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EVALUATION OF FEATURES DISTINCTIVE IN THE TAXONOMY OF THE CYPRIDACEA, ABOVE THE GENERIC LEVEL

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Published descriptions of extant cypridacean ostracods are often incomplete: only a few of the appendages and features of the carapace are illustrated and/or described. In taxonomic descriptions of different species, different characters are diagnosed, while others may not even be mentioned. It appears therefore that either authors disagree on what characters are taxonomically important for the Cypridacea, or that such characters have not beenestabilished by ostracod taxonomists. To remedy this problem, an attempt is being made here to find out which features are important in taxonomy. I have already examined a large number of features for two groups of Australian ostracods to determine taxonomic significance at both genus and speices levels (De Deckker 1978, 1979). At present a similar study is being prepared for all the cypridacean genera to determine which features are taxonomically important above the generic level. Preliminary findings are presented here.

FEATURES OF THE CARAPACE

There are a number of characteristics of the carapace that are important in distinguishing species and genera, such as shape of the valves, overlap of the valves in different areas, presence or absence of tubercles along the margin of the valves etc... These can rarely be tabulated, and it is only the trained eye that enables the taxonomist to differentiate species and genera. Often the size of the carapace is used as the only feature to separate species. I want to stress the fact that this factor is insufficient to separate ostracods into diferent species because there are numerous examples that show adult cypridacean ostracods, collected at the same locality at different times of the year (when the temperature, dissolved oxygen, amount of food available and sometimes salinity values are different), can vary tremendously in size.

The following details of the carapace are found to be helpful in separating ostracods into different families and subfamilies:

— presence or absence of eye tubercles: only a few ostracod genera possess 2eye tubercles on the carapace and these have been grouped together by De Deckker (1979) into the Notodromadidae, therefore separating this group from other families in the Cypridacea. (Note that other features were used to raise this group to the family level and separate it from other families).

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— type of normal pores: this was investigated by Puri (1974) with SEM photography. Most cypridacean ostracods have the simple type pore (A′ or A″ of PURI) but notodromadidid species appear to have the type C (of PURI). Further study is necessary before accepting the use of this feature in separating some families from others.

— muscle scars pattern (=MSP): the significance of this feature has been recognized by taxonomists, the results of which were collated by Van Morkhoven (1962). However, it is important to be aware the MSP can vary greatly on different specimens belonging to one species (Omatsola, 1971; Sczechura, 1971). Maddocks (1969) has already illustrated the different arrangements of MSP in various families and subfamilies. Further separation might be possible on this basis as already shown by De Deckker (1979) for the Notodromadidae. Maddocks' (1969) separation of the Cypridinae and the Cypridopsinae is perhaps not justified. On the other hand, it is worth noting that the MSP of the Notodromadidae (sensu De Deckker, 1979) is distinct from that of other families but is very similar to the one of the fossil Cyprideidae and even the Robsoniellidae. The position of the latter family has been already discussed by Gramm & Kuznetzova (1970).

— marginal pore canals (=MPC): this feature is often illustrated by various authors. Only 3 major types of MPC are recognized and these are used to distinguish various subfamilies from others that share other anatomical characteristics. The 3 types (Fig. 1) are:

type 1: pattern irregular; many pore canals branching in all directions from a main broader one. This groups the Macrocyprididae, Pontocyprididae and Paracyprididae.

type 2: broad opening at base of pore which then narrows into many straight branches (usually 3 and resembling a hand) towards edge of shell. This groups the Herpetocypridinae, Dolerocypridinae and Mesocypridinae. These subfamilies are grouped together within the Cyprididae as also shown by other anatomical features.

type 3: simple, almost straight, narrow pores. They occasionally branch into many arms (Fig. 1d).

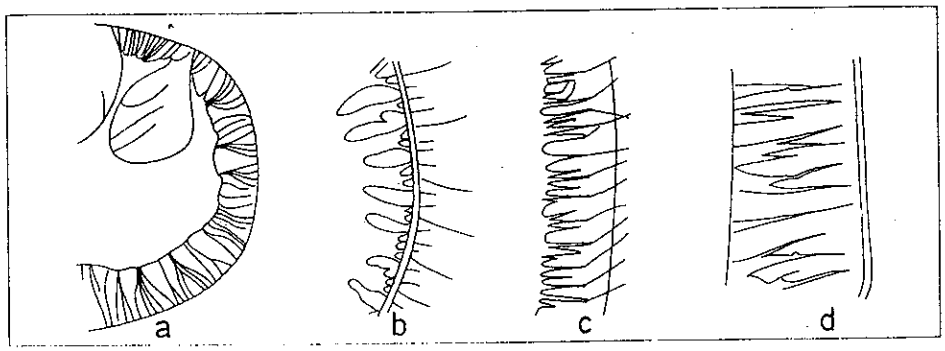

Fig. 1. To show the 3 major types of marginal pore canals. a. *Macrocypris cylindracea*, b. *Isocypris beauchampi*, c. *Chlamydotheca hummelincki*, d. *Moenocypris francofurta* (after Triebel, 1960, 1951, 1961, 1959).

— position and shape of selvage and inner lamellae: these features (seen most adequately when the valves are sectioned) were already diagnosed through Triebel's work and were summarized by Van Morkhoven (1962) and Hartmann (1966). These details, which cannot be easily tabulated, are excellent features for separating genera and subfamilies.

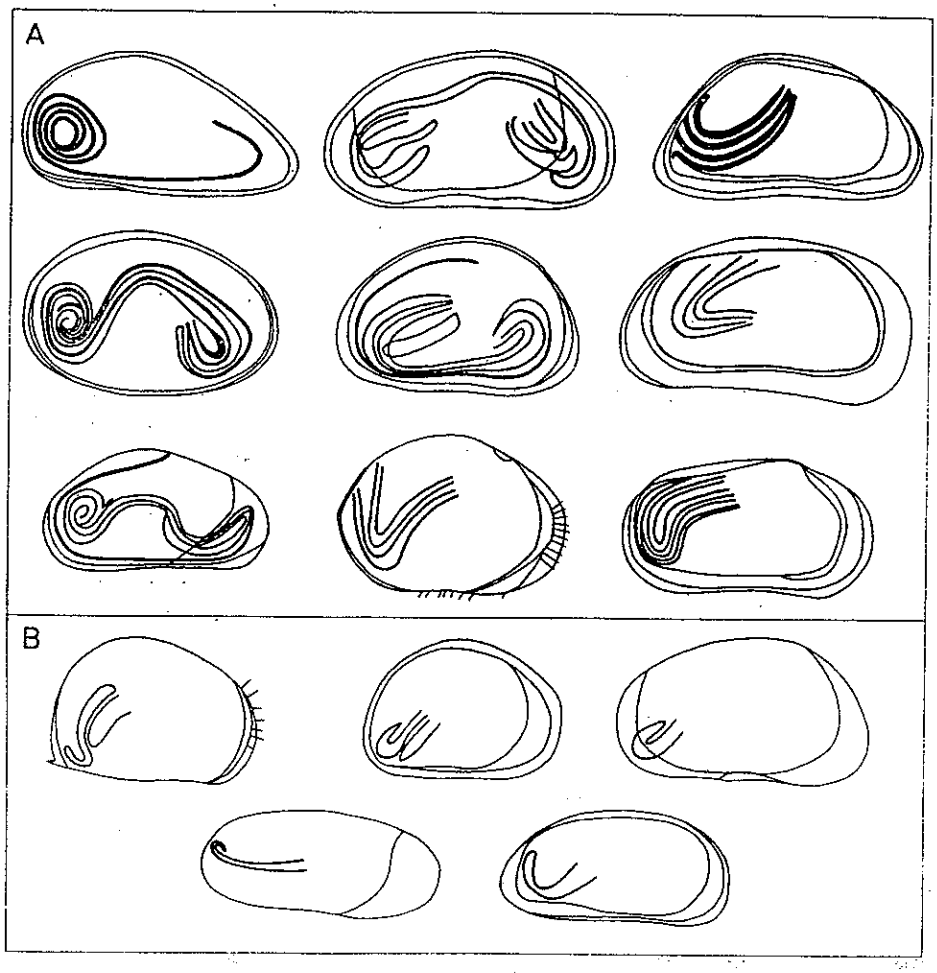

Fig. 2. To show different arrangements of:

a — seminal vesicles (from left to right, top to bottom: *Propontocypris intermedia, Kapcypridopsis barnardi, Candona holmesi, Cypricercus obliquus, Pseudocypris gibbera, Hungarocypris madaraszi, Potamocypris steuri, Notodromas persica, Hypselecypris wittei)*

b — ovaries; *(Notodromas monacha, Cyprois flava, Zonocypris uniformis, Amphibolocypris exigua, Allocypria navicula.).* Mainly taken from Hartmann, 1966; McKenzie, 1977; Petkovski, 1959, 1960, 1964; Rome, 1962, 1964.

— pattern of the seminal vesicles inside the valves: this pattern is particularly useful for recognizing many genera, even when the ostracod valves are closed. The pattern is surely indirectly related to the shape of the shell but still allows separation at subfamily and genus levels. (Fig. 2a shows some of the variations found between many genera). This feature, often called »imprint of the testes« is occasionally noticeable in fossil specimens. Complete illustrations for this feature will be published elsewhere. Similarly, it appears that the pattern left by the ovaries is also of taxonomic importance.

FEATURES OF THE SOFT PARTS

— type of the eye: the only group of cypridacean ostracods having the 2 cups of the nauplius eye separated is the Notodromadidae (sensu De Deckker, 1979). Therefore this feature is of some use in separating this family from other.

— number of segments of the endopodite of the antennula: this feature is already widely used for separating families.

— length-width ratio of the endopodite segments of the antennula: this is already used for separating various subfamilies. e.g. Diacypridinae vs. Eucypridinae.

— presence or absence and shape of 3rd endopodite segment of antenna: this allows distinction between various families as recognized by many authors.

— number of end claws on antenna: this is of importance at the family level, however one must be aware of the sexual dimorphism of these claws; sometimes number and type of claws vary between the sexes.

— size of basal podomere of mandible compared to endopodite: it has been noticed that there is considerable difference between these two features in different families. This, however, could be a result of the mode of feeding or respiration of the animals.

— α, β, γ bristles on mandibular endopodite: Danielopol first suggested the investigation of these 3 bristles as was done by Danielopol & McKenzie (1977). At this stage it is not known if this chaetotaxy is taxonomically important above the generic level.

— rake-like process: Triebel (1968) illustrated magnificently some of these processes and distinguished 4 morphological types. At first glance major groups can easily be recognized:

1 — teeth numerous (10—20), short, narrow and often sharp (Fig. 3a).

2 — teeth less numerous (6—10), occasionally stout, long and broad at the base and often with rounded ends; the inner tooth is often bifid (Fig. 3b).

The second distinction relies on the shape of the rake; Symmetrical or asymmetrical (Fig. 3a-b). The rake-like process, also illustrated by Schulz (1975, 1976) is an excellent feature for distinguishing various families. The morphology of this organ was used to separate the Notodromadidae from the Cyprididae by De Deckker, 1979. Note that *Hungarocypris* has a very unusual rake-like organ (see Fig. 3c).

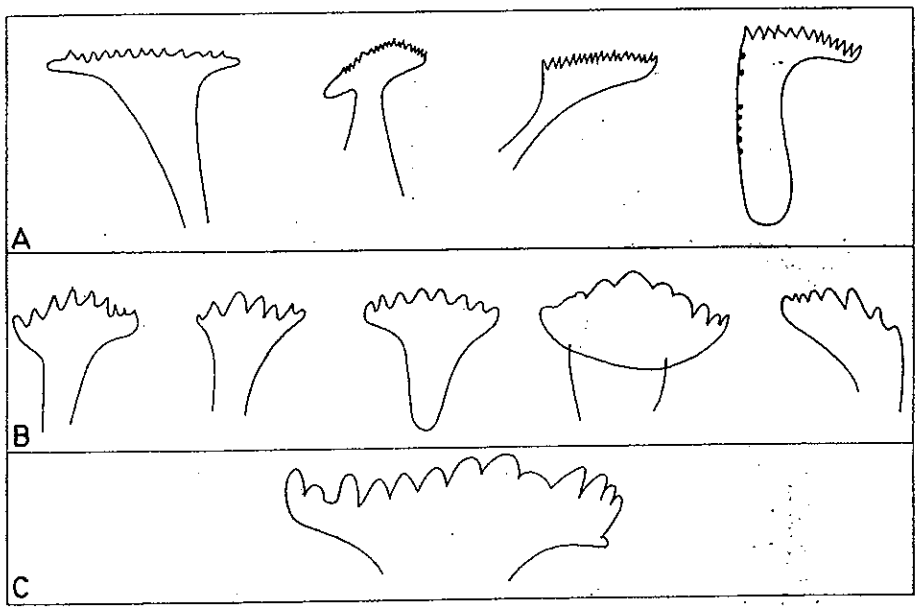

Fig. 3. Variations in rake-like process morphology (clockwise from top left: *Platycypris* sp., *Cypria* sp., *Newnhamia* sp., *Cyprinotus salinus, Australocypris* sp., *Mesocypris* sp., *Candonocypris* sp., *Herpetocypris reptans; Hungarocypris madaraszi* at bottom).

— number of Zahnborsten on the maxillar outer masticatory process: this number can go up to 6 and is a good tool for separating most families. Anomalies can occur.

— segmentation of the female maxilla: this detail was recognized by McKenzie (1971) as useful for separating most families.

— number of end claws on thoracopoda I: this feature allows separation of some subfamilies.

— presence or absence of 4th segment associated to the morphology of the distal segment of thoracopoda II plus size of the long seta compared to that of the segments: this entails obvious separation between families.

— ejaculatory tube: (= Zenker organ) the potential use of this organ was partly investigated by Triebel (1968). Fig. 4 illustrates 7 groups based on different shapes of the tube (with both ends funnel--shaped, globular etc...) which are taxonomically significant at the family and subfamily levels. The number of rosettes is sometimes useful for distinguishing various families (e.g. Candonidae <8, Cyprididae >10) or subfamilies.

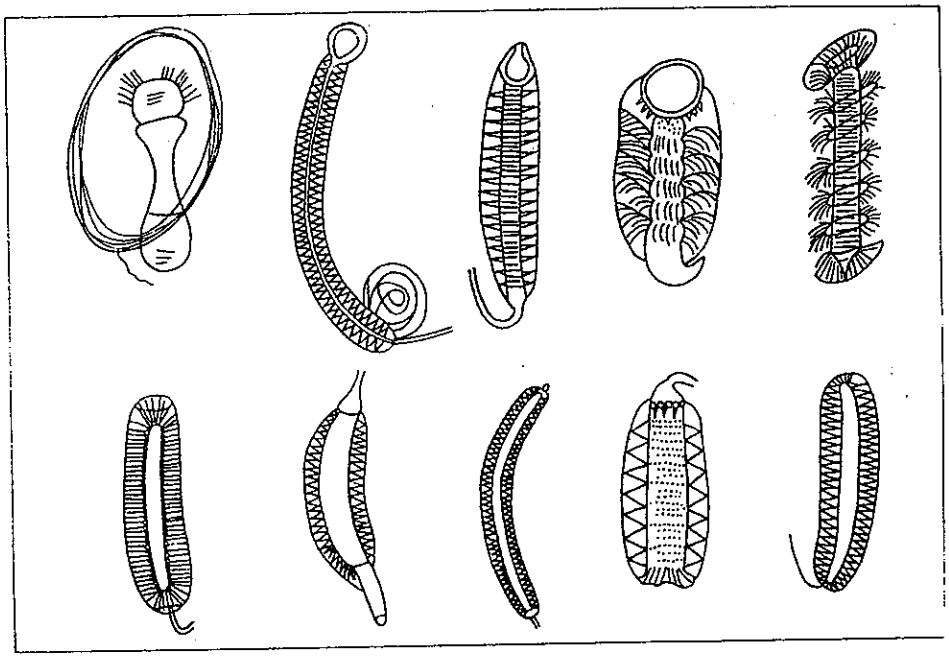

Fig. 4. Variations in ejaculatory tube morphology (clockwise from top left: *Propontocypris* sp., *Macrocypris* sp., *Ilyocypris* sp., *Mecynocypria* sp., *Candona* sp., *Notodromas* sp., *Amphibolocypris* sp., *Australocypris* sp., *Mesocypris* sp.,) mainly taken from Maddocks, 1969, Triebel, 1960, 1968, Rome, 1962.

— presence and position of bristles and claws on furça: this is taxonomically important at both family and subfamily leves, as widely recognized. The problem of the whip-like furca in cypridopsid ostracods has not been resolved: is this feature *alone* suficient for separating these ostracods from the Cyprididae, and putting them in a separate family regardless of the similarity of the rest of their anatomy to that of the Cyprididae?

— ornamentation of the furcal attchment: this was originally used by Rome (1969) to illustrate the differences between all subfamilies. This is obviously an excellent taxonomic tool.

CONCLUSIONS

All the features mentioned above, which have been investigated for most of the Cypridacea, are summarized in Table 1 and will be fully illustrated elsewhere (De Deckker, in prep.).

TABLE 1. SUMMARY OF FEATURES IMPORTANT IN THE TAXONOMY OF THE CYPRIDACEA.

	family level	group of families	subfamily level	group of subfamilies
CARAPACE				
eye tubercle	some			
type of normal pore	some			
muscle scars pattern	×			
marginal pore canals		some		some
selvage & inner lamella			×	
seminal vesicles pattern			×	?
ovaries pattern			?	?
ANATOMY				
type of eye		×		
antennula — no. segm. endopodite	×			×
— shape of segments			×	
antenna — 3rd endopodite segm.	×			
— no. claws	×			
mandible — size basal pod. vs endop.	×			
— segmentation in ♀		×		
thoracopoda I — no. end claws				×
thoracopoda II — last segm. + bristle	×			
ejaculatory tube			×	
furca — position bristles & claws				×
furcal attach. — ornamentation				×

× = important feature.

It has been noticed though, that occasionally one feature of the anatomy or the carapace appears to be »anomalous« for one genus compared to others within the same subfamily: e.g. 2 claws on furca of Centrocypris compared to 3 in all other notodromadidid ostracods; type C pore (of PURI, 1974) for Cyclocypris laevis compared to type A″ for Cyclocypris ovum and other candonidid ostracods; funnel-shaped ends of ejaculatory tube of *Hungarocypris madaraszi* compared to flat and round ends in all other cypridiid ostracods. This illustrates DANIELOPOL's point that »many morphological trends can be activated irregularly leading to a mosaic pattern« (DANIELOPOL, 1976) for the Ostracoda, and that totaly unrelated ostracods can occasionally share a similar feature of the anatomy or the shell.

Consequently, changes to Hartmann & Puri's (1974) classification are proposed on the basis that the features mentioned above are valid for distinguishing families and subfamilies:

1 — *Indiacypris* + Indiacypridinae should be transferred to the Ilyocyprididae because of their similarity of MSP, pattern of seminal vesicles, rake-like organ, shape of maxillar palp and outer palp plus number of Zahnborsten, thoracopoda II, shape of ejaculatory tube (1 globular end), type of furca and furcal attachment.

2 — the Notodromadidae (elevated at the family level) grouping the Notodromadinae, Centrocypridinae, Cyproidinae and Oncocypridinae as suggested by De Deckker, 1979. The Cyprideidae could be closely related to this family.

3 — *Platycypris* and *Amphibolocypris* are to be grouped into the Platycypridinae as they share many anatomical and carapace details (shape of segments of antennula, shape of palp and distal palp of maxilla (*Platycypris* has 5Zahnborsten and *Amphibolocypris* only 2), male maxilla almost identical, thoracopoda I with 2 claws and 1 bristle at distal end, thoracopoda II identical, shape of hemipenis similar, ejaculatory tube (26—27 rosettes) each with a rounded end (see fig. 4), furcal attachment very similar with forked articulary end). The Isocypridinae are closely related to this subfamily but too many anatomical features separate the 2.

4 — *Scottia* and *Mesocypris* are to be included within a single subfamily the Scottinae as these 2 genera are closely allied. This was foreshaddowed by Danielopol in McKenzie (1971a).

5 — *Cypricercus* and *Strandesia* are to be grouped together into a new subfamily the Cypricercinae because they differ from the Cypridinae in the following features: pattern of seminal vesicles (fig. 2a), furcal attachment (dorsal branch with eyelet at base and ventral branch forked distally and median branch with small proximal hook), ejaculatory tube bladder-like at one extremity.

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