

## Sperm Ultrastructure in the Cirripedia and its Phylogenetic Significance

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**ABSTRACT.** Sperm morphology was examined in 42 species of Thoracica, from 32 genera in 11 families, and in one species of Acrothoracica. The filiform spermatozoa of Thoracica, Acrothoracica and Rhizocephala share: (1) an axoneme capped by a conical acrosome; (2) a filiform nucleus running parallel to the axoneme; (3) an elongate mitochondrion posterior to the nucleus; (4) glycogen deposits. This sperm type links the Thoracica, Acrothoracica and Rhizocephala and distinguishes them from the other Thecostraca. Structural differences in the sperm nucleus separate the three groups and are further consistent with segregation of the Rhizocephala from the Thoracica + Acrothoracica (= Cirripedia *sensu* Newman). In spermatozoa from seminal vesicles of Thoracica, an accessory droplet is usually present. This structure, produced by the Golgi complex during spermiogenesis, shows variation among species in its form and internal substructure. The Iblidae, Lepadidae and Scalpellidae have distinctive modifications of the accessory droplet. Among the scalpellids, the Pollicipedinae retain a generalised thoracican sperm morphology, while other subfamilies which have been studied (Lithotryinae, Scalpellinae, Calanticinae) display differing modifications of nuclear and droplet structure. Sperm morphology of *Verruca* is consistent with derivation of the Verrucomorpha from scalpelloids related more closely to the Pollicipedinae than to the Calanticinae, Lithotryinae or Scalpellinae. The retention of a generalised sperm morphology in *Catomerus* is further consistent with the derivation, on other grounds, of the Balanomorpha from a scalpelloid ancestry. Within the Balanomorpha, sperm data offer indications of phylogenetic patterns in the Chthamaloidea (*Chamaesipho* derived from catophragmids independently of the chthamalids), Coronuloidea (*Cylindrolepas* related to *Tubicinella*; tetraclitids monophyletic and including *Austrobalanus*) and Balanoidea (archaeobalanids polyphyletic; *Armatobalanus* related to Pyrgomatidae; *Balanus* and the megabalanines both probably complex groups of perhaps multiple origins). Present sperm data do not assist in the elucidation of relationships between balanomorph superfamilies. Basal members of each superfamily retain a generalised thoracican sperm structure.

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