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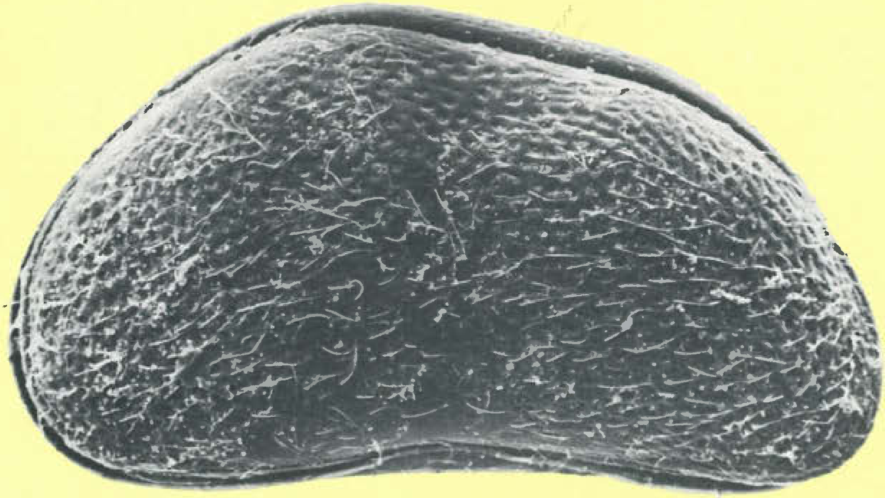

III

REVISION OF THE RECENT WESTERN EUROPE SPECIES OF GENUS POTAMOCYPRIS (Crustacea, Ostracoda)

PART I

SPECIES WITH SHORT SWIMMING SETAE ON THE SECOND ANTENNAE

by Claude MEISCH

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La photo de la page de couverture montre la carapace de *Potamocypris zschokkei* (KAUFMANN) au microscope électronique à balayage (longueur : 0,62 mm).

The photograph on the cover shows the carapace of *Potamocypris zschokkei* (KAUFMANN) under the scanning electron microscope (length : 0,62 mm).

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REVISION OF THE RECENT WESTERN EUROPE SPECIES OF GENUS POTAMOCYPRIS (CRUSTACEA, OSTRACODA).

Part I: Species with short swimming setae on the second antennae.

by Claude MEISCH[1]

Abstract: The recent Western Europe species with short swimming setae on the second antennae are revised. The work is based on the examination of the type-material of 10 of the 11 species described in the literature. Diagnosis, complements of description, taxonomic history and discussion, data on ecology and geographical distribution are given for each species. The carapace of each species is shown on scanning electron micrographs. Tables allowing direct comparison between closely related species are given. Two keys to the species are proposed.

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I. SYSTEMATIC POSITION OF THE GENUS POTAMOCYPRIS

Classification according to HARTMANN and PURI (1974):

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

II. ACKNOWLEDGEMENTS

This work would not have been possible without the generous help of numerous persons. First I wish to thank Prof. Gerd HARTMANN (Hamburg) who gave me on loan a most important *Potamocypris* collection from the Zoological Museum of the University in Hamburg. This collection includes among others the whole Ostracod material deposited by W. KLIE and the Asian material studied by Prof. HARTMANN (1964) himself.

I am much indebted to my friend Dr. Karel WOUTERS (Brussels) for our joint work on the scanning electron microscope (all of the SEM photographs illustrating this work, except 2, have been taken at the Institut Royal des Sciences Naturelles de Belgique), also for a spirit tube with *P. fulva* specimens collected by himself in Belgium, and also for the long discussions on Ostracod taxonomy.

For the loan of type-material I thank:
Dr. P.S. DAVIS, Hancock Museum, Newcastle upon Tyne (types of *P. fulva*, BRADY collection);
Dr. B. HAUSER, Zoological Museum in Geneva (types of *P. similis* and *P. zschokkei);*
Dr. G.A. BOXSHALL, British Museum (Natural History), London (types of *P. fallax;* one spirit tube labelled *P. fulva* from the isle of Bute, NORMAN collection);
Dr. R. MARGALEF, University of Barcelona (types of *P. wolfi pyrenaica);*
Dr. G. MÜLLER, University of Greifswald, GDR, (1 spirit tube with specimens of *P. fulva* deposited by G.W. MÜLLER).
Dr. B. SCHARF, Mainz, showed me specimens of *P. pallida* collected in Germany. Other zoologists gave me helpful information on the Ostracod collections deposited in their institute. I shall quote them in the text.

I am grateful to Dr. Norbert STOMP, curator at the Natural History Museum in Luxembourg, for his constant help. My thanks also go to Jean-Marie BODÉ who improved the English manuscript and Paul KREMER who helped me by translating several Russian texts by BRONSTEIN.

With great pleasure I thank Prof. Jos. HOFFMANN (Luxembourg) who, a few years ago, directed my interest towards the Ostracods.

Finally I would like to call attention to the precious help offered by the INDEX AND BIBLIOGRAPHY OF NONMARINE OSTRACODA published by E. KEMPF (1980). INDEX A of this work gives the complete list of all the nominal species hitherto described. In the absence of this work, I probably would not have had the courage to begin the present revision.

III. INTRODUCTION

1. Necessity of the revision of genus *Potamocypris:*
Even among Ostracodologists, species of the genus *Potamocypris* are reputed to be "difficult" species. This is partly due to the fact that some species initially have been poorly described and that successive redescriptions of a same species visibly apply to distinct species. Moreover, the specific determination requires the study of an abundant and widely scattered literature.

Thus ABSOLON (1973 : 52) writes : "Es ist besonders schwer, fossile sowie rezente Arten der Gattung *Potamocypris* richtig zu bestimmen." PETKOVSKI (1969 : 77) draws the attention to the urgent need of a revision, because : "von den insgesamt 24 für Europa angeführten Formen, können sogar spezialisierte Zoologen nur 5 Arten zuverlässig bestimmen...").

2. Summary of the taxonomic history of genus *Potamocypris:*
The genus *Potamocypris* was established by G.S. BRADY in 1870 for the single species *P. fulva* (BRADY, 1868). As the most important feature of the new genus (a feature which is still retained now) BRADY gives the striking asymmetry of the 2 valves forming the carapace : the right valve is higher than the left one and overlaps it dorsally (see Fig. 5 - e for the frontal view of a typical *Potamocypris* carapace).

Examination of the type-material deposited by BRADY (THE HANCOCK MUSEUM, Newcastle upon Tyne) allowed me to establish that BRADY by the name *P. fulva* designated all the non-swimming *Potamocypris* species of his collections. So the type-material of *P. fulva* includes specimens of *P. zschokkei, P. fallax, P. pallida, P. similis* and, fortunately, also of *P. fulva* as it was redescribed by G. W. MÜLLER in 1900.

After 1870, several new genera were created which incorporated species which at present are put into genus *Potamocypris* (see the list of synonyms below).

It is the distinguished French zoologist Henri GAUTHIER (1934 and especially 1939) who clarified the taxonomic relations with the closely allied genera *Cyprilla, Cypridopsella, Cypridopsis* and *Pionocypris.* The same author formulated a clear and unambiguous diagnosis of the genus. I think that the conclusions of GAUTHIER'S work still remain valid today.

3. Limits of the revision:

The revision (parts I and II) is restricted to the species inhabiting the regions of Western Europe: the few species from Soviet Union described by BRONSTEIN are not revised here. The reason for this is that I was not successful in locating the museum or the institute where the collections of BRONSTEIN are deposited (if these collections still exist). Nevertheless, probable synonymies concerning these BRONSTEIN species will be discussed in the systematic part of this work.

4. Number of species:

In Europe (East and West), genus *Potamocypris* includes 12 recent nominal species with short natatory setae on the second antennae. I was able to examine the syntypes of 9 species, of one species (i.e. *P. wolfi* BREHM) the topotypes; the types of another species have to be considered as being lost (*P. pallida* ALM). The remaining species comes from Eastern Europe (*P. tarnogradskyi* BRONSTEIN), of which I have not seen any specimen. (But this species is most probably synonymous to *P. zschokkei;* see the discussion *sub P. zschokkei).* The synonymies established in this revision reduce the 11, respectively 12, nominal species (if *P. tarnogradskyi* is included) to 5 actually existing species.

IV. ABBREVIATIONS USED IN THE TEXT

The following abbreviations will be used:

A1 = antennula; A2 = antenna; Swset = swimming setae; Mx1 = maxillula; Mx2 = maxilla; T1 and T2 = thoracopods 1 and 2 (walking leg and cleaning leg); Fu = furcal ramus; l.v. and r.v. = left and right valve; l.v.>r.v. = the left valve overlaps the r.v. (anteriorly or posteriorly); selv. = selvage (Saum, lamelle hyaline).

SEM = Scanning electron microscope;

ZMH = Zoologisches Museum und Zoologisches Institut der Universität Hamburg;
HMNT = Hancock Museum, Newcastle upon Tyne;
BMNH = British Museum (Natural History), London;
MHNG = Muséum d'Histoire Naturelle de la ville de Genève;
IRSNB = Institut Royal des Sciences Naturelles de Belgique, Brussels;
ZIGR = Zoologisches Institut der Ernst-Moritz-Arndt-Universität, Greifswald (GDR);
PVLP = Polyvinylalcohol mixture for the mounting of dissected specimens.

V. DIAGNOSIS OF GENUS POTAMOCYPRIS

Cypridopsinae Ostracods of small or medium size (from 0,40 to about 0,90 mm). Carapace with 2 distinctly asymmetrical valves: the r.v. is higher and overlaps the l.v. dorsally (cf. Fig. 5-e).

Occlusion of the carapace: the l.v. embraces (see explanation below) the r.v. at least dorsally and ventrally, in general also anteriorly and posteriorly. So, ventrally, when the carapace closes, the r.v. widely covers the marginal zone of the l.v.

Palp Mx1: terminal segment distally enlarged (spatula-like), bearing long spines (not simple setae) (see the example in Fig. 1-b).

Respiratory plate of Mx2 with 1 or 2 branchial filaments.

Furcal rami regressed, flagellum-like.

Most of the species inhabiting fresh waters; some species occuring in brackish waters. Numerous parthenogenetic species.

TYPE-SPECIES: *Potamocypris fulva* (BRADY, 1868).

SYNONYMS: *Candonella* KLAUS, 1891; *Cypridopsella* KAUFMANN, 1900a (partim); *Paracypridopsis* KAUFMANN, 1900a; *Cyprilla* SARS, 1924. Discussion: Only the last synonymy has to be discussed. The above diagnosis clearly incorporates the *Cyprilla* species (see also the discussion in GAUTHIER 1939). Nevertheless, recently MCKENZIE (1971) has maintained genus *Cyprilla*, whereas HARTMANN and PURI (1974) keep *Cyprilla* as a subgenus of *Potamocypris*, but without giving arguments.

DISCUSSION OF THE DIAGNOSIS

1. Occlusion of the carapace.

The diagnosis given above is based, as far as carapace features are concerned, on the most important work of GAUTHIER (1939), which deals with the carapace structure in genus *Potamocypris* and in some closely related genera. GAUTHIER emphasizes that in genus *Potamocypris* the r.v. embraces the l.v. on the whole or at least on part of the carapace's periphery. The meaning of "embracement" is that the inner side of the r.v. "leans against or at least faces the outer side of the l.v." (Gauthier, 1939: 210; see also the excellent figures and explanations of this author). Here it has to be recalled that the limit between the inner and the outer "side", i.e. the inner and the outer lamella of an ostracod valve is given by the selvage (which itself depends on the inner lamella)[1]. On the right valve of all *Potamocypris* species the selvage is peripheral: so the apparent border of the valve is identical with the real (= as given by ontogeny) border of the valve. On the left valve, the selvage may be displaced from the apparent border, which is formed by a lobe-like extension of the outer lamella (for examples see Figs 6-d, 7-c, 16-d and 9-h). This extension will be called "outer extension" in this work. This enables us to understand now why the right valve may embrace the left one even if the r.v. is overlapped by the l.v. (This is for instance the case in the anterior part of the carapace in *P. fallax;* see Figs 13-a, 13-b and 9-h).

Given the importance of the mode of occlusion of the carapace, (i.e. wether the r.v. embraces the l.v. or the opposite) and the fact that this character has been poorly used in taxonomy, I venture to repeat (see the diagnosis), that this mode of occlusion is best seen in the ventral part of the carapace (ventral view!), where one of the 2 valves widely covers the marginal zone of the opposite valve when the carapace closes.

2. Taxonomic relations with closely allied genera occurring in Europe. I completely agree with Gauthier (1939) when he states that the mode of occlusion of the carapace is a decisive feature at the generic level: species having an opposite mode of occlusion have to be included in separate genera. Or this feature, together with the terminal segment of the Mx1 palp allows easy distinction between the 3 European genera bearing flagellum-like furcal rami:

Potamocypris	*Cypridopsis* s.str.	*Plesiocypridopsis*
Type species: *P. fulva*	*C. vidua*	*P. newtoni*
Ventrally, r.v. embraces l.v.	the opposite: l.v. embraces r.v.	ventrally the carapace closes as in *Potamocypris*
Mx1: terminal segment spatula-like, with 3 to 5 distal spines.	this segment cylindrical, with simple setae.	this segment as in *Cypridopsis* s.str.

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[1] For explanations on the rather complex structure of the Ostracod carapace see Fassbinder (1912) and Hartmann (1966) especially.

REMARKS :

1. *Plesiocypridopsis newtoni* initially was put in genus *Cypridopsis.* Or the mode of occlusion of the carapace clearly shows that this species is not a *Cypridopsis* (see the table above). Genus *Plesiocypridopsis* was established by McKENZIE (1971). (See also ROME 1965).

2. *Cypridopsis aculeata* COSTA also has to be removed from genus *Cypridopsis:* in this species too the r.v. embraces the l.v. ventrally. McKENZIE (1977) transferred this species to the new genus *Sarscypridopsis* McKENZIE (type species : *S. gregaria*). But at present it is not yet certain if this transfer is justified (the species possibly belongs to genus *Plesiocypridopsis*). For this reason, genus *Sarscypridopsis* is not included in the table above. Note that *Sarscypridopsis* shares with *Plesiocypridopsis* the features indicated in the table. For the problem of *Sarscypridopsis aculeata* see McKENZIE (1977 : 48-49) and also De DECCKER (1981).

3. Genus *Pionocypris* (type species : *P. vidua*) should no more be considered as being a valid genus : it is synonymous with *Cypridopsis* s. str. The taxonomic status of *Pionocypris* is inconsistent with the nomenclatural priority rule. For the problem *Pionocypris* - *Cypridopsis* see HOWE (1962 : 61; 179) especially.

VI. THE TAXONOMIC CHARACTERS AT SPECIES LEVEL

1. CARAPACE.

One has to consider the shape of the carapace (in lateral and in dorsal view), the size, the ornamentation, the structure of the anterior and posterior marginal zones of the left valve. The shape and the size of the carapace show quite a striking intraspecific variability. The variability may be so wide that in certain cases one may have some difficulty to imagine that these "forms" belong to one and a same species (see for instance *P. zschokkei, P. pallida* below). This variability has been poorly studied by zoologists. On the contrary, the detailed descriptions of the shell and the valves given by the classic authors (see MÜLLER, 1900; SARS, 1924 etc) suggest that the carapace has a constant shape within each species. It is most important to note that the variability of the carapace shape not only exists in the parthenogenetic species, but is also observed in the species having both sexes : see for instance *P. arcuata* (which will be revised in part II of this work) for which GAUTHIER (1928 : 10-12) has described a large carapace variability in bisexual populations coming from Algeria. As a conclusion, I wish to point out that the shape and the sizes of the carapace should only be used with great prudence in taxonomy.

Dorsal view of the carapace: the relative position of the l.v. and the r.v. at the anterior respectively the posterior end of the carapace is a good taxonomic feature in some species, where this character appears to be constant (see *P. pallida* for instance). In other species however, this character too shows some variation (see *P. fulva* for instance).

The ornamentation of the shell is relatively discreet and may be even absent in the *Potamocypris* species. Moreover, it changes during the life-history of the specimens. So in *P. zschokkei,* the juvenile carapace shows a net of delicate ribs; the adult valves on the contrary show irregular pits (cf. Figs 11-d and 10-b). In other species, a very discreet sculpture exists in juvenile stages, but vanishes afterwards, the adult specimens having smooth valves (see for instance *P. pallida*). The ornamentation has to be observed under the stereomicroscope (incident light, minimum 40 X, preferably 60 X or even 80 X) and, above all, unter the SEM. One has to take into consideration that the ornamentation may deteriorate in the conservation liquid: the deterioration progresses slowly in alcohol (70 %), rapidly in formaldehyde, which strongly decalcifies the valves.

The structure of the marginal zones on the anterior and posterior end of the left valve has to be considered as being a most important taxonomic feature: this structure appears to be constant within each species but varies widely from species to species. On the l.v., anteriorly or/and posteriorly, the outer lamella of the valve shows a lobe-like excrescence which extends more or less beyond the selvage. This causes the selvage to be more or less displaced from the actual border of the valve towards the central parts of the valve. In some species, the outer lobe-like extension is well-developed at both ends of the l.v.: for instance in *P. fallax* (Figs 13-b and c), in *P. similis* (Fig. 16-c and d) and in *P. producta* (2nd part of the revision). In other species this outer extension is only well-marked at one of the two ends of the l.v.: for instance in *P. zschokkei* (Fig. 11-b). I recall that the outer extension is absent on the r.v., which causes the selvage to be peripheral on this valve. In one species (i.e. *P. steueri,* 2nd part of the revision), the outer extension is also absent on the l.v.

The structure of the marginal zones is best seen on SEM photographs of the ventral view of a partially closed carapace.

2. APPENDAGES.

Antennula (A1): the length by which the longest Swset reach beyond the distal end of the antennula allows to distinguish between 2 closely allied species (namely *P. zschokkei* and *P. fallax*) and this in spite of a large intraspecific variability.

Antenna (A2). The length of the Swset is a classic taxonomic feature. But the large variability of this feature has often been neglected. For instance, in *P. villosa* (2nd part of the revision) the relative length on which the Swset reach beyond the tips of the claws goes from 23 % to 45 % of their total length. The length of the aesthetasc allows to recognize, in spite of a certain variability, one of the European species, namely *P. pallida.* This feature is new in the literature.

Maxillula (Mx1). FOX (1965 : 628) discovered the taxonomic importance of the number of spines on the apical segment of the Mx1-palp. In European species there are 4 or 5 spines. At first sight this character may appear as being "weak"; but I have been able to verify the intraspecific constancy of this feature on the totality of the specimens I have dissected. This makes this character one of the most important diagnostic features in genus *Potamocypris.*

Maxilla (Mx2). The number of branchial filaments (1 or 2 in European species) on the respiratory plate is a precious diagnostic character. I have myself verified the intraspecific constancy of this number in all the specimens I have dissected. Unfortunately the detachment of the Mx2 is not easy and requires some practice in the dissection of Ostracods. Even if this condition is fulfilled, the dissection is not always successful : the filaments are very fine and transparent, sometimes they cling together. I was able to find out that the use of the phase contrast microscope largely facilitates the checking of this feature.

Thoracopod 1 (T1, walking leg). On this appendage I could find out a feature which was hitherto not known : the tip of the terminal claw of the T1 bears a point which is devoid of spines. In some species, this point is very short, nearly absent, in others it is well developed. This feature readily allows to separate 2 closely allied species : *P. fulva* and *P. pallida* (see these species below).

Thoracopod 2 (T2, cleaning leg). The structure of this leg shows a remarkable interspecific constancy, which probably is best explained by the uniform function (cleaning function) of this appendage in the whole genus and even family (stabilizing action of natural selection).

Furcal rami. The length and the angle at which the posterior seta of the furcal ramus is bent upwards have been used as taxonomic features by certain authors. But I have been able to find out that these 2 features, and above all the angle of the posterior seta, show a large variability[1]: they have to be considered as being of no use at all in this genus. Another feature often used are the relative lengths of the furcal trunk and flagellum. But the trunk of the furcal ramus is difficult to delimit and, moreover, this relation shows considerable intraspecific variability, which makes the taxonomic interest of this feature tend to zero.

Other features. I tried, without success, to use the chaetotaxy of the mandibular palp as a taxonomic character. This failure is due to the fact that this chaetotaxy shows a remarkable constancy in the species considered here. Some authors tried to use the relative lengths of the segments of different appendages (A1, A2, T1 and T2). After having token very numerous measurements on these appendages, I came to the conclusion that at least in the species considered here, the variability of these measures does not allow to separate species on this basis.

The rake-like organ (see Fig. 8-g) and the genital hook of the females (Fig. 8-h) turned out to be of no diagnostic use in the species considered here.

VII. TWO KEYS TO THE SPECIES

I would like to give 2 alternative keys to the species revised here. The first key is based on a most classic feature, i.e. the number of branchial filaments (1 or 2) on the respiratory plate of Mx2. This feature offers the advantage to be highly reliable. But its checking is only possible after the correct detachment of the Mx2; this detachment is rather laborious and requires a good practice in dissecting these small animals.

The second key uses as a major dichotomic character a feature which is easy to observe: it is the length of the spineless, "naked" distal point of the T1 claw. This character is new to the literature. It has only been checked on a relatively small number of dissected specimens. (But in my opinion this character most probably will turn out to be constant.)

FIRST KEY

1 a. Second antenna with well-developed Swset, reaching at least to the tips of the terminal claws . . . . PART II of the revision;

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[1] WOLF (1920) showed that in *Potamocypris* the "posterior seta" of the Fu is not homologous to the posterior seta on the Fu of species having a well-developed Fu, but corresponds to the posterior terminal claw of the Fu.

1 b. A2-Swset reduced, extending at the utmost to the basis of the terminal claws. 2

2 a. Respiratory plate of the maxilla (Mx2) with 1 branchial filament (Fig. 1-c); adult valves smooth 3

2 b. Respiratory plate of Mx2 with 2 branchial filaments (Fig. 8-d); adult valves smooth or with pits. 4

3 a. A2-Swset short, the longest reaching the middle of the penultimate segment; thoracopod T1 with a well-developed spineless distal point (Fig. 1-d) . . . . *P. fulva*

3 b. A2-Swset longer, the longest extending to the 2/3 or even to the distal end of the penultimate segment (Fig. 4-a); T1-claw with a tiny spineless distal point (fig. 4-d) . . . . *P. pallida*

4 a. Palp of the maxillula (Mx1) with 4 distal spines (Fig. 14-c); carapace egg-shaped in dorsal view (Fig. 15-a). . . . . *P. similis*

4 b. Mx1-palp with 5 distal spines (Fig. 8-c); carapace slender in dorsal view (Fig. 10-c) 5

5 a. Valves smooth (ad. and juv.); carapace in dorsal view: anteriorly the l.v. overlaps the r.v. . . . . *P. fallax*

5 b. Valves with pits (ad. and juv.); carapace in dorsal view: anteriorly the r.v. generally overlaps the l.v. (Fig. 10-c) (rarely both valves at the same height, exceptionally l.v>r.v.). . . . . *P. zschokkei*

SECOND KEY

1 a.
1 b. As in the first key

2 a. Mx2-palp with 4 distal spines . . . . *P. similis*

2 b. Mx2-palp with 5 distal spines 3

3 a. T1-claw with a well-marked spineless distal point (20-25 μm; Fig. 2-f). . . . . *P. fulva*

3 b. T1-claw with a tiny spineless distal point (10 μm or less; Figs 4-d, 8-e) 4

4 a. A2-Swset extending to the 2/3 or the distal end of the penultimate segment (Fig. 4-a). Mx2 with 1 branchial filament . . . *P. pallida*

4 b. A2-Swset shorter, only to the middle of the penultimate segment (Fig. 8-a). Mx2 with 2 branchial filaments. 5

5 a.
5 b. As in the first key. (*P. fallax* and *P. zschokkei*)

VIII. SYSTEMATIC PART: REVISION OF THE SPECIES

1. POTAMOCYPRIS FULVA (BRADY, 1868)

(Figs 1, 2 and 3)

Bairdia fulva BRADY, 1868: 474, pl. 28 fig. 21;
Bairdia fulva BRADY & ROBERTSON 1869: 365-366, pl. 18 figs 1-4;
Potamocypris fulva BRADY 1870: 365-377, pl. 14 fig. 4;
BRADY, CROSSKEY & ROBERTSON 1874: 130, pl. 1 figs 20-24;
BRADY & NORMAN 1889: 93, pl. 22 figs 13-17;
MÜLLER 1900: 86, pl. 18 figs 6-9, 13 and 14 [detailed redescription];
STEPHANIDES 1948: 85-86, pl. 31 figs 389-390 [ecology];
FOX 1965: 630 [taxonomy].

TYPE-MATERIAL: Syntypes at HMNT (BRADY collection): slide 1.18.04 (2 carapaces); slide 1.18.05 (only the rows 1 and 3: 22 carapaces); slide 2.01.15 (only one carapace = the first carapace on the left in the upper row); slide 1.18.07 (with a dissected specimen).

All these syntypes are empty shells (except the last one) coming from Scotland: "side of Loch Ascog", "side of Loch Fad" and "Fulwell Cemetery" (= BRADY's inscriptions on the slides).

DESIGNATION OF LECTOTYPE: Carapace number 2 (from the left) in the first row on slide 1.18.05 (see above) is proposed as the lectotype. The soft parts of the lectotype do not exist.

TYPE-LOCALITY: "Side of Loch Ascog" (Scotland, isle of Bute), where the lectotype comes from, is chosen as restricted type-locality.

MATERIAL EXAMINED: 26 syntype specimens (25 carapaces, 1 dissection, BRADY collection HMNT); 4 alcohol samples from Germany (Isle of Rügen, coll. KLIE; Greifswald, coll. G.W. MÜLLER), from Belgium (coll. K. WOUTERS) and from Corfu (coll. STEPHANIDES). On the whole about 90 specimens. See also the detailed list in the appendix.

DIAGNOSIS

CARAPACE. Surface of adult valves smooth; numerous pores (only visible under the SEM) near the edge of the valves (Fig. 3-a).
In dorsal view, anteriorly the r.v. overlapping the l.v.; posteriorly both valves reaching perceptibly to the same height, or one of the valves (the l.v. mostly) reaching slightly beyond the other (Fig. 2-b).
Marginal zones of the l.v.: posterior zone with a moderately developed outer extension; anterior zone with a poorly developed, lip-like outer extension (selvage near the actual anterior border of the valve).
Size: 0,55-0,75 mm. Colour of shell: yellow to yellowish brown.

APPENDAGES. Antenna (A2): Swset short, the longest reaching to the middle of the penultimate segment.
Maxillula (Mx1): terminal segment of the palp with 5 distal spines.

Maxilla (Mx2) : 1 branchial filament.
Thoracopod T1 : distal claw with a well-developed spineless terminal point (20-25μm long : Figs 1-d and 2-f) (this point nearly absent in the related *P. pallida*).
Males unknown.

COMPLEMENTS OF DESCRIPTION

In dorsal view the *P. fulva* carapace may in general be recognized by the anterior and posterior outer extension of the l.v. which draws more or less obliquely away from the major axis of the carapace (see Fig. 2-b and also the Fig. 8 pl. 18 in MÜLLER, 1900). However this character is not plainly developed on all the specimens.

The surface of the juvenile valves shows a very fine ornamentation, barely visible under the stereomicroscope (40X to 60X); for SEM photographs of the juvenile valves see Fig. 3-c, d.

Colour of the shell : According to MÜLLER (1900), the carapace is of a sulphureous yellow; according to STEPHANIDES (1948) it is yellowish brown. I did not myself see any living specimens. In my opinion the colour of living specimens has to be re-examined.

Contrary to MÜLLER's (1900) and KLIE's (1938) indication, the Fu of *P. fulva* bears a well-developed posterior seta. FOX (1965a) first showed the presence of this seta. I was able to check myself the presence of a well-developed seta on all the specimens I dissected (these specimens include those studied by MÜLLER 1900 and KLIE 1925, 1938). The erroneous observations of KLIE and MÜLLER may be explained by the fact that according to the position of the Fu, this seta sometimes happens to be masked by the trunk of the furca.

RELATIONS

P. fulva is closely allied to *P. pallida* with which it may be easily confused. For direct comparison see the table on page 23.

On the thoracopod T1 I could find out a hitherto unknown feature which readily allows to separate *P. fulva* not only from *P. pallida* but also from the other allied species. In *P. fulva* the T1 bears a terminal claw which has a well-developed naked point. On the contrary, *P. zschokkei, P. fallax* and *P. pallida* have a T1 claw which is armed with spines close to the tip of the claw (length of the point in *P. pallida* less than 6 μm, in *P. fulva* 20-25 μm). Compare Figs 1-d and 2-f for *P. fulva* with Figs 4-d and

6-e for *P. pallida*. This feature may appear to be somewhat weak: but I was able to verify its intraspecific constancy on all the specimens I have dissected, these specimens coming from regions in Europe distant from each others. I rather think that this feature will turn out to be a useful diagnostic help in the future.

TAXONOMIC DISCUSSION

The "*P. fulva*" material deposited by BRADY at the HMNT includes (a) 9 micropaleontological slides bearing empty carapaces and valves, (b) 2 dissected specimens on microscopic slides, (c) one spirit tube with numerous specimens.

The examination of this material showed that BRADY grouped in *P. fulva* all the different non-swimming *Potamocypris* species of his collections. Indeed, the type-material includes, side by side, specimens of *P. zschokkei, P. pallida, P. fulva* and *P. similis*. On the slides, only 25 carapaces from 60 belong to *P. fulva*. The about 1300 specimens in the spirit tube all belong to *P. fallax, P. pallida* and *P. villosa*. One of the 2 dissected specimens (*sub* b above) probably belongs to *P. fulva*.

The slides 1.17.38. (Roundstone, 1 left valve) and 1.17.39. (Scarpa Bay, Orkney, 1 entire carapace) include without any possible doubt the specimens which BRADY used as a basis for his first description of the species (see BRADY 1868 : 474 who says, as type-material is concerned : "a single valve of the left side (...) from Roundstone" and : "... a perfect specimen found (...) at Scarpa Bay, Orkney"; the last locality was corrected by the author as indicated here, see BRADY & ROBERTSON 1869 : 366)

However I was able to verify that the 3 type-specimens mentioned above belong to *P. zschokkei*; moreover the original figure given by BRADY (1868, pl. 28 fig. 21) shows without any possible doubt the carapace of *P. zschokkei* (valves with pits !). If the priority-rule has to be carried out strictly, *P. zschokkei* should now be called *P. fulva* ! But rather than upset the well-established nomenclature, I propose to consider the whole material which has been labelled *P. fulva* by BRADY (and which is incorporated in the BRADY collection at the HMNT) as forming the type-material of *P. fulva*. Among this material I propose to designate a lectotype corresponding to the detailed redescription of *P. fulva* given by G.W. MÜLLER in 1900. It is indeed this redescription which has served since 1900 to recognize *P. fulva*.

Remark : The figure 17, pl. 22 in BRADY & NORMAN (1889) is annotated : "Copulative organ of male, with coil of spermatic filaments". In reality, this figure shows the genital system and the copulative hook of the female. The males of *P. fulva* have never been found.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. fulva is a somewhat rare species, which makes that its ecology is badly known. The species seems to show a preference for shallow, slow-flowing waters. It has indeed been sampled in ditches filled with dead leaves in and at the edge of forests (MÜLLER, 1900, near Greifswald, GDR), in ditches filled with filamentous algae (STEPHANIDES, 1948, Corfu), in a small stream flowing in a forest (coll. K. WOUTERS, Belgium) and in a slow stream (FOX, 1965a, Great Britain).

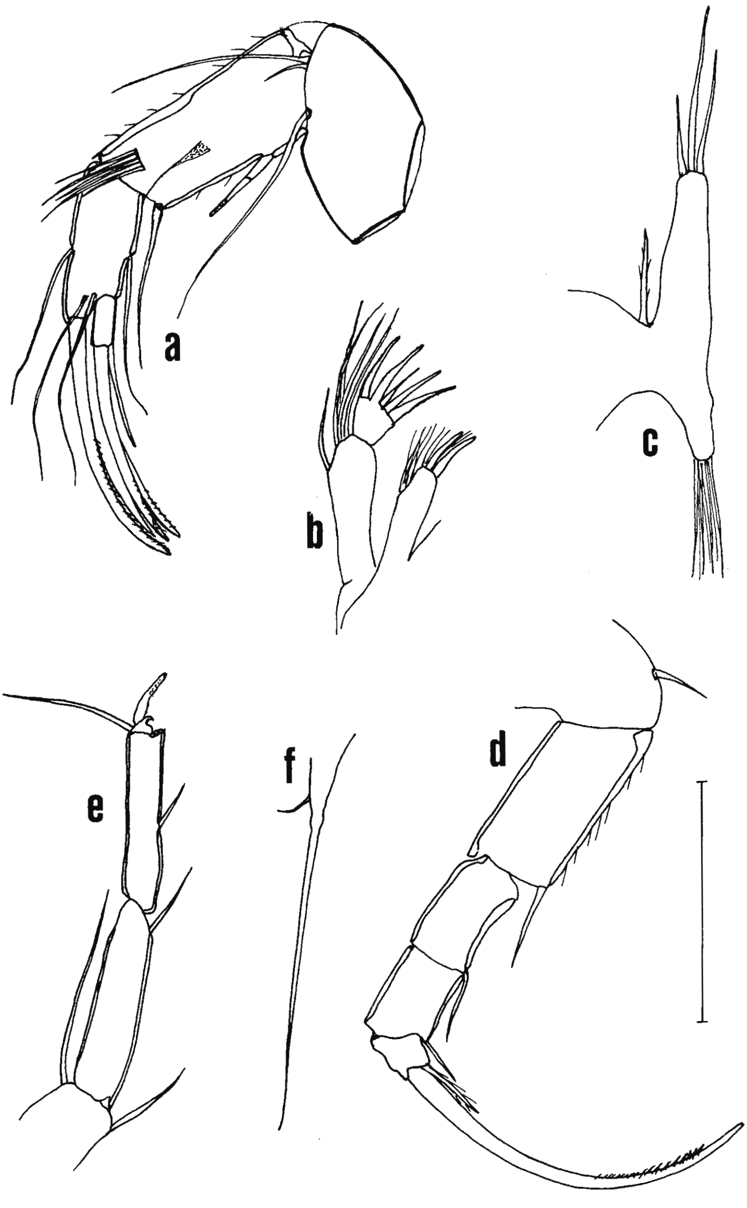

Fig. 1. - *Potamocypris fulva.*

a: Second antenna (A2); b: Palp and 3rd masticatory process of the maxillula (Mx1); c: Maxilla (Mx2); d: Thoracopod T1; e: Thoracopod T2; f: Furcal ramus (Fu). Scale=100 μm.

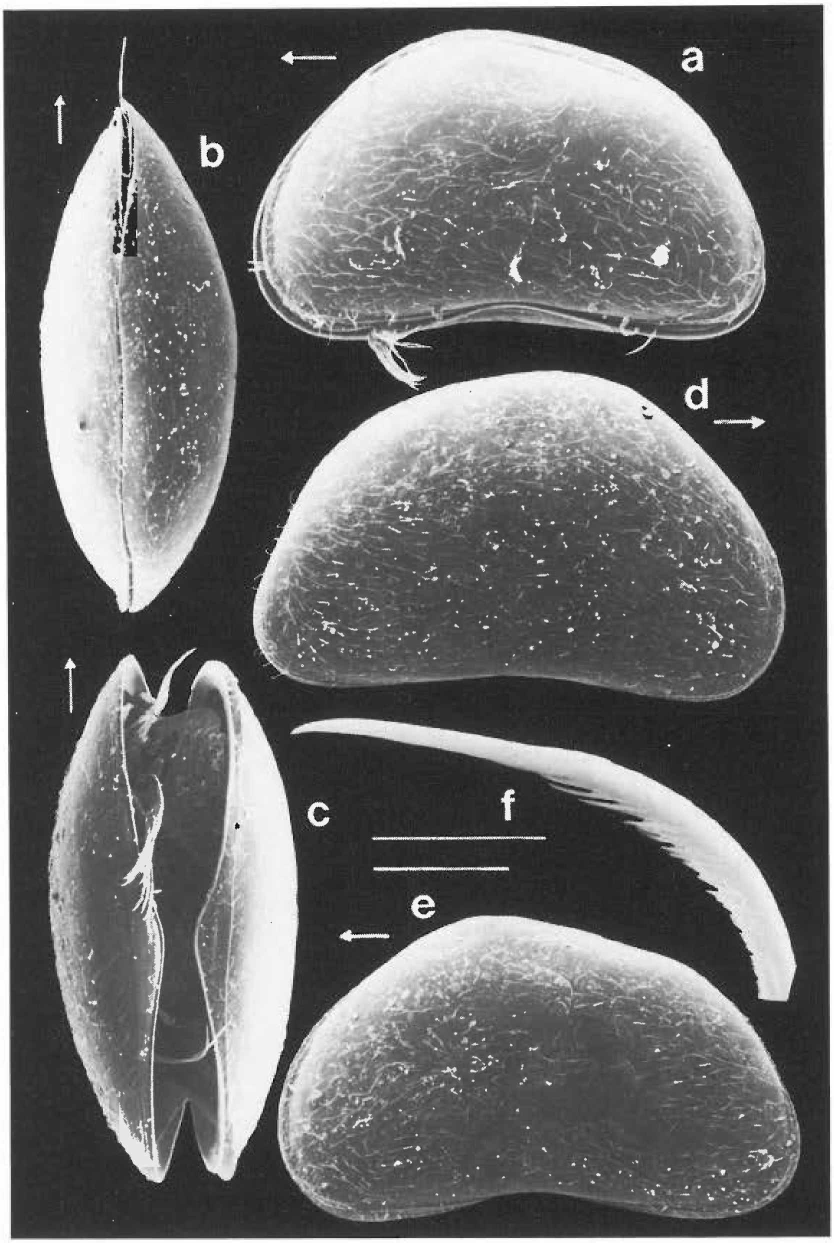

Fig. 2. - *Potamocypris fulva.*

a : Lateral view of the carapace; b : Dorsal view of the carapace; c : Ventral view of the carapace; d : Right valve, external; e : Left valve, external; f : Terminal claw of the T1 (see the well-developed distal spineless point). These specimens from Belgium (forest near Lessines, coll. K. WOUTERS). Large scale = 0,20 mm for a-e. Small scale = 10 μm for f.

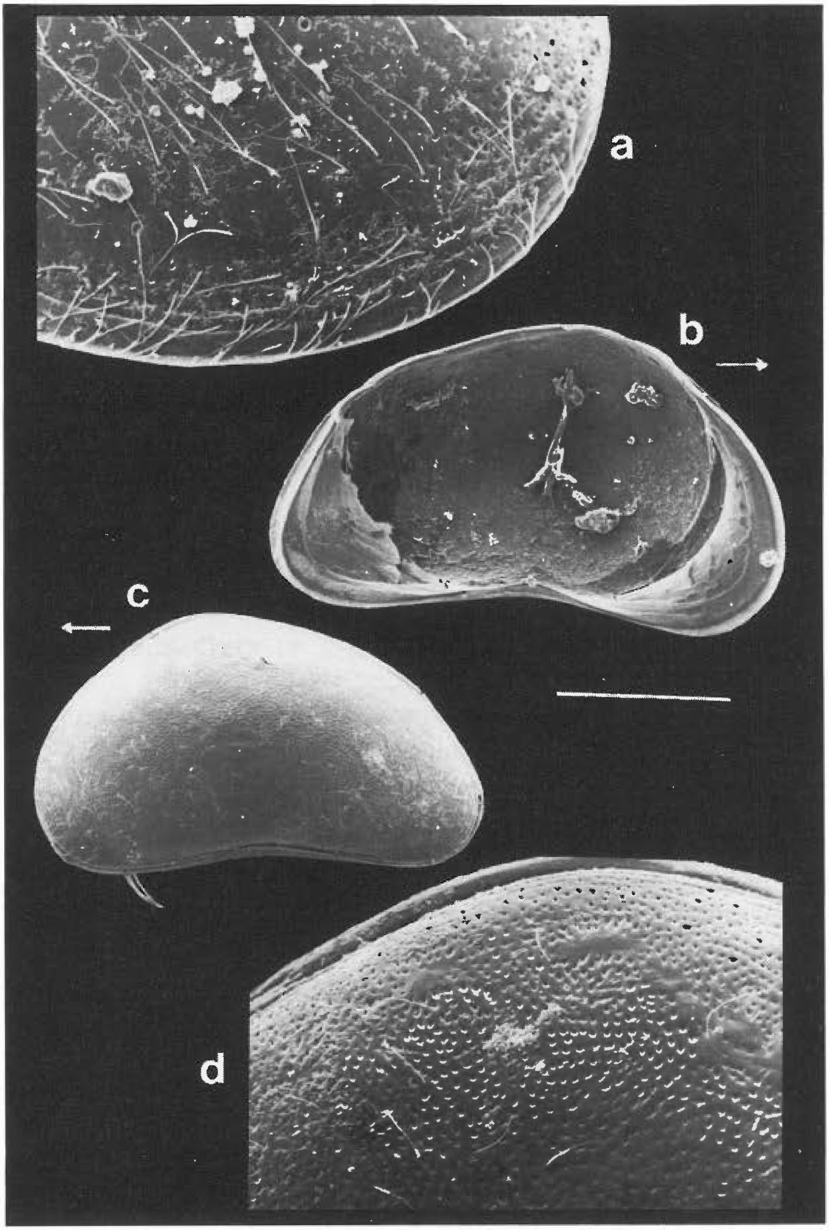

Fig. 3. - *Potamocypris fulva.*

a : Antero-ventral margin of the right valve (see the pores); b : Left valve, internal; c : Juvenile carapace in lateral view; d : Detail of c (see the ornamentation). These specimens from Belgium (small stream in a forest near Lessines, coll. K. WOUTERS). Scale = 50 μm for a and d; = 0,20 mm for b and c.

P. fulva has also been found in springs (KLIE, 1925, isle of Rügen) and the interstitial underground waters (ANGELIER, 1953, in the French Alps, together with *P. pallida*). GHETTI (1973) captured the species in rice-fields in Italy. I did not find it in Luxembourg.

Paleontology: LÜTTIG (1955) reports the occurrence of the species in quaternary sediments (Elster/Saale interglaciation) from Germany. The sub-species *P. fulva fulvoïdes* was described from Miocene sediments in France (CARBONNEL, 1969).

As the taxonomic features of *P. fulva* were not clearly known till now, I rather think that part of the above mentioned occurrences have to be re-examined.

2. POTAMOCYPRIS PALLIDA ALM, 1914

(Figs 4, 5, 6 and 7)

Potamocypris pallida ALM, 1914 : 470 fig. 2; ALM 1915 : 86 fig. 49;
LÖFFLER 1961a : 34-36 [ecology];
LÖFFLER 1961b : 338-339 [synonymy with *P. thienemanni*, ecology];
LÖFFLER 1963 : 198-199 [ecology];
NÜCHTERLEIN 1969 : 268 [ecology];
Potamocypris thienemanni KLIE, 1925 : 270-271 figs 1-3.

TYPE-MATERIAL : The types neither exist at the Museum in Stockholm (communication of Dr Å FRANZÉN), neither in Uppsala (communication of Dr L. WALLIN) where ALM was working. The types have to be considered as having been lost.

TYPE-LOCALITY : Härjedalen : Ransjö, in Sweden.

MATERIAL EXAMINED : Syntypes of *P. thienemanni* (ZMH);
8 samples coming from Germany, Great Britain, France and Italy. See the detailed list in the appendix.

DIAGNOSIS

CARAPACE. In lateral view : shape of striking variability, more or less compact or elongate. In dorsal view : anteriorly the l.v. overlaps the r.v.; posteriorly the l.v. overlaps the r.v.
Marginal zones of the l.v. : anteriorly the outer extension is only lip-like, so that the selvage reaches beyond it (Fig. 7-b); posteriorly there is a well developed outer extension (Fig. 7-c), the selvage being distinctly displaced from the border of the valve.

Surface of adult valves: totally smooth (stereomicroscope and SEM). Size: 0,64-0,75 mm. Colour of shell: green pale, yellowish green.

APPENDAGES. Swset A2 reduced but relatively long, the longest extending to the distal end or at least to the 2/3 of the penultimate segment.
Aesthetasc A2 long: 41-50 μm (less than 38 μm in the related *P. fulva*).
Maxillula (Mx1): terminal segment of the palp with 5 distal spines.
Maxilla (Mx2): one single, long and strong branchial filament.
Thoracopod T1: spineless distal point on the terminal claw less than 6μm long (20-25 μm in *P. fulva*).
Males unknown.

COMPLEMENTS OF DESCRIPTION

The carapace of this species shows a striking variability in lateral view. Some carapace forms are shown in Figs 5-a, b, c, d and 6-a, b. The variability is so large that one might doubt that all these forms belong to the same species. But the totality of the other taxonomic features - on the carapace (especially the structure of the marginal zones) as well as on the appendages - are in perfect agreement. Moreover it is important to note that the carapaces shown in the figures of this work are connected by numerous carapaces of intermediate shape.

The carapace of *P. pallida* is constant in dorsal view: in all the specimens I have examined, the r.v. widely overlaps the l.v. anteriorly; posteriorly the opposite relative position is observed (see Fig. 6-c).

The juvenile valves bear a very fine surface ornamentation which is only visible under the SEM.

The taxonomic unity of all the populations grouped in *P. pallida* is stressed by the existence of a feature which is not found in any of the related species: it is the striking size of the aesthetasc on A2. In *P. pallida* this aesthetasc is 41-50μm long. In the related species, more particularly in *P. fulva,* the aesthetasc has a maximum length of 37 μm. However I think that the constancy of this character, which was hitherto unknown, has to be checked in a greater number of dissected specimens.

RELATIONS

P. pallida is closely allied to *P. fulva.* For the comparison of these 2 species see the table below.

TAXONOMIC DISCUSSION

The original description of *P. pallida* by ALM shows an elongate, kidney-shaped carapace. KLIE (1925) described specimens with a shorter and more rounded carapace (his fig. 13, p. 270) by the name *P. thienemanni*. KLIE's indication on the length of the A2 Swset ("die längste reicht etwa bis zum Beginn des nächsten Antennengliedes") is not correct. I was able to check this feature on the syntypes deposited by KLIE (ZMH, K20743) : in reality these Swset are longer and extend to the distal end of the penultimate segment (this length being characteristic for *P. pallida*). KLIE's erroneous observation is most certainly due to the fact that the tips of these Swset are very fine and difficult to make out.

LÖFFLER (1961b) was the first to suggest the synonymy between *P. pallida* and *P. thienemanni* : his suggestion was based on the examination of specimens having intermediate shapes. Besides, KLIE obviously was aware of the probable synonymy between *P. thienemanni* and *P. pallida*, because 2 of the tubes of his collections are labelled : *"Potamocypris spec. neque thienemanni neque pallida"* (ZMH, 1169 Erzgebirge; 1190 Schlesien).

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

The ecology of *P. pallida* is relatively well known. The species inhabits springs, cold streams flowing from springs and ponds fed by springs. LÖFFLER (1961a and 1961b) points out that the species has only been found in springs having a low concentration in electrolytes; this sort of springs is found in regions with cristalline rocks. Indeed, the species has never been captured in calcareous regions, where the water of springs necessarily is enriched with electrolytes. The locality in the French Pyrenees (still water in a torrent of the mount Canigou), where I sampled the species myself, conforms to LÖFFLER's observation.

ANGELIER (1953) reports the occurence of *P. pallida* in the interstitial underground waters (together with *P. fulva*) in the French Alps.

P. pallida has been found in Sweden (ALM, 1915), in Germany (KLIE, 1925; LÖFFLER, 1961b and 1963; PETKOVSKI, 1962; NÜCHTERLEIN, 1969), in France (ANGELIER, 1953; MEISCH, unpublished, see above), in Czechoslovakia (PETKOVSKI, 1966), in Hungary (FARKAS, 1958, but this observation probably has to be re-examined), in Italy (FOX, 1966), in Great Britain (FRYER, 1955), in Poland (SYWULA, 1974). I found specimens belonging to this species in 2 spirit tubes labelled *"P. fulva"* coming both from the isle of Bute, Great Britain (BMNH, NORMAN collection, 1911.11.8 and HMNT, BRADY collection).

FURTOS (1933) reports the occurence in the U.S.A.; DELORME (1967) found it in Canada.

To my knowledge, it has never been found as a fossil.

TABLE COMPARING P. FULVA TO P. PALLIDA

	P. fulva	*P. pallida*
Surface of carapace:	smooth	smooth
Dorsal view of the carapace:	anteriorly: r.v.>l.v. posteriorly: both valves approximately at the same height or one of the valves overlapping the other; (Fig. 2-b)	anteriorly: r.v.>l.v. posteriorly: l.v.>r.v. (Fig. 6-c)
Anterior and posterior outer extension on the l.v.	this extension more or less obliquely drawn away from the major axis of the shell; (Fig. 2-b,c)	the outer extensions parallel to the major axis of the shell; (Fig. 6-c)
A 2 Swset:	the longest reaching to the middle of the penultimate segment; (Fig. 1-a)	the longest reaching to the 2/3 or the distal end of the penultimate segment; (Fig. 4-a)
A 2 aesthetasc:	of "normal" length: 32-37 μm;	this aesthetasc longer: 41-50 μm;
Mx 1: terminal segment of the palp:	5 distal spines;	5 distal spines;
Mx 2:	1 branchial filament	1 branchial filament
T 1 terminal claw: spineless distal point:	this point well developed (20-25 μm).	this point nearly absent (less than 6 μm).

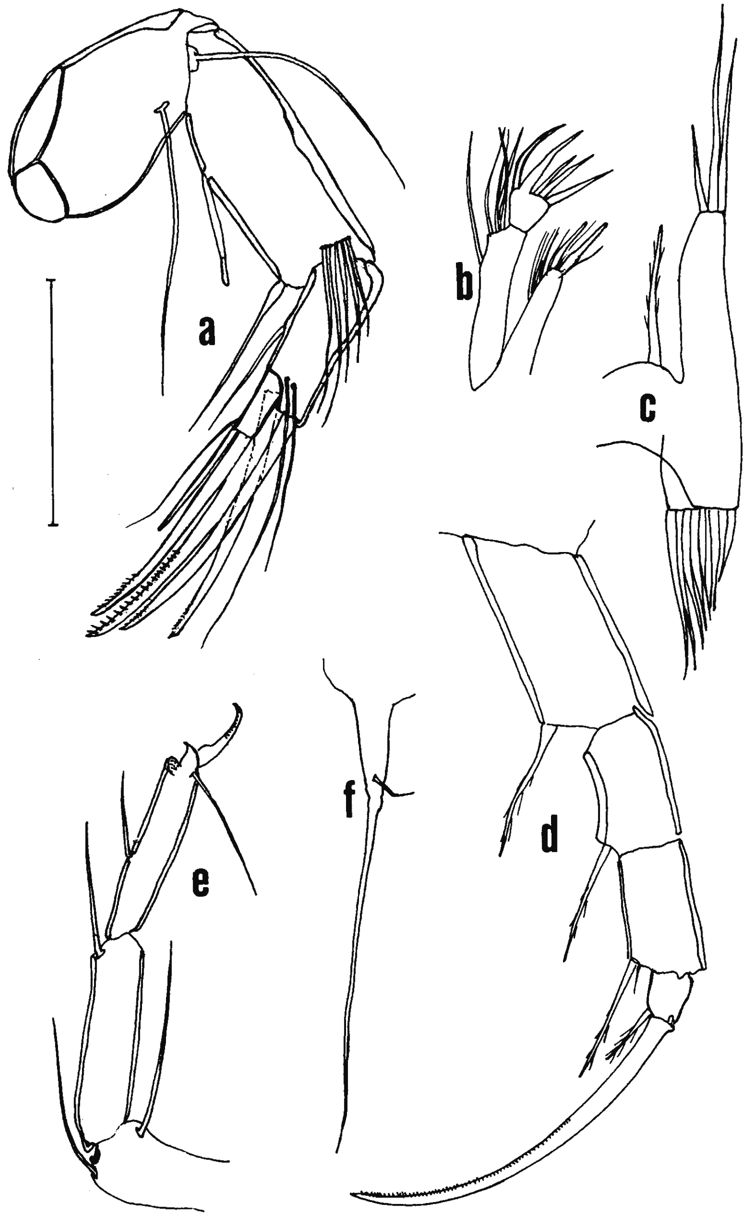

Fig. 4. – *Potamocypris pallida.*

a: Second antenna (A2); b: Palp and 3rd masticatory process of the maxillula (Mx1); c: Maxilla (Mx2); d: Thoracopod T1; e: Thoracopod T2; f: Furcal ramus (Fu). Scale = 100 μm.

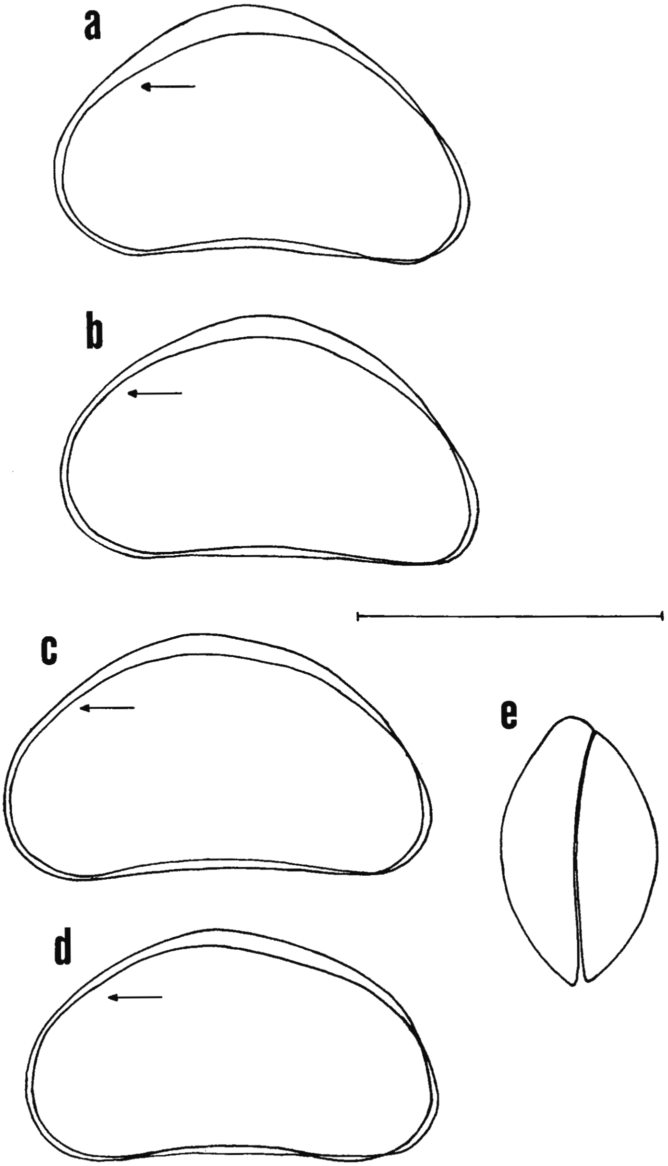

Fig. 5 - *Potamocypris pallida.*

a-d : Variability of the carapace shape (after specimens from the KLIE collection); a : ZMH 1169, "Erzgebirge"; b and c : ZMH 1182, "Sudeten"; d : ZMH 1176, Rumania; e : Frontal view of the carapace. Scale = 0,50 mm for all.

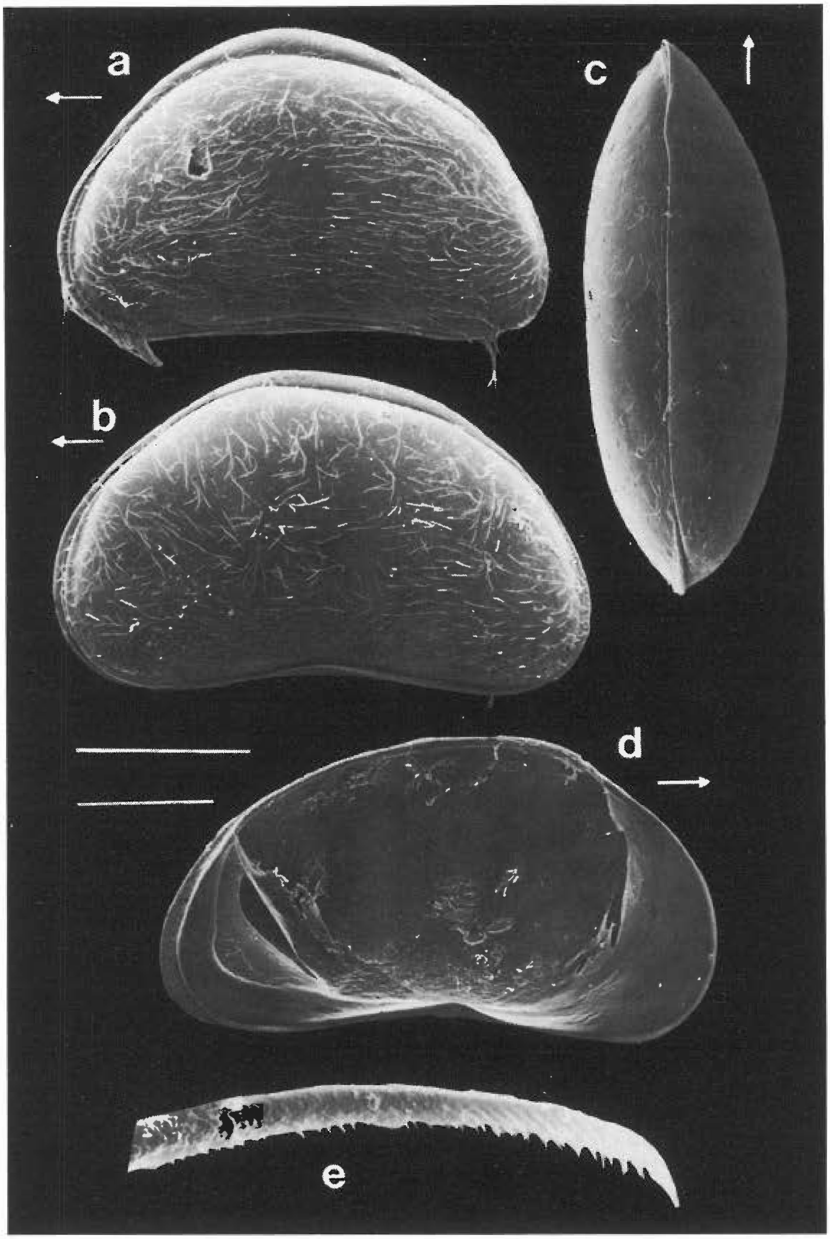

Fig. 6. – *Potamocypris pallida.*

a and b : Lateral view of the carapace; c : dorsal view of the carapace; d : Left valve, internal; e : Terminal claw of the thoracopod T 1 (see the absence of a well-developed spineless point). Specimen a is a syntype specimen of *P. thienemanni* (ZMH), the remaining specimens from the Pyrenees. Large scale = 0,20 mm for a-d. Small scale = 10 μm for e.

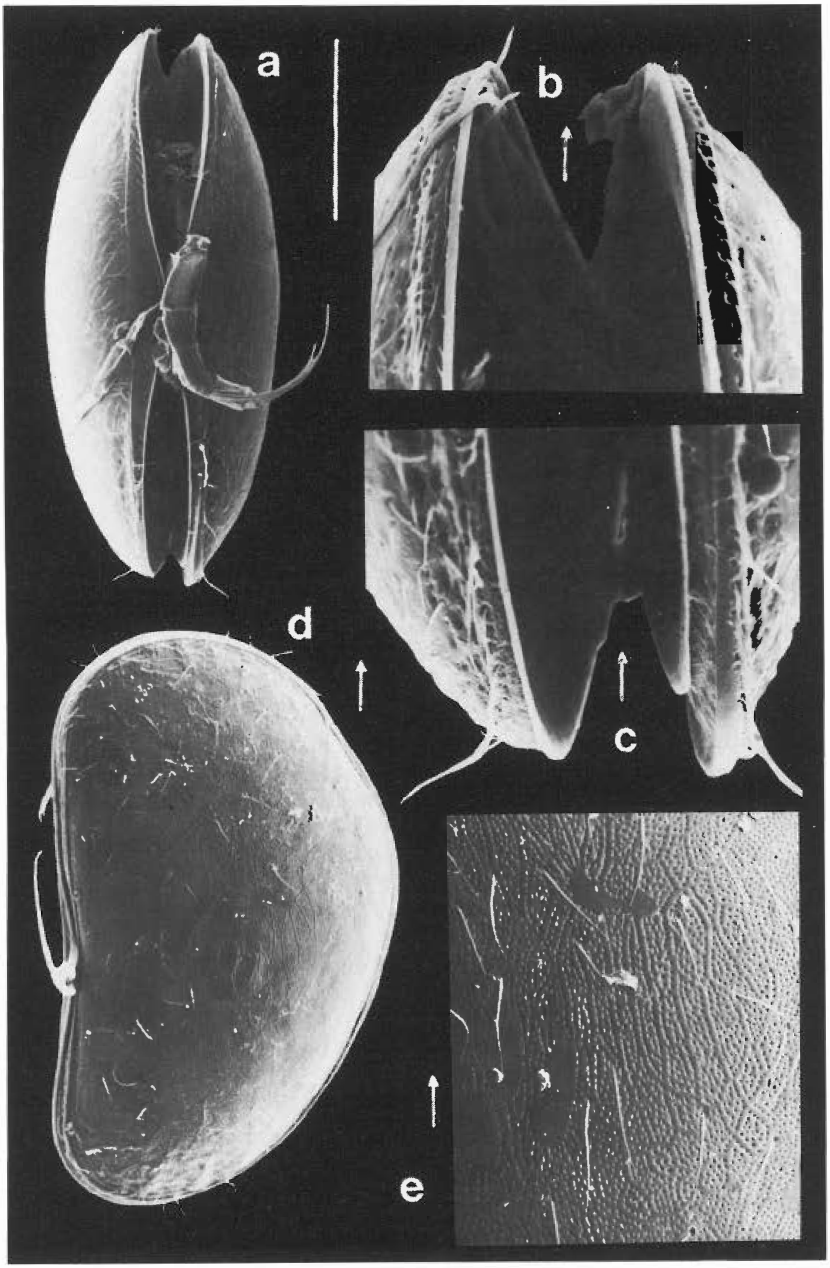

Fig. 7. – *Potamocypris pallida.*

a : Ventral view of the carapace; b : anterior detail of a; c : posterior detail of a; d : Juvenile carapace in lateral view; e : Detail of the ornamentation of a juvenile valve. These specimens from the Pyrenees. Scale = 0,20 mm for a; = 50 μm for b, c and e; = 0,10 mm for d.

3. POTAMOCYPRIS ZSCHOKKEI (KAUFMANN, 1900)
(Figs 8-11)

Paracypridopsis zschokkei KAUFMANN, 1900 : 317, pl. 19 figs 18-20 and pl. 22 figs 26-30;
Potamocypris hambergi ALM, 1914 : 473; ALM 1915 : 86 fig. 50a-d; KLIE 1925 : 268-270;
Potamocypris hambergi rotundata ALM, 1915 : 87-88 fig. 51;
Potamocypris wolfi BREHM, 1920 : 6;
Potamocypris compacta KLIE, 1925 : 271-272 figs 4-5;
Non *Potamocypris wolfi* BRONSTEIN 1924 and 1947 : 167 fig. 85;
Potamocypris wolfi sensu KLIE 1938 : 141-142 figs 473-476;
Potamocypris pyrenaica MARGALEF, 1947 : 166-168 figs 1-2;
Potamocypris wolfi pyrenaica MARGALEF, 1953 : 164;
Potamocypris foxi SYWULA, 1972 : 247 (*nowen novum*);
? Potamocypris tarnogradskyi BRONSTEIN, 1928 : 79; BRONSTEIN 1947 : 167.

TYPE-MATERIAL : 7 syntype specimens (4 ad. and 3 juv. females, MHNG).

DESIGNATION OF LECTOTYPE : The adult syntype female which I have dissected : soft parts on a microscopic slide in PVLP, valves in a separate spirit tube. This lectotype deposited in MHNG).

TYPE-LOCALITY : Switzerland, canton St. Gallen; environs of Buchs in the Rhine valley.

MATERIAL EXAMINED : Syntypes deposited by KAUFMANN; the single syntype specimen of *P. hambergi* still existing (ZMH); topotypes of *P. wolfi*; the single type specimen of *P. compacta;* the whole of the specimens which served KLIE (1925 and 1938) for the redescription of *P. wolfi;* 2 syntype specimens of *P. pyrenaica*[1].
On the whole 13 samples coming from Sweden, Switzerland, Germany, Great Britain, France, Spain, Turkey and Luxembourg. See the detailed list in the appendix.

IMPORTANT LITERATURE : WOLF (1920), KLIE (1925), GRAF (1938), MARGALEF (1953), NÜCHTERLEIN (1969) : ecology.
DIEBEL& WOLFSCHLÄGER (1975), DIEBEL & PIETRZENIUK (1975 and 1978) : paleontology.
MARGALEF (1947) : description of the male.

DIAGNOSIS (FEMALES)

CARAPACE. Surface of adult valves with numerous irregular pits. In dorsal view : anteriorly the r.v. mostly overlaps the l.v. (rarely both valves reach to the same height, exceptionally the l.v. overlaps the r.v.); posteriorly the l.v. always overlaps the r.v.

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[1] Dr Ramon MARGALEF (Barcelone) was so kind as to send me these 2 type specimens (mounted on a slide) as a present (1 male and 1 female). This preparation is incorporated in the collections of the Museum of Natural History in Luxembourg.

Marginal zones of the l.v.: anterior zone with a small outer extension, which reaches little beyond the selvage; posteriorly there is a well marked outer extension (selvage markedly displaced towards the inner part of the shell).
Size: 0,65 - 0,76 mm, more rarely up to 0,85 mm. Colour of shell: palish green to dark green.

APPENDAGES. A2 with short Swset, the longest reaching the middle of the penultimate segment.
Maxillule Mx1: terminal segment of the palp with 5 distal spines.
Maxilla Mx2: respiratory plate with 2 branchial filaments.
Populations with both sexes in the Pyrenees; parthenogenetic populations in all the other known localities.

COMPLEMENTS OF DESCRIPTION (FEMALES ONLY)

CARAPACE

1. The ornamentation in adult specimens somewhat recalls the aspect of an orange-peel. The pits are visible (sometimes with some difficulty) under the stereomicroscope. Magnifying power: 40-80X. For the juvenile carapace: see below.

2. Carapace shape and variability:
a) In lateral view the carapace shows a well marked variability, so that several "forms" or "varieties" may be distinguished. Typically, the carapace is stretched, elongate: This form, which I shall call "E" (for elongate) shows a height/length relation (H/L) of the carapace which goes from about 0,50 to 0,55. Other specimens have a carapace which is distinctly shorter, compacter (this form will be called "C"): H/L equals or even exceeds 0,58 (see Fig. 9-a, b, c, d). In actual fact, all the possible intermediate forms between E and C are found and I should like to point out that no particular taxonomic status has to be given to the forms E and C (this remark also applies to the forms R, LR and L described below). The description of these forms simply allows to give an outline of the carapace's variability. Form E is the most frequent form; the extreme forms E and C coexist in some populations (for instance in the samples collected by KLIE, 1925, in Holstein, Germany). KLIE (1925) created the species *P. compacta* based on one single "C" specimen found in a spring on the isle of Rügen (see also the discussion below).

b) In dorsal view: posteriorly the l.v. overlaps always the r.v. Anteriorly, the relative positions of the valves allow to recognize 3 distinct forms : The form which may be called R (for right) where the r.v. overlaps the l.v.; the L-form where the l.v. overlaps the r.v. and finally, the intermediate LR-form where both valves come to the same height in front. The R-form is the most widespread; I have found the LR-form in small numbers in several populations of the examined material. The L-form on the contrary seems to be rather rare : I found only a few specimens belonging to this form in a population sampled in Luxembourg (5 L-specimens among about 500 R-specimens). The figures 9-e (R-form), 9-f (LR-form) and 9-g (L-form) clearly show that there is no difference in the structure of the valve's marginal zones, as might have been expected. Such differences, if they existed, would in my opinion justify the specific separation of these forms. (Remark : the above mentioned figures represent schematic frontal sections through the anterior part of the carapace. The figures have been drawn from SEM photographs of valves and ventral views of open shells).

I would like to point out that the L-form of *P. zschokkei* must not be confused with the species *P. fallax* in which the l.v. also anteriorly overlaps the r.v., but where the anterior marginal zone of the l.v. shows distinct structure (this structure is shown for comparison on Fig. 9-h).

As a conclusion I would like to point out that the R, L and LR forms described here only differ by the relative positions of both valves in the anterior part of the carapace and not by the structure of the valve's marginal zones. I would tentatively suggest that the L-form is a rare mutant form. The carapace variability described here had not yet been studied.

3. Carapace of juveniles : it is distinctly more stretched, elongate than in the adults. The surface of the valves bears delicate ribs deliminating pits. These ribs form a sort of net which may be seen under the stereomicroscope (40-80X), but which is best seen under the SEM (fig. 11-d,e). The ornamentation of adult valves seems to be elaborated by irregular reinforcement of the juvenile ribs.

A thorough knowledge of the ornamentation and the shape of the juvenile carapace should avoid confusions with related species.

4. The furcal ramus bears a posterior seta which is strongly developed and which is often bent upwards at right angle in the middle or closer to its tip. But this bend is absent in numerous specimens : the form of this seta quite evidently lacks any taxonomic significance (contrary to BREHM's 1920 and MARGALEF's 1947 and 1953 opinions).

PARTHENOGENETIC AND SEXUAL REPRODUCTION

The discovery in the Spanish Pyrenees by MARGALEF (1947 *sub P. pyrenaica* and 1953 *sub P. wolfi pyrenaica*) of populations having both sexes deserves the full interest of biologists. Indeed until now this is the first time that the males of this species have been captured: the very numerous other European localities where the species has been sampled seem to be inhabited by females only.

The commonly accepted hypothesis is that the parthenogenetic forms of a given species show a larger ecological tolerance than the forms which possess sexual reproduction. This makes that the parthenogenetic forms are able to spread and to reproduce in localities where the populations with sexual reproduction do not survive. This hypothesis is eventually verified by *P. zschokkei* in the Pyrenees. According to MARGALEF (1953) the populations which include both sexes occur in localities situated above 1400 m (maximum 2600 m).[1] Males are as numerous as females. The parthenogenetic populations on the contrary are found in localities situated below 1300 m.

This suggests that the high mountain regions (and localities offering similar ecological conditions, such as for instance the surroundings of continental glaciers during the glaciation eras) offer optimum conditions to this species, allowing the populations having sexual reproduction to survive.

If this is correct, then the populations which include males and females have to be considered as being relic populations which, after the end of the last glaciation, found a refuge in some Pyrenean regions situated above 1400 m. Given the interest of parthenogenesis in general biology as well as in ecology, the exact distribution of these 2 forms of *P. zschokkei* in the Pyrenees would deserve a more detailed study. Furthermore, the presence or absence of populations including males should be re-examined in the high mountain regions of the Alps.

RELATIONS

P. zschokkei may be distinguished from *P. pallida* and *P. fulva* by the surface ornamentation of the valves (valves with pits in *P. zschokkei*,

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[1] Here are MARGALEF's (1947) exact indications on the place where he found these populations: Province Gerona, La Molina Segremorta; different affluents of the river Alp.

smooth adult valves in both other species) and the respiratory plate of Mx2 (2 branchial filaments in *P. zschokkei,* 1 filament in both other species).

P. zschokkei is closely allied to *P. fallax* FOX. The soft parts of these species are identical, except for one character : the A1 Swset are longer in *P. zschokkei* than in *P. fallax.* (This feature is new in the literature). I measured the length by which the longest Swset overlap the distal end of the antennula. This measurement is 270-330 μm in *P. zschokkei* and 165-230μm in *P. fallax.* (See also the table below which compares these 2 species and the chapter "relations" *sub P. fallax*).

P. zschokkei may be readily distinguished from *P. similis* by the Mx1 : 5 distal spines on the palp in *P. zschokkei,* 4 in *P. similis.* In dorsal view the carapace of *P. zschokkei* is slender, in *P. similis* it is nearly ovoid.

TAXONOMIC DISCUSSION

The taxonomic history of *P.zschokkei* is somewhat agitated. This is essentially due to the fact that 2 most important taxonomic features, namely the presence of pits on the valves and the relative position of the valves in dorsal view, are missing in KAUFMANN's original description. The taxonomic history is recalled and discussed here, which allows me to justify the synonyms I have adopted.

1. The description of *P. hambergi* by ALM (1914) was based on a sample of specimens coming from swamps of the mount Sarek in Lappland (Sweden). The types of this species neither exist in the Museum in Stockholm (communication of Dr Å FRANZÉN) nor in Uppsala (communication of Dr L. WALLIN) where ALM was working. But in the collections deposited by KLIE, there is a tube (ZMH 1158) with one single specimen labelled : "Potamocypris hambergi, Nordschweden : Sarek, fide J.P. WOLF". Knowing that the Sarek mountains are the type-locality of *P. hambergi* and that WOLF (1920 : 48) writes that he got some *P. hambergi* specimens from ALM, there can no longer be any doubt about the fact that the single specimen in tube 1158 in the KLIE collection is a syntype specimen of *P. hambergi.* The examination of this specimen proves that it belongs to *P. zschokkei.*

KLIE (1925) writes that he found *P. hambergi* together with *P. wolfi (=P. zschokkei)* in springs from Holstein (Germany). But these specimens are *P. zschokkei* specimens with elongate carapaces, as I could convince myself.

2. BREHM (1920) describes *P. wolfi* with few words and without giving any figure. He characterizes the species essentially by its strong posterior seta on the furcal ramus, this seta being bent upwards at right angle. As I showed above, this character is highly variable (the seta is often straight). The types of *P. wolfi* are absent in Plön (Hydrobiologische Anstalt, now Max-Planck-Institut für Limnologie) where BREHM was working. BREHM in general did not keep or deposit type-material of the new species he described (communication of Dr W. HOFMANN, Plön). It was the examination of the topotypes which allowed me to check the synonymy with *P. zschokkei.* These topotypes (coll. KLIE, ZMH 20742) come from the exact spring (near the "Dieksee") in which BREHM sampled the lost type-material of *P. wolfi* : this spring is designated DIV (see BREHM, 1920; KLIE, 1925 and THIENEMANN, 1922 for the designation of the springs around the "Dieksee").

3. BRONSTEIN (1924 and 1947) redescribed *P. wolfi* coming from Russia. (I was not successful in locating BRONSTEIN's collections, if they still exist). But this redescription obviously applies to a different species *(P. fallax)*. This is proved by the dorsal view of the carapace (see BRONSTEIN, 1947 : 166-167) : the l.v. distinctly overlaps the r.v. in front.

4. KLIE (1938) redescribed *P. wolfi*. The material he examined came from Northern Germany and included topotype-material of the species. (I have myself examined the whole of this material which is deposited in ZMH). This redescription was published in the most widely used reference book for European freshwater Ostracods and has been used as the means of recognizing the taxon until now.

5. KLIE (1925) based his description of *P. compacta* on one single specimen found in a spring on the Isle of Rügen (Baltic Sea). According to KLIE (1925 and 1938) this species differs only in a single feature from *P. wolfi*: it has a carapace which is distinctly more compact in lateral view. To my knowledge no other author reported the capture of *P. compacta* in the literature. On the other hand, KLIE (1925 : 269) himself, when examining his *P. wolfi* specimens from Germany notes the presence of at least one other specimen having a compact carapace : "... in L.I neben 3 Exemplaren mit typischem Schalenumriß auch ein Tier mit auffallend kurzer und hoher Schale". KLIE (1925) however ranged this specimen among *P. wolfi*. I was able to verify that KLIE's *P. wolfi* collections from Northern Germany (for a detailed list of this material see the appendix, *sub P. zschokkei* : b-f) include some further specimens belonging to the C-form of *P. zschokkei;* these specimens were not mentioned by KLIE (1925). The valves of the single type-specimen (ZMH 1178) clearly show the same structure of the marginal zones than in *P. zschokkei*. The C-form obviously forms part of the variability field of *P. zschokkei*. I think this eliminates any doubt about the synonymy *P. compacta - P. zschokkei*.

6. *P. foxi* SYWULA 1972 is a *nomen novum* for *P. wolfi* sensu KLIE 1938. As *P. wolfi* sensu BRONSTEIN 1924 is not identical with *P. wolfi* sensu KLIE 1938, SYWULA (1972 : 247) gives priority to the redescription given by BRONSTEIN in 1924. So one should have : *P. wolfi* sensu BRONSTEIN = *P. fallax* FOX and logically *P. wolfi* sensu KLIE has to be renamed, the new name being *P. foxi*. Fortunately the adoption of this new name becomes unnecessary after the establishment of the synonymy *P. wolfi* sensu KLIE = *P. zschokkei* in this revision.

7. Unfortunately I was not successful in locating the collections of BRONSTEIN : so I was not able to examine the type-material of *P. tarnogradskyi*. This species shares with *P. zschokkei* the following features : valves with pits, the same dorsal view (= anteriorly the r.v. overlaps the l.v., posteriorly the opposite), A2-Swset reaching to the middle of the penultimate segment, Mx2 with 2 branchial filaments. The ecology is similar : springs and ponds fed by springs.

I am inclined to believe that the synonymy between these 2 names is most probable. This synonymy becomes all the more plausible if one is aware that BRONSTEIN gave the name *P. wolfi* to the species which is now called *P. fallax*. So BRONSTEIN needed a new name for *P. wolfi* sensu KLIE : this name was *P. tarnogradskyi*.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

P. zschokkei is a stenotherm species occuring in cold waters (optimum temperature probably near 9° C for the parthenogenetic form). It shows preference for shallow, slowly running waters. It has been found in springs, in waters flowing from springs and in ponds fed by springs.

In the high mountain regions it has been found above the altitude of 2000 m in the Alps (ZSCHOKKE, 1900). Populations including males are known from the Spanish Pyrenees (MARGALEF, 1947 and 1953; see also above).

P. zschokkei has been found in all the European countries where its presence has been checked. I sampled it myself in Luxembourg (in a ditch flowing from an abandoned railway tunnel near Hobscheid) and in South-western France (in several wash-houses in the Dordogne valley).

The species is well known from holocene sediments found in East Germany (see DIEBEL & PIETRZENIUK, 1975, 1978). The calcareous sediments in which the fossil *P. zschokkei* specimens are embedded have been deposited in the surroundings of springs.

NEGADAEV-NIKONOV (1968) has described the subspecies *P. wolfi faveolata* occurring in alluvial sediments dating from Pleistocene.

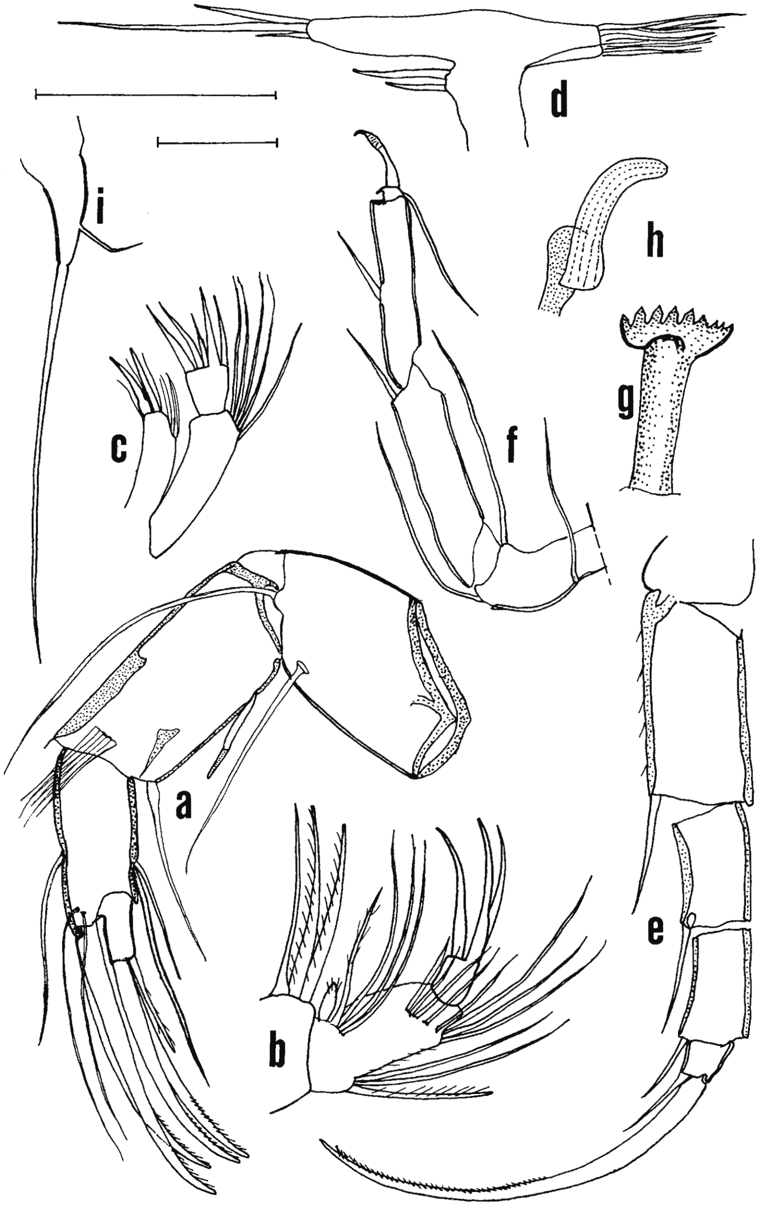

Fig. 8. – *Potamocypris zschokkei.*

a : Second antenna (A 2); b : Chaetotaxy of the mandibular palp; c : Palp and 3rd masticatory process of the maxillula (Mx1); d : Maxilla (Mx2); e : Thoracopod T1; f : Thoracopod T2; g : Rake-like organ; h : genital hook of the female; i : Furcal ramus (Fu). Large scale = 100 m for a-f and i. Small scale = 25 μm for g and h.

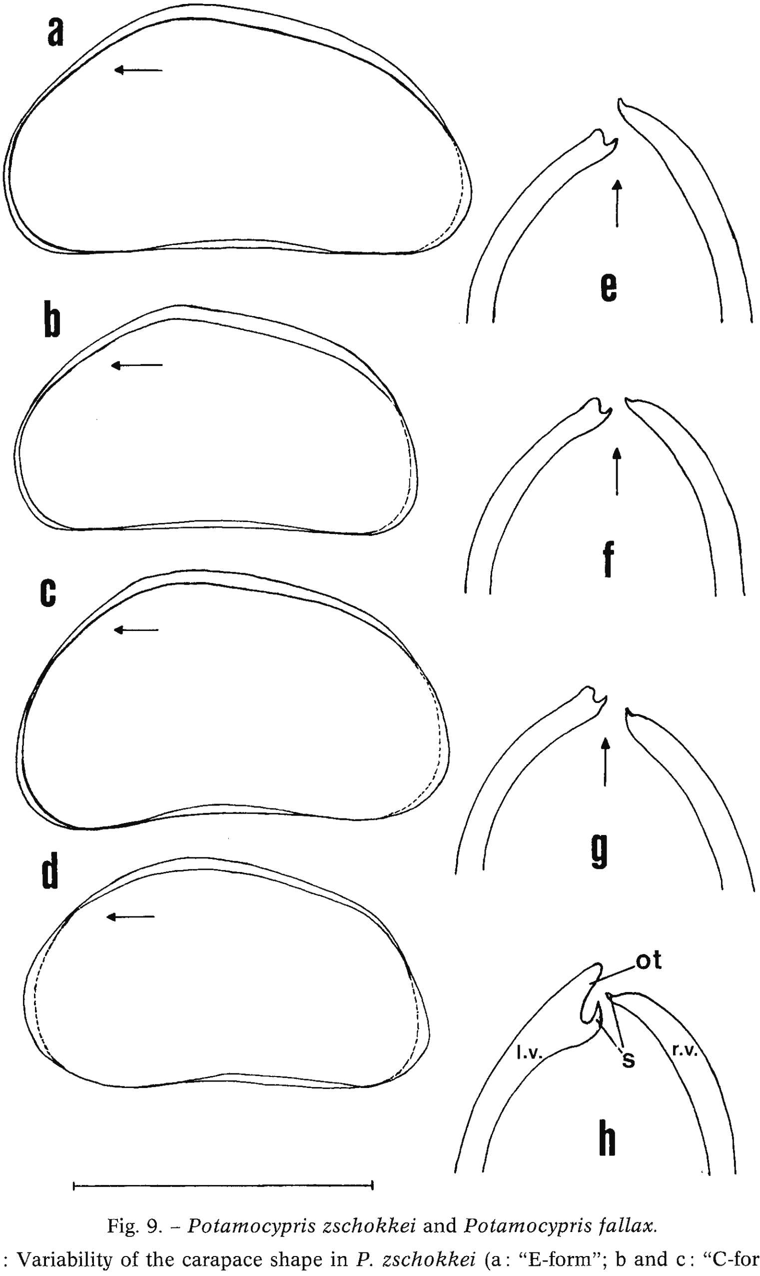

Fig. 9. – *Potamocypris zschokkei* and *Potamocypris fallax.*

a-c: Variability of the carapace shape in *P. zschokkei* (a: "E-form"; b and c: "C-form"; a and c: ZMH 1165, Holstein, Germany; b: ZMH 1166 "Waldecker Quellen"); d: *P. fallax* (ZMH 1164, "Sperlingsberge" near Moscow); e-h: Anterior frontal sections through the carapace of *P. zschokkei* (e-g) and *P. fallax* (h); s=selvage; ot="outer extent" of the l.v. (for explanations see the text). Scale (for a-d only) = 500 μm.

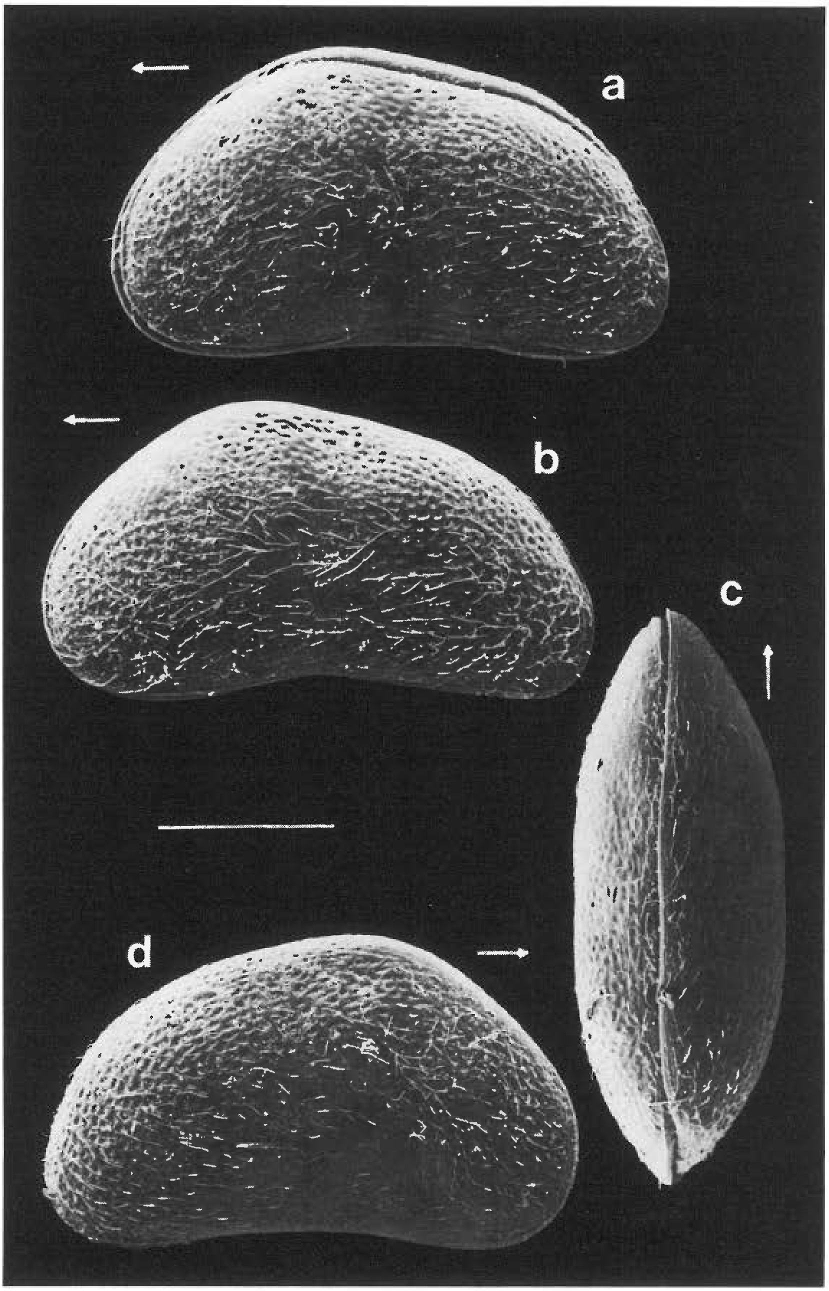

Fig. 10. - *Potamocypris zschokkei.*

a : Carapace in lateral view; b : Left valve, external; c : Dorsal view of the carapace; d : Right valve, external. These specimens from Luxembourg. Scale = 0,20 mm.

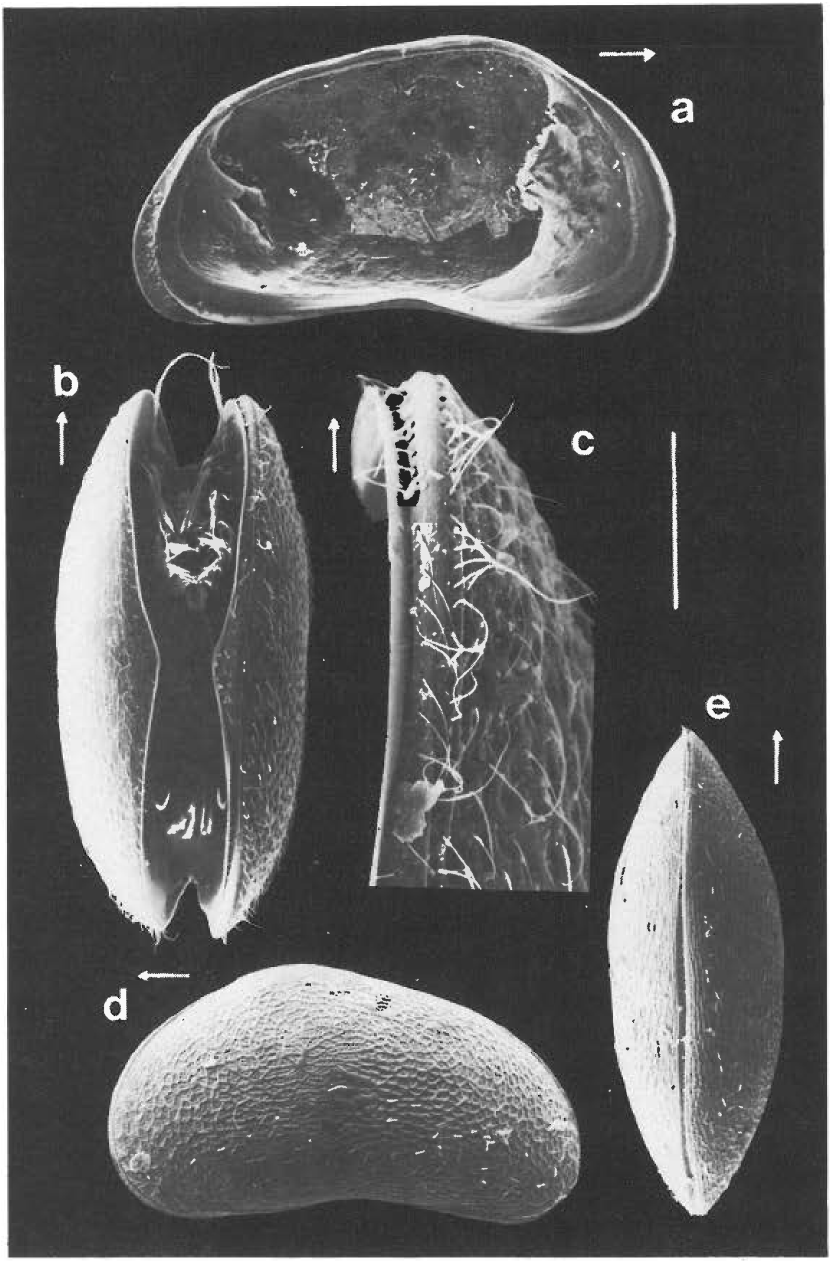

Fig. 11. – *Potamocypris zschokkei.*

a : Right valve, internal; b : Ventral view of the carapace; c : Antero-ventral part of the l.v.; d : Juvenile carapace in lateral view; e : Juvenile carapace in dorsal view. These specimens from Luxembourg. Scale = 0,20 mm for a, c, d and e; = 0,10 mm for c.

4. POTAMOCYPRIS FALLAX (Fox, 1967)

(Figs 12 and 13)

Potamocypris fallax Fox, 1967 : 555-557, fig. 5;
Potamocypris wolfi sensu Bronstein 1924 : 94 and 1947 : 167, fig. 85;
non *Potamocypris wolfi* sensu Klie 1938 : 141-142, figs 473-476;
Potamocypris cf. wolfi in Hartmann 1964 : 67.
Potamocypris wolfi sensu Sywula 1974 : 245;
?Potamocypris hambergi rotundata Alm, 1915 : 87, fig. 51.

TYPE-MATERIAL: Numerous syntype specimens deposited by Fox (BMNH); for the complete list see Fox, 1967 : 557.

DESIGNATION OF LECTOTYPE: The lectotype is chosen among the syntype specimens coming from Malham Tarn (Yorkshire, England) : BMNH 1967.4.3.8. Fox collection. Soft parts mounted in PVLP on a slide, valves in a micropaleontological slide (BMNH).

TYPE-LOCALITY: I propose to restrict the type-locality to Malham Tarn (Yorkshire, England) where the lectotype comes from.

MATERIAL EXAMINED: The syntype specimens coming from Malham Tarn (England); 5 other samples coming from England, Scotland, Germany, Soviet Union and Turkey. (See the detailed list in the appendix).

DIAGNOSIS

CARAPACE. Surface of adult valves smooth (stereomicroscope and SEM). In dorsal view, the l.v. overlaps the r.v. in front and behind. Marginal zones of the l.v.: anteriorly and posteriorly with a well developed, lobe-like outer extension; selvage anteriorly and posteriorly distinctly displaced from the border of the valve.
Carapace size: 0,66 - 0,78 mm. Colour: pale green, dark green.

APPENDAGES. Swset on A1 relatively short, the longest extending 220 μm (maximum) beyond the distal end of the antennule (minimum 270 μm in *P. zschokkei*).
The other appendages as in *P. zschokkei.*
Males unknown.

COMPLEMENTS OF DESCRIPTION

CARAPACE. In lateral view, the carapace shape is variable: some carapaces are elongate, others are more compact. This variability strongly recalls that of *P. zschokkei.*

On the contrary, the relation of the valves in dorsal view is invariable : the l.v. overlaps the r.v. in front and behind.

Juvenile carapace : the juvenile valves appear to be smooth in the stereomicroscope (40-80X); but under the SEM a delicate ornamentation is seen (Fig. 13-d,e,f). This ornamentation disappears on the adult valves (Fig. 12-c,d).

RELATIONS

For a long period *P. fallax* was not distinguished from *P. zschokkei* (see also the discussion *sub P. zschokkei*). The most significant taxonomic feature differentiating both species is found on the anterior marginal zone of the l.v. : in *P. fallax* this marginal zone bears a well developed, lobe-like outer extent; in *P. zschokkei* this outer extent is poorly developed, lip-like. This difference may be seen in Fig. 9-e, f, g, h, which represent frontal sections through the anterior part of the carapace. Among the very numerous specimens coming from distant European regions, I did not find a single specimen showing intermediate carapace features. This is the reason why I am convinced that *P. fallax* and *P. zschokkei* are “good” species.

P. zschokkei and P. fallax may also be recognized in lateral and dorsal view of the carapace. *P. zschokkei* in general shows a well-marked postero-dorsal angle in the lateral view, this angle being more rounded in *P. fallax.* In dorsal view, the carapace of *P. zschokkei* is somewhat sharp-pointed on both ends, *P. fallax* being more rounded. But often these features are not very useful because there is an overlapping variability.

On the antennule A1 I was able to find out a feature allowing to separate the soft parts of *P. zschokkei* and *P. fallax* (this had not been possible until now) : it is the absolute length of the A1 Swset (in fact I measure the length by which the longest Swset extend beyond the distal end of the antennula). In spite of a well-marked intraspecific variability, I am able to range each of the specimens I have dissected into the “correct” species. (For precise values, see the diagnosis above). However I think that this feature has to be checked on a larger number of dissected specimens.

Juvenile specimens of *P. zschokkei* and *P. fallax* may be distinguished easily under the stereomicroscope (40-80X) by the ornamentation of the valves: smooth valves in *P. fallax,* valves with a net of delicate ribs in *P. zschokkei.*

TAXONOMIC DISCUSSION

1. *P. fallax* was for a long period confused with *P. zschokkei.* BRONSTEIN (1924) first described the species, but he believed his specimens to belong to *P. wolfi* BREHM : the figures (see especially the dorsal view in BRONSTEIN 1947 : 166) of this author clearly show that the species which he examined is *P. fallax* and not *P. wolfi* sensu KLIE 1938 : the l.v. overlaps the r.v. in front, the surface of the valves is smooth. FOX (1965a and 1967) was the first to separate these 2 closely allied species, which he found together in several localities (after FOX the specific name "fallax" has to refer to the near relation of this species with *P. zschokkei*).

2. It may be that *P. hambergi rotundata* ALM, 1915 is synonymous to *P. fallax.* Both "forms" share the following features : carapace more rounded in lateral view (with a more or less well-marked postero-dorsal angle in *P. zschokkei*) and also more rounded on both ends in the dorsal view (the carapace of *P. zschokkei* often is more sharp-pointed in dorsal view). ALM's description of this subspecies was based on the examination of specimens included in the LILLJEBORG collection deposited in the Museum in Stockholm, these specimens coming from Sweden (Jämtland : Ostersund). But ALM did not label any of LILLJEBORG's tubes with the name *P. hambergi rotundata* (communication of Dr L. WALLIN) so that it is no longer possible to find the type-material of the subspecies. But the name *"rotundata"* should have priority over *"fallax"*. As this synonymy, however, is dubious and as the type-material of *P. hambergi rotundata* is not available, my proposal is to let the name *P. hambergi rotundata* fall into oblivion *(nomen oblitum)*. Besides, to my knowledge this name has not been used in the literature since 1915.

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

As *P. fallax* was not recognized as a separate species until recently, its ecology is rather badly known. The species having been found together with *P. zschokkei* (FOX, 1964 and 1967), it seems to share at least partly the ecology of that species : both live in springs and waters flowing from springs.

P. fallax is known from Great-Britain (FOX, 1965 a and 1967), from Scotland (some of the specimens labelled *"P. fulva"* by G.S. BRADY, deposited HMNT, det. C. MEISCH), from Poland (SYWULA, 1974 : 245, called *P. wolfi*), from Turkey (HARTMANN, 1964, called *P. cf. wolfi*) and from Soviet Union (BRONSTEIN, 1924 and 1947, called *P. wolfi;* for the determination by BRONSTEIN, see the discussion above).

Tube 1164 (labelled *P. wolfi*) deposited by KLIE (ZMH) includes about 20 specimens of *P. fallax* captured in springs of the "Sperlingsberge" near Moscow (see KLIE, 1925 : 250).

Tube 1167 (labelled *P. wolfi*) of the same KLIE collection (ZMH) includes 10 specimens of *P. fallax,* which had been captured by KLIE in a spring near Pyrmont, Germany (see KLIE, 1925 : 251). This is the first time that *P. fallax* is reported from Germany.

Fossil specimens of *P. fallax* have been found in quaternary (late and postglacial) sediments in the CSSR and/or in Bavaria (Germany) (ABSOLON, 1973 : 52, fig. 12 p. 71; the author speaks of *P. zschokkei* but his figure 12 shows quite obviously the carapace of *P. fallax* : in front, the l.v. overlaps distinctly the r.v.; anterior marginal zone of the l.v. with a well-marked outer extension). This material should be re-examined to show if all or only part of the samples recorded by ABSOLON belong to *P. fallax*. The fossil specimens were embedded in sediments which had been deposited in springs.

TABLE COMPARING P. ZSCHOKKEI WITH P. FALLAX

	P. zschokkei	*P. fallax*
Surface ornamentation of the valves (40-80 X)	Valves with pits (ad. and juv.)	Valves smooth (ad. and juv.)
Dorsal view of the carapace	anteriorly : r.v. > l.v. r.v. = l.v. (rare) l.v. > r.v. (very rare)	anteriorly : l.v. > r.v.
Anterior marginal zone of the l.v.	outer extension small, lip-like (Figs 9-e, 11-c)	outer extension strongly developed, lobe-like (Figs 9-h, 13-b)
Antennule A1 : length by which the longest Swest reach beyond the A1.	l = 270-330 μm	l = 165-230 μm.

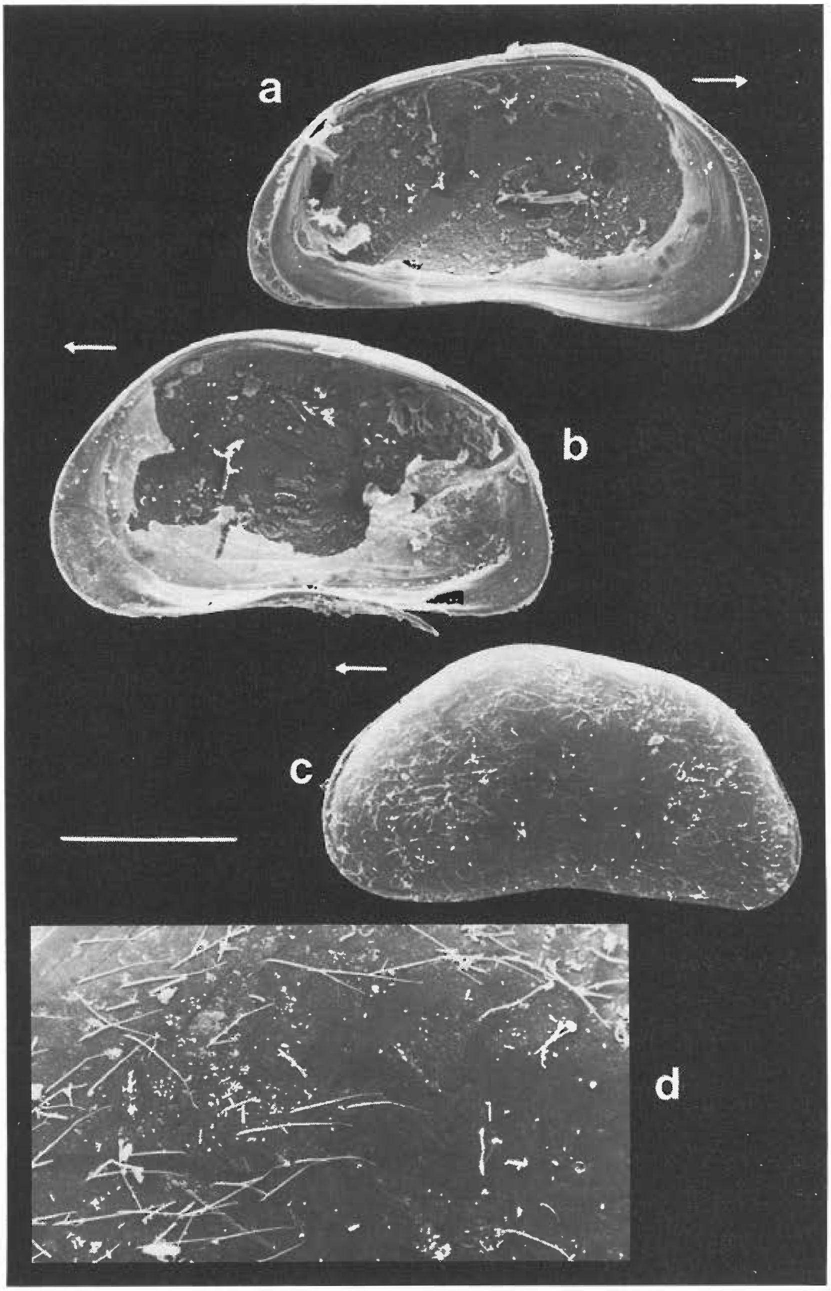

Fig. 12. – *Potamocypris fallax.*

a : Left valve, internal; b : Right valve, internal; c : Left valve, external; d : Detail of c (see the absence of ornamentation). Scale = 0,20 mm for a-c.

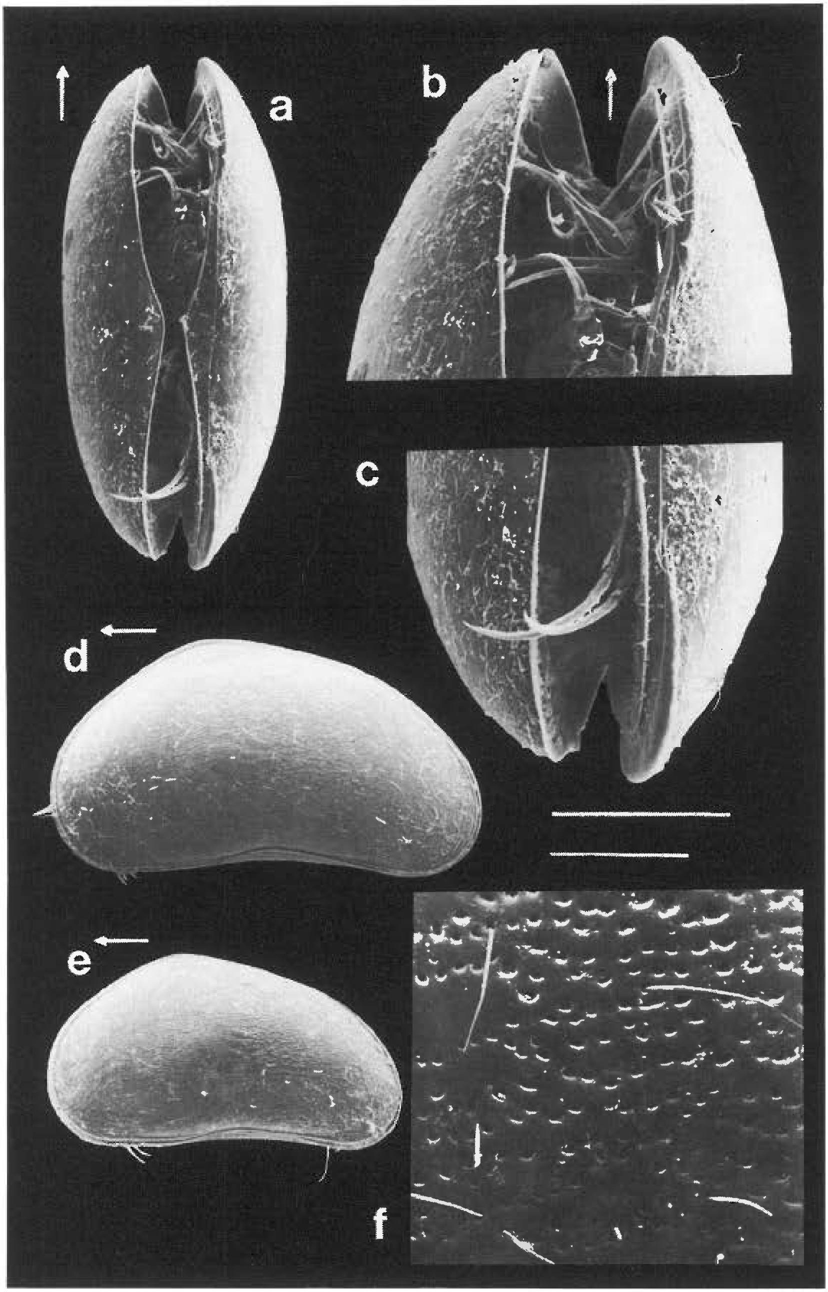

Fig. 13. - *Potamocypris fallax.*

a : Ventral view of the carapace; b : Anterior detail of a; c : Posterior detail of a; d and e : 2 juvenile carapaces. Large scale = 0,20 mm for a, d and e; = 0,10 mm for b and c.

5. POTAMOCYPRIS SIMILIS MÜLLER, 1912
(Figs 14, 15 and 16)

Paracypridopsis variegata (BRADY & NORMAN, 1889) sensu KAUFMANN 1900 : 316-317 pl. 19 figs 16-17 and pl. 22 figs 24-25;
Non *Potamocypris variegata* (BRADY & NORMAN, 1889);
Potamocypris similis MÜLLER, 1912 : 215 *(nomen novum)*;
FOX 1965a : 629-630 [taxonomy].

TYPE-MATERIAL : 42 syntype specimens deposited by KAUFMANN (MHNG) coming from Lake Lucerne, Switzerland.

DESIGNATION OF LECTOTYPE : The syntype specimen I have dissected is chosen as lectotype : soft parts mounted in PVLP on a microscopic slide; valves in a micropaleontological slide (MHNG).

TYPE-LOCALITY : Lake Lucerne, Switzerland.

MATERIAL EXAMINED : Syntypes deposited by KAUFMANN (MHNG); 3 samples coming from Scotland (BRADY collection) from France and from Luxembourg. See the detailed list in the appendix.

DIAGNOSIS

CARAPACE. Surface of the valves covered with round pits, clearly visible under the stereomicroscope (40-60X). In dorsal view : carapace somewhat egg-shaped, rounded both behind and in front; the l.v. overlaps the r.v. in front and behind.

Marginal zones of the l.v. : anteriorly and posteriorly with a well-marked, lobe-like outer extension (selvage distinctly displaced from the border of the valve).

Size : 0,45-0,58 mm. Colour : yellowish with 2 dark green transverse bands best seen in the dorsal view.

APPENDAGES : The longest A2 Swset reaching the distal border of the penultimate segment.

Maxilulla (Mxl) : terminal segment of the palp with 4 distal spines.

Maxilla (Mx2) : respiratory plate with 2 branchial filaments.

Thoracopod T1 (walking leg) with a terminal claw bearing a long spineless distal point (Fig. 14-e).

Males unknown.

COMPLEMENTS OF DESCRIPTION

Here are 2 taxonomic features which have not yet been mentioned in the literature :

a) The outer extent on the anterior marginal zone of the l.v. bears on its inner side a series of long setae. One may think that these setae give information on the closing of the carapace. On the posterior outer extent (l.v.) these setae are very small (Fig. 16-c, d).

b) The terminal claw of T1 bears a well-marked spineless point (Fig. 14-e). Such a spineless point is also found in *P. fulva,* but in this species it is distinctly shorter.

RELATIONS

P. similis was rather badly known during a long period. This was partly due to the fact that KAUFMANN (1900b) erroneously identified it with *P. variegata* (BRADY & NORMAN). (This species is revised in the second part of this work).

FOX (1965a) found out a character which readily allows recognition of the species among *Potamocypris* species with short A2 Swset : it is the number of terminal spines (4) on the Mx1 palp. (In the other European species bearing short A2 Swset, the Mx1 palp has 5 distal spines).

P. similis is closely allied to *P. variegata* (BRADY & NORMAN). Both species share the following features : carapace of small size, valves with pits (but they are more irregular in *P. variegata*), the colour of the shell, Mx1 with 4 distal spines on the palp, 2 branchial filaments on Mx2. The length of the A2 Swset allows easy separation of these 2 species : the Swset extend beyond the tip of the distal A2-claws in *P. variegata;* in *P. similis* these setae only reach the distal end of the penultimate segment.

TAXONOMIC DISCUSSION

In 1900b, KAUFMANN gives a redescription of *P. variegata* (BRADY & NORMAN); but this redescription obviously applies to a new species, which MÜLLER (1912) renames *P. similis,* without however having seen himself specimens of this new species. FOX (1965a) was the first to capture the species after KAUFMANN and to show how to recognize it easily.

ECOLOGY AND GEOGRAPHIC DISTRIBUTION

As *P. similis* was not recognized during a long period, its ecology is badly known. It has been found in lakes and large ponds.

P. similis is known from Switzerland KAUFMANN (1900), from Great Britain (FOX, 1965), from Northern Italy (FOX, 1965 and 1966), from Germany (SCHARF, 1980) and from Poland (SYWULA, 1971 and 1974). I found it myself in Luxembourg (in a pond with rich aquatic vegetation; this pond is located in a former gravel pit in the valley of the Moselle, near Remerschen and also in France (pond in the "Jardin des Plantes" at Angers).

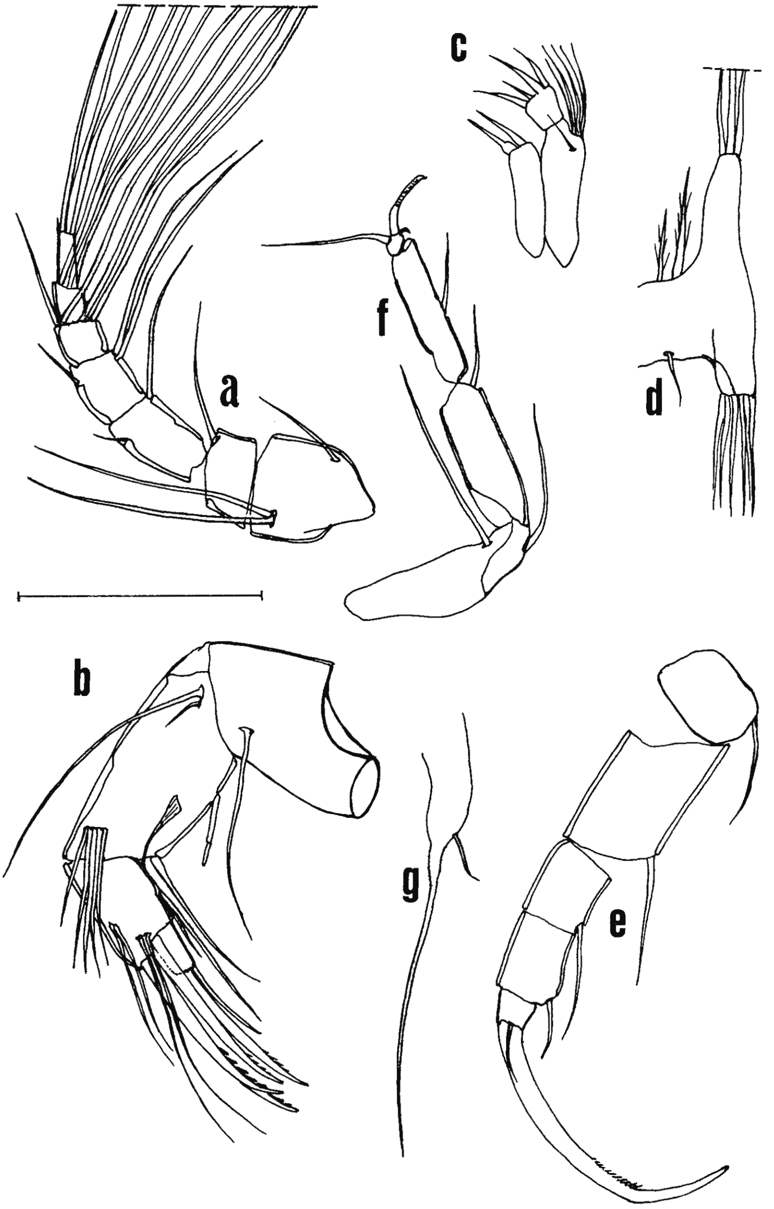

Fig. 14. – *Potamocypris similis.*

a : Antennula (A 1); b : Second antenna (A 2); c : Palp and 3rd masticatory process; d : Maxilla (Mx 2); e : Thoracopod T 1; f : Thoracopod T 2; g : Furcal ramus (Fu). Scale = 100 μm.

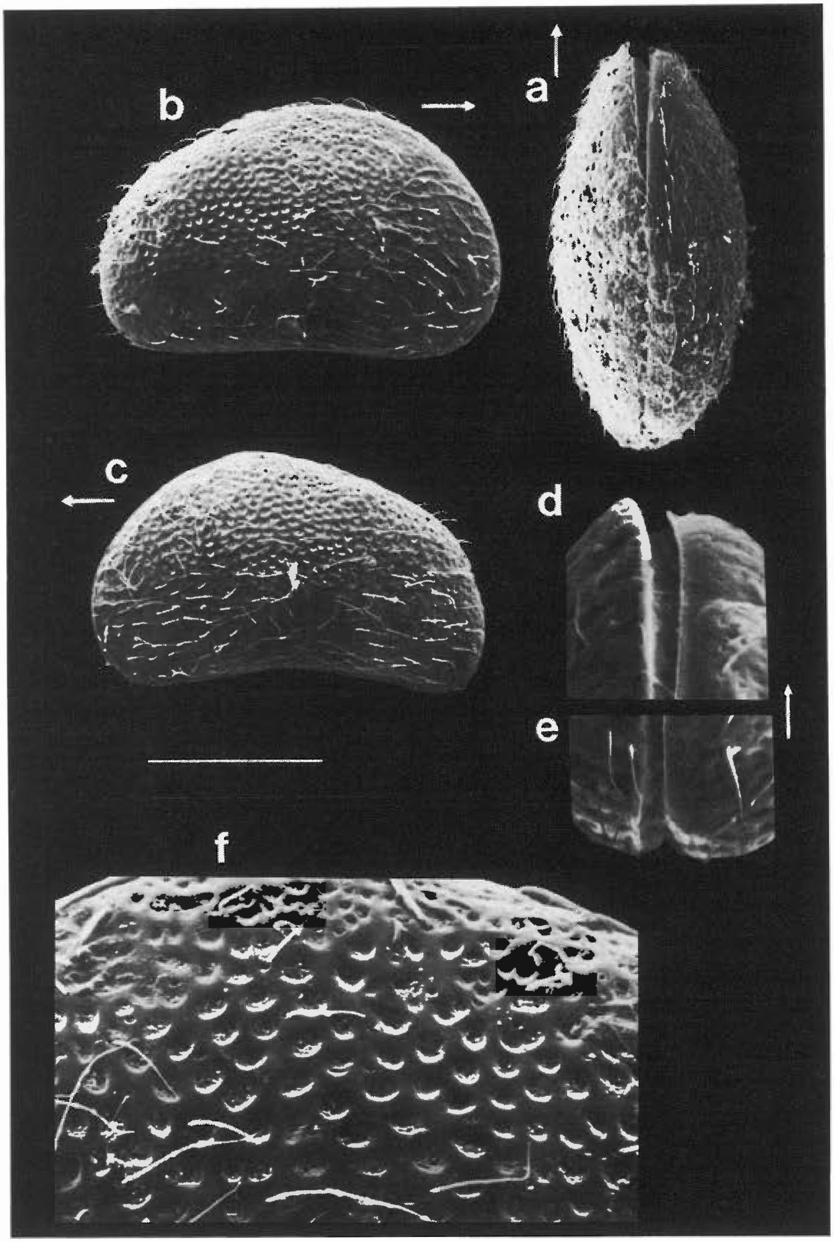

Fig. 15. – *Potamocypris similis.*

a : carapace, dorsal view; b : right valve, external; c : left valve, external; d : anterior end of the carapace, dorsal view; e : posterior end of the carapace, dorsal view; f : surface ornamentation of the valves (detail). These specimens from Luxembourg. Scale = 0,20 mm for a-c; = 50 μm for f.

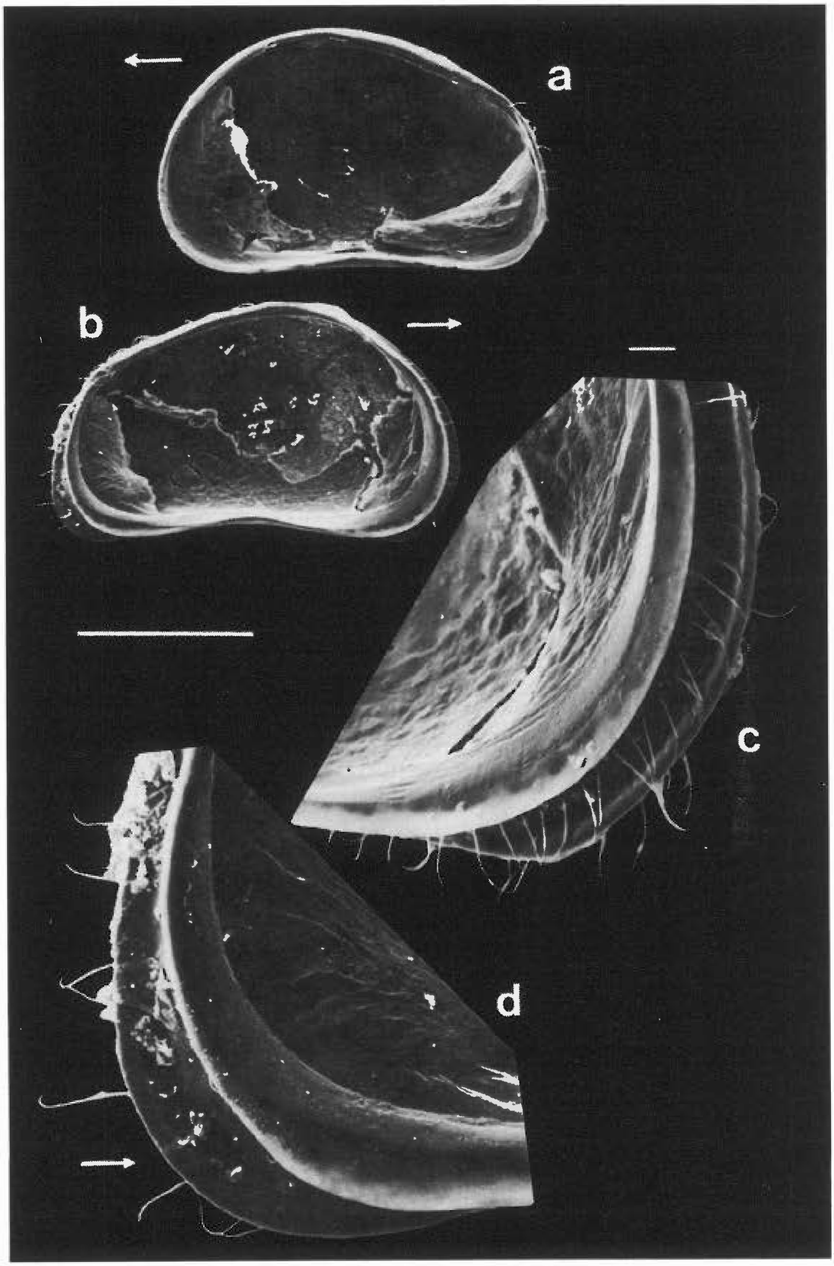

Fig. 16. – *Potamocypris similis.*

a: right valve, internal; b: left valve, internal; c: left valve, anterior marginal zone, internal (detail); d: left valve, posterior marginal zone, internal (detail). This specimen from Luxembourg. Scale = 0,20 mm for a and b; = 50 μm for c and d.

IX. APPENDIX: DETAILED LIST OF THE MATERIAL EXAMINED

1. *Potamocypris fulva.*

a) The material labelled *P. fulva* by BRADY (BRADY collection, HMNT) including 12 slides, i.e. 10 slides with valves and carapaces (1.17.38; 1.17.39; 1.18.01. - 1.18.06; 2.01.15; 2.02.38) and 2 slides with soft parts (1.18.06 badly preserved, determination impossible and 1.18.07 eventually with *P. fulva*). Only the slides 1.18.04 and 1.18.05 bearing *P. fulva* carapaces.

b) One spirit tube labelled *P. fulva* (BRADY collection, HMNT) from "Pools at Loch Fadd", Isle of Bute. This tube includes *P. fallax* (about 1300 specimens), *P. zschokkei* (about 100 specimens), *P. pallida* (12 specimens) and *P. villosa* (several specimens) but no *P. fulva* specimen.

c) One spirit tube labelled *P. fulva* from the Isle of Bute, GB (BMNH, NORMAN collection 1911.11.8.33053). This tube includes the same species as *sub* b above, but no *P. fulva* specimen.

d) Germany (Eastern), Eldena near Greifswald: 64 egg-bearing females (ZIGR 151a, coll. G.W. MÜLLER, June 1888). Cf. MÜLLER, 1900.

e) Germany (Western), Isle of Rügen (Baltic Sea): 2 specimens (ZMH 1179, coll. KLIE 1923). Cf. KLIE, 1925.

f) Greece, Corfu: about 35 specimens (ZMH 1180, KLIE collection, coll. STEPHANIDES in March 1935).

g) Belgium, river Aremberg in a forest near Lessines: about 50 specimens (IRSNB 26043, coll. K. WOUTERS).

2. *Potamocypris pallida* ALM

a) Germany, "Thüringen bei Dietharz": about 100 specimens (ZMH K20743, coll. KLIE). These specimens are the SYNTYPES of *P. thienemanni* KLIE. Cf. KLIE, 1925.

b) Germany (GDR), "Thüringen": numerous specimens (ZMH 1181, coll. KLIE in 1923). Cf. KLIE 1925.

c) Germany (GDR), "Erzgebirge": 12 specimens (ZMH 1169, coll. MÜHLBERGER in 1943).

d) Germany (GDR), Silesia: "Leopoldshayn": 3 specimens (ZMH 1190, coll. SCHÄFER).

e) Czechoslovakia, "Sudeten: Spieglitzer Schneeberg": 16 specimens (ZMH 1182, coll. F. PAX in 1944).

f) Rumania, ("Moos am Serbota"): about 10 specimens (ZMH 1176, coll. P.A. CHAPPUIS.

g) Great Britain, Isle of Bute, Loch Fadd: 12 specimens (HMNT, BRADY collection, in a spirit tube labelled "*P. fulva*").

h) Great Britain, Isle of Bute: 4 specimens (BMNH NORMAN collection, in the spirit tube 1911.11.8.33053.072 labelled "*P. fulva*".

i) France, Eastern Pyrenees, mount Canigou, 1900 m: 12 specimens, coll. C. MEISCH in August 1982.

3. *Potamocypris zschokkei* (KAUFMANN)

a) Switzerland, St. Gallen, near Buchs in the Rhine valley: 7 TYPE SPECIMENS (MHNG, coll. KAUFMANN).

b) Germany, Eastern Holstein, "Dieksee": 5 specimens (ZMH 20742, coll. KLIE). TOPOTYPES of *P. wolfi* BREHM. Cf. KLIE 1925.

c) Germany, Holstein : numerous specimens, some of it belonging to the C-form (ZMH 1165, coll. KLIE). Cf. KLIE 1925.

d) Germany (springs at "Waldeck") : about 40 specimens (ZMH 1166, coll. KLIE). Cf. KLIE 1925.

e) Germany, Isle of Rügen (Baltic Sea) : 1 specimen (ZMH K 28538, coll. KLIE 1925).

f) Germany, Isle of Rügen : 1 specimen (ZMH 1178, coll. KLIE). TYPE of *P. compacta* KLIE. Cf. KLIE 1925.

g) Asia (?) : 6 specimens (ZMH K 28694B).

h) England, Malham Tarn (Yorkshire) : 4 specimens, in the spirit tube including *P. fallax* specimens (BMNH 1967.4.3.8, coll. FOX).

i) Great Britain, Isle of Bute : about 50 specimens (BMNH NORMAN collection 1911.11.8., this spirit tube labelled *"P. fulva"*).

j) Great Britain, Isle of Bute : about 100 specimens (HMNT BRADY collection, in a spirit tube labelled *"P. fulva"*).

k) Pyrenees : 10 specimens (ZMH 1170, coll. VIETS 1937).

l) France, valley of the Dordogne, in a wash-house at Grolejac : 6 specimens, coll. C. MEISCH (August 1982).

m) France, Lorraine, in a wash-house at Guermange : about 10 specimens, coll. C. MEISCH (July 1983).

4. *Potamocypris fallax* FOX.

a) England, Malham Tarn (Yorkshire) : about 65 SYNTYPE specimens, (BMNH 1967.4.3.8, coll. FOX). Cf. FOX 1967.

b) Great Britain, Isle of Bute : about 1300 specimens (HMNT BRADY collection, in a spirit tube labelled *"P. fulva"*).

c) Germany, near Bad Pyrmont (SW of Hannover) : 10 specimens (ZMH 1167, coll. KLIE). Cf. KLIE 1925.

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

e) Rumania, near Bedelen, Cluj, Suveag : about 30 specimens (ZMH 1173, coll. CHAPPUIS in 1924).

f) Turkey : about 40 specimens (ZMH 27631 labelled *"P. wolfi"*).

5. *Potamocypris similis* MÜLLER.

a) Switzerland, Lake Lucerne : 43 TYPE specimens (MHNG, coll. KAUFMANN).

b) England, river Nene near Peterborough : 8 specimens (HMNT, BRADY collection, slide 1.18.03 labelled *"P. fulva"*).

c) France, Angers (Pond in the "Jardin des Plantes") : about 30 specimens, coll. C. MEISCH (in August 1983).

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