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SUPPLEMENTARY DATA ON THE MORPHOLOGY OF *NEONESIDEA* AND REMARKS ON THE SYSTEMATIC POSITION OF THE FAMILY BAIRDIIDAE (OSTRACODA: PODOCOPIDA)

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During recent years studies on the morphology of ostracodes advanced very much. However the details of the antennae (especially their chaetotaxy), of the mandibular gnathobasis, the lower lip, and the male copulatory organ were not studied thoroughly. I remarked in several notes (Danielopol 1968, 1969a, 1969b, 1970) that many minute details of these limbs are very constant and can be used for the systematics of different groups of Podocopids.

The morphology and systematics of Recent bairdiids progressed during recent years thanks to the contributions of Kornicker (1961) and Maddocks (1969).

Through the kindness of Dr. Louis S. Kornicker, I had the opportunity to study a small collection of bairdiids of the National Museum of Natural History, Smithsonian Institution. I was especially interested in the minute details of the limbs I mentioned above. According to these observations I shall present several remarks on the systematic position of the family Bairdiidae.

G. W. Müller (1894), Alm (1916) and, recently, Hartmann (1963) and McKenzie (1968) showed that the Bairdiidae are closely related to the Cytheridae. McKenzie (1968) considered that these two families represent one suborder Podocopina,

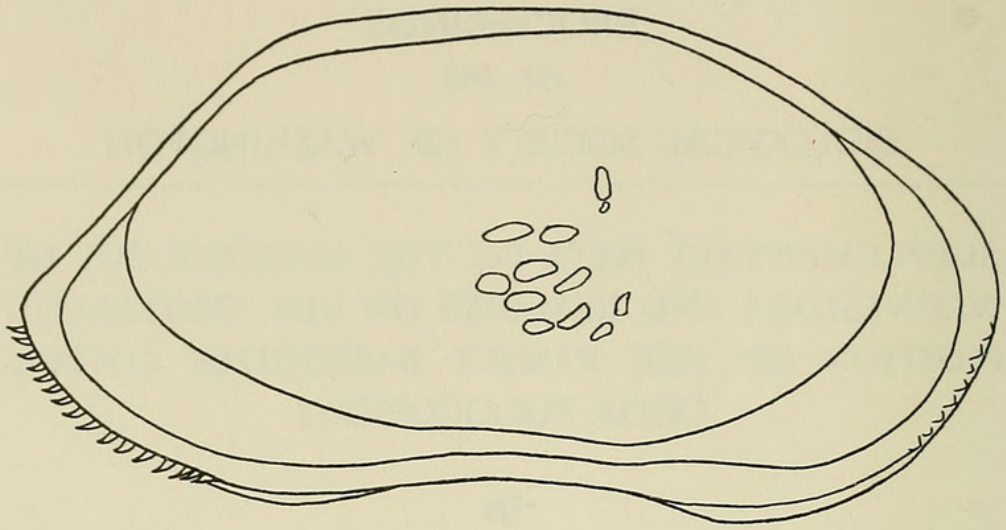

FIG. 1. *Neonesidea* sp., male USNM 98553. Right valve, externo-lateral aspect.

while the families Saipanettidae, Cyprididae and Darwinulidae belong to another suborder Metacopina.

Sars (1923), Schweier (1940), Sylvester-Bradley (1961), and, recently, Gründel (1967) considered the Bairdiidae related to the Cyprididae. The last author proposed a new suborder Bairdiocopina to include the bairdiids, cypridids and ?darwinulids.

A quite opposite opinion was developed by Skogsberg (1920) who considered the families Cytheridae, Bairdiidae, and Darwinulidae as belonging to a single group (named by him Cypriformes, but which is a junior synonym of the suborder Podocopa Sars 1866.).

Van Morkhoven (1962), suggested that the family Bairdiidae has an intermediary position between the Cyprididae and the Cytheridae.

The morphological features of the limbs I shall discuss here represent new data to confirm the last two opinions.

The material was collected in the South Pacific Ocean, near Ifalik Atoll (Carolina Islands); USNM nos. 98546, 98549, 98550, 98552, 98553, and consists of *Neonesidea* sp. and *N. schulzi ifalikensis*. I studied the limbs of two males of *Neonesidea* sp. (USNM 98553) and two females of *N. schulzi ifalikensis* (USNM 98549).

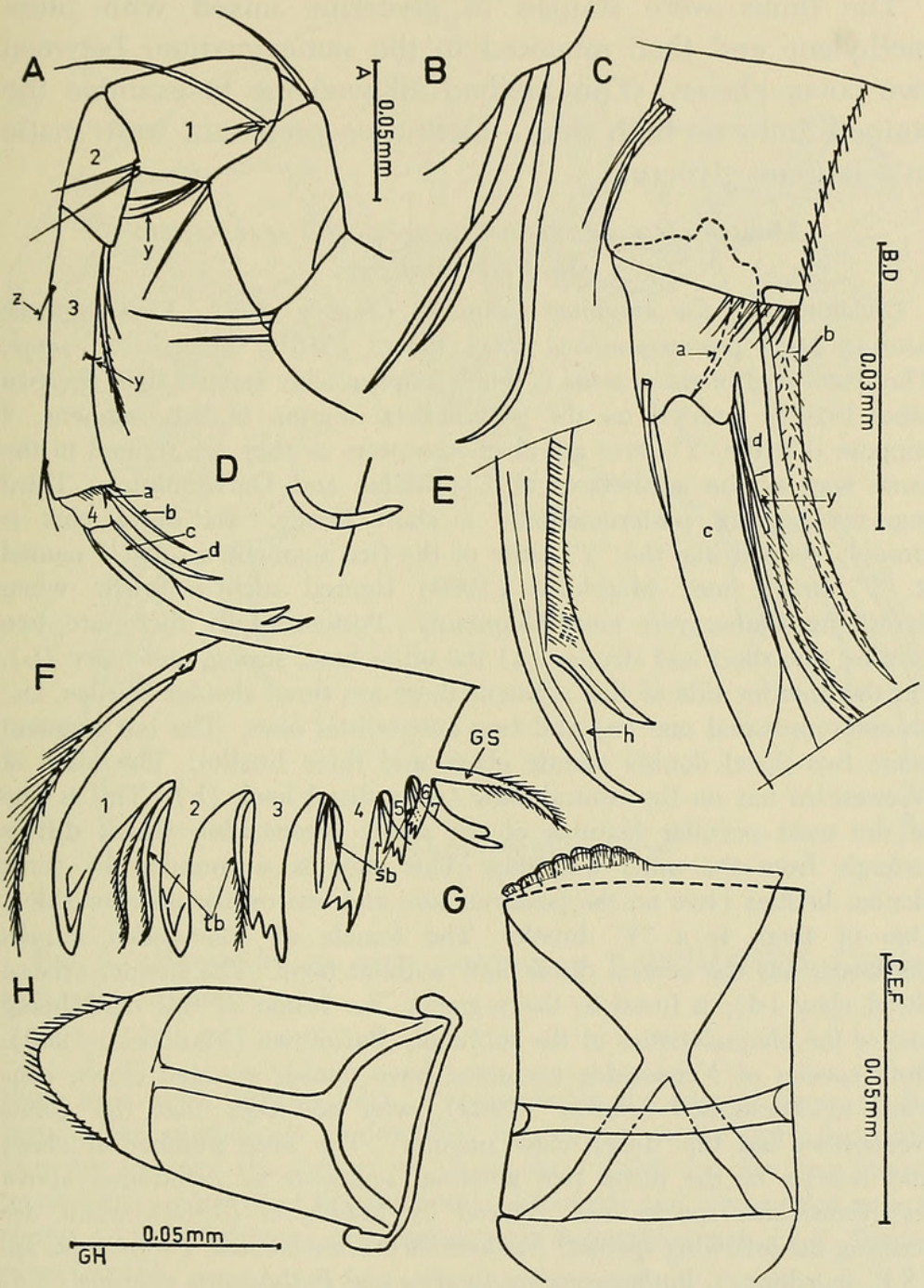

FIG. 2. *Neonesidea* sp., male, specimen no. 1, USNM 98553. A-E-second antenna. A, general aspect; B, "Y" bristle of the first endopodial segment; C, distal third of the endopod; D, "Y" bristle of the third endopodial segment; E, distal third of the central claw "C"; F, mandibular gnathobasis; G, the oesophagean masticatory organ; H, lower lip.

The limbs were stained in glycerine mixed with blue-methylene and then mounted in the same medium between two cover glasses. This method allowed me to examine the stained limbs on both sides. Definitive preparata were made in gelatinous glycerine.

Morphology of *Neonesidea schulzi ifalikensis* and *Neonesidea* sp.

Chaetotaxy of the antennal endopod: (Fig. 2, A–E). First segment bearing three posteroproximal setae that I (1970) named "Y" setae. The distal part of these setae is much more quickly stained than the two other bristles inserted on the posterodistal margin of this segment. I suppose that the "Y" setae are chemoreceptors as they are stained in the same way as the aesthetascs of Cypridídae and Darwinulidae. Third segment bearing posteromedially a short bristle. Its distal part is strongly stained like the "Y" setae of the first segment, so that I named it "Y" bristle too. Maddocks (1969) figured such a bristle when describing *Bythocypris mozambiquensis*. Posterodistally there are two bristles, one short and slender (a) the other long, strong, and hairy (b). On the anterior side of this segment there are three slender bristles, i.e., an anteroproximal one (z) and two anterodistal ones. The last segment bears two distal doubly serrate claws and three bristles. The male of *Neonesidea* has on the central claw (c) a distal hook (h). This is one of the most peculiar features of the genus *Neonesidea,* which differs strongly from the other bairdiids. This claw is surrounded by three slender bristles (two on the posterior side and one on the anterior side). One of them is a "Y" bristle. The female of *Neonesidea schulzi ifalikensis* has the central distal claw without hook. The slender second distal claw (d), is fused to the segment, the fusion of this claw being one of the characteristics of the subfamily Bairdiinae (Maddocks, 1969). Both species of *Neonesidea* examined have doubly serrated claws, contrary to Maddock's opinion (1969), who considers that the genus *Neonesidea* has the "fused claw smooth." The same number of claws and bristles of the distal two antennal segments as mentioned above for *Neonesidea* species was figured by Maddocks (1969) when describing the following species: *Neonesidea cracenticlavula, Paranesidea* sp. (S.F. Bairdiinae), *Bythocypris spiriscutica* and *Bythocypris eltanina* (S.F. Bythocypridinae). It seems that this is a peculiarity of the family Bairdiidae.

Mandibular gnathobasis: (Fig. 2, F). Represented by seven teeth, several interdental bristles and a posterior guide seta (GS). All teeth except the last one, have three cusps. The first four anterior teeth are well developed, the last three are smaller and slender. In the first and second (anterior) interdental space, there are three long bristles of "tooth brush" type (tb) bristles, two in the first space and one in the second space; in the other three interdental spaces there are two or

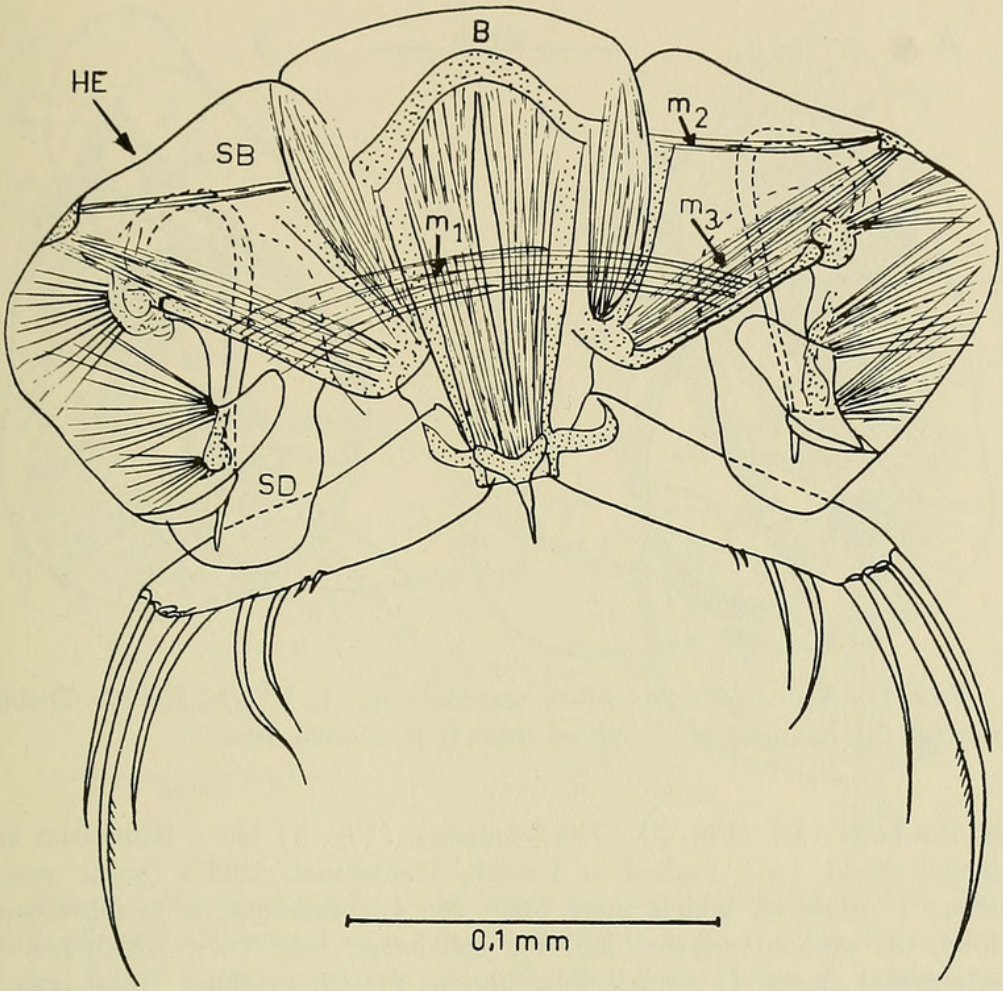

Fig. 3. *Neonesidea* sp., male, specimen no. 2 USNM 98553. Copulatory organ and furca.

three small spiky bristles (sb). Very probably the general shape of the mandibular gnathobasis as described here is proper for many bairdiids (see for instance the figures of Maddocks (1969) for the mandibular gnathobasis of *Bairdia* (*Bairdiopilata*) *alcionicola* and *Neonesidea pateriformis* (S.F. Bairdiinae) and *Bythocypris mozambiquensis* (S.F. Bythocypridinae)).

Lower lip: (Fig. 2, H). The outer surface of this limb has a groove with fringed margins. There are no dentiferous rakelike organs.

Oesophagean masticatory organ: (Fig. 2, G). A thorough study of this organ was published by G. W. Müller (1894). It seems that this strong organ sets off the lack of dentiferous rakelike organs. The oesophagean masticatory organ is certainly the most original feature of the Bairdiidae.

Male copulatory organ of Neonesidea sp.: (Fig. 3–5). Formed by two hemipenes (he) fused by their basal part to the posteroventral part

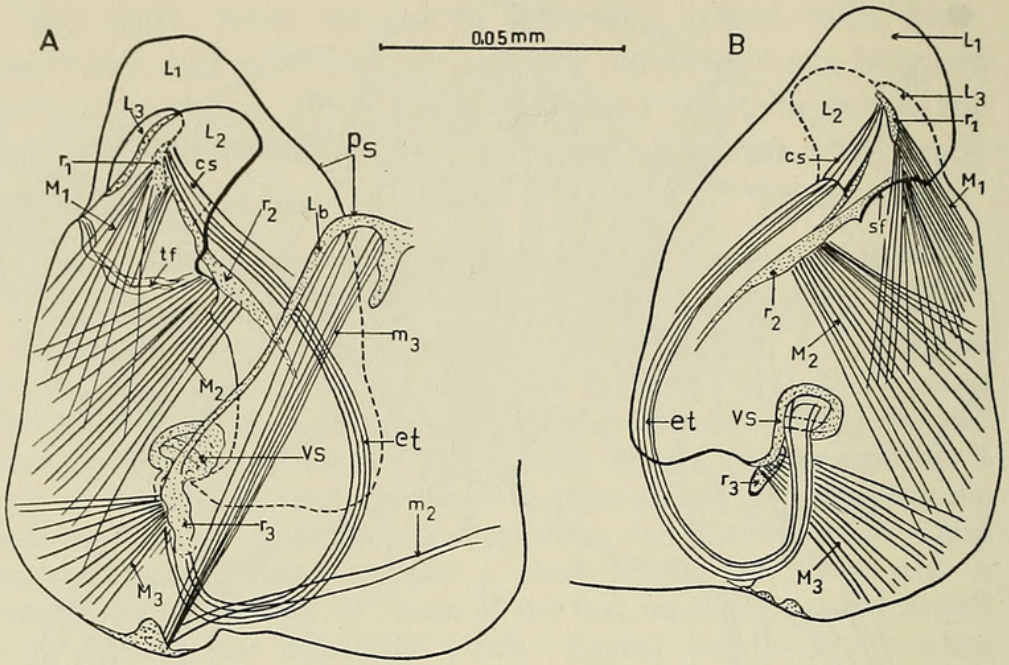

FIG. 4. *Neonesidea* sp., male, specimen no. 1, USNM 98553. Distal part of the hemipenis. A, lateral aspect; B, medial aspect.

of the body (B) (Fig. 3). The hemipenis (Fig. 4) has a peniferum or penial shield (ps) (called in French, Danielopol, 1969b "gaine penienne") inside of which there are: the vas deferens, a membranous tube; the seminal vesicle (vs); the ejaculatory tube (et), which has a sclerotized sleeve (I named this tube in French (1969b) "tube copulateur"); a concial sleeve (cs) which seems to belong to the peniferum; the erector muscles (m and M), and several sclerotized strips (r).

Every hemipenis (Fig. 3) has a basal side (SB) and a distal side (SD). Laterally seen (Fig. 3) the basal side of the hemipenis has a triangular shape. The lateral shield of this side (Fig. 4, A) has a lobe (Lb) which joins the ejaculatory tube. Within the basal part of the peniferum there are three muscles that I named "m_1", "m_2", "m_3" (Fig. 3). The position of the muscle "m_1" is transversal, joining the two hemipenes. The "m_2" has a transvero-oblique position. The "m_3" has a longitudinal position (Fig. 4, A).

On the distal side (Fig. 4, A, B) the peniferum has the medial shield with a largely rounded lobe "L_1"; its dorsal margin is slightly bent. The lobe "L_1" has, ventrally (Fig. 4, B) a sigmoid fold (sf). The lateral shield of the peniferum (Fig. 4, A), much more slender than the medial shield, has a distal digitiform lobe (L_2); the dorsal margin of this lobe joins the basal part of the ejaculatory tube; this lobe has a transversal fold (tf); the lobe "L_2" can be more or less retracted inside the peniferum. Between the lobes "L_1" and "L_2" there is a smaller one, named lobe "L_3" (Fig. 5, A).

Inside the peniferum there are several sclerotized strips. The most

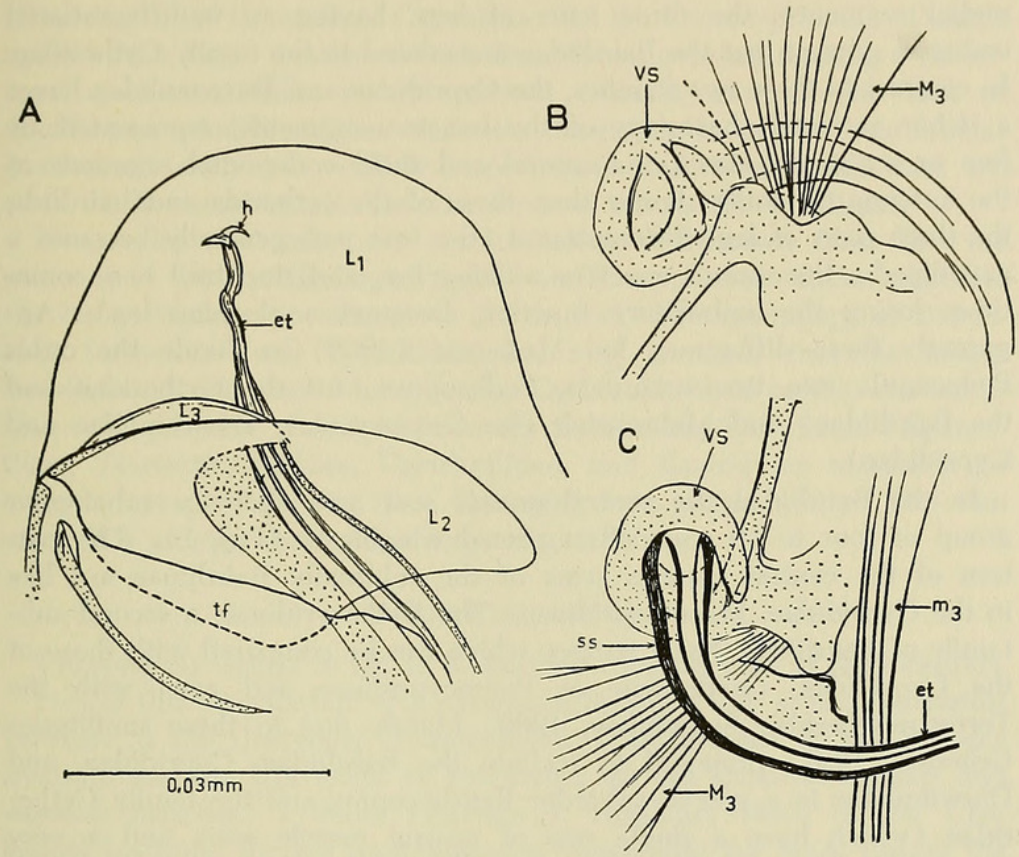

Fig. 5. *Neonesidea* sp., male, specimen no. 2, USNM 98553. Details of the male copulatory organ. A, the lobes L_1-L_3 and the ejaculatory tube. B and C, vesica seminis and the ejaculatory tube; B, medial aspect; C, lateral aspect.

important are named "r_1", "r_2", "r_3"; on these three strips the erector muscles, "M_1", "M_2", "M_3" are inserted (Fig. 4, A, B). The membranous "vas deferens" ends in a globular strongly sclerotized cavity (vs) (Figs. 4, A, B and 5, B, C). G. W. Müller (1894) named it "vesica seminis." In my opinion this is homologous with the "labyrinth" of the Cypridinae (see Danielopol, 1969b). The "vesica seminis" (Fig. 5, C) is prolonged by the ejaculatory tube (et), which has a strong sclerotized sleeve (ss). The proximal part of this tube is larger than the distal part which is narrow, slender, and ends with three small hooks (h) (Fig. 5, A). The distal part of the ejaculatory tube slips into a groove made by the "r_2" strip and a fold of the medial shield. The distal third of the ejaculatory tube is covered by a conical sleeve (cs) which seems to be a fold of the medial shield.

The Systematic Position of the Family Bairdiidae

The general shape of the antennae (i.e., the reduced chaetotaxy, the presence of only one or two distal claws, the third very elongated endo-

podial segment), the three pairs of legs, having an undifferentiated endopod suggest that the Bairdiidae are related to the family Cytheridae. In contrast to these two families, the Cyprididae and Darwinulidae have: a richer antennal chaetotaxy of the last two segments, represented by five or six strong claws, the second and third endopodial segments of the antenna generally shorter than those of the cytherids and bairdiids, the three pairs of legs differentiated (the first pair generally becomes a maxillipede; the second one is a walking leg; and the third one, sometimes losing the ambulatory function, becomes a cleaning leg). Apparently these differences led McKenzie (1968) to divide the order Podocopida into two suborders, Podocopina (for the Cytheridae and the Bairdiidae) and Metacopina (for Saipanettidae, Darwinulidae and Cyprididae).

In the Bairdiidae the central muscle scar area shows a subcircular group of four to 10 scars often placed irregularly (Fig. 1). The pattern of the central muscles scars of the subfamily Bairdiinae are like in the Cyprididae, Macrocypridinae. The Bythocyridinae, a second subfamily of Bairdiidae, has a pattern which can be compared with those of the Cyprididae, Candoninae or Pontocypridinae and even with the Terrestricytheridae Schornikov, 1969. Mainly due to these similitudes Gründel (1967) proposed to include the Bairdiidae, Cyprididae, and Darwinulidae in a special suborder Bairdiocopina and the family Cytheridae (which have a single row of central muscle scars and a very diversified and sometimes complicated hinge) in another suborder, Cytherocopina, both belonging to the order Podocopida.

The morphological data presented above suggest the following: 1. The antennal "Y" bristles of the first endopodial segment of the bairdiids are like the aesthetascs of Cyprididae, Macrocypridinae (Danielopol, 1971a); they can be homologized also with the "Y" aesthetascs of the Darwinulidae (Danielopol, 1970). The "Y" bristles of the third and fourth endopodial segment of the antenna of bairdiids could be homologous with the aesthetascs "Y_2" and "Y_3" of the Darwinulidae and Cyprididae (Danielopol, 1970). The chaetotaxy of the distal third, of the third endopodial segment of the antenna of bairdiids, i.e., four bristles, two anterior and two posterior, can be homologized to the distal claws of the third endopodial segment of the Cyprididae and Darwinulidae; the anterior proximal bristle "z" of the bairdiids is in my opinion homologous with bristle "z" of the Darwinulidae and Cyprididae (Danielopol, 1970). The chaetotaxy of the distal antennal segment of bairdiids represented by two claws and three slender bristles (one of these bristles being a "Y" bristle) are like the chaetotaxy of some Cyprididae, see for instance the subfamily Candoninae or Cypridinae. 2. The presence of seven mandibular teeth and three "tooth brush" bristles is another similitude with most of the Cyprididae (Danielopol, 1970) and Cytheridae (Danielopol, 1969a). 3. The male copulatory organ has the general structure we find in some cytherids like the Enthocytheridae,

(Danielopol, 1971b) or some Cyprididae like the Pontocypridinae (Danielopol in litt.), i.e., a peniferum with distal lobes, a vesica seminis, a sclerotized ejaculatory tube, several erective muscles, etc. 4. The lack of dentiferous rakelike organs and the development of the mandibular gnathobasis with four well-developed teeth and three small ones are some of the most remarkable characters of the family Bairdiidae.

If we also now take into account some well-known facts like the presence of the "brush-shaped organ" and the presence of the exopodite (or traces of this appendage) on the legs of different groups of Bairdiidae, Cytheridae and Cyprididae, one may conclude that the family Bairdiidae is not much closer to the Cytheridae than to the Darwinulidae or Cyprididae. In my opinion the Cytheridae, Bairdiidae, Saipanettidae, Terrestricytheridae, Darwinulidae, and Cyprididae represent six independent phylogenetic lines belonging to a single group. One can name this group suborder Podocopa Sars 1866.

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