

Phylogeny of Harpacticoida (Copepoda):
Revision of
“Maxillipedasphalea” and Exanechentera

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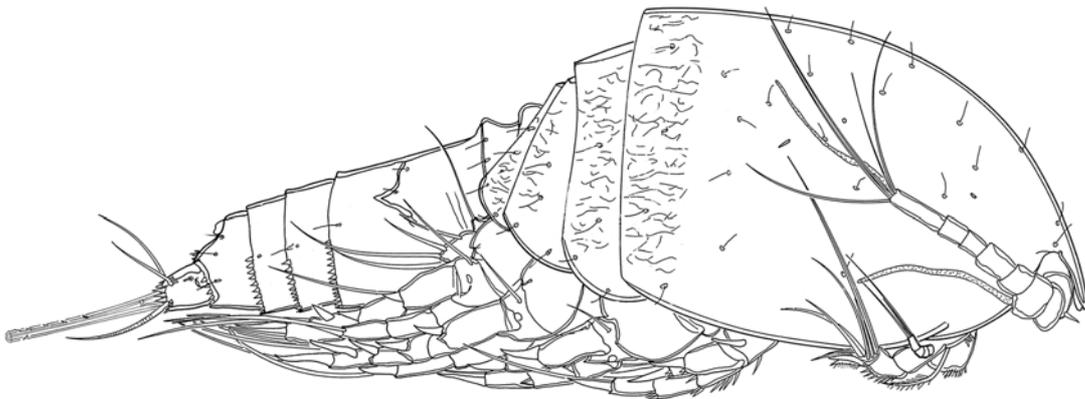
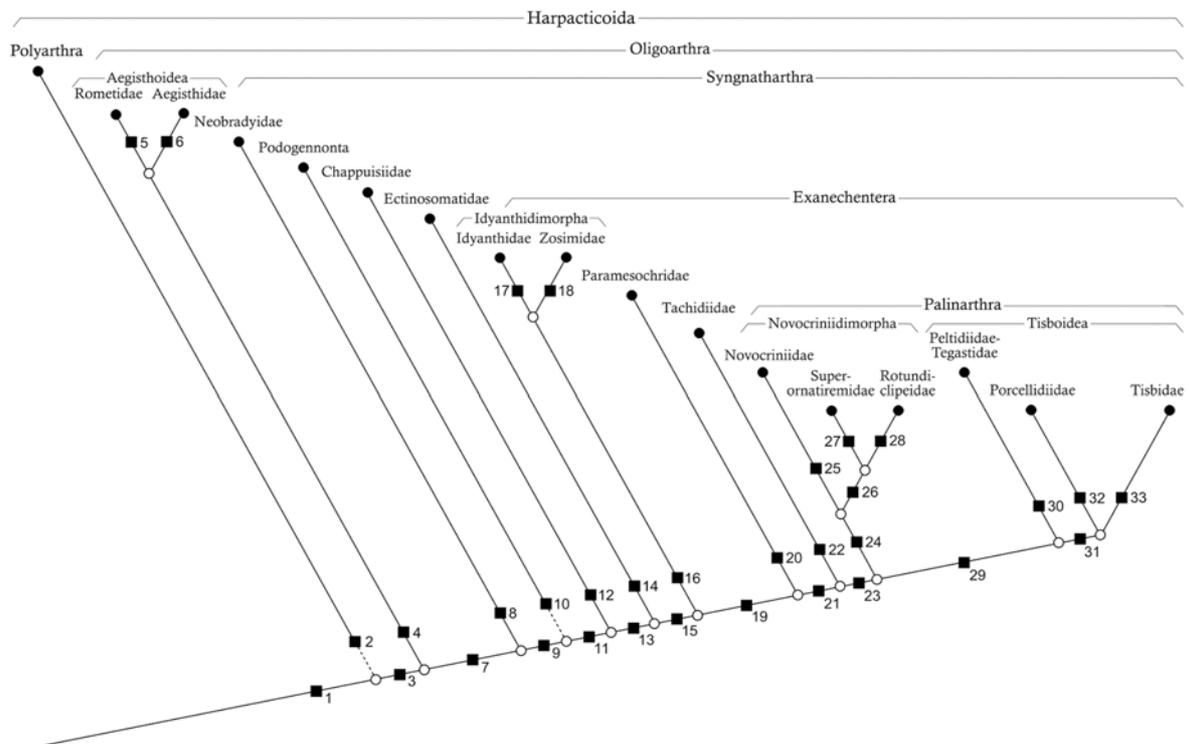


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DIAGRAM OF PHYLOGENETIC RELATIONSHIPS WITHIN HARPACTICOIDA



- Oligoarthra is monophyletic. Many autapomorphies support this hypothesis. The groundpattern of Oligoarthra is completed here. Some character states that are traditionally considered as plesiomorphic within Oligoarthra could be described as secondarily evolved or apomorphic within Oligoarthra (e.g. the separated first pedigerous somite, 2 egg-sacs, 2 proximal setae on the cutting edge of the mandible, the 2-segmented endopod of the mandible, setation of P5 within Podogenonta). Sometimes a different character state as hitherto maintained has to be assumed for the groundpattern of Oligoarthra; e.g. an allobasis and a 3-segmented endopod of maxilla is the plesiomorphic condition; the strong claw (I) of the maxilla is not fused with the endite of the basis and the praecoxa and the coxa of the maxilliped are fused to a syncoxa in the groundpattern of Oligoarthra.
- “Maxillipedasphalea” (Aegisthidae, Chappuisiidae, Darcythompsoniidae, Ectinosomatidae, Neobradyidae, Phyllognathopodidae) is polyphyletic and therefore not maintained here. Darcythompsoniidae and Phyllognathopodidae are integrated in Podogenonta.
- A cladistic analysis demonstrates: *Neocervinia* and *Pseudocervinia* are synonyms of *Cervinia* and *Brotskayaia* is a synonym of *Expansicervinia*.
- “Neobradyoidea” (Chappuisiidae, Darcythompsoniidae, Neobradyidae, Phyllognathopodidae) is polyphyletic and therefore not maintained here.
- *Paramesochra australis* belongs to Ameiridae (Podogenonta) as *Psammoleptomesochra australis*.
- Ectinosomatoidea is synonymized with Ectinosomatidae, as both taxa embrace the same species.
- The monophyly of Exanechentera is confirmed. The exanechenteran species share a bevelled antennal endopod, a bulge at the proximal border of the mandibular gnathobase and the claw with the pointed end of the male antennule. Thompsonulidae is excluded from Exanechentera and is transferred to Podogenonta. Novocriniidae, Paramesochridae, Rotundiclipeidae, and Superornatiremidae are integrated in Exanechentera.
- Idyanthidimorpha tax. nov. contains Zosimidae tax. fam. and Idyanthidae. They mainly share the displaced coxal setae of the maxilliped, the morphology of the P1 and the sexual dimorphism of P2.
- Lang (1944) established Idyanthinae. Idyanthinae is excluded from Tisbidae *sensu strictu* and is raised to family rank. The species of Idyanthidae are mainly characterised by the elongated exopod of the maxillula, the characteristic endopod of P1, and the lack of the inner setae of the P2 enp-3 in male. *Dactylophia* together with *Idyanthe*, *Idyella*, *Idyellopsis*, *Styracothorax*, and *Tachidiella* represents the taxon Idyanthidae. *Tachidiopsis* is excluded from Idyanthidae and transferred to Neobradyidae mainly on the basis of the shape and arrangement of the syncoxal setae of the maxilliped, and the sexual dimorphism in P2 and P3. *Tachidiopsis bozici*, *T. ibericus*, *T. laubieri*, *T. parasimilis*, and *T. sarsi* are moved from *Tachidiopsis* to *Marsteinia*. Styracothoracidae is synonymized with Idyanthidae, as *Styracothorax gladiator* has the autapomorphies of Idyanthidae. *Neoscutellidium* is excluded from Idyanthidae and is transferred to Cholidiinae (Tisbidae *sensu strictu*).
- *Zosime*, *Peresime*, and *Pseudozosime* are excluded from Idyanthidae and are combined in Zosimidae tax. fam. This monophyletic species group is characterised by many autapomorphies.
- *Idyanthopsis psammophila* belongs to Paramesochridae as *Diarthrodella psammophila*.
- As Harpacticidae was integrated in Podogenonta, “Tachidioidea” is polyphyletic and therefore not maintained here.
- The monotypic Euterpinidae is synonymized with Tachidiidae, as *Euterpina acutifrons* has all autapomorphies of Tachidiidae.
- The taxon Palinarthra tax. nov consists of Novocriniidimorpha tax. nov. (Novocriniidae - Superornatiremidae - Rotundiclipeidae) and Tisboidea (Peltidiidae - Tegastidae -

Porcellidiidae - Tisbidae *sensu strictu*). The species of Palinarthra mainly share the oral cone, the elongated and narrow gnathobase mandible and praecoxal arthrite of the maxillula, the ornamentation of the distal syncoxal endite of the maxilla, and the short syncoxa of the maxilliped. Novocriniidimorph species share at least 13 autapomorphies. Tisboidea is mainly characterised by the proximally displaced fused praecoxal endites of the maxilla, the elongated enp-2, exp-1 and exp-2 of P1, and the rounded small exp-3 of P1 with the transformed spines.

- Clytemnestridae is synonymized with Peltidiidae, because the eight species of *Clytemnestra* - *Goniopsyllus* belong to an advanced taxon within Peltidiidae. A complete revision of Peltidiidae - Tegastidae on species level is needed to clarify whether Tegastidae is either the sister taxon of Peltidiidae or a monophyletic taxon within Peltidiidae probably related to *Clytemnestra* - *Goniopsyllus*.
- The hypothesis of oligomerization in Oligoarthra, i.e. the reduction in the number of segments of the appendages and the body and additionally their ornamentation was tested and confirmed in general.
- In the evolution of Harpacticoida it is rare but possible, that a character state evolves resembling a formerly reduced state. For some character states it could be shown that it is not the recovered plesiomorphic state, but a new state resembling the plesiomorphic one. These rare evolutionary events lead mainly to the reappearance of segments, setae and aesthetascs.
- Every segment and almost all setae could be homologised in all examined adult species of Harpacticoida. The homology of setae of antenna, maxillula, maxilla, and maxilliped is completed here.
- First steps towards the characterisation of the evolution of Harpacticoida are made.