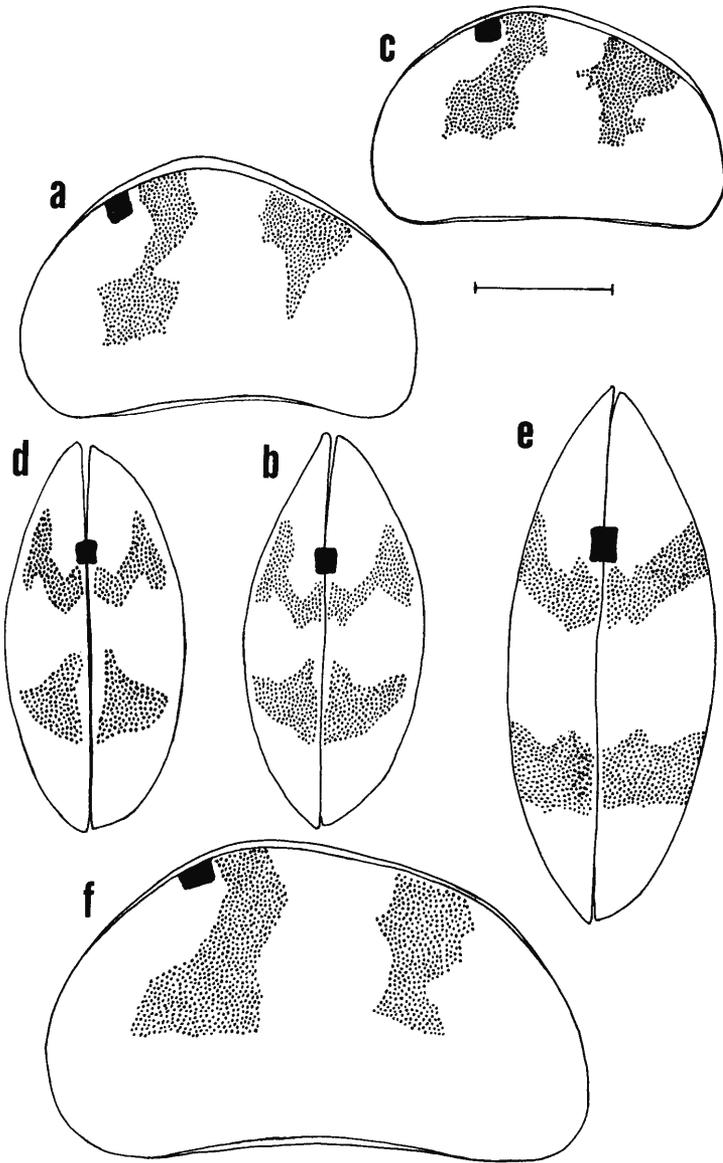


Fig. 6. - *P. variegata*, *P. similis* and *P. smaragdina*.

a and b: *P. variegata*; c and d: *P. similis*; e and f: *P. smaragdina*; a, c and f: Carapaces in lateral view; b, d and e: Carapaces in dorsal view. See the colour pattern. Scale = 0.20 mm for all; a-d: Luxembourg, Moselle valley; e-f: Angers, France.

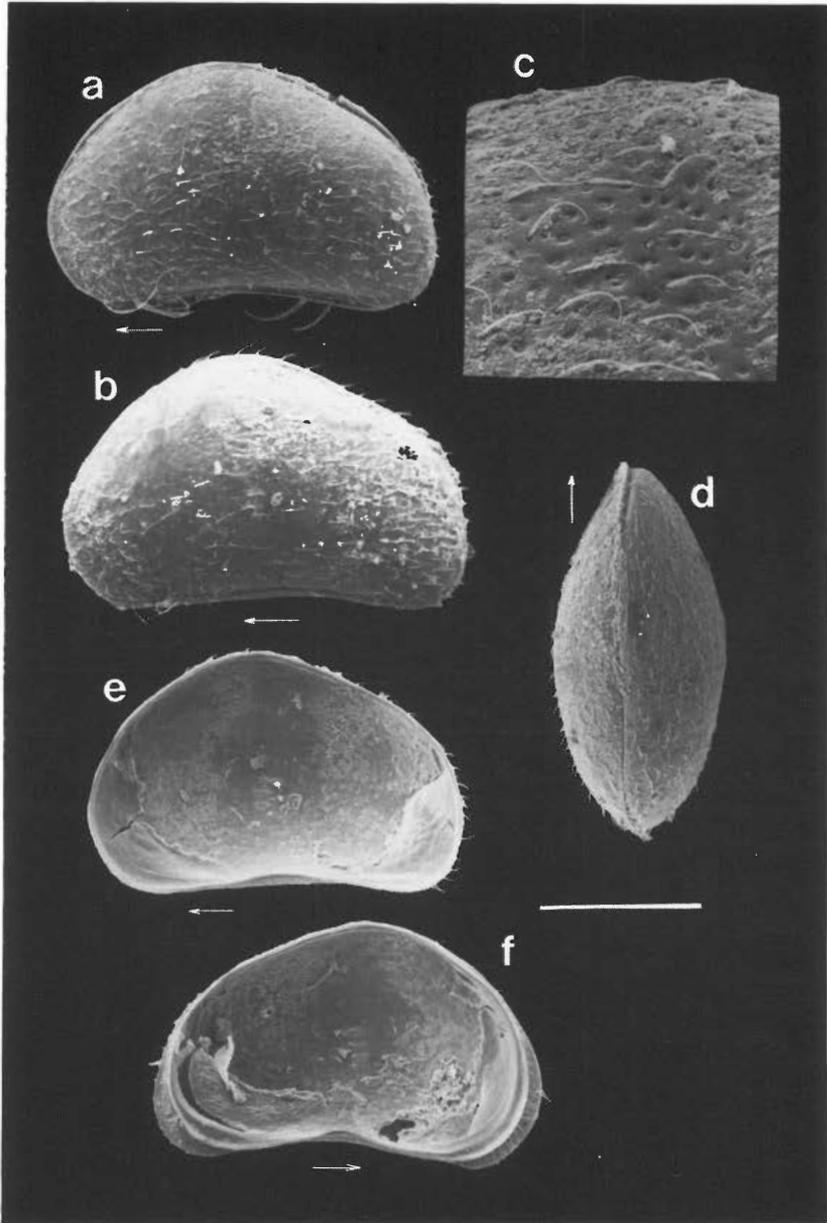


Fig. 7. - *Potamocypris variegata*.

a and b: Carapaces in lateral view; c: Surface ornamentation; d: Carapace in dorsal view; e: Right valve, internal; f: Left valve, internal. Scale = 0.20 mm for a, b, d, e and f; = 50 μ m for c; b-c: Luxembourg, near Remerschen; a and d-f: France, Sologne.

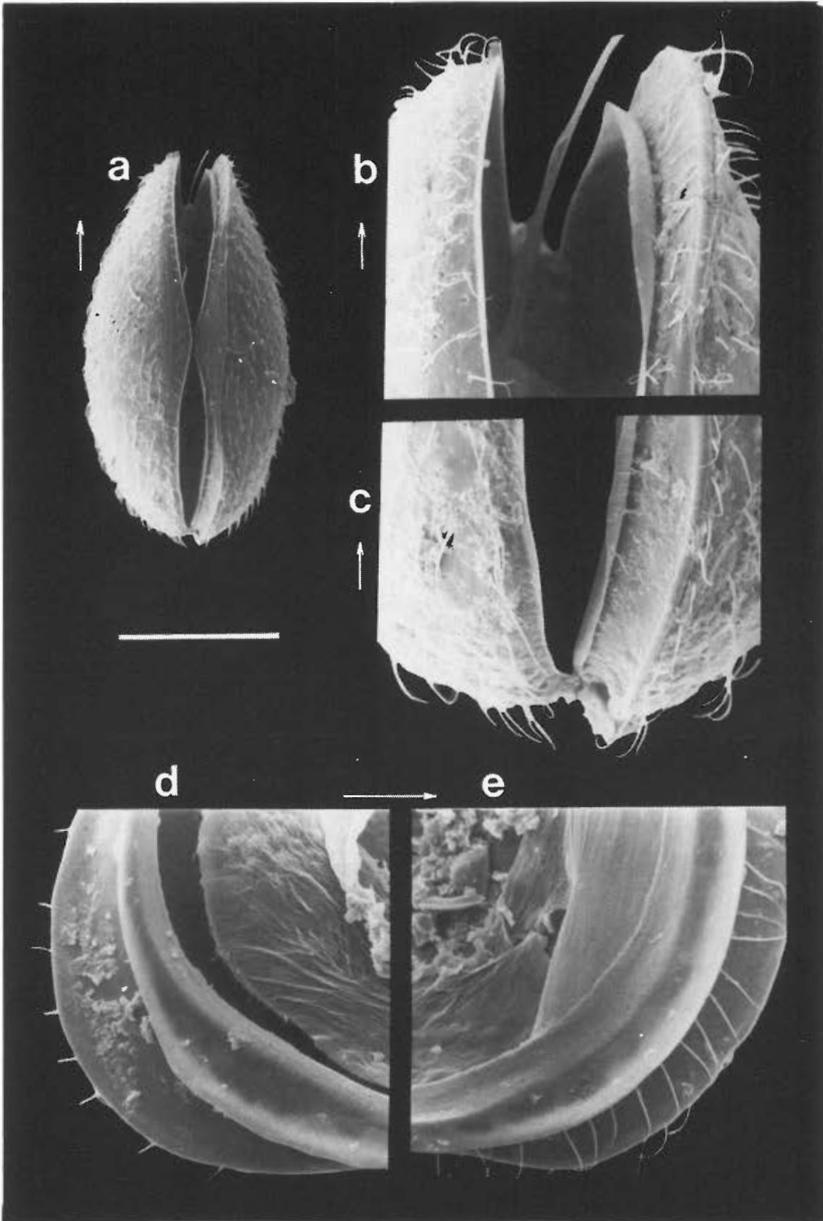


Fig. 8. - *Potamocypris variegata*.

a: Ventral view of the carapace; b: Anterior detail of a; c: Posterior detail of a; d: Posterior marginal zone of the left valve; e: Anterior marginal zone of the left valve. Scale = 0.20 mm for a; = 50 μ m for b, c, d and e; a-e: France, Sologne.

3. POTAMOCYPRIS UNICAUDATA SCHÄFER, 1943
(Figs 9 - 11)

Potamocypris unicaudata SCHÄFER, 1943: 212-216, figs 6-10;
Potamocypris vanoyei DE VOS, 1946: 168-170.

TYPE-MATERIAL: Numerous syntype-specimens were sent by SCHÄFER to KLIE. These type-specimens are deposited in ZMH, KLIE collection, registration number 1183. The tube is labelled: «*Potamocypris unicaudata*, Holstein: Graben am Barsbeker See, 28.9.1936 coll. A. MEUCHE». A holotype was not designated.

DESIGNATION OF LECTOTYPE: One of the syntype-specimens which I dissected (deposited in ZMH), soft parts and valves (decalcified) on 2 separate microscopic slides (in PVLP and in Euparal).

TYPE-LOCALITY: The region around Lake Barsbek, Holstein, northern Germany.

MATERIAL EXAMINED: The syntype-specimens deposited in ZMH and 5 samples coming from Germany, Belgium and Luxembourg.

IMPORTANT LITERATURE: LÖFFLER 1957, 1959 and 1961, NÜCHTERLEIN, 1969 and HILLER, 1972: ecology; SLUYS, 1979: synonymy with *P. vanoyei*; ABSOLON, 1973: fossil occurrence (Holocene) in central Europe.

DIAGNOSIS

CARAPACE. In lateral view as shown on Fig. 10-a.

Surface of the valves smooth under the stereomicroscope (40-80X), with tiny pits under the SEM (minimum 500X).

Dorsal view: anteriorly the r.v. overlapping the l.v., posteriorly the l.v. overlapping the r.v.

Marginal zones of the l.v.: anterior flange barely developed (the selvage extends beyond the anterior flange); posterior flange well developed.

Size: 0.70-0.85 mm. Colour: more or less uniformly green or yellowish green.

APPENDAGES. A2 Swset overlapping the tips of the terminal claws by 35-45% of their total length.

Mx1 - palp: terminal joint with 4 distal spines.

Mx2 - respiratory plate: with 1 strong branchial filament.

Occurring in slightly brackish water and in fresh water.

Males unknown.

COMPLEMENTS OF DESCRIPTION

The relative position of the valves in dorsal view is constant in all the samples which I have examined: the r.v. extends beyond the l.v. in front; the opposite position is shown at the posterior end of the carapace.

In the 3 syntype-specimens which I have dissected, the A2 Swset overlap the tips of the claws by 40-44% of their total length.

The appendages of *P. unicaudata* cannot be distinguished from those of *P. smaragdina*.

RELATIONS

P. unicaudata is closely allied to *P. smaragdina*. Both species share the following features: carapace of similar shape, Swset overlapping by 35-45% of their total length, Mx1 - palp with 4 distal spines, Mx2 with 1 branchial filament. In fact I am not able to distinguish the soft parts of both species. However, the following carapace features easily allow recognition of each of them:

P. unicaudata

Dorsal view, anterior end:

r.v. > l.v.

Frontal view: dorsal hump of the r.v. well developed;

valves smooth, covered with «normal» setae;

l.v. anteriorly with a lip-like flange;

carapace uniformly greenish;

P. smaragdina

Dorsal view, anterior end:

l.v. > r.v.

Frontal view: r.v. with a barely developed dorsal hump;

valves with shallow pits (barely visible under the stereomicroscope) and covered with numerous long and stiff setae;

l.v. anteriorly with a well-developed, lobe-like flange;

carapace with 2 dark green transverse bands.

TAXONOMIC DISCUSSION

DE VOS (1946) described *P. vanoyei* from the Netherlands. This species should only differ from *P. unicaudata* by the shape of its carapace. I was not successful in my request for getting on loan the type-material of this species. (The types are deposited in the Zoological Museum in Amsterdam). But SLUYS (1979) examined the type-specimens and convincingly showed that *P. vanoyei* has to fall in synonymy with *P. unicaudata*.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. unicaudata is a characteristic inhabitant of slightly salty waters. In suitable biotopes it often forms very large populations (SCHÄFER, 1943; HILLER, 1972; my own observations). According to LÖFFLER (1961:358) the upper limit of tolerated salinity attains 3.7‰, the upper concentration in chloride being 0.5‰. (According to the same author, fresh water is defined by a total salinity equal or inferior to 1‰ and a chloride concentration equal or inferior to 500 mg Cl⁻/l).

P. unicaudata is frequently found in ditches and ponds situated near the sea-shore, where the fresh water slightly mingles with the sea water. But the species is also found in inland waters slightly enriched with salt. It often lives in association with another ostracod-species showing a similar preference for salty water, i.e. *Heterocypris salina* (see DELORME, 1971; ABSOLON, 1973). I myself captured the species in abundant numbers in Luxembourg in an abandoned reservoir the water of which was formerly used for the irrigation of vineyards (see the appendix). In this locality *P. unicaudata* is associated with *Heterocypris salina* and *Herpetocypris chevreuxi*: the latter species too is known for its preference for slightly salty waters.

LÖFFLER (1957 and 1959) captured *P. unicaudata* in shallow ponds (called «Lacken») filled with alkaline water in the surroundings of the Neusiedlersee in Austria. The species is absent in the ponds where the chloride concentration is superior to 100 mg Cl⁻/l.

P. unicaudata is known from Germany (SCHÄFER, 1943; NÜCHTERLEIN, 1969; HILLER, 1972; VESPER, 1975), from the Netherlands (DE VOS, 1946 under *P. vanoyei*; DU SAAR, 1967; SLUYS, 1979), from Belgium (MARTENS, 1982; at Neeryse, coll. K. WOUTERS, unpublished), from Austria (LÖFFLER, 1957, 1959, 1963) and from Luxembourg (see above). It is also reported from the Balkans (in LÖFFLER & DANIELOPOL, 1978).

DELORME (1970:257) writes that *P. unicaudata* is the most frequent *Potamocypris*-species in Canada («found throughout the interior plains»).

P. unicaudata is known as a fossil from Central Europe (ABSOLON, 1973, in Holocene sediments) and from Canada (DELORME, 1971, in Holocene sediments).



Fig. 9. - *Potamocypris unicaudata*.

a: Antenna (A2); b: Mandibular palp; c: Maxillule Mx1 (palp and 3rd masticatory process); d: Maxilla (Mx2); e: Thoracopod T1; f: Thoracopod T2; g: Furcal ramus; h: Genital hook. Scale = 100 μ m for a-g; = 50 μ m for h; a-h: Luxembourg, Winrange.

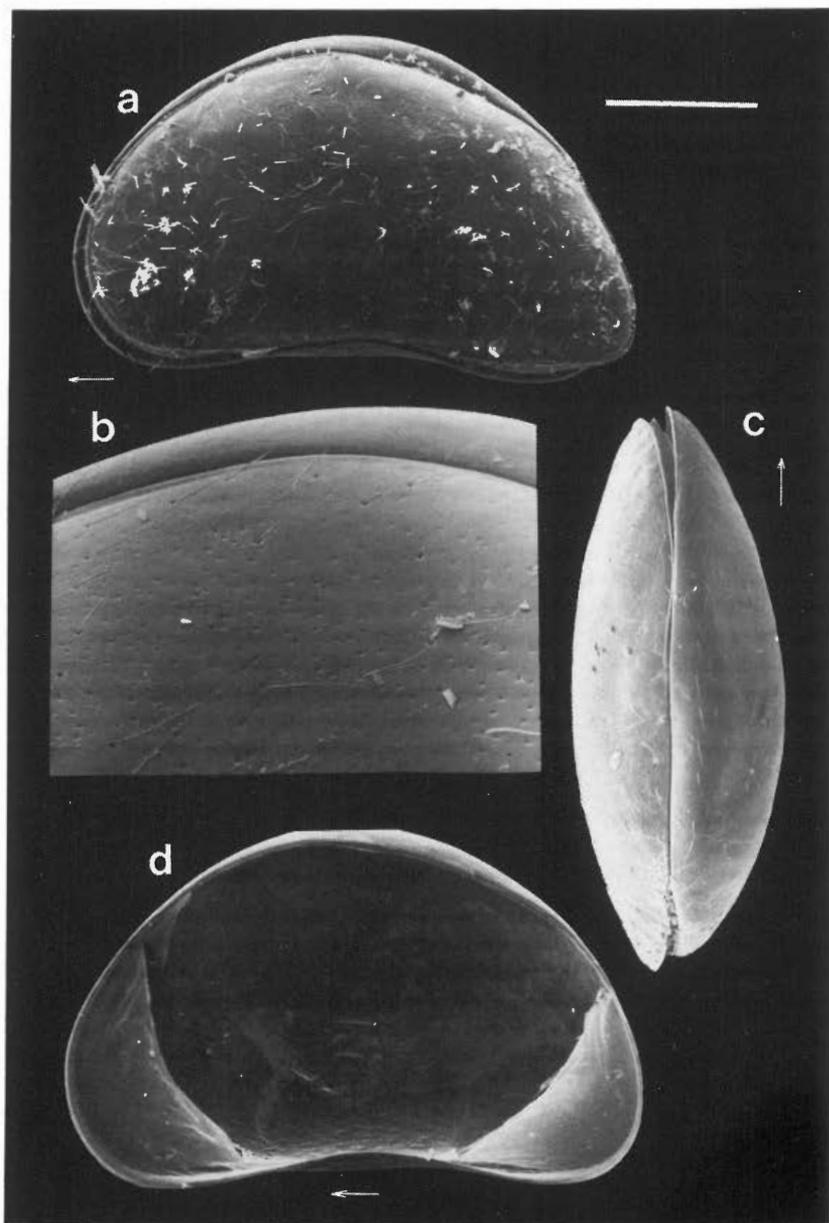


Fig. 10. - *Potamocypris unicaudata*.

a: Carapace in lateral view; b: Surface ornamentation (detail); c: Carapace in dorsal view; d: Right valve, internal. Scale = 0.20 mm for a, c and d; = 0.10 mm for b; a-d: Luxembourg, Wintrange.

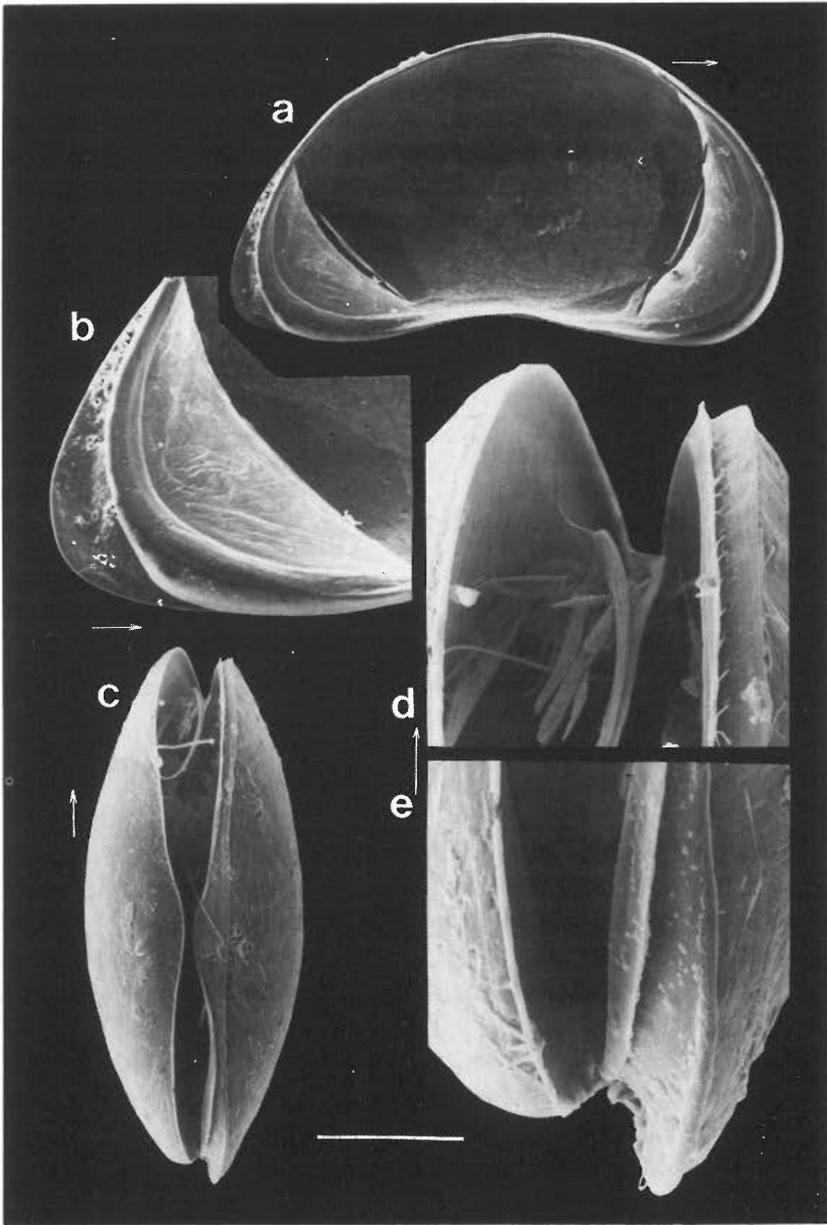


Fig. 11. - *Potamocypris unicaudata*.

a: Left valve, internal; b: Posterior marginal zone of the left valve; c: Ventral view of the carapace; d: Anterior detail of c; e: Posterior detail of c. Scale = 0.20 mm for a and c; = 0.10 mm for b; = 50 μ m for d-e; a-e: Luxembourg, Wintrange.

4. POTAMOCYPRIS SMARAGDINA (VAVRA, 1891)
(Figs 12 and 13)

- Cypridopsis smaragdina* VAVRA, 1891: 80-81, fig. 26:1-3;
Candonella smaragdina (VAVRA, 1891) VAVRA, 1898:12;
Potamocypris smaragdina (VAVRA, 1891) DADAY 1900:193;
Potamocypris smaragdina var. *compressa* FURTOS 1933:435-437, pl. VI
figs 10-14;
*Potamocypris diana*e FOX, 1965: 628-629.
? *Potamocypris comosa* FURTOS, 1933: 435, pl. VII figs 11-20.

TYPE-MATERIAL: It does not exist in the Museum in Prague where VAVRA was working (communication of Dr KURKA). It has to be considered as lost.

TYPE-LOCALITY: Surroundings of the locality «Oberbaumgarten» in Bohemia (now Sady, near Bolkow in Poland).

MATERIAL EXAMINED: The syntypes of *P. diana*e from Great Britain and 5 samples coming from France, Germany and Belgium. (See details in the appendix).

IMPORTANT LITERATURE: NÜCHTERLEIN 1969, HILLER 1972: ecology;
FURTOS 1933, HOFF 1942 and TRESSLER 1959: occurrence in the USA;
FERGUSON, 1944: life-history (in the USA);
HOFF, 1942: description of the male.

DIAGNOSIS (FEMALES ONLY)

CARAPACE. Lateral view as shown on Fig. 12-a.
Surface of the valves with shallow pits, barely visible under the stereomicroscope (40-80X). Valves covered with numerous long and stiff setae, all directed towards the posterior end of the carapace.
Dorsal view: the l.v. extends beyond the r.v. in front and behind.
Marginal zones of the l.v.: anterior and posterior flange well developed (selvage distinctly displaced inwards).
Size: 0.60-0.79 mm. Colour: light green or yellowish-green with 2 transverse green bands.

APPENDAGES. A2 Swset very long, overlapping the tips of the terminal claws by 35-45% of their total length.
Mx1 - palp: terminal joint with 4 distal spines.

Mx2 - respiratory plate with 1 branchial filament.

Bisexual populations not rare in North America. Males unknown in Europe.

COMPLEMENTS OF DESCRIPTION (FEMALES)

The characteristic colouring of *P. smaragdina* allows easy and rapid recognition of the species. The conservation in alcohol preserves the colour during at least several months.

The density of the characteristic setae covering the valves is somewhat variable. But I did not see any specimen without stiff setae.

The relative position of the valves in dorsal view is constant in all the specimens I have examined: the l.v. overlaps the r.v. in front and behind.

Dorsally, the r.v. most generally only slightly overlaps the l.v. (see Fig. 12-a). This character differs in the related *P. unicaudata*, where the r.v. is in general distinctly higher than the l.v. This character, however, is somewhat variable in both species.

The appendages of the female specimens of *P. smaragdina* cannot be distinguished from those of *P. unicaudata*. (This is why I give no figures of the appendages of *P. smaragdina*). Both species only differ by carapace features.

The occurrence of males is reported from the USA by HOFF (1942) and FERGUSON (1944). RAMIREZ (1967) described the male from Argentina: but his description probably applies to a different species (see the discussion below).

SYNGAMIC AND PARTHENOGENETIC REPRODUCTION

Until now, no male of *P. smaragdina* has been found in Europe. In North America, on the contrary, monosexual populations (with females only) and bisexual populations are found. HOFF (1942) reports that in Illinois (USA), males are present in six populations on fifty. In bisexual populations the males equal the females in number.

If it is true that all European populations are parthenogenetic, then *P. smaragdina* shows an interesting case of geographical parthenogenesis: parthenogenetic and syngamic reproduction in North America, parthenogenetic reproduction only in Europe. This leads to the hypothesis that the species was originally implanted in North America and that it later invaded the European continent. Only the parthenogenetic populations were capable of spreading in Europe.

RELATIONS

P. smaragdina has to be compared with *P. unicaudata*, *P. villosa* and *P. arcuata*.

1. *P. smaragdina* and *P. unicaudata* can only be distinguished by carapace features. For a comparison of the two species see the chapter «Relations» under *P. unicaudata*.

2. *P. smaragdina* and *P. villosa* share the following features: valves with numerous long and stiff setae all directed towards the posterior end of the carapace; Swset overlapping by about 1/3 of their length. The species may be distinguished by the following features:

P. smaragdina

A2 Swset overlapping by 35-45%;

Mx1 - palp with 4 distal spines;

Mx2 with 1 branchial filament;

valves with pits (barely visible under the stereomicroscope);

carapace with 2 green transverse bands;

P. villosa

Swset overlapping by 20-36% (most often 20-30%);

this palp with 5 distal spines;

Mx2 with 2 branchial filaments;

valves smooth (stereomicroscope and SEM);

carapace more or less uniformly green.

3. *P. smaragdina* and *P. arcuata* differ by the following features:

P. smaragdina

Valves with pits barely visible under the stereomicroscope;

carapace with 2 green transverse bands;

Mx1 - palp with 4 distal spines;

Mx2 with 1 branchial filament;

P. arcuata

valves with distinct pits, visible under the stereomicroscope;

carapace uniformly green or with a dark green dorsal blob;

this palp with 5 distal spines;

Mx2 with 2 branchial filaments.

TAXONOMIC DISCUSSION

1. *P. smaragdina* requires an exhaustive discussion. Indeed one may doubt the identity of VAVRA's *P. smaragdina* with the species presented here. Furthermore, *P. smaragdina* caused some confusion in the literature. Thus, when I started working on the present revision, it was not possible to know from the European literature what was the exact species meant by the name *P. smaragdina*.

According to VAVRA's original description, *P. smaragdina* shows the following diagnostic features: (a) carapace rather egg-shaped in dorsal view; (b) surface of the valves with pits; (c) valves with numerous long and stiff setae; (d) carapace of bright green colour («grasgrün»); (e) A2 Swset largely overlapping the tips of the claws; (f) Mx1 - palp with 5 distal spines (see VAVRA's Fig. 26-3).

Unfortunately, the type-material of *P. smaragdina* is lost and so it is no longer possible to verify the exact identity of the species collected by VAVRA.

The characters under (b), (c) and (e) favour the identification of VAVRA's specimens with the species described here. On the contrary, the characters (a), (d) and (f) are rather opposed to this identity. In dorsal view the present species is rather slender and sharp-pointed at both ends (Fig. 12-c) and not ovate as figured by VAVRA. Furthermore, VAVRA writes that his species is of a bright green colour («grasgrün»). It seems difficult to admit that VAVRA, who obviously observed living or at least recently killed specimens (he describes the colour of the eggs!) did not see the striking pattern of the colour (i.e. two green transverse bands) of the present species. Finally, VAVRA's Fig. 26-3 shows a Mx1 - palp with 5 distal spines. VAVRA writes that this palp bears «three strong setae and a few fine setae», but this observation is most certainly erroneous. The Mx1 - palp of none of the known species bears more than 5 spines. Consequently the character (f) has to be excluded from the discussion.

The discussion above shows that the identity of VAVRA's species with the species presented here is not completely certain. On the other hand, one may notice that the diagnostic features under (a) - (f) also apply to another species, namely *P. arcuata*.

However, if one considers *P. smaragdina* sensu VAVRA as synonymous to *P. arcuata* SARS, 1903, then the well established nomenclature will be upset severely: priority should be given to the senior synonym and so *P. arcuata* now should be called *P. smaragdina*. One might propose to consider *P. smaragdina* as an unused senior synonym of *P. arcuata*, hence as a nomen oblitum, but this is not possible because of the fact that *P. smaragdina* is not an unused name: it currently served to designate the species presented here. Furthermore, the species discussed here should be renamed, the available name being *P. dianae* FOX.

For reasons of stabilization of the long established names *P. smaragdina* and *P. arcuata*, I would like to propose that the identity of VAVRA's *P. smaragdina* with the species presented here should be accepted. I do not believe it reasonable to change species names which are well accepted and widely used since the beginning of the century. Indeed, as far as *P. smaragdina* is concerned, since 1897 (see SHARPE, 1897) the American zoologists have identified the species discussed here (which is one of the most common ostracod species in North American inland waters) with VAVRA's *P. smaragdina* (see especially FURTOS, 1933; HOFF, 1942; TRESSLER, 1959).

In Europe, however, the identification of *P. smaragdina* caused some confusion. PETKOVSKI (1963 and 1964) described *P. smaragdina* from the Azores and from Yugoslavia. Dr PETKOVSKI was so kind as to write to me that in his present opinion those specimens actually belong to a form related to *P. arcuata* and that he now identifies *P. smaragdina* with the species discussed here. In 1965, the species was even redescribed as new by FOX under the name *P. diana*e (see also below). Recently MARTENS (1982) described *P. smaragdina* from Belgium. Koen MARTENS friendly sent me some of his material (he even was so kind to return to his locality, the Hoboken Polder, in order to collect a second sample including more numerous specimens): the examination of these specimens revealed that they belong to *P. arcuata*.

P. smaragdina was recorded from Germany by NÜCHTERLEIN (1969) and by HILLER (1972). As both authors fail to give details on the taxonomic features of the specimens they examined, it is not possible to know with certainty what species is meant. I was able to examine the samples studied by both authors. (Dr NÜCHTERLEIN was so kind as to send me a large part of his material; I got a large part of the material studied by Dr HILLER through Dr B. SCHARF). The samples studied by both authors turned out to belong to *P. smaragdina* as described in this work.

2. The type-locality where VAVRA collected the type-material is a pond near «Oberbaumgarten» in Bohemia. The major part of Bohemia presently belongs to the CSSR. However, SYWULA (1974 and personal communication) draws the attention to the fact that Oberbaumgarten now is called Sady and is situated within Poland near Bolkow. Unfortunately the type-material collected by VAVRA has to be considered as lost.

3. The examination of the syntypes of *P. diana*e FOX, 1965 described from Great Britain showed that these specimens without any doubt belong to *P. smaragdina* as it is described here.

4. FURTOS (1933) described *P. smaragdina* from Ohio (USA) under the name *P. smaragdina* var. *compressa*. The author writes that in dorsal view this var. is more slender than the one figured by VAVRA. But contrary to VAVRA's Fig. 26-2, the European form too is laterally compressed in dorsal view (see Fig. 12-c). As a conclusion, the maintenance of the var. *compressa* is no longer justified. HOFF (1942) expressed the same opinion.

5. DOBBIN (1941) reports the occurrence of *P. smaragdina* var. *compressa* from the surroundings of Washington (USA). But the Mx2 - respiratory plate of this form bears 2 branchial filaments (DOBBIN, 1941:231, pl. II, fig.4). If this indication is correct, then these specimens surely have to be ranked in a different species.

6. Possibly *P. comosa* FURTOS, 1933, described from the USA, is synonymous to *P. smaragdina*. Unfortunately FURTOS did not compare her species with *P. smaragdina*. The only feature allowing separation of both species seems to be the length and the density of the stiff setae covering the valves: *P. comosa* is described as being «excessively hairy». But I found out that the density of the setae on the valves shows some interpopulational variability in *P. smaragdina*. This observation suggests a probable synonymy between both species.

7. RAMIREZ (1967) reports the finding of *P. smaragdina* in Argentina (surroundings of Buenos Aires) and gives a detailed description of the male. However, this form most probably belongs to a different species. The description shows a carapace which is pale green and, above all, the Mx2 bears 2 branchial filaments (RAMIREZ, 1967:37, fig. 70, pl. X).

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

As the identification of *P. smaragdina*, at least in Europe, was not certain until now, the records in the literature dealing with this species have to be used with prudence. The records below, except those specially commented, apply with certainty to *P. smaragdina* as described in this work.

P. smaragdina has been collected in ponds, fish-ponds, lakes and streams. Because it has been found together with *P. unicaudata* by several authors (see HILLER, 1972; MARTENS & DUMONT, in press), it may not be excluded that the species tolerates a slight increase in salinity.

The species is known from Germany (NÜCHTERLEIN, 1969; HILLER, 1972), from Switzerland (ZSCHOKKE, 1900 in alpine lakes above 1500 m, but this record certainly has to be re-examined), from Italy (GHETTI, 1973 in rice-fields, this record too should be re-examined) and from Great Britain (FOX, 1965 as *P. diana*).

MARTENS & DUMONT (in press) recently found the species in Lake Donk, Belgium (K. MARTENS sent me some of his material for examination).

I did not find the species in Luxembourg.

DU SAAR (1967) reports the finding of a species designated as «*Potamocypris spec.*» from the Netherlands and which the author possibly believes to belong to a species not yet described. This form most probably belongs to *P. smaragdina*. The species indeed shows the following features: carapace with 2 green transverse bands, valves with pits, Swset very long, Mx2 with 1 branchial filament.

P. smaragdina is one of the most common fresh-water ostracods in the USA, where bisexual populations have been reported as being not rare. See especially FURTOS (1933), HOFF (1942), FERGUSON (1944), SWAIN (1955), TRESSLER (1959), KING & KORNICKER (1970). DELORME (1970) reported the species from Canada. The same author (1967) recorded the fossil occurrence of the species in Quaternary sediments in Canada.

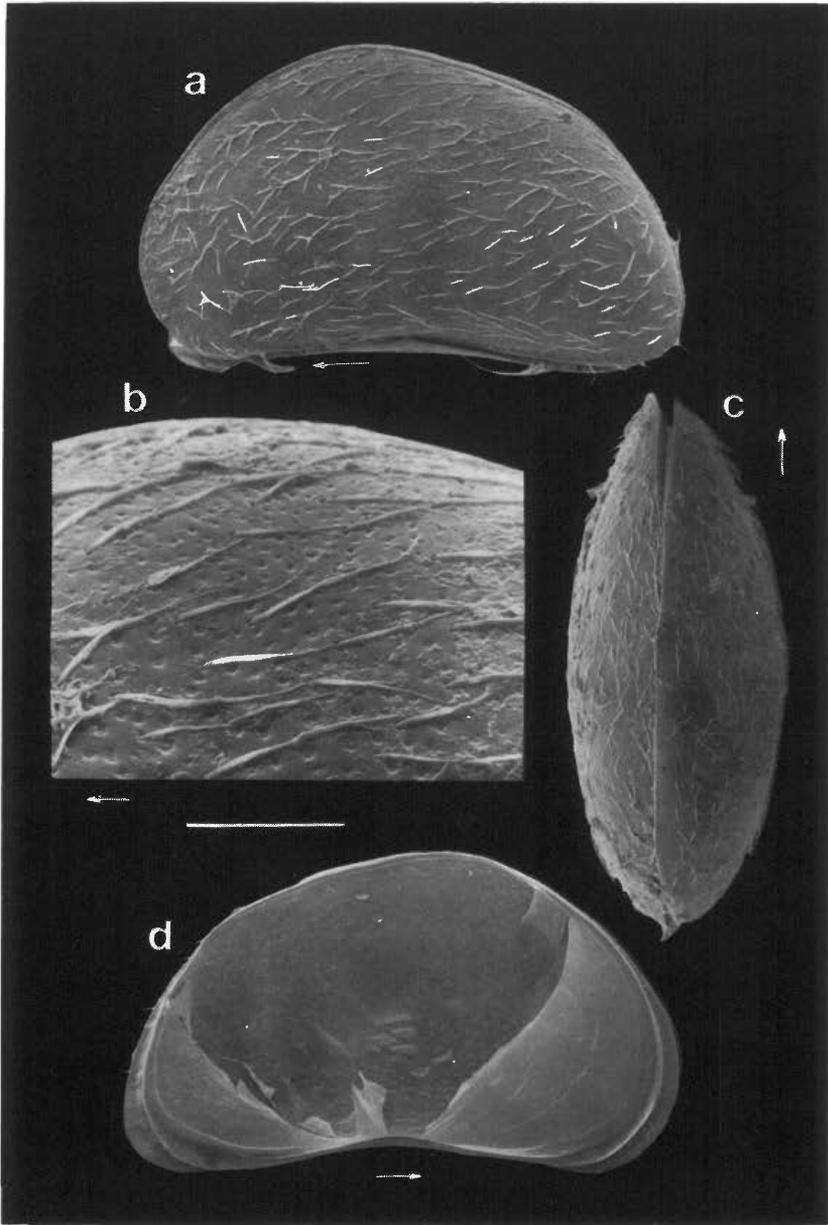


Fig. 12. - *Potamocypris smaragdina*.

a: Carapace in lateral view; b: Surface ornamentation (detail); c: Carapace in dorsal view; d: Left valve, internal. Scale = 0.20 mm for a, c and d; = 0.10 mm for b; a-d: France, Angers.



Fig. 13. - *Potamocypris smaragdina*.

a: Ventral view of the carapace; b: Anterior detail of a; c: Posterior detail of a; d: Posterior marginal zone of the left valve; e: Anterior marginal zone of the left valve. Scale = 0.20 mm for a; = 0.10 mm for b-e; a-e: France, Angers.

5. POTAMOCYPRIS VILLOSA (JURINE, 1820) SARS, 1890
(Figs 14 - 16)

Monoculus villosus JURINE, 1820:178, pl. 19 figs 14-15;
Cypridopsis villosa BRADY, 1868:377, pl. 24 figs 11-15, pl. 36 fig. 9;
Cypridopsella villosa KAUFMANN, 1900:311, pl. 19 figs 6-9,
pl. 22 figs 12-14;
Cypridopsis villosa crassipes MASI, 1905:125;
Potamocypris villosa crassipes (MASI, 1905) MÜLLER 1912:216;
Potamocypris crassipes (MASI, 1905) GHETTI & MCKENZIE, 1981:48.

TYPE-MATERIAL: It does not exist at the Natural History Museum in Geneva, the town where JURINE lived (communication of Dr B. HAUSER). The type-material has to be considered as lost.

TYPE-LOCALITY: Surroundings of Geneva (Switzerland).

MATERIAL EXAMINED: 13 samples coming from France, Germany, Great Britain, Norway, Poland, Yugoslavia, Afghanistan, Belgium and Luxembourg.

IMPORTANT LITERATURE: KAUFMANN 1900, ALM 1915, SARS 1925: redescrptions of the species;
WOLF 1920, NÜCHTERLEIN 1969: ecology;
PETKOVSKI 1966: redescription of *P. villosa crassipes*.

DIAGNOSIS

CARAPACE. Shape in lateral view as in Fig. 15-a.

Surface of the valves totally smooth in juveniles and adults (stereomicroscope and SEM).

Valves densely covered with long and stiff setae all directed towards the posterior end of the carapace.

Dorsal view: anteriorly, the r.v. generally overlaps the l.v. or both valves extend to the same height, more rarely the l.v. overlaps the r.v.

Marginal zones of the l.v.: anterior flange poorly developed; posterior flange well developed (selvage distinctly displaced inwards).

Size: 0.56-0.80 mm (mostly 0.65-0.75 mm). Colour: light green to bright green.

APPENDAGES: A2 Swset of medium length, overlapping the tips of the terminal claws by 20-36% of their total length.

Maxillule Mx1: terminal joint of the palp with 5 distal spines,
Maxilla Mx2: respiratory plate with 2 branchial filaments of about
equal length.

Males unknown.

COMPLEMENTS OF DESCRIPTION

1. The «hairy aspect», the smooth valvès and the length of the Swset (overlapping by 20-36%) characterize this species. However, the hairiness of the carapace is somewhat variable: in some populations the setae are distinctly less dense than in others, but I did not see any specimen completely lacking these characteristic setae.

The carapace shape in lateral view as well as in dorsal view is highly variable (see the Figs 15 and 16). This variability is probably in relation with the fact that *P. villosa* is a most common and almost cosmopolitan species.

In dorsal view, the carapace generally shows almost equally rounded anterior and posterior ends (Fig. 15-c,d). In some populations, both ends are rather sharp-pointed, in others they appear more rounded (see also the discussion on *P. villosa crassipes* below).

Among the material which I have examined, three samples include specimens showing a carapace which strikingly differs from that found in the remaining samples. The first of these three samples comes from Yugoslavia (Istria, ZMH 1187), the two remaining samples both come from southern France (from Ribiers, leg. WOUTERS and from near Draguignan, leg. MEISCH; both localities are situated in the Haute Provence).

The carapaces of these three samples clearly are of a similar shape and size (see Fig. 16 - d,e,f.). They show the following features: (a) size relatively small: 0.63-0.65 mm, respectively 0.56-0.62 mm and 0.64-0.68 mm; (b) the dorsal hump on the r.v. is strikingly narrow and high (this feature is best seen in frontal view); (c) in dorsal view these carapaces are relatively slender and distinctly sharp-pointed on both the anterior and posterior end. Till now such a carapace shape never had been described for *P. villosa*. One might even be tempted to put this form in a separate,

not yet described species. Nevertheless, the thorough examination of all the other taxonomic features (structure of the marginal zones of the l.v., surface ornamentation of the valves, anatomy of the appendages ...) did not allow me to find any difference which might justify a specific separation. In my opinion, the carapace shape described above forms part of the variability field of *P. villosa*.

2. PETKOVSKI (1966) showed that the A2 Swset display a variability which seems to be in relation with the geographical distribution of the species: populations from northern and central Europe have Swset which are shorter than those found in the South European populations. Here are the measurements that I was able to take on the specimens which I dissected (the number of dissections is given in parentheses, the numbers on the right indicate the percentages of the length by which the Swset overlap the tips of the terminal A2 claws):

| | |
|------------------------------------------------------|--------|
| Norway (SARS collection) (1): | 26% |
| Great Britain, isle of Bute (NORMAN collection) (1): | 25% |
| Poland (KLIE collection) (2): | 24-27% |
| Luxembourg (coll. MEISCH) (6): | 24-28% |
| France, Vosges (KLIE collection) (1): | 23% |
| France, South-West (coll. MEISCH) (6): | 21-27% |
| France, South (coll. WOUTERS and MEISCH) (6): | 25-30% |
| Yugoslavia, Istria (KLIE collection) (3): | 30-34% |
| Afghanistan (KLIE collection) (3): | 34-36% |

In spite of the reduced number of measurements, these data rather seem to corroborate PETKOVSKI's observations: the southern specimens actually seem to have longer Swset. But it should be noted that all the intermediate lengths between 20% and 36% are found.

Furthermore, PETKOVSKI (1966) draws the attention to the fact that southern populations have small and distinctly ovate carapaces while populations from northern regions have shells which are larger and more sharp-pointed in dorsal view. As a conclusion, PETKOVSKI (1963 and 1966) ranks the specimens from southern Europe in a separate subspecies, named *P. villosa crassipes*. (This form had been described formerly from Italy by MASI as a variety of *P. villosa*; see also the discussion chapter below).

The following objections, however, may be opposed to such a sub-specific separation: (a) the specimens with Swset of intermediate length

cannot clearly be ranked in the one or the other subspecies; and (b) above all the carapace shape of *P. villosa* is shown to be strikingly variable in dorsal and in lateral views and this in the northern as well as in the southern populations. PETKOVSKI (1963:60, figs 5 and 7) showed the high variability of the carapace shape in a population from the Azores, a population which he ranks in the subspecies *crassipes*. Furthermore the 3 populations from southern France and Yugoslavia (Istria) mentioned above, because of their southern origin, should belong to the subspecies *crassipes*. But these specimens clearly differ in shape (they appear sharp-pointed in dorsal view) from the *crassipes* form as it was described by PETKOVSKI (which appears egg-shaped in dorsal view).

As a conclusion, I propose not to concede subspecific rank to the *crassipes* form, but rather to consider it as a part of the variability of the highly variable *P. villosa*.

REMARK: When this work was finished, Koen MARTENS (University of Ghent) sent me a sample with *P. villosa* specimens recently collected in a mountain lake in NW Spain. The sample includes males and females in about equal numbers. The male specimens will be described soon in a separate publication. (For the finding of males reported by MONIEZ, 1891 a,b, see the taxonomic discussion below).

RELATIONS

P. villosa has to be compared with *P. smaragdina* (see that species) and *P. arcuata*.

P. villosa shares the following features with *P. arcuata*: valves covered with dense hairs (but in *P. villosa* the setae are longer and stiffer), Mx1 - palp with 5 distal spines, Mx2 with 2 branchial filaments. The species differ by the following features:

P. villosa

Valves smooth;

A2 Swset relatively short, overlapping by 20-36% of their total length;

Mx2 with 2 branchial filaments of almost equal length;

P. arcuata

valves with distinct pits;

A2 Swset overlapping by 35-54% of their total length;

Mx2 with 2 filaments, distinctly of unequal length.

TAXONOMIC DISCUSSION

1. As the type-material of *P. villosa* is lost, it is no longer possible to check the identity of the present species with the one originally described by JURINE (1820). But this identity has been admitted by all the specialists. For reasons of stability of the names, this identity should not be discussed.

2. *P. villosa* var. *crassipes*. MASI (1905) briefly described this variety (under the generic name *Cypridopsis*) from specimens collected in Italy in a ditch near Carsoli (region of Rome). According to MASI this form differs from the nominal form as it was redescribed by KAUFMANN (1900) essentially by its A2 Swset which extend beyond the tips of the claws by 1/3 of their length. (KAUFMANN writes that the Swset «barely extend beyond the tips of the claws»).

The type-material of *P. villosa crassipes* neither exists in the collections of the Zoological Institute in Rome (where MASI was working) nor in those of any other Institute in Rome (communication of Dr F.G. MARGARITORA). So these types have to be considered as lost.

PETKOVSKI (1963 and 1966) redescribed *P. villosa crassipes* and identified it with the South European populations of *P. villosa*. According to PETKOVSKI, the subspecies *crassipes* differs from the nominal form (living in central and northern Europe) by its longer Swset and also by its carapace shape which is more ovate in dorsal view (see also the discussion above).

LÖFFLER (1960:29), on the contrary, suggested that *P. villosa crassipes*, as it was described by MASI, is identical with *P. arcuata*. But *P. villosa* has smooth valves, while in *P. arcuata* the valves show distinct pits. So MASI should not have seen these pits. But I believe this to be rather improbable (MASI for instance was aware of the pits on the valves of his *P. dubia*).

I would like to recall that my proposal is to consider the subspecies *crassipes* as part of the variability of *P. villosa* but without giving this form a subspecific rank (see the discussion above).

3. Recently GHETTI & MCKENZIE (1981) raised *P. villosa crassipes* to specific rank and the authors ascertain in doing so the presence of two species in Italy namely *P. villosa* and *P. crassipes*. As the authors failed to give details on the differences between the two species, it may be admitted that the presumed differences are those mentioned by PETKOVSKI (1963 and 1966) for *P. villosa* and *P. villosa crassipes*. I would like to recall that in my opinion both forms belong to one single variable species, without deserving subspecific rank.

4. MONIEZ (1891a: 257 and 1891b) reported the occurrence of bisexual populations of *P. villosa* in saline lakes in North Africa (Algeria and Tunisia). The author, however, fails to describe the male. (The males remain unknown until now). MONIEZ (1891a) states that the carapace size of the females belonging to the bisexual populations ranges from 0.90 mm to 1.04 mm (the same author indicates a length of 0.70-0.73 mm for *P. villosa* specimens from the Azores).

Because *P. villosa* specimens with a length of 1.0 mm or even 0.90 mm have never been observed by any other author and because MONIEZ fails to give precise taxonomic indications on his specimens, his observation is at least doubtful. Furthermore, *P. villosa* is not known as tolerating an increase in salinity. Thus the observation of MONIEZ is generally considered as being due to a determination error. No other author reported the finding of males of *P. villosa*. (See also the remark under «Complements of description» above).

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. villosa has been captured in springs, in ditches and small ponds. It seems to be rather rare in lakes.

P. villosa probably is a true cosmopolitan species: it has been sampled on all continents, except the Antarctic and Australia. In Europe, it has been found in all countries in which it has been searched for.

I captured the species in southwestern France (in several springs in the Dordogne valley), in southern France (in a small stream near Draguignan) and in Luxembourg (near Huldange, in two small fish-ponds fed by a cold spring).

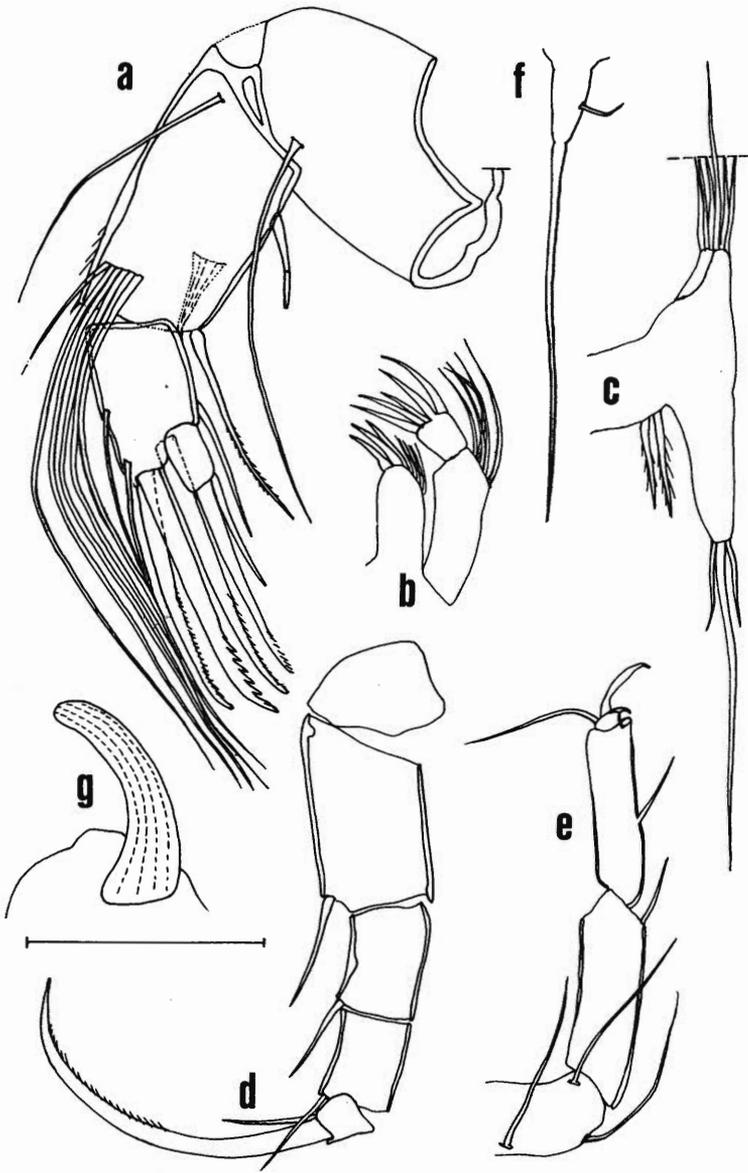


Fig. 14. - *Potamocypris villosa*.

a: Antenna (A2); b: Palp and 3rd masticatory process of the maxillule (Mx1); c: Maxilla (Mx2); d: Thoracopod T1 (walking leg); e: Thoracopod T2 (cleaning leg); f: Furcal ramus; g: Genital hook. Scale = 100 μ m for a-f; = 50 μ m for g; a-g: Luxembourg, near Huldange.

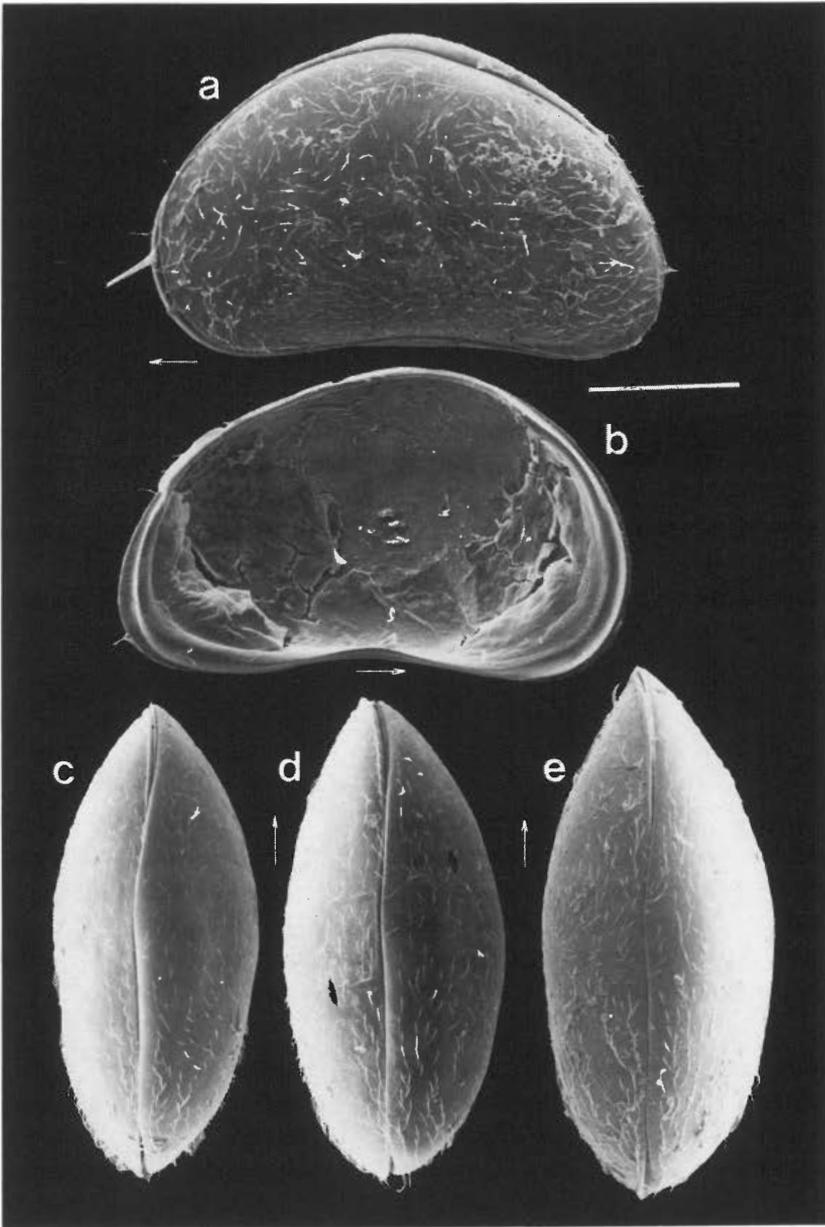


Fig. 15. - *Potamocypris villosa*.

a: Carapace in lateral view (Luxembourg); b: Left valve, internal (France, Dordogne); c-e: Carapaces in dorsal view (c: France, Pas-de-Calais; d: France, Dordogne; e: Luxembourg, near Huldange). Scale = 0.20 mm for all.

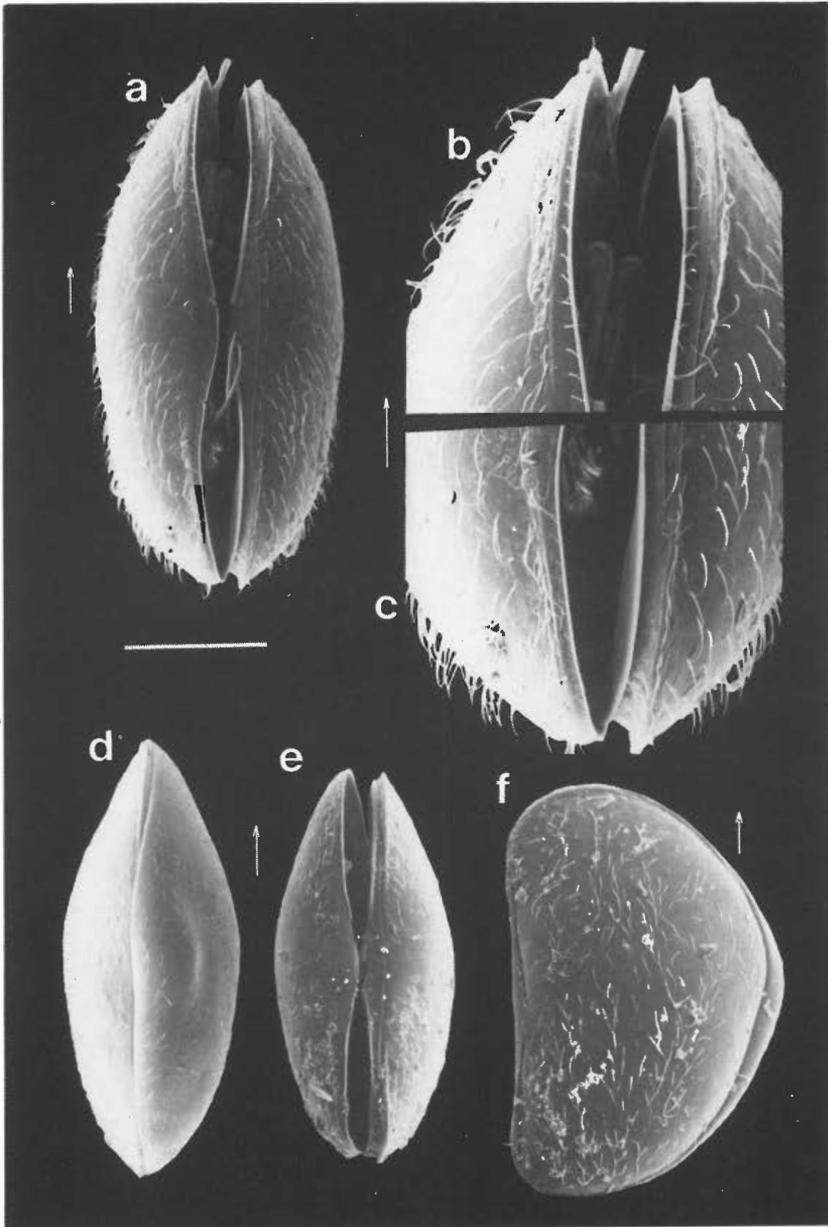


Fig. 16. - *Potamocypris villosa*.

a: Ventral view of the carapace; b: Anterior detail of a; c: Posterior detail of a; d: Dorsal view; e: Ventral view; f: Lateral view; a-c: France, Dordogne; d-f: South France, Ribiers. Scale = 0.20 mm for a and d-f; = 0.10 mm for b, c.

6. POTAMOCYPRIS ARCUATA (SARS, 1903)

(Figs 17 - 21)

Cypridopsella arcuata SARS, 1903a: 225-226, pl. 16, figs 5, 5a;
Potamocypris maculata ALM, 1914: 468-470, fig. 1; 1915:85, fig. 48;
Potamocypris almasyi caspica HARTMANN, 1964; 44-47, figs 13-14;
Potamocypris almasyi minor HARTMANN, 1964:67;
Potamocypris caspica (HARTMANN, 1964) SYWULA 1968: 40:41, fig. 16;
Potamocypris caspica var. *microgranulata* SYWULA 1968:41;
Potamocypris caspica var. *macrogranulata* SYWULA 1968:41;
non *Cyprilla arcuata* SARS, 1924: 170-171, pl. 16, figs 1-11;

Possible synonymies:

? *Potamocypris almasyi* DADAY, 1904: 519-520, pl. 29, figs 89-97;
? *Potamocypris almasyi angulata* BRONSTEIN, 1925: 17-18, pl. 1, figs 1-8.
? *Potamocypris longisetosa* BRONSTEIN, 1928: 95-96, fig. 1.

TYPE-MATERIAL: Syntype-specimens were deposited by SARS in the Zoological Institute in Leningrad and in the Zoological Institute in Oslo.

1. From ZIL I received a spirit tube with 5 well preserved female type-specimens. I dissected one of these specimens, a second specimen was prepared for the SEM (see Fig. 21). These two specimens are now deposited in NHML.¹⁾

2. The SARS collection in ZMO includes 1 microscopic slide (prepared by SARS) bearing 3 complete specimens (ZMO F 117 66 Mp 509). This slide is rather badly preserved. A holotype was not designated.

DESIGNATION OF LECTOTYPE: The syntype-specimen from ZIL which I have dissected is designated as the lectotype: appendages in PVLP, valves in a micropalaeontological slide. The lectotype is deposited in NHML.

TYPE-LOCALITY: Territory of Atbassar in the Soviet Union (SSR of Kazakhstan): «deepenings of Kara-sai».

MATERIAL EXAMINED: The types of *P. arcuata*, *P. maculata*, *P. almasyi caspica*, *P. almasyi minor* and 14 samples coming from Belgium, Germany, Greece (Corfu), Algeria, Macedonia, Hungary and Finland. See also the detailed list in the appendix.

IMPORTANT LITERATURE: GAUTHIER, 1928: variability of the carapace shape in bisexual populations from North Africa, description of the male;

GAUTHIER, 1939b: structure of the carapace;

LÖFFLER, 1960: suggestion of the synonymy *P. arcuata* - *P. maculata*;

DIEBEL & WOLFSCHLÄGER, 1975 and DIEBEL & PIETRZENIUK, 1975, 1978: palaeontology (Quaternary).

¹⁾ Dr O.A. SCARLATO (Zoological Institute of the Academy of Sciences in Leningrad) was so kind as to send me these two specimens as a present.

DIAGNOSIS

CARAPACE. Lateral view as shown on Figs 18 and 19-a.

Surface of the valves with pits, visible under the stereomicroscope (40-80x) and with dense hairs.

Dorsal view: anteriorly the l.v. generally overlaps the r.v. or both valves extend to the same height, more rarely the r.v. overlaps the l.v.; posteriorly the l.v. always overlaps the r.v.

Marginal zones of the l.v.: anterior and posterior flange well developed (selvage distinctly displaced inwards).

Size: 0.50 - 0.81 mm. Colour: pale green with a green dorsal blob.

APPENDAGES. A2 Swset very long, extending beyond the tips of the terminal claws by 35-54% of their length.

Maxillule Mx1: terminal joint of the palp with 5 distal spines.

Maxilla Mx2: respiratory plate with 2 branchial filaments of unequal length.

Bisexual populations known from North Africa. Parthenogenetic reproduction in all the other known localities.

COMPLEMENTS OF DESCRIPTION

P. arcuata turned out to be the most «difficult» species among those revised here. This is why I wish to show the details of the variability of the taxonomic features as I was able to observe them on the material I have studied. This material is particularly interesting, since it comprises eighteen samples coming from Europe, North Africa, the Near East and Asia.

CARAPACE. The carapace shape in lateral view presents a striking variability. (This variability recalls that of *P. pallida* in lateral view: see the first part of the revision). The carapace shape not only differs from one population to another, but even within populations. (See for instance the carapaces figured by GAUTHIER, 1928, from a bisexual population in North Africa).

The carapaces shown on Fig. 18 may be split in three groups: a first group with carapaces showing a more or less regularly rounded postero-

dorsal margin (Fig. 18-a,b), a second group with the postero-dorsal margin presenting a distinct angle (Fig. 18-c,e,f,h) and a third group of carapaces with intermediate shape (Fig. 18-d,g). It should be noted that all the intermediate carapace shapes are found, often within the same population.

The carapace size too is highly variable. Among the 18 samples which I have examined, 13 include specimens measuring 0.58 - 0.68 mm, 3 samples include specimens of smaller size: the sample from Finland (0.52 - 0.59mm), one of the two samples from Corfu (BMNH, FOX collection: 0.50 - 0.60 mm) and the sample from Afghanistan (ZMH, HARTMANN collection: 0.54-0.60 mm). On the contrary, 3 samples show larger specimens: the sample from Greifswald (ZMH, KLIE collection: 0.69 - 0.81 mm), the second sample from Corfu (ZMH, KLIE collection: 0.68 - 0.71 mm) and the sample from Belgium (coll. MARTENS: 0.69 -0.72 mm).

I would like to point out that I hesitated for quite a time before ranking carapaces showing such different shapes - see above all the small and rather rounded carapaces and the large carapaces with a distinct postero-dorsal angle - in one and the same species. But I should emphasize once more that all the intermediate shapes exist. Furthermore, the thorough examination has shown that all the other taxonomic features on the carapace and the appendages are in perfect agreement.

The variability of the carapace shape in dorsal view has been given in the diagnosis. On the posterior end, the l.v. extends beyond the r.v. in all the samples I have examined. This observation disagrees with 2 figures given by GAUTHIER (1939b:211 and 219) where the r.v. overlaps the l.v. behind. In dorsal view, the anterior end of the shell most often is obliquely drawn towards the left (Fig. 19-c,d,e). This feature is not found in any of the remaining species revised here. Unfortunately this character is not distinctly expressed in all the specimens.

The valves of *P. arcuata* are covered with numerous and relatively long setae (see Fig. 19-a in this paper and also Fig. 1-B in GAUTHIER, 1939b:211). This feature had not yet been mentioned in the literature.

The structure of the anterior and above all the posterior marginal zone on the l.v. is remarkably constant in all the samples I have exami-

ned: see for instance Fig. 21-c,d,e for the l.v. of the lectotype and Fig. 20-a,b,c for a specimen from Belgium. In my opinion the constancy of this feature is a particularly strong argument for the specific identity of these forms.

APPENDAGES. HARTMANN (1964) described in *P. almasyi caspica* (which is considered as synonymous to *P. arcuata* in this work) the presence of a sort of membrane («häutiger Anhang») on the Mx1 - palp (see the Fig. 13-e in HARTMANN, 1964:45). According to HARTMANN, only the tips of the setae normally found at this place stick out beyond the distal end of the «membrane». At high magnifying power (oil immersion, 1250X) and also in phase contrast, I was able to observe that the membrane in question is formed by the very particular structure of the lateral Mx1 - setae. Indeed, in the *caspica*-specimens these setae bear very fine and long setules (Fig. 17-d). These setules fix some sort of granular mucus, the whole structure showing up like a membrane at «normal» magnifying power. Then I thoroughly verified this lateral group of setae on all other *P. arcuata* specimens which I have dissected. Result: lateral setae with fine setules are found on the Mx1 - palp of numerous other specimens lacking the characteristic membrane mentioned above; but in all these specimens the fine setules are shorter and less numerous, so that they are not able to gather and hold back the mucus. As a conclusion I would like to point out that the feature «lateral setae with fine setules on the Mx1 - palp» shows continuous variation. Only the specimens in which this character is strongly developed present the mucus fixing setae. Further investigations have to show if this character is constant in certain geographical regions; if this is the case, the subspecific separation of these populations (under the name *P. arcuata caspica*) will probably be justified.

I have examined the Mx2 - respiratory plate of the specimens I have dissected with the greatest care. The number of branchial filaments on this plate (1 or 2 according to the species considered) proved to be one of the most reliable taxonomic features at species level. In the literature, 2 filaments have been reported for *P. arcuata* (GAUTHIER, 1934:82; PETKOVSKI, 1963:61), while several authors observed the presence of 1 filament in *P. maculata* (KLIE, 1938:146; HARTMANN, 1964:46 under *P. almasyi caspica*; it should be recalled that *P. maculata* and *P. almasyi caspica* are considered as being synonymous to *P. arcuata* in this work). The observation of the Mx2 - respiratory plate is particularly difficult

in *P. arcuata*: the branchial filaments often break during dissection and, moreover, they often cling together and so they show as one single filament under the microscope. Here are the results of my observations:

a) on the single type-specimen of *P. arcuata* as well as on the single type-specimen of *P. maculata* which I have dissected, I was lucky enough to observe with absolute certainty two filaments on the Mx2. (It should be noticed that in ALM's original description of *P. maculata* there is no indication on the number of Mx1 - branchial filaments).

b) In each of the other samples which I have examined, except the three samples coming from Germany, I found at least one specimen bearing 2 filaments (I dissected 2 or 3 specimens from each sample). Nevertheless, in a certain number of specimens I only observed 1 filament.

c) In the 3 samples coming from Germany (13 specimens dissected) I observed on most of the specimens 1 filament; in one or other specimen I rather believed I could see 2 filaments, but I was not sure.

Three hypotheses may be formulated from these observations:

- the Mx2 - respiratory plate of *P. arcuata* bears 2 branchial filaments. The observations of one single filament are erroneous and should be explained by the technical difficulty of the dissection and/or the observation;
- the number of branchial filaments is variable in *P. arcuata*: the specimens either bear 1 or 2 filaments;
- the samples examined include two distinct species, a first species having one and a second species having 2 filaments.

In my opinion, the third hypothesis has to be excluded: I did not find any other character justifying a specific separation. Actually I rather believe that the first hypothesis will prove true. Future investigators should pay special attention to this feature.

RELATIONS

P. arcuata has to be compared with *P. variegata*, *P. smaragdina* and *P. villosa*. See each of these species for tables allowing easy specific distinction.

TAXONOMIC DISCUSSION

1. Remarks on the type-material of *P. arcuata* SARS and *P. maculata* ALM.

In the original description of *P. arcuata*, SARS (1903a) writes: «surface (of the valves) smooth, sparingly punctate». The examination of the syntypes deposited by SARS showed that this statement is not correct: the valves of the type-specimens actually present the shallow but distinct pits which characterize this species (see Fig. 21-a,b). The Mx2 of the syntype-specimen which I dissected bears 2 branchial filaments. (This latter character was not mentioned in the original description).

ALM (1914 and 1915) failed to describe the surface of the valves as well as the number of branchial filaments on the Mx2 in *P. maculata*. The type-material of this species is deposited in the Natural History Museum in Stockholm, Sweden. This material includes three empty shells and one complete specimen. The valves and also the soft parts of this latter specimen are perfectly preserved. The valves show the characteristic *P. arcuata* pits under the stereomicroscope. On one of the Mx2 - respiratory plates of this specimen I am sure I observed 2 branchial filaments. Finally the structure of the marginal zones on the l.v. is identical with that found in the types of *P. arcuata*. All the remaining features (valves and soft parts) are in perfect agreement. The comparison, side by side, of the type-specimens of *P. arcuata* and *P. maculata* allowed me to find out that these specimens only differ by the carapace shape. (The *P. maculata* type-specimens are larger and more elongate than the *P. arcuata* specimens). In my opinion there can no longer be any doubt about the synonymy of the two species.

2. Taxonomic history of *P. arcuata* and *P. maculata*.

The original descriptions of both species apply to parthenogenetic populations found in central Asia (*P. arcuata*) and Sweden (*P. maculata*).

GAUTHIER (1928) redescribed *P. arcuata* from specimens collected in North Africa (Algeria and Tunisia) belonging to bisexual populations. The author shows the large variability of the carapace shape in lateral and dorsal view. In 1934:82, GAUTHIER reconsidered his description given in 1928 and specified the number of branchial filaments (namely two) found in the specimens he had examined in 1928.

In 1960, LÖFFLER proposes the synonymy *P. arcuata* = *P. maculata* after examination of *P. arcuata* specimens from Austria. The author argues that the carapace shapes of both species (in dorsal view especially) appear to be rather similar. PETKOVSKI (1963) when examining *P. arcuata* specimens from the Azores, agrees with this proposition. (It should be recalled that the examination of the type-material of both species allowed me to confirm this synonymy).

3. Comparison with *P. almasyi* DADAY, 1904.

P. almasyi is known from the Soviet Union, the Near East and Asia. It has not yet been reported from West Europe. As this species is certainly closely related to *P. arcuata*, its taxonomic status is nevertheless discussed here.

I was not able to locate the type-material of *P. almasyi*. It does not exist in the large DADAY collection deposited at the Natural History Museum in Budapest (communication of Dr L. FORRÓ). This type-material most probably has to be considered as lost.

P. arcuata and *P. almasyi* share the following features: valves with pits, carapace with a latero-dorsal dark green blob, A2 Swset very long, Mx1 - palp with 5 distal spines, Mx1 with 2 branchial filaments. It should also be noted that the type-locality of *P. almasyi* is situated in Turkestan, a region which includes part of Kazakhstan, where the type-material of *P. arcuata* was collected!

LÖFFLER (1960) was able to compare side by side specimens of *P. arcuata* from Austria with *P. almasyi* specimens from Iran. The author (1960:29) states that «these two species must not be confused»; nevertheless he fails to give indications on how to distinguish between these closely related forms. Moreover, to the best of my knowledge, no author examining *P. almasyi* specimens clearly compares this form with *P. arcuata*. It seems to me that authors who considered *P. almasyi* as a valid species, used the carapace shape (in lateral view especially) as the only criterion to recognize *P. almasyi* (LÖFFLER, 1960; BRONSTEIN, 1947; HARTMANN, 1964; YASSINI, 1976): carapaces showing a distinct postero-dorsal angle were ranked in *P. almasyi*. (BRONSTEIN, 1925, even created a separate subspecies for specimens showing a striking postero-dorsal angle, a subspecies named *P. almasyi angulata*; but in 1947 the same author drew the attention to the large variability of the carapace shape of *P. almasyi* and he logically withdrew the subspecies *angulata* arguing that it merely belongs to the variability-field of *P. almasyi*). Specimens showing a more regularly rounded postero-dorsal margin, on the contrary, were ranked in *P. arcuata*.

Considering the striking variability of the carapace shape of *P. arcuata* (and in ostracods in general!) it seems rather difficult to me to admit a specific separation based on this single feature.

In my opinion the examination under the SEM of the marginal zones of the l.v. of the specimens which are believed to belong to *P. almasyi*, will most probably allow a decision on the taxonomic status of *P. almasyi*. In the meantime I cannot help believing that *P. arcuata* and *P. almasyi* belong to the same species.

Remark: YASSINI (1976) shows SEM pictures of *P. almasyi* carapaces from Iran. I am not able to distinguish between these valves and carapaces and those of *P. arcuata*.

4. *Potamocypris almasyi caspica* HARTMANN, 1964.

HARTMANN described this subspecies on the basis of specimens coming from Iran (Sabzevar, Elburz mountains). The subspecies *caspica* only differs from the nominal subspecies by the existence of a lateral «membrane» on the Mx1 - palp (see also the chapter «Complements of description» above). I was able to examine the soft parts only of the types of this subspecies (deposited in ZMH, 27626). This examination as well as the description of the carapace by HARTMANN (1964) show that this form clearly belongs to *P. arcuata*, possibly with subspecific rank (*P. arcuata caspica*).

SYWULA (1968) raised *P. almasyi caspica* to species rank. The author reports the finding of *P. caspica* in Bulgaria and Poland. He describes 2 forms based on differences in the ornamentation of the valves: f. *oligogranulata* with few small pits in the central part of the valves and f. *macrogranulata* with large pits covering the whole surface. The author points out that «these forms do not deserve a rank either of an ecological variety or of a geographical race (a subspecies)».

In 1974 SYWULA puts *P. caspica* in synonymy with *P. maculata* without mentioning the *caspica* form as a subspecies. (The author obviously now ranks the *caspica* form in the variability field of *P. maculata*).

In my opinion, the subspecies *P. arcuata caspica* only has to be maintained if further studies show that its diagnostic feature (i.e. the presence of a lateral «membrane» on the Mx1 - palp) is actually shown to be constant in one or several regions of the distribution area of the species.

Remark: Contrary to HARTMANN's (1964) indication, the pincer-organ («Zangenapparat») on the cleaning leg is normally developed on the types of *P. almasyi caspica*.

5. *Potamocypris almasyi minor* HARTMANN, 1964.

HARTMANN described this subspecies after specimens coming from Afghanistan. The author writes that it differs from the nominal form only by the smaller size of its carapace (0.50 mm). The examination of the type-material (ZMH, 27627) allowed me to see that this form, except for its smaller size, is identical to *P. arcuata*. (It should be called *P. arcuata minor* from now on). The maintenance of the separate subspecific status is only justified if its diagnostic feature (i.e. the very small carapace, about 0.50 mm long) proves to be constant in the geographical area from which it was described.

6. *Potamocypris longisetosa* BRONSTEIN, 1928.

This species was described from central Asia (Karabin plateau near Gerns, in the Soviet Union). It has not been reported from Europe. As this species is at least closely related to *P. arcuata*, its taxonomic status will nevertheless be discussed here. I was not able to locate the type-material of this species. According to BRONSTEIN (1928 and 1947), *P. longisetosa* only differs from *P. almasyi* and *P. maculata* by the shape of the carapace in lateral view. Considering the large variability of this feature in *P. arcuata*, it may not be excluded that this species too is synonymous with *P. arcuata*. Remark: BRONSTEIN (1928 and 1947) reports the finding of male and female specimens of this species.

7. *Cyprilla arcuata* SARS, 1924 is not identical with the species discussed here. SARS described two distinct species under the specific name *arcuata*, namely: *Cypridopsella arcuata* SARS, 1903 (which is the species discussed here) and *Cyprilla arcuata* SARS, 1924. As both species at present rank in the genus *Potamocypris*, the junior name had to be replaced. This was done by GAUTHIER (1939b): *Cyprilla arcuata* SARS, 1924 is now called *Potamocypris paludum* GAUTHIER, 1939.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

The ecology of *P. arcuata* is rather poorly known. The species has been collected in small ponds and in ditches warmed up by the sun. It has been found in North Africa (GAUTHIER, 1928 and MARTENS, 1981, unpublished, mémoire de licence), in Turkey (SCHÄFER, 1952), in Corfu (STEPHANIDES, 1948, as *P. maculata*), in Macedonia (KLIE, 1941, as *P. variegata*; see the chapter «Ecology and geographical distribution» under *P. variegata*), in Spain (MARGALEF, 1953, as *P. maculata*). These data tend to show that *P. arcuata* has a wide circum-mediterranean distribution.

P. arcuata is probably common in Iran, where its occurrence is reported by HARTMANN (1964, as *P. almasyi caspica*), KLIE (1937b) and by YASSINI (1976, as *P. almasyi*).

P. arcuata seems to be rather rare in central and northern Europe. It is reported from Austria (LÖFFLER, 1960), from Germany (KLIE, 1938 as *P. maculata*), from Poland (SYWULA, 1974 as *P. maculata*) and from Finland (coll. PURASJOKI, KLIE collection, ZMH 1163, unpublished; see the appendix). PETKOVSKI (1963) recorded the species from the Azores. The present work allows to add the following occurrences (see also the appendix): Hungary (DADAY collection, HNHM: several localities including Lake Balaton) and Belgium (leg. K. MARTENS).

Until now the species has not been found in Luxembourg.

Remark: The specimens from Hungary (DADAY collection) will be figured and described in a separate publication (see MEISCH & WOUTERS, in press).

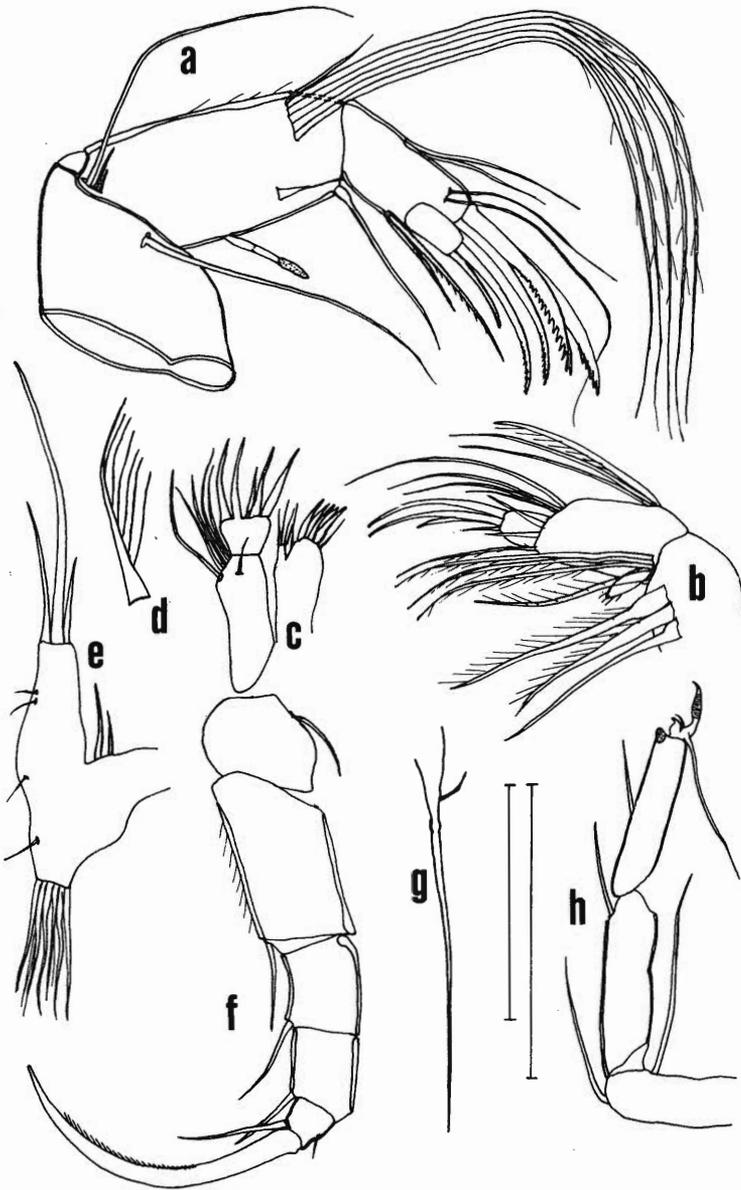


Fig. 17. - *Potamocypris arcuata*.

a: Antenna (A2); b: Mandibular palp; c: Maxillule Mx1 (palp and 3rd masticatory process); d: lateral barbed seta of the Mx1-palp of a *P. arcuata caspica* type-specimen; e: Maxilla (Mx2); f: Thoracopod T1; g: Furcal ramus; h: Thoracopod T2. Small scale = 100 μm for a-c and e-h. Large scale = 50 μm for d; a-c and e-g: Greece, Corfu.

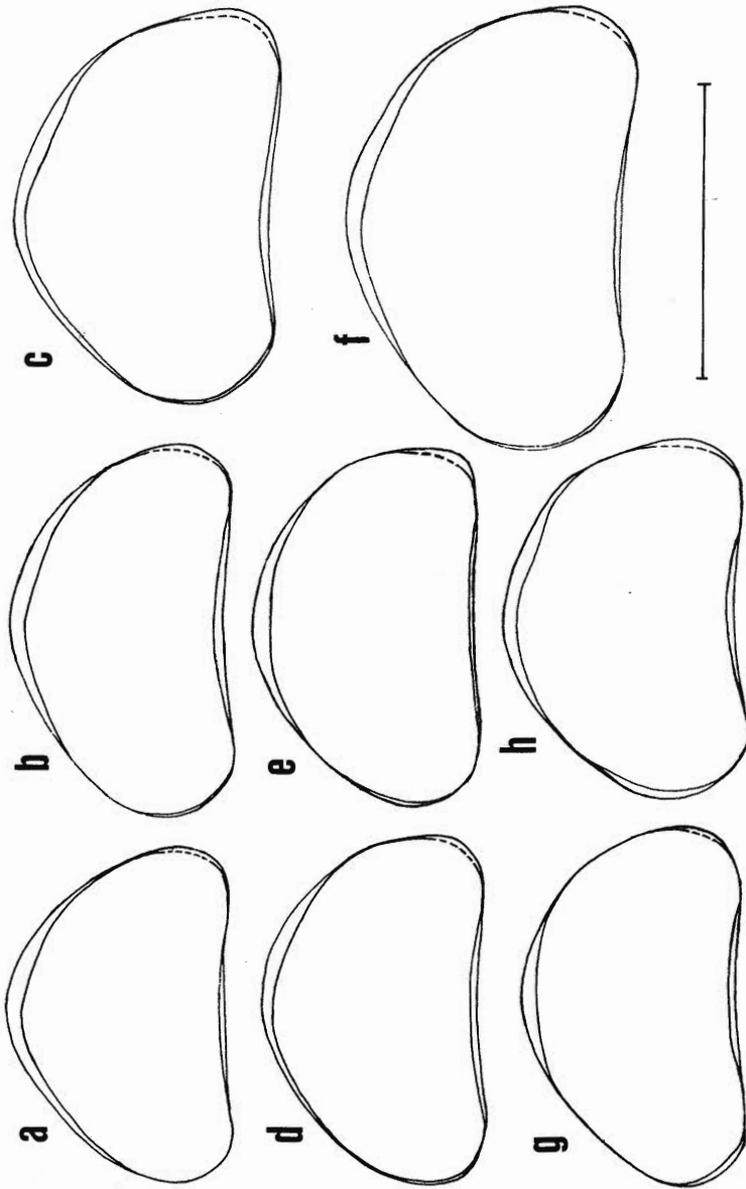


Fig. 18. - *Potamocypris arcuata*.

Variability of the carapace shape in lateral view; a: Finland (ZMH 1163); b: Iran, Sabzevar (ZMH 27625); c: Germany, Thüringen (ZMH 1161); d and e: Iran, Damavand (ZMH 1171); f: Germany (ZMH 1161); g: Iran (ZMH 1171); h: Macedonia (ZMH 1168). Scale = 0.20 mm for all. All these specimens are included in the KLIE collection (ZMH), except for ZMH 27625 (HARTMANN collection).

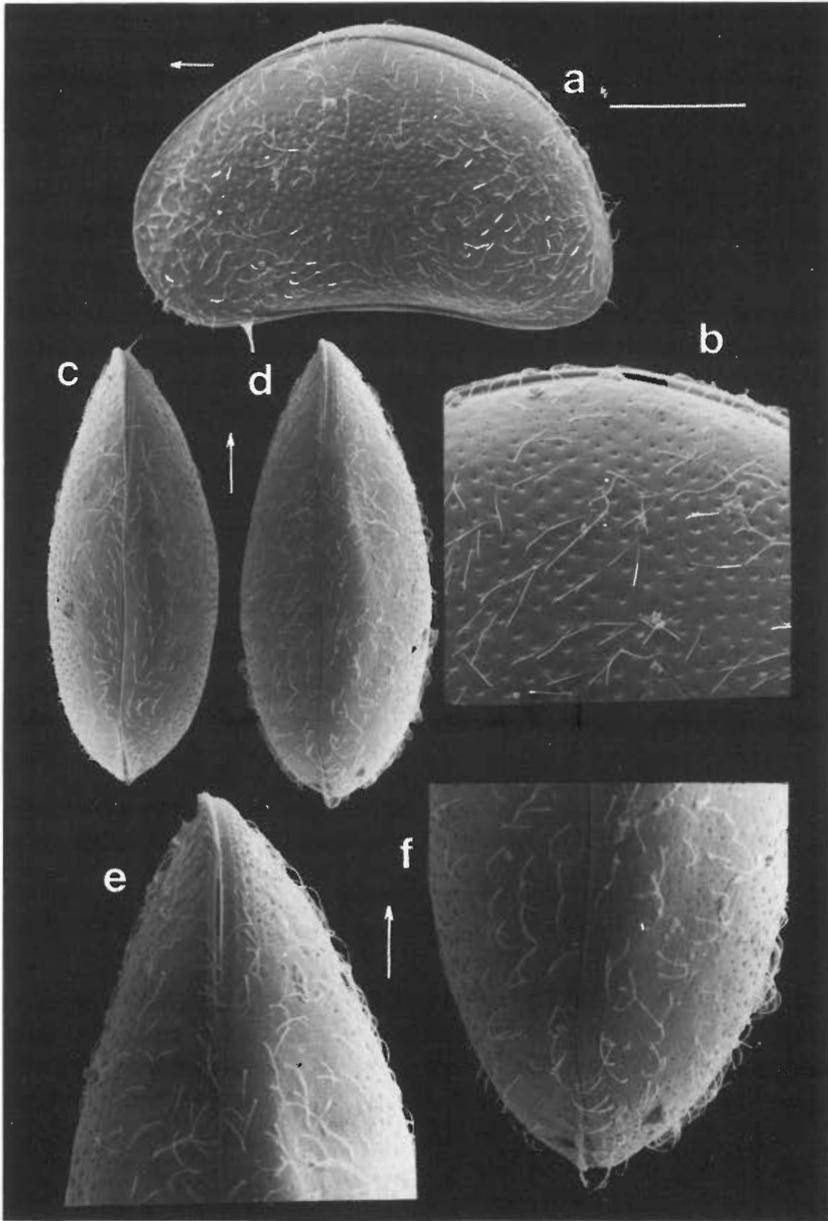


Fig. 19. - *Potamocypris arcuata*.

a: Lateral view of the carapace; b: Surface ornamentation (detail); c and d: Dorsal view of the carapace; e: Anterior detail of d; f: Posterior detail of d. Scale = 0.20 mm for a and c-d; = 0.10 mm for b-e and e-f; a-f: Belgium, Hoboken Polder.

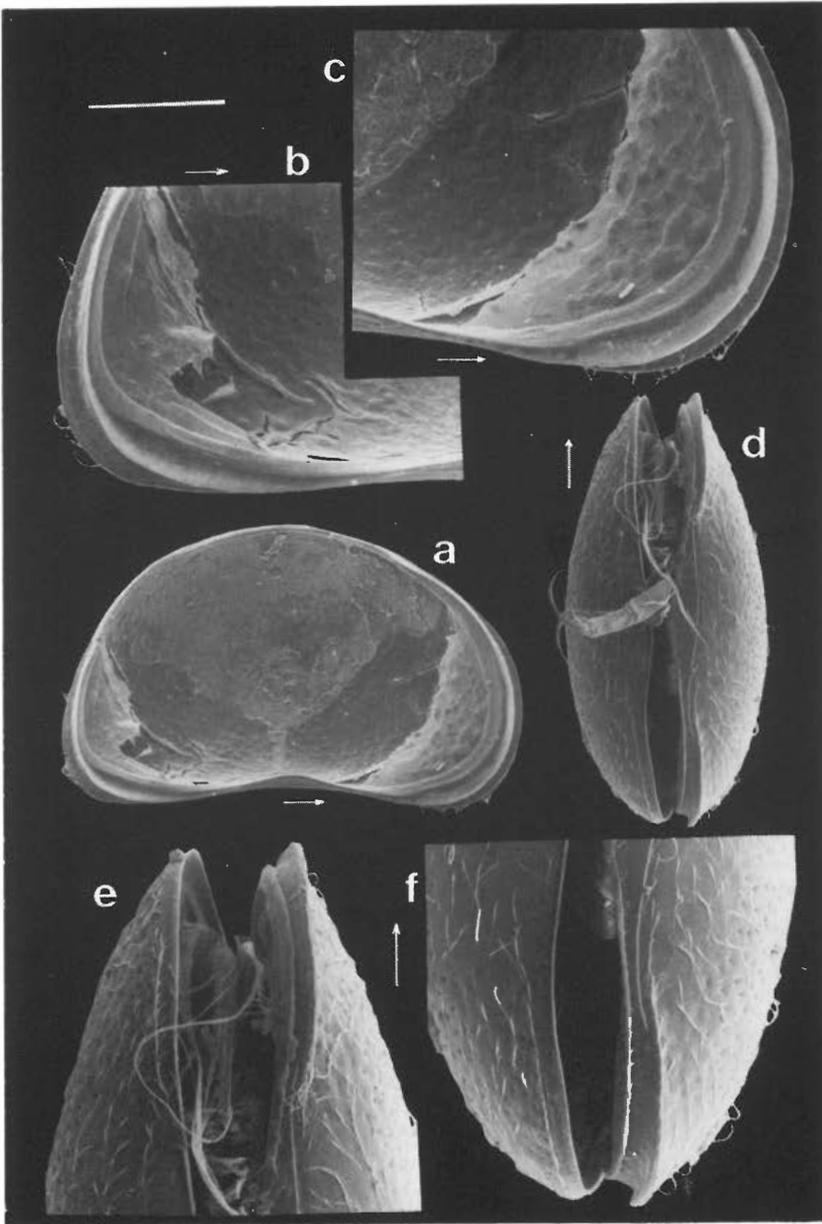


Fig. 20. - *Potamocypris arcuata*.

a: Left valve, internal; b: Posterior marginal zone of the left valve; c: Anterior marginal zone of the left valve; d: Ventral view of the carapace; e: Anterior detail of d; f: Posterior detail of d. Scale = 0.20 mm for a and d; = 0.10 mm for e and f; = 50 μ m for b and c; a-f: Belgium, Hoboken Polder.

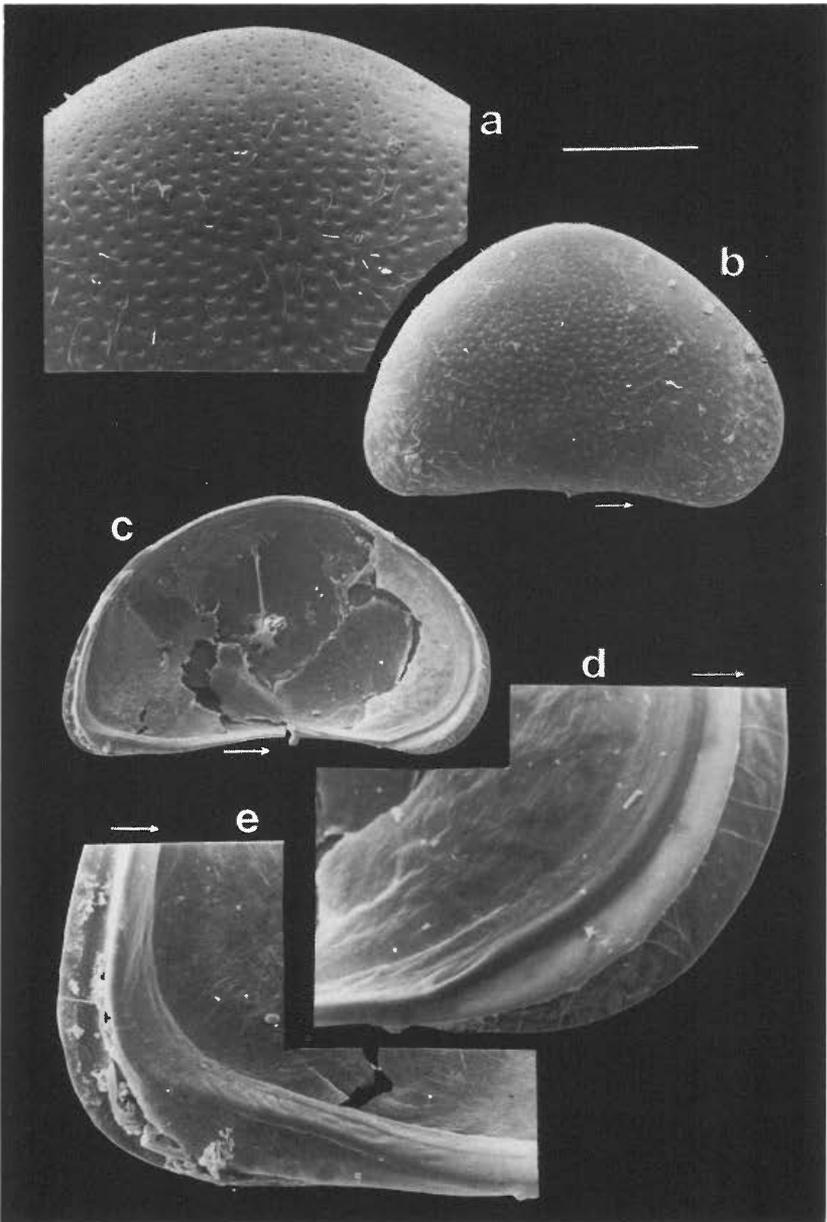


Fig. 21. - *Potamocypris arcuata*.

a: Surface ornamentation; b: Right valve, external; c: Left valve, internal; d: Anterior marginal zone of the left valve (detail of c); e: Posterior marginal zone of the left valve (detail of c). Scale = 0.20 mm for b and c; = 0.10 mm for a; = 50 μ m for e and d. This specimen is a TYPE-SPECIMEN (female, collected in Kazakhstan).

7. POTAMOCYPRIS PRODUCTA (SARS, 1924)
(Figs 22 - 24)

Cyprilla producta SARS, 1924: 173-174, pl. XVI figs 25-26;
Potamocypris producta (SARS, 1924) GAUTHIER 1939a: 220, 222,
figs 1,4,5.

TYPE-MATERIAL: 12 female specimens deposited in the South African Museum (SAM, A 11162) and 2 microscopic slides deposited in the Zoological Institute in Oslo (ZMO, F10946-7). A holotype was not designated.

DESIGNATION OF LECTOTYPE: The type-specimen from SAM which I dissected is designated as the lectotype: soft parts in PVLP, valves in a micropalaeontological slide. Both slides deposited in SAM.

TYPE-LOCALITY: South Africa, surroundings of Kimberley.

MATERIAL EXAMINED: The type-material deposited in SAM and ZMO and two samples from Yugoslavia and South Africa. (See details in the appendix).

IMPORTANT LITERATURE: GAUTHIER, 1939b: structure of the carapace;
HARTMANN, 1957 and MARTENS, 1984: geographical distribution in Africa;
PETKOVSKI, 1964: the only record of the species from Europe until now.

DIAGNOSIS (FEMALES)

CARAPACE. Lateral view as in Fig. 23-a.

Surface of the valves smooth under the stereomicroscope (40-80X). Under the SEM, small shallow pits can be seen.

Dorsal view: carapace strikingly slender, the l.v. extending beyond the r.v. in front and behind.

Marginal zones of the l.v.: anterior and posterior flanges remarkably developed, lobe-like (selvage anteriorly and posteriorly distinctly displaced inwards).

Size: 0.55-0.64 mm. Colour: pale yellowish green with an irregular dark shadow.

APPENDAGES. A2 Swset long, extending beyond the tips of the terminal claws by 43-47% of their total length.

Maxillula Mx1: terminal joint of the palp with 5 distal spines.

Maxilla Mx2: respiratory plate with 2 branchial filaments.

Males only reported once and not yet described.

COMPLEMENTS OF DESCRIPTION

I have not seen any living specimen of this species. The description of the carapace colour given in the diagnosis is due to SARS (1924).

The carapace of *P. producta* shows in an exaggerate manner the two features which characterize the genus *Potamocypris*: the carapace is strikingly slender in dorsal view and, above all, the l.v. bears «excessively» developed flanges (Fig. 24-e,f,g).

The Mx2 - respiratory plate is most fragile in this species: this makes the observation of the branchial filaments most difficult.

According to GAUTHIER's (1939a: 203) fig. 15-c and PETKOVSKI's (1964:175) fig. 61, the marginal zones of the l.v. (i.e. the posterior zone of GAUTHIER's, and the anterior and posterior zones of PETKOVSKI's figures) show a serrated structure. GAUTHIER writes that this structure corresponds to the free margin of the selvage. But under the SEM (see Fig. 24-e,f,g) the selvage appears to be smooth and, moreover, the serrated line in question does not show at all. It is only visible by transparency in the light microscope. So it has to be concluded that this structure is an internal one.

SARS (1924) who reared his specimens from dried mud collected in South Africa, observed both sexes, but without giving a description of the males. To the best of my knowledge, no other author has reported the occurrence of males. I myself did not see any male specimens among the material which I have examined. Nevertheless, it has to be noted that the female type-specimen which I have dissected (and which is designated as the lectotype) bears numerous spermatozoa.

RELATIONS

P. producta is easy to recognize. Especially because of its characteristic carapace features, it may not be confused with any other European *Potamocypris*-species.

TAXONOMIC DISCUSSION

1. Remarks on the type-material of *P. producta*: the spirit tube registered A 11162 deposited in the SAM includes 12 female specimens. It neither bears a label written by SARS, nor even an indication of the locality where the material was collected. But never-

theless one may reasonably assume that this material constitutes the type-material studied by SARS (communication of Mrs Van der Merve, SAM). McKENZIE (1971:192) gives the same information.

SARS deposited two microscopic slides with several type-specimens in the Zoological Institute in Oslo. Unfortunately I was not able to examine these two slides.

2. *Proteocypris reniformis* BRADY, 1907 was described from South Africa. This species certainly belongs to the genus *Potamocypris*: indeed the fig. 5, pl. 30 given by BRADY shows the characteristic spatula-like terminal joint of the Mx1 - palp. Nevertheless, the original description does not allow to decide with certainty on the exact species meant by BRADY. McKENZIE (1971:159) first suggested that the species is possibly identical to *P. producta*.

The type-material of *P. reniformis* is deposited in HMNT: it comprises 2 microscopic slides (HMNT, BRADY collection, slide 1.41.12.: soft parts and slide 1.41.13: valves). Unfortunately these two slides are so badly preserved, that it is no longer possible to check any of the taxonomic features of the species.

If *Potamocypris reniformis* is regarded as a senior synonym of *P. producta*, then it should be considered as a nomen oblitum (in agreement with articles 23 and 29 of the ICZN dealing with unused senior synonyms), in order to guarantee the stabilization of the well-established name *P. producta*.

3. *Cypris mastigophora* METHUEN, 1910 was described from South Africa (Lake Chrissie). McKENZIE (1971:159) drew attention to the fact that this species too is most probably identical with *P. producta*. I was not able to locate the type-material of this species (if it still exists).

Remark: According to KLIE (1935b:49) *Cypris mastigophora* should be ranked in the genus *Cypridopsis*. KLIE supposed that the two figures of *Cypris chrissienses* and *C. mastigophora* were interchanged by error in METHUEN's publication.

In order to avoid any taxonomical confusion in the future, my proposal is to consider *C. mastigophora* as an unused senior synonym of *P. producta* and, as a consequence, to let it sink into oblivion (nomen oblitum).

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

There is practically no information on the ecology of *P. producta* in the literature. The species seems to be widely distributed on the whole African continent south of the Sahara. (For a complete survey of the literature relating the distribution of *P. producta* in Africa, see MARTENS, 1984:43, under *P. mastigophora*).

Up to now, the species has been reported only once from Europe: PETKOVSKI (1964) collected numerous specimens in rice-fields in Macedonia. It will probably be found in other circum-mediterranean regions in the future.

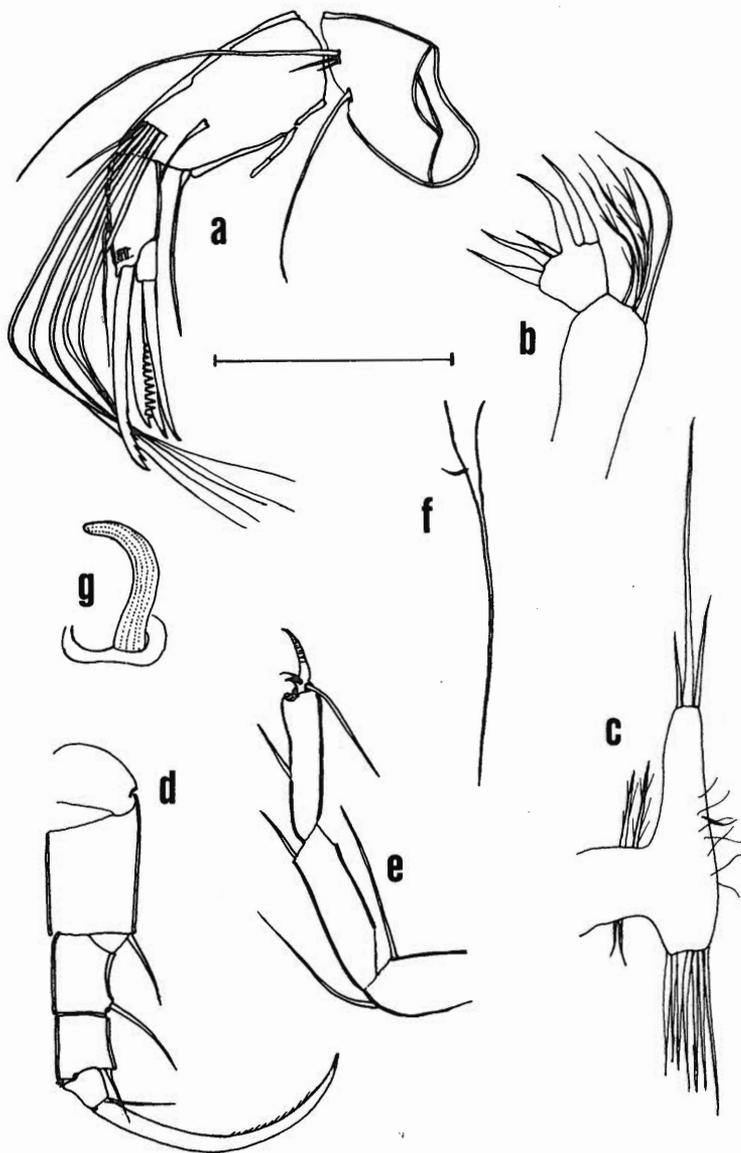


Fig. 22. - *Potamocypris producta*.

a: Antenna (A2); b: Palp of the maxillule (Mx1); c: Maxilla (Mx2); d: Thoracopod T1;
e: Thoracopod T2; f: Furcal ramus; g: Genital hook. Scale = 100 μm for a and c-f;
= 50 μm for b and g; a-g: Yugoslavia, Macedonia.

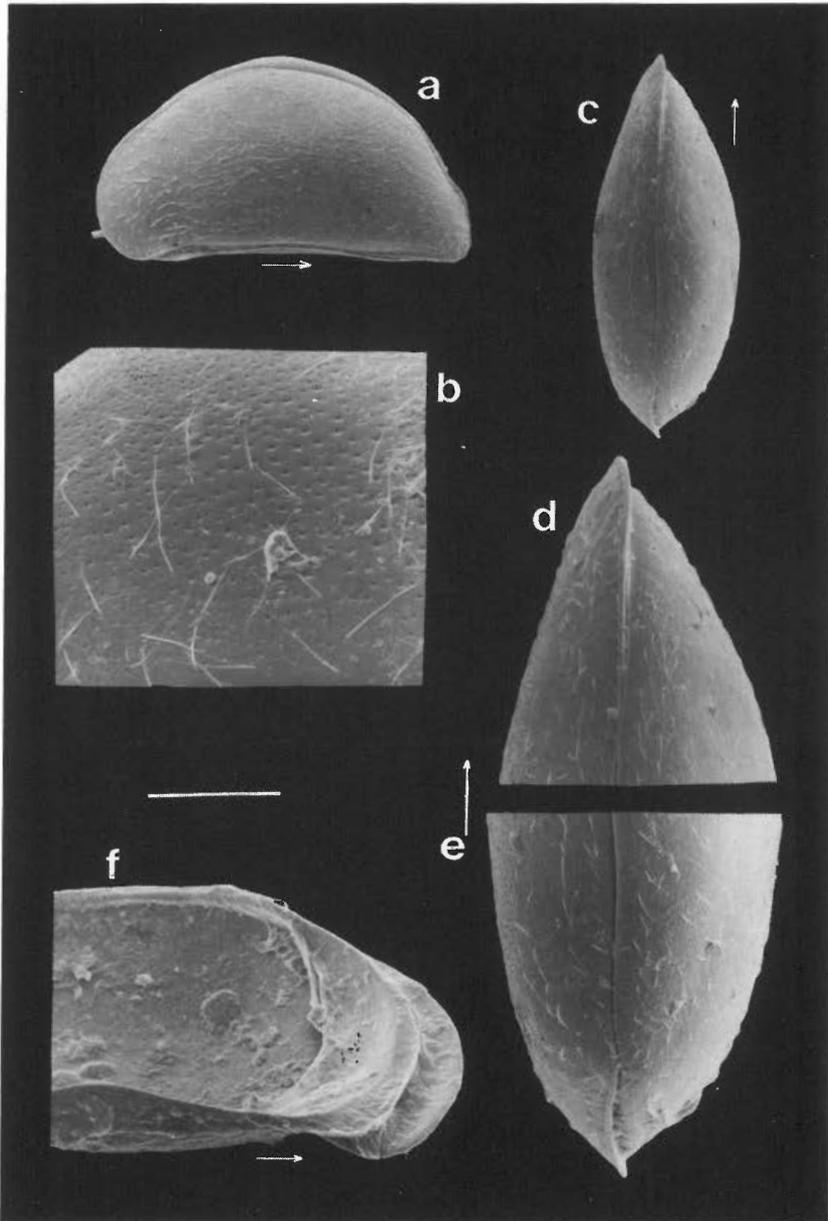


Fig. 23. - *Potamocypris producta*.

a: Lateral view of the carapace; b: Surface ornamentation (detail); c: Dorsal view of the carapace; d: Anterior detail of c; e: Posterior detail of c; f: Anterior marginal zone of the left valve (inclined view). Scale = 0.20 mm for a and c; = 0.10 mm for d-f; = 50 μ m for b; a-f: Yugoslavia, Macedonia.

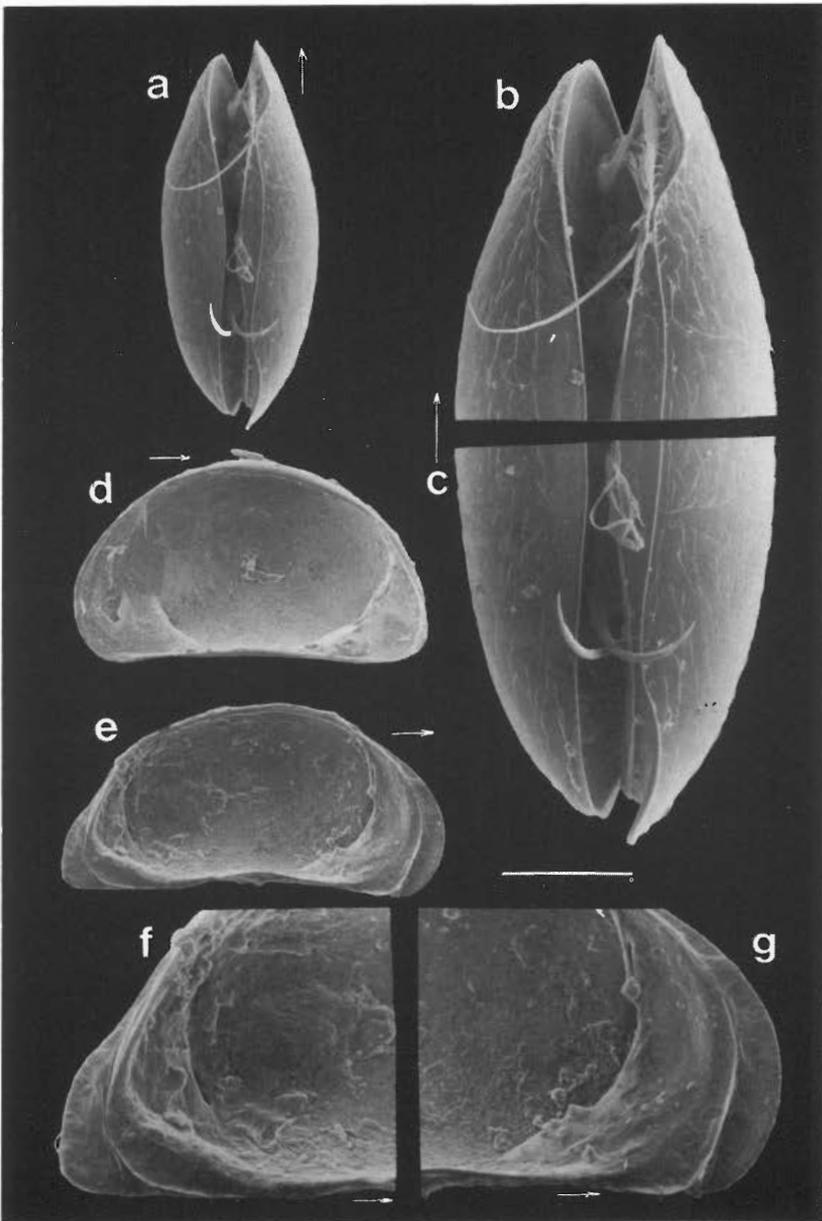


Fig. 24. - *Potamocypris producta*.

a: Ventral view of the carapace; b: Anterior detail of a; c: Posterior detail of a; d: Right valve, internal; e: Left valve, internal; f: Posterior marginal zone of the left valve; g: Anterior marginal zone of the left valve. Scale = 0.20 mm for a and d-e; = 0.10 mm for b-c and f-g; a-g: Yugoslavia, Macedonia.

8. POTAMOCYPRIS HUMILIS (SARS, 1924)

(Figs 25 - 27)

Cyprilla humilis SARS, 1924: 173, pl. XVI figs 23-24.

TYPE-MATERIAL: a) 1 microscopic slide prepared by SARS, bearing 4 complete (non dissected) syntype-specimens. This slide is deposited in the Zoological Museum in Oslo (SARS collection, 10922, Mp464);

b) 1 spirit tube with 2 syntype-specimens deposited in the South African Museum (S.A.M. A11306). These 2 specimens are rather badly preserved: valves decalcified, soft parts partially decomposed.

A holotype was not designated.

DESIGNATION OF LECTOTYPE: In my opinion, the designation of a lectotype among the material mentioned above would not be of any taxonomic help and therefore no lectotype is designated.

TYPE-LOCALITY: South Africa, the surroundings of Faure on the Cape Flats.

MATERIAL EXAMINED: The type-material of the species (ZMO and SAM) and 3 samples coming from Africa (Lake Chrissie) and Finland. (See details in the appendix).

IMPORTANT LITERATURE: PURASJOKI, 1948 and HAGERMANN, 1967: occurrence of the species in Europe (Finland);

PURASJOKI, 1948: description of the juvenile carapace.

DIAGNOSIS (FEMALES)

CARAPACE. Lateral view as in Fig. 26-a.

Surface of the valves covered with dense and deep pits, distinctly visible under the stereomicroscope (40-60X).

Dorsal view: the l.v. extending beyond the r.v. anteriorly and posteriorly.

Marginal zones of the l.v.: anteriorly and posteriorly with a well-developed flange.

Size: 0.54-0.60 mm. Colour: pale yellowish grey with a greenish shade.

APPENDAGES. A2 Swset extending beyond the tips of the terminal claws by 40-47% of their total length.

Maxillula Mx1: terminal joint of the palp with 5 distal spines.

Maxilla Mx2: respiratory plate with 2 branchial filaments.

Males rare.

COMPLEMENTS OF DESCRIPTION (FEMALES)

The carapace colour described in the diagnosis above is due to PURASJOKI (1948). I have not seen any living specimen of this species. According to the same author, the eggs are of «vermilion reddish» colour.

SARS (1924) writes that he observed one male specimen among the material he had studied, but he failed to describe this male. To my knowledge, no other author reported the finding of males.

The surface of the juvenile carapace is practically smooth; but each valve bears two big tubercles in dorsal position (see PURASJOKI for the description of the juvenile carapace). I found these knobs on the juveniles of all the samples I have examined.

RELATIONS

Because of the characteristic form and ornamentation of the carapace, *P. humilis* may not be confused with any other European *Potamocypris* species.

SARS (1924) described from South Africa a species which seems to be closely allied to *P. humilis*, namely *Cyprilla deflexa*. Both species share the following features: valves covered with dense pits, carapace shape very similar. According to SARS (1924:pl. XVI figs 17 and 24), the carapace of *P. humilis* is distinctly slender in dorsal view (see also Fig. 26-c in the present work), whereas the carapace of *P. deflexa* is rather ovate. In my opinion this is the only feature allowing separation of the two species. The soft parts of *P. deflexa* (except the length of the Swset) are unknown. This species has not been recorded since 1924.

P. humilis is situated somewhat apart in the genus *Potamocypris*: see the carapace form in lateral view (dorsal margin nearly straight) and above all the very characteristic ornamentation of the juvenile carapace (each valve with two very conspicuous tubercles). Nevertheless the species presents the diagnostic features of the genus: the r.v. embraces the l.v. ventrally; the l.v. has an anterior and a posterior flange and the Mx1 - palp has a spatula-like distal joint.

TAXONOMIC DISCUSSION

It is not necessary to give a discussion on the taxonomic status of *P. humilis* because this status has not been disputed.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

The ecology of *P. humilis* is badly known. The species has been found in one European country only, namely in Finland, by PURASJOKI (1948) and HAGERMANN (1967). The specimens collected by both authors were sampled in rock-pools situated on islands in the Gulf of Finland (Tvärminne area). PURASJOKI (1948) gives the following description of these rock-pools: situated some 8-9 m above sea-level, they are 1-3 m in diameter and 20-30 cm deep. The water is slightly salty. PURASJOKI found the species on one island only (Storsundsharun, «a small bare rock island»). HAGERMANN reports the species from Storsundsharun and from Spikarna (both islands are situated in the Tvärminne area).

PURASJOKI's (1948) hypothesis is that the species was occasionally introduced in these rock-pools by migratory birds wintering in South Africa. According to the same author, the species should only survive with great difficulty in this locality. HAGERMANN (1967) found the species in the same area some 20 years after PURASJOKI. He doubts that the hypothesis mentioned above is correct and he does not exclude that the species is a durable inhabitant of the rock-pools in the Gulf of Finland.

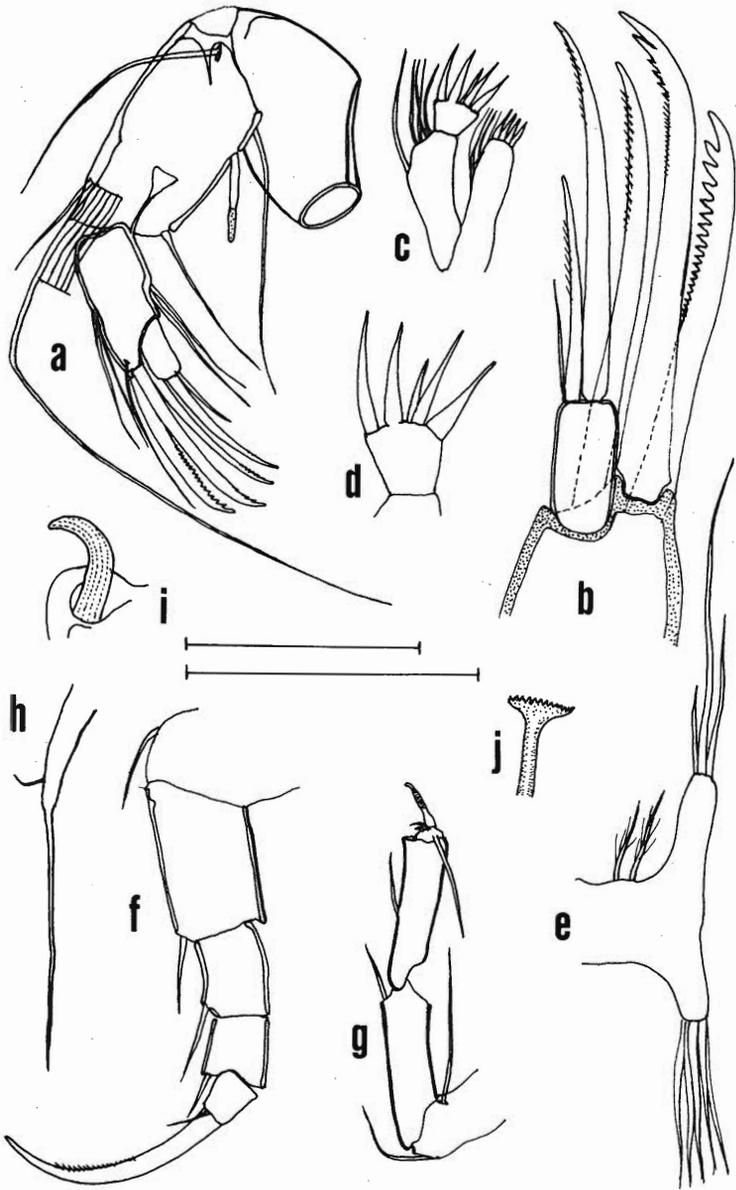


Fig. 25. - *Potamocypris humilis*.

a: Antenna (A2); b: Distal claws of A2; c: Palp and 3rd masticatory process of the maxillule (Mx1); d: Terminal joint of the Mx1 - palp; e: Maxilla (Mx2); f: Thoracopod T1; g: Thoracopod T2; h: Furcal ramus; i: Genital hook; j: Rake-like organ. Small scale = 100 μ m for a, c and e-h; = 50 μ m for d, i and j; large scale = 50 μ m for b; a-j: Finland, Tvärminne area.

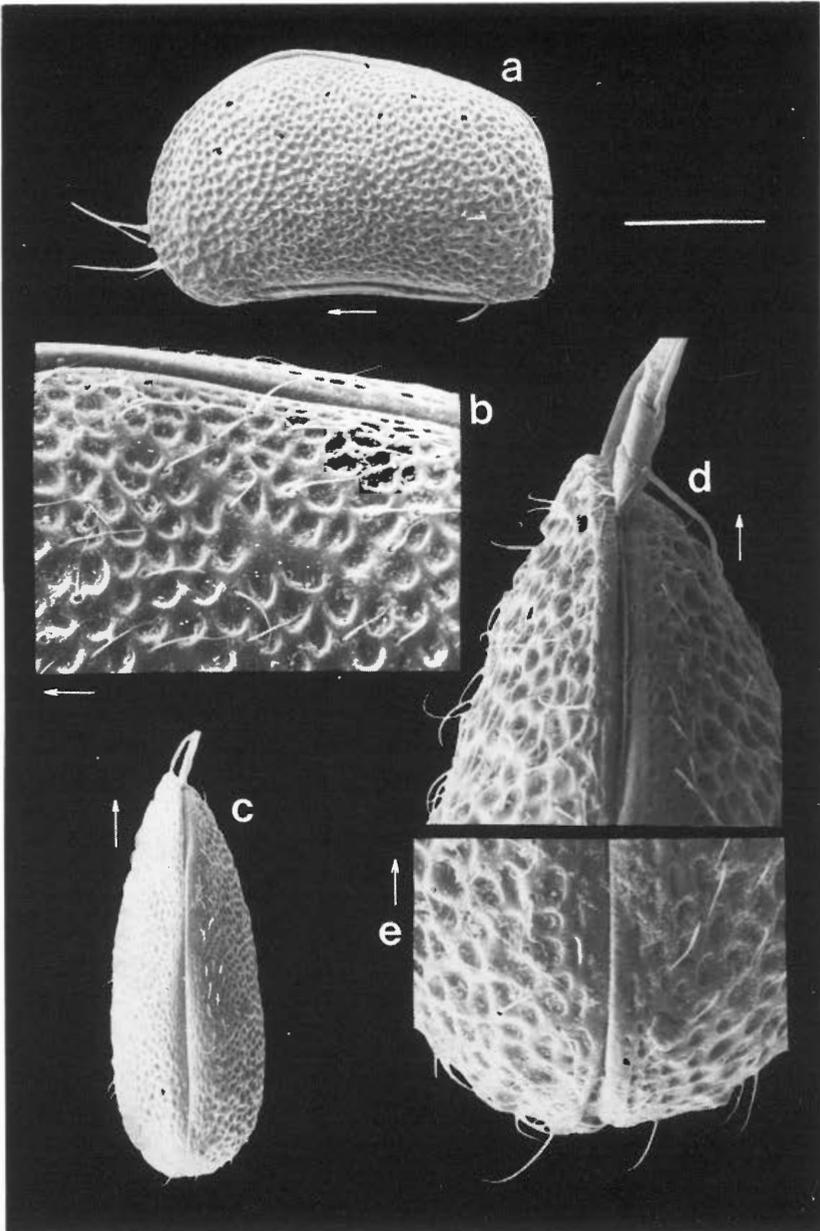


Fig. 26 - *Potamocypris humilis*.

a: Lateral view of the carapace; b: Surface ornamentation (detail); c: Dorsal view of the carapace; d: Anterior detail of c; e: Posterior detail of c. Scale = 0.20 mm for a and c; = 50 μ m for b and d-e; a-e: Finland, Tyärminne area.

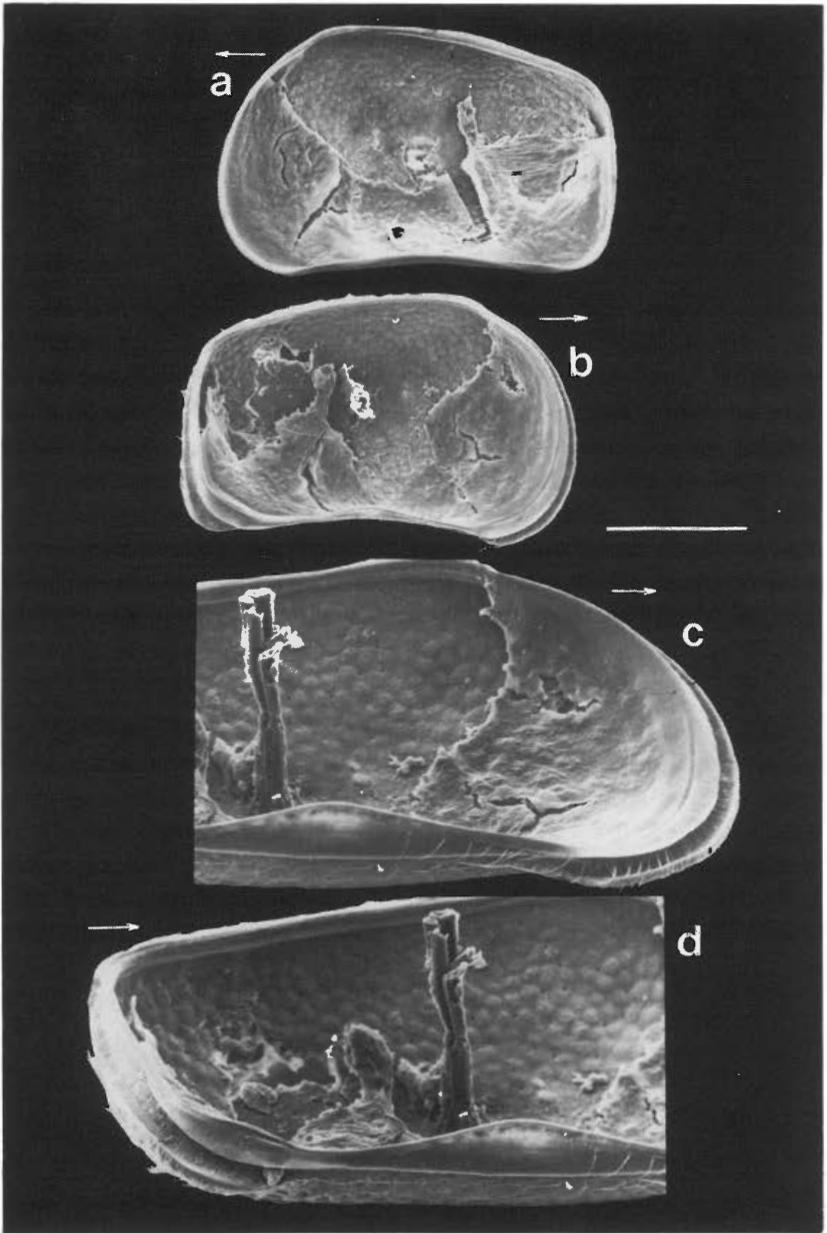


Fig. 27. - *Potamocypris humilis*.

a: Right valve, internal; b: Left valve, internal; c: Anterior marginal zone of the left valve; d: Posterior marginal zone of the left valve. Scale = 0.20 mm for a-b; = 0.10 mm for c-d; a-d: Finland, Tvärminne area.

9. POTAMOCYPRIS RULLIERI ANICHINI, 1968

TYPE-MATERIAL: It has to be considered as lost. (See the discussion below).

TYPE-LOCALITY: The town of Angers, western France.

DIAGNOSIS

According to ANICHINI's (1968) description and figures, the species shows the following diagnostic features:

Valves smooth, with numerous long setae.

Left valve anteriorly and posteriorly with a well-developed flange.

Dorsal view: carapace nearly egg-shaped, slightly more sharp-pointed in front than behind. The l.v. overlapping the r.v. in front and behind (but on ANICHINI's fig. 4 the opposite relation is observed behind: here the r.v. overlaps the l.v.).

Size: 0.67 mm; colour: uniformly green.

A2 Swset extending beyond the tips of the claws by a little less than 50% of their total length.

Palp Mx1: terminal joint with 4 distal spines (Fig. 10 of ANICHINI).

Mx2: respiratory plate with 2 branchial filaments.

Males unknown.

DISCUSSION

A hundred specimens of *P. rullieri* were collected by ANICHINI in July 1966 in two irrigation basins («bassins d'arrosage») situated in the garden of the Université Catholique in Angers (western France). The species has not been sampled since that date.

ANICHINI (1968:594) writes that a holotype was deposited in the Zoological Institute of the University in Cagliari (Sardinia). Mrs ANICHINI died in 1981. In fact she did not deposit the types of any of the species she had described as new in the collections of the Institute in Cagliari (communication of Prof. Renzo STEFANI). After having made further (but unsuccessful) efforts to find the missing types, I have to conclude that this material is lost.

In July 1983 I went to Angers in order to visit the type-locality in the garden of the Université Catholique. Unfortunately I found that the irrigation basins mentioned by ANICHINI had been destroyed. (Only some stone remains were still visible).

In my opinion it may not be excluded that *P. rullieri* is identical with a species already described. Indeed, ANICHINI obviously was not acquainted with a large part of the pre-existing taxonomic literature and so she was not aware of several species already described. (This remark is also valid for D.R. ROME whose student ANICHINI was).

So ANICHINI only compared *P. rullieri* with *P. wolfi* BREHM (now called *P. zschokkei*), a species which has short Swset! She writes: *P. rullieri* «differs from all the other *Potamocypris*-species by the greater length of the Swset». But there are two other European species showing very long Swset (overlapping by about 50% of their total length): *P. smaragdina* and *P. arcuata*.

P. smaragdina needs not to be considered here because ANICHINI would not have failed to see the characteristic colour pattern of that species (two dark green transverse bands, while the carapace of *P. rullieri* is described as uniformly green).

One may see that the diagnosis of *P. rullieri* is largely in agreement with that of *P. arcuata*. The dorsal view of the carapace of *P. rullieri* (Fig. 4 of ANICHINI) strikingly recalls the carapace of *P. arcuata* (in particular, the anterior end of the carapace of *P. rullieri* is slightly drawn to the left!).

But the following two features do not allow us to synonymize *P. rullieri* with *P. arcuata*: (a) the valves of *P. rullieri* are smooth (with pits in *P. arcuata*) and (b) the Mx1 - palp of *P. rullieri* bears 4 distal spines (see Fig. 10 of ANICHINI) while in *P. arcuata* there are 5 distal spines. ANICHINI most probably did not know the taxonomic importance of the latter feature which was discovered by FOX in 1965: so her observation is possibly erroneous. Nevertheless, the presence of smooth valves in *P. rullieri*, if the observation is correct, is incompatible with the hypothesis that *P. rullieri* is a junior synonym of *P. arcuata*.

So in my opinion, it is not possible to decide on the specific status of *P. rullieri* until the species will be sampled and described again. In case the species is not found again, it most probably has to be considered as synonymous with *P. arcuata*.

10. SPECIFIC NAMES PROPOSED AS NOMINA OBLITA

I would like to propose to consider the following specific names, which are unused senior synonyms of well-established names, as nomina oblita. Indeed they clearly fulfil the conditions required for nomina oblita by the ICZN (articles 23 and 79).

A) *Potamocypris dubia* (MASI, 1905)

The species was found in a pool at Rome (Italy). It was briefly described under the name *Cypridopsis dubia* with the following comment: «= *Cypridopsis villosa* partim». According to the author (MASI, 1905: 125-126) the species differs from *P. villosa* by the presence of pits on the valves. The second difference mentioned by MASI, namely the greater length of the A2 Swset («extending beyond the tips of the claws by 1/3 of their length») is not a true difference: on the contrary, such a length is characteristic for *P. villosa*.

The type-material of *P. dubia* neither exists in the collections of the Zoological Institute of the University in Rome, nor in any other Institute in Rome (communication of Dr. F.G. MARGARITORA). Thus the objective verification of the specific status of *P. dubia* is no longer possible.

MÜLLER (1912:216) placed *P. dubia* in synonymy with *P. smaragdina*, but this synonymy remains doubtful, especially because the status of *P. smaragdina* too was not clear in 1912. (*P. dubia* is certainly not identical with *P. smaragdina* as it is described in the present work: MASI certainly would have observed and described the striking green transverse bands of this species).

In my opinion, *P. dubia* is most probably identical to *P. arcuata*, because all the different features mentioned by MASI (above all the pitted valves and the length of the A2 Swset) are in perfect agreement with the diagnosis of *P. arcuata*.

As a conclusion, my proposal is to consider *P. dubia* as being an unused senior synonym of *P. arcuata*. Since 1905, the name has not been used even once in the literature. It is not mentioned either in the

recently published Fauna of Italian freshwater ostracods (GHETTI & MCKENZIE, 1981). *P. dubia* obviously should be considered as a nomen oblitum.

Remark: *Cypridopsis dubia* MASI, 1905 is not identical with *Cypridopsis dubia* SARS, 1903b described from Sumatra and which was also found in Africa (GAUTHIER, 1939a) and in Europe (PETKOVSKI, 1964 under *C. cf. dubia*).

B) *Potamocypris ophthalmica* (JURINE, 1820) DADAY, 1900.

In 1855, FISCHER described and figured a species which obviously belongs to the genus *Potamocypris* but which he erroneously identified as *Cypris ophthalmica* JURINE, 1820. Indeed, all other Ostracod specialists agreed to identify *Cypris ophthalmica* JURINE with the species now called *Cypris ophthalmica*.

I was not able to locate the material studied by FISCHER (if it still exists). FISCHER's species certainly belongs to the genus *Potamocypris*: see especially his figs 14 and 16 (plate 19) showing a carapace with the r.v. distinctly overlapping the l.v. dorsally. The description, however, does not allow the recognition of the exact species.

In 1900, DADAY (p. 202-204) transferred FISCHER's species in the genus *Potamocypris*; he maintains the specific name *ophthalmica*. Moreover, DADAY redescribes the species after specimens collected in Hungary (in Lake Balaton at Felsőörs and in a sodic pond at Hódmezővásárhely). I was able to examine the material studied by DADAY (HNHM, 2 spirit tubes: 1194/1899 and 954/1892). The examination showed that these specimens belong to *P. arcuata*. But this, quite evidently, does not prove that FISCHER's *P. ophthalmica* specimens too belong to *P. arcuata*.

The name *P. ophthalmica* has not been used in the literature since DADAY's (1900) monography. The species is not considered in the Fauna of Hungarian Ostracods published by FARKAS (1958).

My proposal is to consider *P. ophthalmica* as being an unused senior synonym of *P. arcuata*. Thus it should be regarded as a nomen oblitum.

C) *Potamocypris verrucosa* (DADAY, 1897)

DADAY's description of this species (under the name *Cypridopsis verrucosa*) was based on the examination of one single specimen found in Hungary (Lake Balaton). The original description does not allow us to recognize which species actually is meant. Even the genus assignment is not certain.

In 1900, DADAY placed *C. verrucosa* in synonymy with *P. ophthalmica* FISCHER. The type-material of *P. verrucosa* does not exist in the large DADAY collection deposited in the Museum in Budapest (communication of Dr L. FORRÓ). To my knowledge, the name *P. verrucosa* has not been used in the literature since 1900. *P. verrucosa* is not mentioned in the Hungarian Fauna of ostracods published by FARKAS (1958).

As *P. verrucosa* DADAY, 1897 was put in synonymy with *P. ophthalmica* by DADAY (1900) himself and as the specimens determined as *P. ophthalmica* by DADAY actually revealed to belong to *P. arcuata*, my proposal is to consider *P. verrucosa* as an unused senior synonym of *P. arcuata*. Consequently, it should be regarded as a nomen oblitum.

VII. SYNOPTIC TABLE LISTING SPECIES NAMES AND
SYNONYMS ADOPTED IN THE PRESENT REVISION

| | | | |
|--------------------------------|-----|-----------------------------|----------|
| <i>Potamocypris steueri</i> | (t) | <i>P. tetrataeniata</i> | |
| <i>Potamocypris variegata</i> | (t) | — | |
| <i>Potamocypris unicaudata</i> | (t) | <i>P. vanoyei</i> | |
| <i>Potamocypris smaragdina</i> | | <i>P. diana</i> | (t) |
| <i>Potamocypris villosa</i> | | <i>P. villosa crassipes</i> | |
| | | <i>P. crassipes</i> | |
| <i>Potamocypris arcuata</i> | (t) | <i>P. maculata</i> | (t) |
| | | <i>P. almasyi caspica</i> | * (t) |
| | | <i>P. caspica</i> | * (t) |
| | | <i>P. almasyi minor</i> | * (t) |
| | | <i>P. dubia</i> | (o) |
| | | <i>P. ophthalmica</i> | (o) |
| | | <i>P. verrucosa</i> | (o) |
| | | ? <i>P. almasyi</i> | * |
| | | ? <i>P. longisetosa</i> | * |
| <i>Potamocypris producta</i> | (t) | <i>P. reniformis</i> | * (t)(o) |
| | | <i>P. mastigophora</i> | * (o) |
| <i>Potamocypris humilis</i> | (t) | — | |
| <i>Potamocypris rullieri</i> | | — | |

Remarks: the species marked with an asterisk have not been recorded in western Europe. The author was able to examine the type-material of the species marked with (t). The names marked with (o) are unused senior synonyms proposed to be considered as nomina oblita.

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VIII. APPENDIX: DETAILED LIST OF THE MATERIAL EXAMINED

1. *Potamocypris steueri* KLIE

- a) Egypt, Lake Maryut: 13 specimens, leg. A. STEUER, 12.9.1933. (TYPE-MATERIAL, ZMH 1175, KLIE collection).
- b) Algeria, Oued Hamiz, bay of Algiers: 5 specimens, leg. GAUTHIER, 1936 (ZMH 1174, KLIE collection). (Cf. GAUTHIER, 1937).
- c) Italy, Lake Patria: about 10 specimens, leg. CONNICCILI, 1951 (ZMH 28262).
- d) Yugoslavia, Lake Mandra, Poda: about 25 specimens, leg. T. PETKOVSKI, 3.8.1965.

2. *Potamocypris variegata* (BRADY & NORMAN)

- a) Ireland, Lough Neagh: 8 specimens (BMNH, NORMAN collection, 1900.3.29.135). TYPE-MATERIAL.
- b) Italy, irrigation channel near Lago di Trasimeno: 3 specimens, leg. C. MEISCH, 12.8.1984.
- c) France, fishpond in the Sologne, near St. Viâtre: about 30 specimens, leg. C. MEISCH, 4.8.1983.
- d) France, Loire valley, small pond near Cheverny: about 50 specimens, leg. C. MEISCH, 4.8.1983.
- e) France, Strasbourg, pond in the Parc Vauban: 1 specimen, leg. C. MEISCH, 28.8.1984.
- f) Germany, Moselle valley, gravel-pit near Nennig: 5 specimens, leg. C. MEISCH, 18.7.1982.
- g) Luxembourg, Moselle valley, gravel-pit near Remerschen: 6 specimens, leg. C. MEISCH, 18.7.1982.

3. *Potamocypris unicaudata* SCHÄFER

- a) Germany, Holstein, «Bersbeker See»: about 60 specimens, leg. A. MEUCHE, 28.9.1936 (ZMH 1183, KLIE collection). TYPE-MATERIAL.
- b) Germany, Berlin, fishpond at Malihow: 10 specimens, leg. SCHÄFER, 16.5.1943 (ZMH 1184, KLIE collection).
- c) Germany, Franconia: about 10 specimens, leg. H. NÜCHTERLEIN.
- d) Belgium, Neerlyse: about 20 specimens, leg. K. WOUTERS, 12.10.1980. (IRSNB, I.G. 26062).
- e) Belgium, Hoboken Polder: about 50 specimens, leg. K. MARTENS, 1.5.1982.
- f) Luxembourg, Wintrange (Felsberg), in an irrigation reservoir: about 300 specimens, leg. C. MEISCH, 1979-1982.

4. *Potamocypris smaragdina* (VAVRA)

- a) Great Britain, Diana Basin (Bushey Park): 34 specimens, leg. H.M. FOX in May 1964 (BMNH 1965. 1.7.2., FOX collection). TYPE-MATERIAL of *P. diana*.
- b) Germany, mouth of the river Main: 7 specimens, leg. B. SCHARF, 29.3.1983.

- c) Germany, Schleswig-Holstein: about 100 specimens, leg. D. HILLER, 1968-1969. (See HILLER, 1972).
- d) Germany, Franconia: about 100 specimens, leg. H. NÜCHTERLEIN. (See NÜCHTERLEIN, 1969).
- e) Belgium, Lake Donk near Ghent: 20 specimens, leg. K. MARTENS, 1983-1984.
- f) France, pond in the «Jardin des Plantes» at Angers: about 100 specimens, leg. C. MEISCH in August 1983.

5. *Potamocypris villosa* (JURINE)

- a) Norway, Dovre, Kongsvoil: about 60 specimens (ZMO F1536, SARS collection).
- b) Great Britain, Isle of Bute: 9 specimens (BMNH 1911.11.8.33053-072, labelled *P. fulva* NORMAN collection).
- c) Great Britain, isle of Bute, Loch Fadd: about 10 specimens (HMNT, tube labelled *P. fulva*, BRADY collection).
- d) Poland, Jaszogurka: about 15 specimens (ZMH 1186, leg. F. PAX, 1942, KLIE collection).
- e) Afghanistan: about 10 specimens (ZMH 27629, HARTMANN collection). (Cf. HARTMANN, 1964:67).
- f) Germany, «Selker Noor»: 1 left valve (ZMH 27630, KLIE collection).
- g) Yugoslavia, Istria, Sassete: about 30 specimens (ZMH 1187, leg. STAMMER, 1930, KLIE collection).
- h) France, Haute Provence, Ribiers: about 20 specimens (IRSNB I.G. 25455, leg. K. WOUTERS, 1976).
- i) France, Haute Provence, «riou de Meaulx», near Draguignan: about 60 specimens, leg. MEISCH, 31.7.1984.
- j) France, Vosges: 2 specimens (ZMH 1185, KLIE collection).
- k) France, Pas-de-Calais, Wimereux: about 20 specimens (IRSNB I.G. 26305, leg. K. WOUTERS 1981).
- l) France, Dordogne valley (several localities): about 400 specimens (leg. C. MEISCH in August 1982).
- m) Luxembourg, near Huldange and Wilwerdange (2 samples): about 30 specimens (leg. C. MEISCH, 1977-1980).

6. *Potamocypris arcuata* (SARS)

- a) Soviet Union, Kazakhstan, territory of Atbassar, «deepenings of Kara-sai»: 5 specimens (ZIL, SARS collection) and 2 specimens (ZMO, SARS collection). TYPE-MATERIAL.
- b) Sweden, Bohuslan (Bonden): 4 specimens (NHMS, leg. THEEL). TYPE-MATERIAL of *P. maculata*.
- c) Germany (Eastern), Thüringen, pond in Ettersburg, near Weimar: about 20 specimens (ZMH 1160, labelled *P. maculata*, leg. REUKAUF, 8.12.1927, KLIE collection).

- d) Germany (Eastern), Thüringen (sample reared from ZMH 1161): about 40 specimens (ZMH 1160, KLIE collection).
- e) Germany (Eastern), Wakerow near Greifswald: about 130 specimens (ZMH 1162, labelled *P. maculata*, KLIE collection, leg. G.W. MÜLLER in October 1932).
- f) Finland, Tvärminne (Enskar): about 40 specimens (ZMH 1163, labelled *P. maculata*, leg. K.J. PURASJOKI, 5.8.1948).
- g) Greece, Corfu: about 30 specimens (ZMH 1159, labelled *P. maculata*, KLIE collection, leg. T. STEPHANIDES in 1935).
- h) Greece, Corfu: about 370 specimens (BMNH 1967.6.7.97, labelled *P. maculata*, FOX collection).
- i) Macedonia, Sedes: several specimens (ZMH 1168, labelled *P. variegata*, KLIE collection, leg. T. STEPHANIDES, 1938). (Cf. KLIE, 1941: 233-234).
- j) Yugoslavia, Szabadka: 1 specimen (HNHM 954/1893, labelled *P. villosa*, DADAY collection).
- k) Hungary, 10 samples coming from 10 different localities, on the whole about 150 specimens (HNHM, DADAY collection: 954/1893 = 5 samples all coll. DADAY, from Kolocsa, Vadkert, Kisujszállás, Akasztó, Tázlár; 970/1893: 2 samples coll. DADAY in Nanas and Fülöpszállás; 1192/1899 = 1 sample coll. PAVEL in F. Pezzér; 1186/1899 = 1 sample coll. SZALAY in Félégyháza). These 10 samples are all labelled *P. villosa*.
- l) Hungary, 2 samples from lake Balaton: on the whole 19 specimens (HNHM, DADAY collection: 954/1892 and 1194/1899, both tubes labelled *P. ophthalmica*, localities: Hódmezővásárhely and Felsőörs).
- m) Iran, Sabzevar, Elburz mountains, Caspian Province: several specimens (ZMH 27626, leg. LINDBERG, HARTMANN collection). TYPE-MATERIAL of *P. almasyi caspica*. (Cf. HARTMANN, 1964).
- n) Iran, Damavand-region (Caspian province): about 30 specimens (ZMH 1171, labelled *P. arcuata*, leg. RUTTNER in 1936, KLIE collection).
- o) Afghanistan: several specimens (ZMH 27627, leg. LINDBERG, HARTMANN collection). TYPE-MATERIAL of *P. almasyi minor*. (Cf. HARTMANN, 1964).
- p) Algeria, Aouari: 12 specimens (MHNL, leg. H.J. DUMONT, gift of K. MARTENS).
- q) Belgium, Hoboken Polder near Antwerp: about 50 specimens, leg. K. MARTENS in June 1984.

7. *Potamocypris producta* (SARS)

- a) South Africa, near Kimberley: 12 specimens (SAM A 11162). TYPE-MATERIAL.
- b) South Africa, Transvaal, Lake Chrissie: about 15 specimens (ZMH 27674, HARTMANN collection). (Cf. HARTMANN, 1957).
- c) Yugoslavia, rice-fields in Macedonia: about 10 specimens, leg. T. PETKOVSKI.

8. *Potamocypris humilis* (SARS)

- a) South Africa, «a dam at Faure, Cape Flats»: 4 specimens on a slide (ZMO F 10922 Mp 464, SARS collection). TYPE-MATERIAL.
- b) South Africa, most probably from the type-locality: 2 specimens (SAM A 11306). (These specimens are badly preserved).
- c) South Africa, «5 miles N.W.A. Lilyfontein, Namaqualand»: 7 specimens (SAM A 11963, leg. R. LAWRENCE in Sept. 1932).
- d) Finland, Gulf of Finland, Tvärminne area, Storsundsharun: about 30 specimens (ZMH 1189 leg. K.J. PURASJOKI, KLIE collection). (Cf. PURASJOKI, 1948).
- e) Finland, Gulf of Finland, Tvärminne area: about 50 specimens (ZMH 27675, leg. K.J. PURASJOKI in July 1954; this tube also includes specimens of *Cypridopsis spinifera*).

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X. CORRECTIONS TO THE FIRST PART OF THE REVISION

The following corrections have to be made to the first part of the revision (MEISCH, 1984):

Back of the front cover, lines 2 and 5 from the bottom: length of the carapace of *P. zschokkei* shown on the cover = 0,73 mm (not 0,62 mm).

page 7, in the diagnosis of the genus *Potamocypris*, lines 12 and 13 from the top: «the r.v. embraces (see explanation below) the l.v. at least . . .». (Not: the l.v. embraces the r.v.).

page 20, in the diagnosis of *P. pallida*, lines 5 and 6 from the bottom: «anteriorly the r.v. overlaps the l.v.;». (Not the opposite).

page 28, line 14 from the bottom; delete: Turkey.

page 38, line 3 from the bottom: «a: left valve, internal». (Not: right valve, internal).

page 51, *P. zschokkei*: material examined; the following data have to be added:

n) Luxembourg, Hobscheid, ditch flowing from the abandoned railway tunnel: about 400 female specimens, coll. C. MEISCH (1979-1983).

o) Spain, Pyrenees (Province of Gerona): 2 specimens (1 male and 1 female) = TYPES of *P. wolfi pyrenaica*, coll. MARGALEF. Cf. MARGALEF 1947 and 1953.

page 51, *P. fallax*: material examined; delete:

d) Spain, Pyrenees (Province of Gerona) etc.

page 51, *P. similis*: material examined; add the following:

d) Luxembourg, near Remerschen, pond in the Moselle valley: 12 specimens, coll. C. MEISCH (July 1982).

