HELLENIC ZOOLOGICAL SOCIETY

XVIIIth INTERNATIONAL CONGRESS OF ZOOLOGY
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BOOK OF ABSTRACTS

3,000 OR 30,000 FREE-LIVING CILIATES? AN INVESTIGATION ON NAMIBIAN SOIL CILIATES

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Soil samples taken from a great variety of biotopes in Namibia (southwest Africa) were investigated for ciliates. Species were determined from life and after silver impregnation. In the 57 samples studied, about 360 taxa were identified, of which circa 150, mainly medium-sized species, were undescribed. This high number of new species was obtained, although we used a conservative species concept, that is, species were identified with poorly described ones when at least one main character matched. As yet, the family Colpodidiidae Foissner contained only 2 species, *Colpodidium caudatum* Wilbert and *C. viride* (Mirabdullaev) Jankowski. We added 2 new genera and 7 new species, which is a three-fold increase in species number. Likewise, of the 10 nassulids found in the Etosha Pan almost half, namely 4 species, were undescribed. Furthermore, detailed investigations on the hypotrich genus *Urosoma* showed that it does not comprise only 2 species, as Borror assumed, but at least 13 species, of which 3 are still undescribed. These few examples, which could easily be enlarged, show an increase of 40–350% in species number during a few detailed investigations. This strongly indicates that the number of free-living ciliates is much higher than the 3 000 species recognized by Finlay et al. Possibly, the real number is somewhere between 15 000 and 30 000.

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The Protozoa-Metazoa Boundary
Conveners: Wilhelm Foissner and Graham Shields

THE "BRUSH PHENOMENON" - A COMMON PROBLEM IN CLASSICAL AND MOLECULAR PHYLOGENIES OF PROTOZOA AND METAZOA

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At the turn of the century, when knowledge was sparse compared with the present, there was much hope that protozoan and metazoan phylogeny could be unravelled by increased research and the discovery of new taxa. In the seventies, cladists were convinced that their method could provide a stable system for all organisms. Finally, in the eighties and nineties, molecular biologists were full of hope that they had the "universal tree of life" at the turn of the millennium. Unfortunately, all claims and hopes were blurred by the "brush phenomenon". Briefly, the phenomenon runs as follows: As long as knowledge is sparse, taxa are separated by very distinct gaps and thus represent highly characteristic evolutionary lines. As knowledge increases, that is, some or many of the less "typical" taxa are included in the analysis, the distinctiveness of the evolutionary pathways decreases more and more and incongruences increase. Finally, the data do not produce a "tree" but a more or less distinct "bush" or "brush". Impressive examples are the papers by Cavalier-Smith (1998: Biol. Rev. 73: 203-266) on protists and by Ehab Abouheif et al. (1998: J. Mol. Evol. 47: 394-405) on multicellular organisms. The brush phenomenon is scale-independent, that is, it can be observed between phyla as well as families and genera. Accordingly, common mechanisms appear likely. I suggest that these mechanisms correspond to parallel and convergent evolution, both of which are likely to be much more common than presently recognized. The more taxa are analyzed, the more unrecognized convergences accumulate and disturb the tree, especially in molecular systematics, where plesiomorphies and apomorphies cannot yet be distinguished. There is little hope that the problems can be solved by any method in the near future. New ways of thinking and working are necessary. For instance, algorithms which combine classical morphological and modern molecular data should be developed and more micropaleontological data should be collected. Likewise, a more intensive collaboration between morphologists and molecular biologists is necessary. Thus, both fields, molecular biology and morphology need equal support by federal governments and grant institutions.

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1999 ABSTRACTS

65 (p. 8A - 9A)

Trachelocercid Karyorelictids (Protozoa, Ciliophora) have a Parakinetal Stomatogenesis. W. FOISSNER and K. AL-RASHEID, Universität Salzburg Institut für Zoologie, Hellbrunnerstrasse 34, A-5020 Salzburg, Austria and King Saud University, Zoology Department, Riyadh, Saudi Arabia.

Ontogenesis in *Sultanophrys arabica* Foissner & AL-Rasheid, 1999, a trachelocercid karyorelictid ciliate, was investigated using live observation, silver impregnation, and scanning electron microscopy. Division is homothetogenic and occurs in freely motile (non-encysted) condition. The parental oral apparatus does not reorganise and cell shape is maintained. Stomatogenesis is parakinetal, that is, the anlage for the opisthe oral apparatus is derived directly from the first ordinary somatic ciliary row right of the glabrous stripe and has no connection with parental mouth structures. The oral primordium appears slightly subequatorially and consists of an anarchic field of basal bodies, from which many short dikinetidal kinetofragments differentiate. The kinetofragments migrate centrifugally and assemble to a circumoral kinety and three minute adoral organelles (brosse kineties). The somatic kineties, the bristle kinety, and the lateral kinety divide without anlagen formation. Thus, morphogenesis of trachelocercid karyorelictids is simple and distinctly different from that of loxodid karyorelictids, which develop the oral primordium buccokinetally. This shows that different stomatogenic modes developed very early in ciliate evolution, which is emphasised by the heterotrichs, whose parakinetal stomatogenesis is rather different from that of the trachelocercids. Nevertheless, our data give some support for the subphyletic division suggested by Lynn (1966), but do not support any of the hypotheses on evolution of ciliate cytoarchitecture.

466

66 (p. 9A)

Metopus, Ciliophora incertae sedis: Morphogenesis does not Support a Relationship with Haptorid Gymnostomes and Heterotrich Clevelandellids as Indicated by Gene Sequence Data. S. AGATHA and W. FOISSNER, Universität Salzburg Institut für Zoologie, Hellbrunnerstrasse 34, A-5020 Salzburg, Austria.

The morphology and morphogenesis of *Metopus hasei* Sondheim, 1929 were investigated using live observation, silver impregnation, and scanning electron microscopy. *Metopus* has a spiral body organization and the ventral margin of the preoral dome bears five specialized ciliary rows, which form the so-called perizonal stripe. Division is homothetogenic, occurs in freely motile (i.e. non-encysted) condition, and includes a partial reorganization of the parental oral apparatus. During division, the complicated cell shape becomes ellipsoidal and all ciliary rows arrange meridionally. Stomatogenesis is entirely somatic (= pleurotelokinetal) and commences with the formation of kinetofragments in some dorsolateral kineties. The fragments become the opisthe's adoral membranelles, while the paroral membrane is generated by the left two perizonal ciliary rows, which proliferate kinetids intrakinetally. The perizonal stripe of the opisthe is generated by the three right parental perizonal kineties, which divide, and by two dorsolateral ciliary rows, which are added. The ontogenetic, ultrastructural, and sequence data available give no clear indication about metopid phylogeny, but definitely exclude metopids from the classical heterotrichs, with which they were classified for more than 100 years.

467

67 (p. 9A)

Trachelocercid Karyorelictids (Protozoa: Ciliophora) Do Not Feed by the Glabrous Stripe, as Proposed by Lenk & Small, but through a Conventional Oral Apparatus at the Anterior End of the Organisms. K. AL-RASHEID and W. FOISSNER, King Saud University, Zoology Department, Riyadh, Saudi Arabia; and Universität Salzburg, Institut für Zoologie, Hellbrunnerstrasse 34, A-5020 Salzburg, Austria.

Trachelocercids contain large metazoan preys, such as rotifers and nauplii, although they are very slender and lack conspicuous mouth structures. In the sixties, specialists assumed, but never observed, apical feeding because of the bulbous apical end (head), where some specialised cilia were recognisable. However, later Lenk & Small reported on experiments indicating that trachelocercids feed by the glabrous stripe, a non-ciliated area, which extends the whole body length in the middle third of the left side. We reinvestigated the problem in flourishing cultures of *Sultanophrys arabica* and *Tracheloraphis* sp., using live observation and scanning electron microscopy. Both species are omnivorous and feed through the apical end. The head greatly expands during the act and contains an inconspicuous but highly organised oral apparatus, which originates parakinetally during cell division. Ingestion of small preys, such as medium-sized ciliates and diatoms, needs only a few minutes, while the uptake of an 1 mm long nematode may need up to 40 min. Accordingly, the proposal by Lenk & Small that trachelocercids feed through the glabrous stripe is a misobservation and refused.

468

68 (p. 9A)

Diversity of Planktonic Freshwater Ciliates. H. BERGER*, W. FOISSNER** and J.SCHAUMBURG***, *Technisches Büro für Ökologie, Radetzkystrasse 10, A-5020 Salzburg, Austria; **Universität Salzburg, Institut für Zoologie, Hellbrunnerstrasse 34, A-5020 Salzburg, Austria; and ***Bayerisches Landesamt für Wasserwirtschaft, Postfach 190241, D-80602, München, Germany.

About 170 species of euplanktonic freshwater ciliates have been described worldwide. Considering that about 25 of them have been described by a handful Eurasian workers during the past two decades, it is very likely that a lot of euplanktonic ciliates are still undescribed. However, diversity of plankton ciliates is distinctly lower than that of benthic ciliates, probably because the pelagial provides fewer niches. 119 species (including 6 new ones) in 64 genera have been described in detail in the book cited below. The largest genera are *Urotricha, Monodinium* and *Rimostrombidium*. Within the higher taxa, the euplanktonic species are distributed as follows: Gymnostomatea 26.7%, Prostomatida 23%, Peritrichia 18.5%, Oligotrichida 15.6%, Hymenostomata 4.4%, Hypotrichia 3.0%, Colpodea 3.0%, Heterotrichida 2.2%, Suctoria 2.2%, Cyrtophorida 0.7%, Nassulida 0.7%. About 20 % of the species have zoochlorellae and/or cleptoplasts, which is a distinct higher proportion than found in benthic species from running waters (only about 5%!), indicating food as limiting factor in plankton ciliate communities. Supported by the Bayerische Landesamt für Wasserwirtschaft, Munich.

469

69 (p. 9A)

A New, Peculiar Colpodid Ciliate from the Tanks of a Brasilian Bromeliad.W. FOISSNER and T. CORDEIRO, Universität Salzburg, Institut für Zoologie, Hellbrunnerstrasse 34, A-5020 Salzburg, Austria; and NEPREMAR-UFPB, Cidade Universitaria, Campus I, 58059-900 João Pessoa, PB, Brazil.

A very peculiar new colpodid ciliate was discovered in the tanks of a bromeliad from a tree of the Nature Reserve Mata do Buraquinho in the town of João Pessoa, Paraiba, Brazil. Pure cultures could be established in table water enriched with some cracked wheat grains or meal worm fragments to stimulate growth of indigenous bacteria and heterotrophic flagellates on which the organism feeds. Ordinary specimens have a length of about 30 µm and are *Metopus*-shaped, that is, have a broad anterior and a narrow postoral half. The oral apparatus is in midbody and is very similar to that found in small members of the genus *Colpoda*, e.g., *Colpoda aspera*. Many other features are different, however: (i) there is a large, unciliated area on the right anterior half; (ii) the species has a distinct life cycle with *Metopus*-shaped theronts and up to 70 µm long, reniform trophonts, which have a huge oral apparatus; (iii) division occurs in freely motile, that is, non-encysted condition and includes the formation of swimming chains composed of four globular daughter cells, which are connected by a unique, plug-like structure; (iv) the resting cysts are ellipsoidal. This species belongs, according to its general morphology, to the order Colpodida. The ontogenetic peculiarities and the unique resting cysts suggest that it is a new genus and the representative of a new family. (Supported by the Austrian FWF, project P 12367 and the University of João Pessoa.)

470