

FAMILY COLPODELLIDAE
SIMPSON & PATTERSON, 1996

By ALASTAIR SIMPSON AND DAVID PATTERSON



Colpodella Cienkowski, 1865, the sole genus in this family, contains free-swimming flagellates that prey on other protists by sucking up the cytoplasm through a **rostrum**. Flagellates exhibiting this behaviour have often been assigned to other genera including *Spiromonas*, *Dinomonas*, *Alphamonas*, *Nephromonas*, *Dingensia* and *Bodo*. Several such organisms have been studied in detail, mostly under the name *Spiromonas* (Brugerolle and Mignot, 1979, Foissner and Foissner, 1984, Krylov and Mylnikov, 1986, Mylnikov, 1991). At the ultrastructural level they were found to be more similar to the apicomplexan parasites than to any other protists.

Colpodella pugnax (Fig. 1) the type species of *Colpodella*, was recently found to have a similar ultrastructure to the previously studied species considered above (Simpson & Patterson, 1996). The name *Colpodella* has priority, with *Spiromonas* being an inappropriate name for flagellates (Patterson & Zölffel, 1991). All free-living flagellates with an apical complex are included in *Colpodella* (Simpson & Patterson, 1996). The generic names *Alphamonas*, *Dingensia* and *Nephromonas* are junior synonyms.

The genus contains seven distinguishable species (Simpson & Patterson, 1996) all of which have two flagella and are under 25 µm long. The flagella insert opposed/ orthogonally in small pockets or grooves at the base of an anterior rostrum. The rostrum attaches to prey cells and cytoplasm is drawn into the *Colpodella*. Fed cells may form cysts in which the cells divide into two or four daughter cells. The life cycle is shown in Fig. 1.

Notable ultrastructural features include: tubular/vesicular mitochondrial cristae, cortical alveoli underlain by longitudinal microtubules subtending the outer plasma membrane, and micropores. The rostrum contains an apical complex with **rhoptries** (Brugerolle and Mignot, 1979; Foissner and Foissner, 1984, Mylnikov, 1991, Simpson and Patterson, 1996). A **conoid** has been identified in several species (Mylnikov,

1991, Simpson and Patterson, in press). This presence of micropores and an apical complex, the ultrastructural synapomorphies of the Apicomplexa means that Apicomplexan monophyly is only ensured if the taxon includes *Colpodella*.

Colpodella may only be distinguished from other flagellates with certainty by ultrastructural examination. The four-way division cyst is probably distinctive for *Colpodella* among flagellates but has not been observed in all species in the genus.

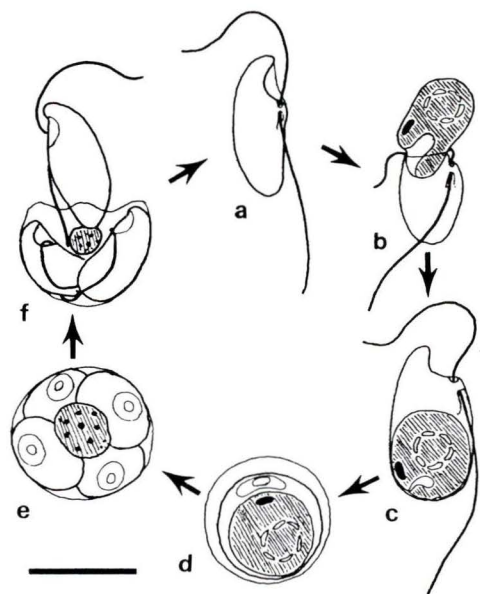


Fig. 1. *Colpodella pugnax* life cycle. a, swimming cell. b, Cell attacking alga c, Cell with ingested alga. d, Young division cyst. e, Older division cyst with 4 daughter cells forming, f, Daughter cells escaping from cyst leaving remains of prey. Scale bar = 10µm

LITERATURE CITED

Brugerolle, G. & Mignot, J.-P. 1979. Observations sur le cycle, l'ultrastructure et la position systématique de *Spiromonas perforans* (*Bodo perforans* Hollande 1938), flagellé parasite de *Chilomonas paramecium*: Ses relations avec les dinoflagellés et sporozoaires. *Protistologica*, 15:183-196.

Foissner, W. & Foissner, I. 1984. First record of an ectoparasitic flagellate on ciliates: an ultrastructural investigation of the morphology of *Spiromonas gonderi* nov. spec. (Zoomastigophora, Spiromonadidae) invading the pellicle of ciliates of the genus *Colpoda* (Ciliophora, Colpodidae). *Protistologica*, 20:635-648.

- Krylov, M. V. & Mylnikov, A. P. 1986. New taxa in the phylum Sporozoa, Spiromonadomorphina subcl. n., Spiromonadida ordo n. *Parazitologiya*, 20:425-430. (In Russian)
- Mylnikov, A.P. 1991. Ultrastructure and biology of certain representatives of the order Spiromonadida (Protozoa) *Zoologicheskij Zhurnal*, 7: 5-15. (In Russian).
- Patterson, D.J. & Zöllfel, M. 1991. Heterotrophic flagellates of uncertain taxonomic position. In: Patterson, D. J. & Larsen, J. (ed) *The Biology of Free-living Heterotrophic Flagellates*. Clarendon Press, Oxford. pp. 427-475.
- Simpson, A. G. B. & Patterson, D. J. 1996. Ultrastructure and identification of the predatory flagellate *Colpodella pugnax* Cienkowski (Apicomplexa) with a description of *Colpodella turpis* (n. sp.) and a review of the genus. *Syst. Parasitol.* 33:427-475.

PHYLUM CILIOPHORA

DOFLEIN, 1901

DENIS H. LYNN and EUGENE B. SMALL

Ciliated protozoa have long been observed and used as research tools: in taxonomy and systematics, nutrition, biochemistry, behavior, cytology, genetics, molecular biology, morphogenesis, physiology, reproduction, and symbiosis and-especially-in electron microscopy in recent years as exponents of cellular structures. Some of the better domesticated ones have become subjects of whole books: *Paramecium* (Wichterman, 1953; van Wagtenonk, ed., 1974; Görtz, ed., 1988); *Tetrahymena* (Hill, 1972; Elliott, ed., 1973); *Blepharisma* (Giese, 1973); *Stentor* (Tartar, 1961); and *Ophryoglena* (Canella and Rochi-Canella, 1976) as prime examples. The entire phylum has been documented (Corliss, 1979) and its biology reviewed (Hausmann and Bradbury, 1996); experimental ciliatology has been reviewed (Nanney, 1980); and their use as models in developmental biology has been examined (Frankel, 1989). Their great importance as research tools is unquestioned.

The great amount of research on the easily cultured ciliates sometimes tends to obscure their great ecological importance; but that has not been ignored. Ciliated protozoa are obvious components of many microhabitats, both visibly and ecologically (Fauré-Fremiet, 1950; Fenchel, 1967, 1968a, b, 1987; Laybourn-Parry, 1984; Nisbet, 1984), both benthically and in planktonic food webs. Marine species such as *Myrionecta* (formerly *Mesodinium*.) *rubrum* may provide much primary productivity in areas of upwelling (Smith and Barber, 1979; Lindholm, 1985). Planktonic tintinnids and oligotrichs are important oceanic secondary consumers (Heinbokel, 1978; Heinbokel and Beers, 1979); possibly, in the central gyres, up to 90% of carbon from primary productivity may cycle through tintinnids (Jackson, 1980). Mixotrophy has now been recognized as an obligate strategy of some planktonic ciliates (e.g., *Laboea*, Stoecker et