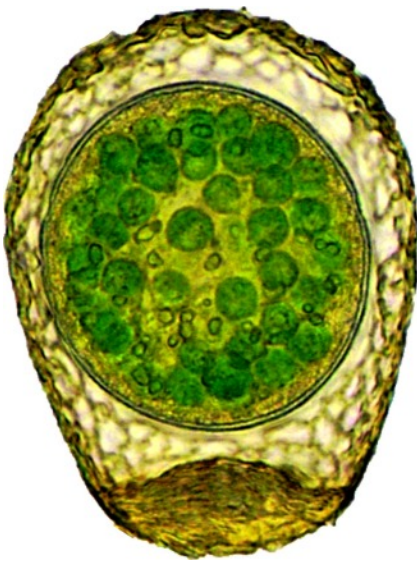


- The cyst in a cyst -  
*Euglypha acanthophora*

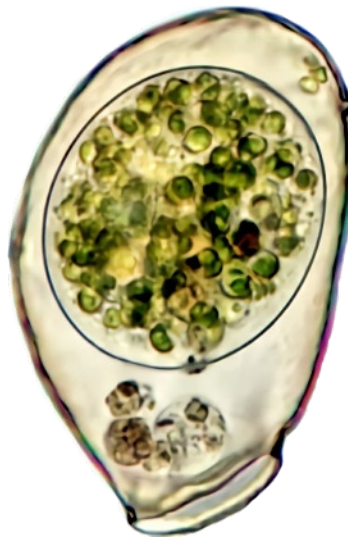
Prologue:

**T**estate amoebae are a group of amoebae that construct and inhabit a protective shell or test. In certain conditions, testate amoebae have the ability to encyst, which means they form spherical cysts - dormant, protective structures that allow them to survive unfavorable environmental conditions.

The cysts provide a physical barrier that shields the amoebae from external stressors, such as frost, desiccation, predators, or toxins. The cyst wall is often composed of complex organic compounds, providing a durable and resistant structure.



*Heleopera sphagni*

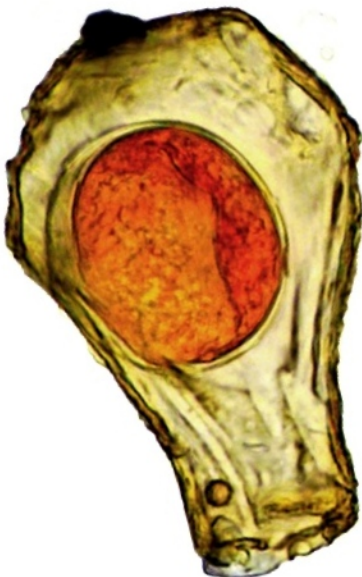


*Hyalosphenia papilio*



*Hyalosphenia elegans*

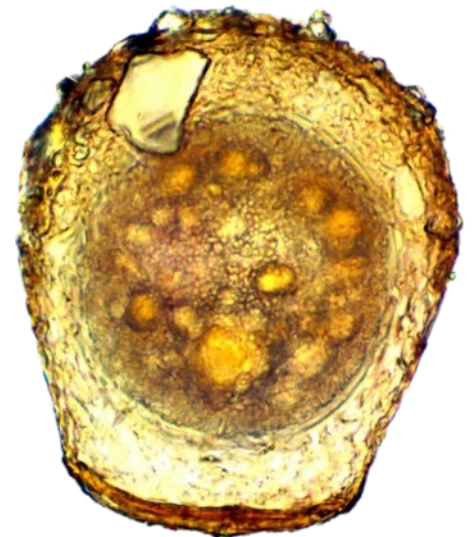
Some typical testacea cysts



*Diffugia rubescens*



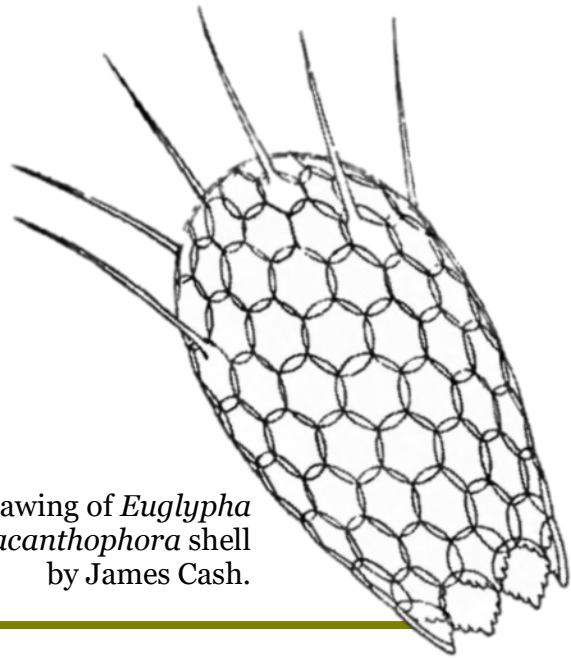
*Arcella* sp.



*Heleopera petricola*

## *Euglypha acanthophora*

*Euglypha acanthophora* is a small unimpressive member of its genus. 50 to 80  $\mu\text{m}$  high, like several *Euglypha* some individuals carry spines.



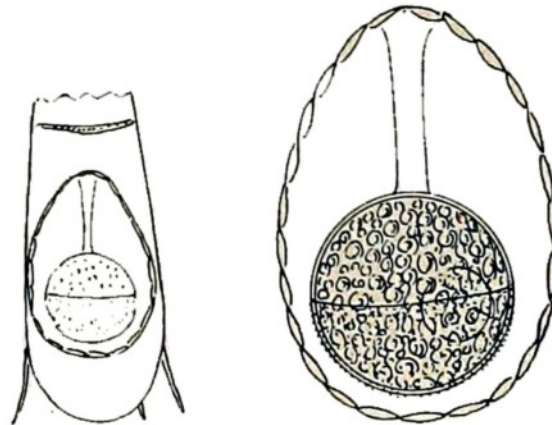
Drawing of *Euglypha acanthophora* shell by James Cash.

One feature distinguishes it (and few close relatives) from all other *Euglypha*, even from all Testacea: its type of permanent cyst.

## Eugène Penard ...

... wrote 1902 [my translation]: "In one of my fishings one met a great number of encysted individuals, belonging to the var. *brevispina* [now *acanthophora*]"

The shell, protected by a transverse diaphragm, contained an ovoid cyst, purplish yellow, formed of small thick scales, solidly and regularly imbricated. Inside this first cyst was a second, spherical, surrounded by a hyaline membrane, which was itself covered, in whole or in part (for example on a hemisphere), with a rough skin, punctuated with very fine granulations or dust of a pinkish brown.



Penard's drawing

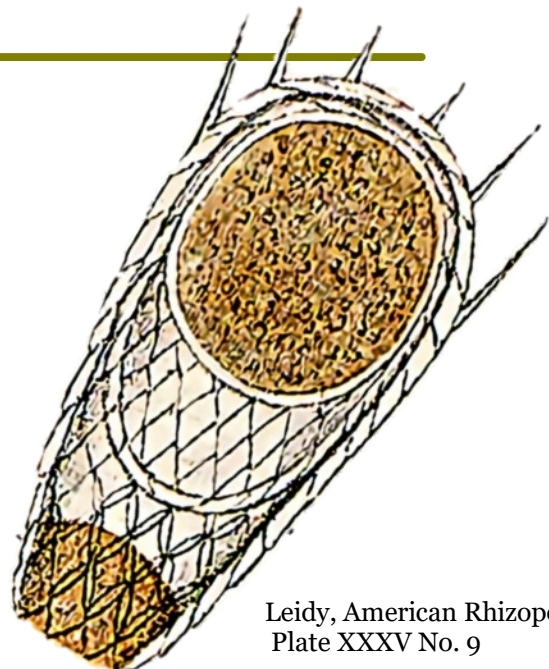
The interior was filled with yellowish shiny grains (excretion grains?), then starch; sometimes, but rarely, a nucleus could be seen, with nucleoli embedded in the nuclear juice.

Finally, this spherical mass or true cyst was connected to the external ovoid cyst, and always at the small end of the latter, by a peduncle, or bluish column, rigid in appearance, very thick, and which seemed to be made of coagulated plasma."

## And Joseph Leidy ...

... wrote already in 1897: "In one of the specimens observed the encysted sarcode mass formed an egg-like body covered with a shell having the same structure as that of the parent shell enclosing it. The sarcode itself was pale yellowish, of uniform granular constitution, mingled with fine oil molecules".

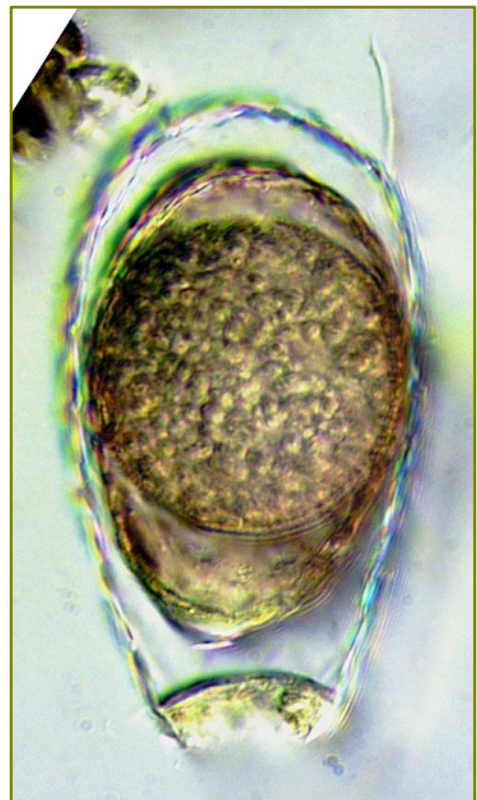
Leidy found similar cyst in *Euglypha mucronata* and *Euglypha alveolata* [obsolete species names], both closely related *Euglypha* species.



Leidy, American Rhizopoda, Plate XXXV No. 9

In 2022 I myself, like Penard (above) found a multitude of encysted *Euglypha acanthophora* in a peat moss sample. In all of them, the actual spherical cyst was in a larger, egg-shaped shell covered with reserve plates (the scales already self-produced for the next generation), a small copy of the outer shell.

My peat moss container has now been out in the garden for over a year, was completely frozen in the meantime, completely dried out in the summer, the moss dead. However, the sample still contains numerous live cysts. Apparently, these cysts represent a survival concept for long periods of time. I have tried several ways to wake them up, but in vain.



Wailes (in Cash/Wailes Volume 3 1915) hypothesized: "The process of encystment and of the development of the cyst in *Euglypha acanthophora* [then *alveolata*] has recently been described and illustrated in detail by Methodi Popoff up to the liberation of the "swarm spores" or gametes; these are isogametes, and from the conjugation of two of them a small amoeboid form results, the further development of which has not been followed."

What Popoff envisioned:

1. The animal becomes encysted, the nucleus divides repeatedly and a large number of minute daughter nuclei are produced.
2. The cytoplasm fragments and a small bit of it surrounds each daughter nucleus and, thus, many minute animals are formed.
3. Under favourable circumstances the cyst bursts and these small animals come out and grow to the adult stage.

Th. Grosspietsch 1958: "... it could be proven that the formations previously regarded as gametes (germ cells) are actually based on the presence of parasites."

Reproduction [of testate amoebae] is, as far as is known, by replication of the parent during asexual binary fission [only] to form an identical daughter-cell. (Ogden & Hedley),

Nowadays testaceans are in the main studied under the aspect of taxonomy and ecology. I therefore could find only these quite outdated mentions of the described phenomena.

Hans Rothauscher, July 2023

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## Literature

- FRESH-WATER RHIZOPODS OF NORTH AMERICA, JOSEPH LEIDY, 1879;  
(From my own illustrations one may see that I am a great admirer of Leidy's lithographs.)
- EUGÈNE PENARD, FAUNE RHIZOPODIQUE DUE LAC LEMAN, 1902;
- JAMES CASH AND GEORGE HERBERT WAILES, THE BRITISH FRESHWATER RHIZOPODA, Vol 3, 1915;
- Th. Grosspietsch: WECHSELTIERCHEN, Kosmos-Verlag 1958:
- OGDEN, C.G.AND HEDLEY, R. H. (1980): AN ATLAS OF FRESHWATER TESTATE AMOEBAE . British Museum (Nat. Hist.);
- I was not yet able to obtain METHODI POPOFF's essay in Archiv für Protist, vol xxv pt. 1.

Comments welcome to E-Mail: [rothauscher@gmx.de](mailto:rothauscher@gmx.de)

<http://hans-rothauscher.de/testaceen>

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