

SOME SAND-DWELLING CILIATES OF SOUTH WALES

by

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Résumé

Six espèces nouvelles de Protozoaires Ciliés psammobiotiques sont décrites, dont cinq appartiennent au genre *Tracheloraphis* et une au genre *Kentrophoros*.

Introduction

An ecological survey of the ciliates of two sea-shores in South Wales which will be reported elsewhere revealed several that appear to be new to science. All occur in the intertidal sand of Swansea Bay (mean grain size 0.25mm, organic carbon content 0.07 percent), or Oxwich Bay (mean grain size 0.34mm, organic carbon content 0.06 percent). The ciliates were extracted using the sea-water ice technique of Uhlig (1964, 1966, 1968) and Uhlig, Thiel and Gray (1973). They were then attached to slides with glycerin albumin, after fixation in Schaudin's acetic acid, and stained with Delamaters basic fuchsin (Delamater, 1948).

DESCRIPTION OF SPECIES

GENUS *TRACHELORAPHIS* Dragesco, 1960

Apical cytostome, nuclear dualism, macronucleus diploid, elongate body form with thigmotactic cilia on the ventral surface, globerulus zone occupies up to half dorsal surface, obligate marine interstitial.

Type: *Tracheloraphis phoenicopterus* (Cohn, 1866).

Tracheloraphis indistinctus nov. sp. (Fig. 1)

This form has an almost circular cross section in life. The posterior region is pointed but not drawn out. The apical region is slightly swollen and has a simple cytostome with no associated

slit. Body colourless in incident light, length between 600 and 1200 μm , average 900 μm .

There are between thirty-nine and forty-seven kineties, average forty-three. The globerulus zone is very narrow and occupies the equivalent of one kinty. Approximately seventeen kineties do not reach the end of the body, terminating against the globerulus zone.

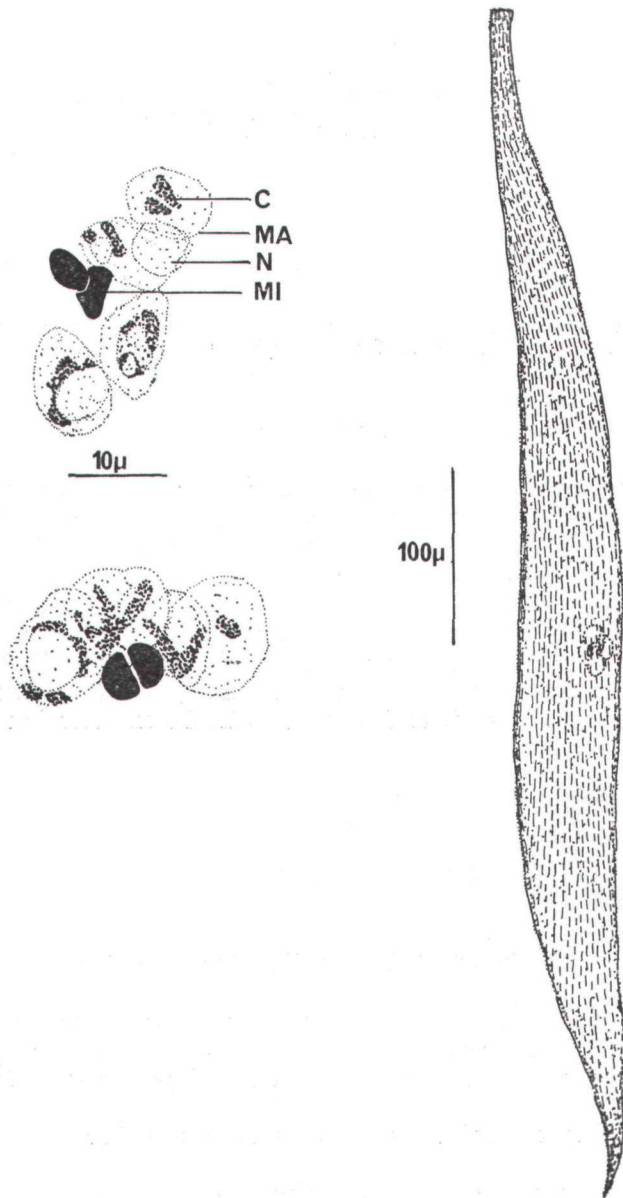


FIG. 1

Tracheloraphis indistinctus now spec. This and all shown subsequently were drawn in fixed condition.

MA: macronucleus; MI: micronucleus; C: chromatin body; N: nucleolus.

There are no interkinetic inclusions; when the ciliate is contracted there are plications between the kineties.

The nuclear material consists of a loosely associated group of macro-and micronuclei in the central region of the ciliate. There are four macronuclei measuring between 7.5 and 11 μm in diameter, each ovoid in shape with a small amount of chromatin. The macronuclei are often difficult to discern as four separate bodies because of the large transparent nuclei often present. The micronuclei measure between 3.5 and 5.5 μm and are often hemispherical.

This species may be found in Swansea Bay in low numbers throughout the year.

Of the other species which are pointed posteriorly with forty or more kineties and a single nuclear group or complex, *T. vermiformis* Raikov, 1962 has approximately seventy kineties, *T. serratas* Raikov and Kovaljeva, 1968 has eight to twelve macronuclei in a group, *T. totevi* Kovaljeva and Golemsky, 1979 contains between sixteen and twenty-two macronuclei and *T. remanei* Dragesco, 1960 is brown in life.

***Tracheloraphis niveus* nov. spec. (Fig. 2)**

This ciliate is almost circular in cross section. The posterior region is usually rounded but may be a stumpy rounded point. The anterior region is swollen, the cytostome is obscured by inclusions but does not appear to have an associated slit. Body white in incident light with a brilliant white head, length between 600 and 1500 μm , average 1000 μm .

There are between thirty-six and forty-seven kineties with an average of forty-three. The globerulus zone is very narrow, occupying the equivalent of one kinety. Approximately fifteen kineties do not reach the end of the body, terminating against the globerulus zone. There are no interkinetic inclusions.

Nuclear material centrally located in a loosely associated group of four macronuclei and two micronuclei. The macronuclei measure between 9 and 18 μm in diameter. They have a large amount of chromatin and occasionally contain large nucleoli. The micronuclei are large, measuring between 4 and 10 μm , average 6 μm . They may be spherical or hemispherical.

This ciliate was found in low numbers throughout the year at Swansea and Oxwich and approximately thirty preparations are available.

Two other species are characterized by a blunt or round posterior with a single nuclear group and more than thirty kineties; *T. lacteus* Raikov and Kovaljeva, 1968 and *T. monocaryon* Dragesco, 1965. In life this species closely resembles *T. lacteus*, but in *T. lacteus* the globerulus zone is two kineties wide, and has a nuclear group that usually consists of eight macronuclei and four micronuclei. The macronuclei also contain less chromatin and always one large nucleolus each. The interkinetic spaces have regularly arranged mucocysts. *T. monocaryon* has its nuclear material associated in a capsule whilst the nucleoli of *T. niveus* are loosely associated.

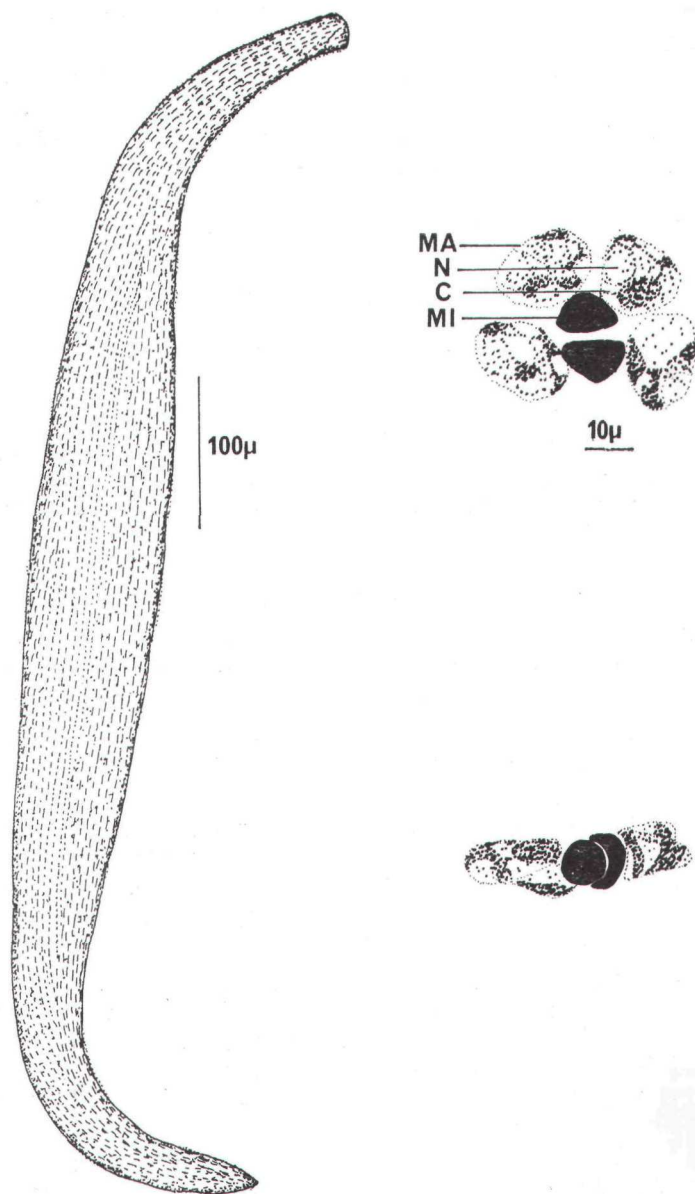


FIG. 2

Tracheloraphis niveus now spec. as in Fig. 1.

T. niveus and *T. indistinctus* differ in a number of respects. The tail region of *T. indistinctus* is always more pointed and never rounded. The nuclei are of different sizes, the micronuclei of *T. niveus* being in general almost twice the diameter of *T. indistinctus*. The macronuclei of *T. niveus* are richer in chromatin than those of *T. indistinctus*, and are therefore more discernible.

***Tracheloraphis hamatus* nov. spec. (Fig. 3)**

This ciliate is colourless, thigmotactic, has a pointed hooked tail and a very prominent globulus zone. The anterior end is not swollen. Length averaging 450 μm .

There are usually between ten and twelve kineties, occasionally thirteen. The globulus zone is wide and occupies the equivalent of eight to ten kineties. The interkinetic spaces have small mucocysts, less than 0.5 μm across, which form a regular pattern of cusps along the edge of the globulus zone.

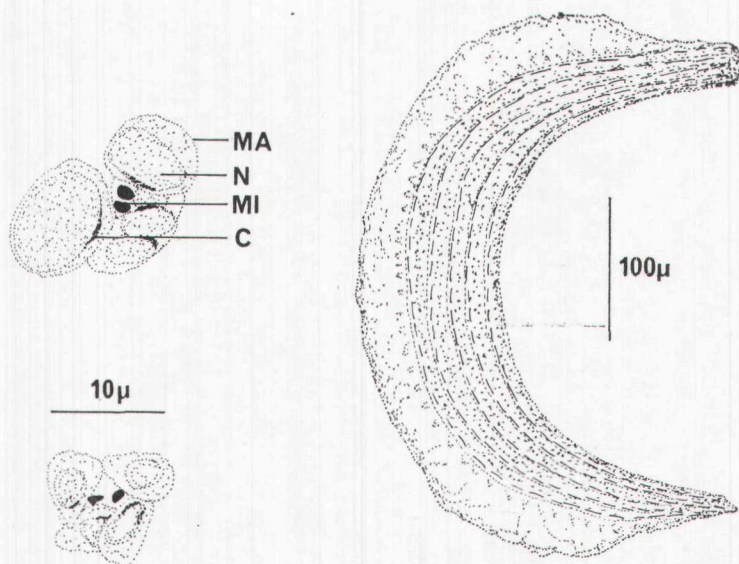


FIG. 3

Tracheloraphis hamatus nov. spec. as in Fig. 1.

The nuclear material is in the form of a closely associated group of macronuclei. There are four macronuclei, varying in size between 5 and 8 μm , average 6 μm . They contain large nucleoli, around the edge of which there are very small amounts of chromatin. The nuclear group measures approximately 11 μm across. In the centre of the group there are two very small micronuclei. They are usually ovoid in shape, though occasionally they have an irregular ovoid outline.

This species was encountered in large numbers throughout the year at both Swansea and Oxwich.

This ciliate is characterised by a single nuclear group, a small number of kineties and a wide globulus zone. Other species that have these characteristics are; *T. africanus* Dragesco, 1965, *T. sarmaticus* Agamaliyev and Kovaljeva, 1966, *T. prenanti* f. *oligocincta*, Raikov et Kovaljeva, 1968 and *T. griseus* (Kahl, 1933).

T. africanus is light brown in life, with fourteen to eighteen kineties and a slightly narrower globulus zone, occupying the

equivalent of six kineties. *T. griseus* has a very wide globerulus zone occupying almost the whole of one side, being the equivalent of fourteen kineties. The single nuclear group consists of six macronuclei and only one micronucleus. *T. sarmaticus* has a fused nuclear complex that contains four or more micronuclei. In *T. prenanti* f. *oligocineata* the nuclear material, as in *T. sarmaticus*, is in a fused complex and contains six or more macronuclei on fragmentation.

Tracheloraphis ditis nov. spec. (Fig. 4)

This ciliate is colourless with a slightly swollen apical region and a rounded posterior end. The cytostome is simple, without a slit and is

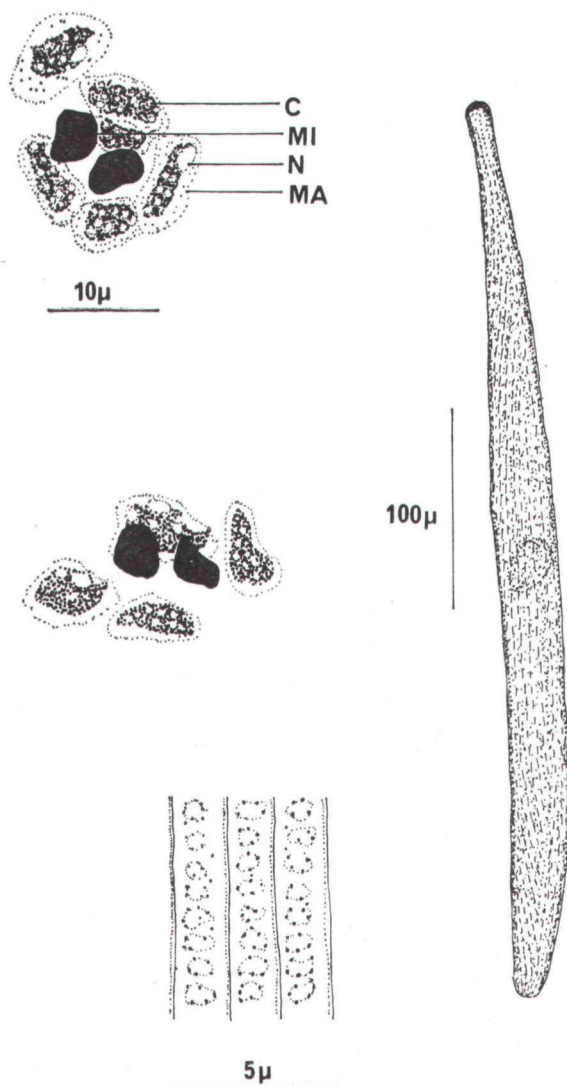


FIG. 4

Tracheloraphis ditis nov. spec. as in Fig. 1 with enlargement showing four kineties and three rows of mucocysts.

occasionally obscured by inclusions. Length between 300 and 800µm, average 450µm.

There are between eighteen and twenty-two kineties; the globerulus zone very narrow and occupying the equivalent of one kinety. The interkinetic spaces and globerulus zone are occupied by plications which have small mucocysts on their surface. The globerulus zone had, on average, eight kineties that terminated against it.

There is a loosely associated group of nuclei located centrally. The macronuclei vary in number between four and six, more usually four. They vary in size between 6 and 8µm. They have an irregular outline, contain a large amount of chromatin and may contain one or two small nucleoli. There are two micronuclei, although on one occasion only a single micronucleus was observed. They are large, measuring 5µm across the longest axis and are ovoid in outline.

Other species with a similarly rounded posterior region, a single nuclear group, a small number of kineties and a very narrow globerulus zone are *T. swedmarki* Dragesco, 1960, *T. gracilis* Dragesco, 1960, *T. conformis* (nov. sp., see below), *T. stephani* Dragesco, 1965, *T. incaudatus* (Kahl, 1933) and *T. incaudatus* f. *quadrimicronucleata* Raikov et Kovaljeva, 1968.

T. swedmarki is brown in life, *T. gracilis* has a wider globerulus zone occupying approximately one sixth of the surface. *T. conformis* looks very similar in life, so much so that these two species had to be included in a single group for purposes of the ecological survey, but it differs in a number of respects. There are fewer kineties and are different in appearance and arrangement. The macronuclei have a very different appearance. *T. stephani* has the nuclear material in a complex, rather than a loosely associated group, and also has a wider globerulus zone. Both *T. incaudatus* and *T. incaudatus* f. *quadrimicronucleata* have more kineties, a wider globerulus zone and the nuclear material forming a complex with two micronuclei in the former and four in the latter.

Tracheloraphis conformis nov. spec. (Fig. 5)

Rounded posteriorly with the anterior end tapering and rather small. Colourless, thigmotactic and measuring between 300 and 800µm, average 450µm.

There are between eleven and fourteen kineties, with a globerulus zone occupying the equivalent of one or two kineties. The pattern of kinety arrangement is unusual, but resembles that of *T. striatus* Raikov, 1962.

The macronuclei are very closely associated but do not form a complex. There are always four macronuclei, varying in size between 5 and 7µm. They have two or three nucleoli, associated with which there are small chromatin bodies. There are two prominent micronuclei, 2µm in diameter.

Both this species and *T. ditis* are very common at both Swansea and Oxwich.

T. conformis is characterized by a rounded posterior end, a single nuclear group, a low number of kineties and a narrow globeru-

lus zone. This species can be differentiated from those discussed when describing *T. ditis* by the loosely associated group of four macronuclei and two micronuclei, and by the arrangement and appearance of the kineties.

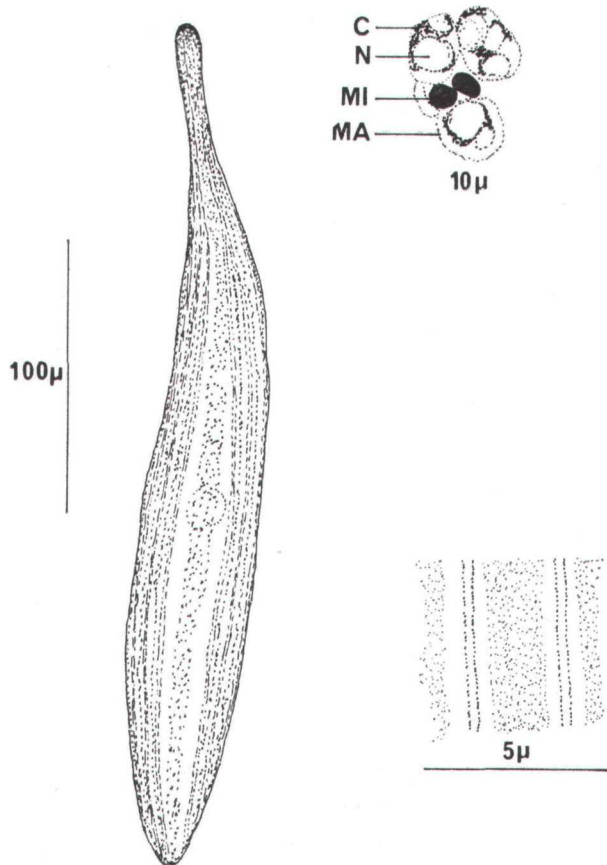


FIG. 5
Tracheloraphis conformis nov. spec, as in Fig. 1 with enlargement of two kineties.

GENUS *KENTROPHOROS* Sauerbrey, 1928

Cytostome absent, nuclear dualism, macronucleus diploid, body laterally compressed with ciliation on right side only, symbiotic bacteria on surface, obligate marine interstitial.

Type: *Kentrophoros fasciolatum* Sauerbrey, 1928

Kentrophoros canalis nov. spec. (Fig. 6)

This is a slow-moving thigmotactic ciliate. The anterior end is blunter than the posterior. In incident light, it is opaque with a lighter central region extending throughout its length.

Length between 300 and 600 μm, average 400 μm.

The apparent lightness of the central region is an effect produced by folds of the longitudinal edge extending towards, but not reaching the central longitudinal axis. The bacteria that cover the surface of

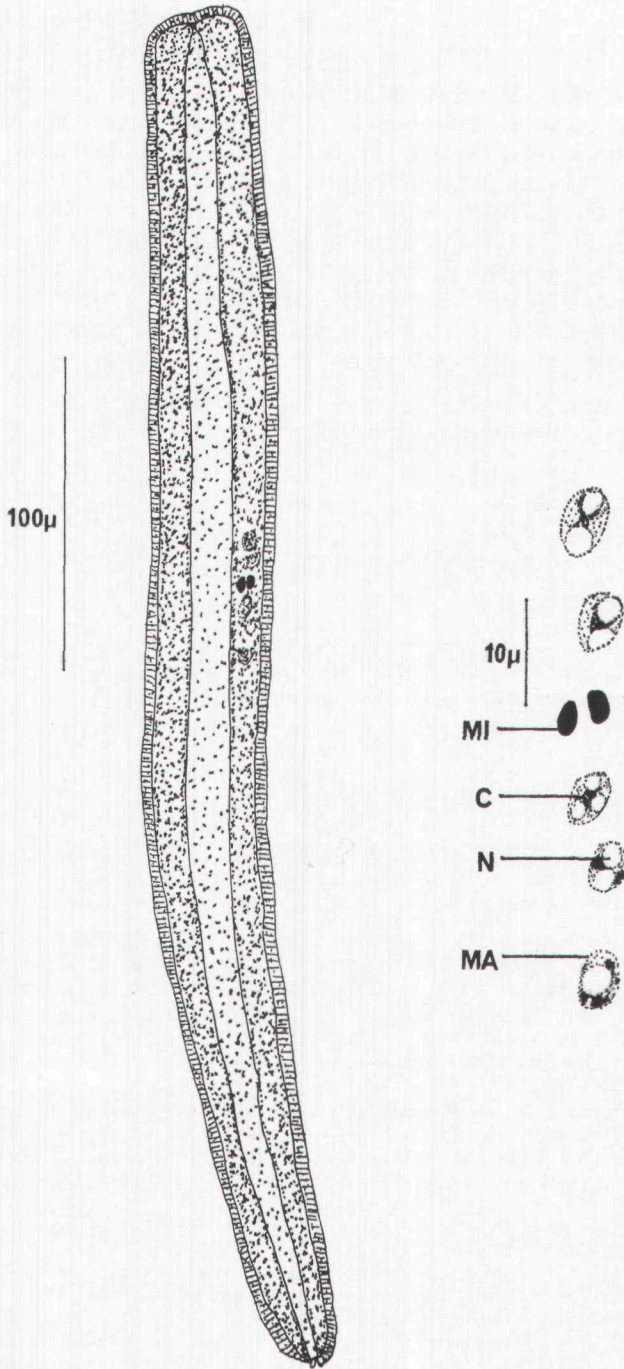


FIG. 6
Kentrophoros canalis nov. spec, as in Fig. 1.

the ciliate are absent from the 'inner' surface, producing the lighter region. The bacterial covering is so dense that it has not been possible to determine the number of kineties. These bacteria measure 2.5 by 0.5 μm , smaller than those recorded by Fauré-Fremiet (1950) on the surface of *K. fistulosa* (Fauré-Fremiet, 1950) and also smaller than those recorded from *K. latum* Raikov, 1962 by Raikov (1974).

The nuclear material is made up of four or more usually five macronuclei and two micronuclei. The macronuclei vary in diameter between 4 and 6 μm . The arrangement of the nuclei follows a typical pattern with two macronuclei close together in the longitudinal axis, then two micronuclei, followed by two macronuclei that are closely associated followed by the most posteriorly located macronucleus. The two micronuclei are always closely associated and may be in juxtaposition or, less commonly, in tandem. They measure 2 μm across. The distance from first to last macronucleus accounts for 15 percent of the ciliates length.

Individuals of this species occur infrequently and in Swansea Bay only; a dozen preparations are available.

This species is characterized by the lighter longitudinal region extending from anterior to posterior; no other species of *Kentrophoros* shows this folding.

Summary

Six new species of psammobiotic ciliates are described, five belonging to the genus *Tracheloraphis* and one to the genus *Kentrophoros*.

REFERENCES

- AGAMALIEV, F.G., 1966. — New species of psammobiotic ciliates of the Western coast of the Caspian Sea. *Ada Protozool.*, 4, pp. 169-184.
- DELAMATER, E.D., 1948. — Basic fuchsin as a nuclear stain. *Stain Tech.*, 23, p. 161.
- DRAGESCO, J., 1960. — Ciliés mésopsammiques littoraux. *Trav. St. Biol. Roscoff* (N.S.), 12, pp. 1-356.
- DRAGESCO, J., 1965. — Ciliés mésopsammiques d'Afrique Noire. *Cah. Biol. Mar.*, 6, pp. 357-399.
- FAURÉ-FREMIET, E., 1950. — Ecologie des Ciliés psammophiles littoraux. *Bull. Biol. France-Belgique*, 14, pp. 35-75.
- KAHL, A., 1933. — Ciliata libera et ectocommensalia. In Grimpe, G. and Wagler, E., eds., *Die Tierwelt der Nord-und Ostsee*, Lief. 23 (Teil II, C4), Leipzig, pp.
- KOVALJEVA, V.G., and GOLEMANSKY, V.G., 1969. — Psammobiotic Ciliates of the Bulgarian coast of the Black Sea. *Acta Protozool.*, 18, pp. 265-285.
- RAIKOV, I.B., 1962. — Les Ciliés mésopsammiques du littoral de la Mer Blanche (U.S.S.R.) avec une description de quelques espèces nouvelles ou peu connues. *Cah. Biol. Mar.*, 3, pp. 325-361.
- HAIKOV, I.B., 1974. — Etude ultrastructurale des bactéries épizoïques et endozoïques de *Kentrophoros latum* Raikov, Cilié Hétérotriche mésopsammique. *Cah. Biol. Mar.*, 15, pp. 379-393.
- RAIKOV, I.B. and KOVALJEVA, V.G., 1968. — Complements to the fauna of psammobiotic ciliates of the Japan Sea (Posjet Gulf). *Ada Protozool.*, 6, pp. 309-333.

- SAUERBREY, E., 1928. — Beobachtungen über einige neue oder wenig **bekannte** marine Ciliaten. *Arch. Protistenk.*, 62, pp. 355-407.
- UHLIG, G., 1964. — Eine einfache methode zur extraktion der vagilen, mesopsammeln mikrofauna. *Helgolander wiss. Meeres.*, 11, pp. 178-185.
- UHLIG, G., 1966. — Untersuchungen zur extraktion der vagilen mikrofauna aus marinen sedimenten. *Zool. Anz. (Suppl.)*, 29, pp. 151-157.
- UHLIG, G., 1968. — Quantitative methods in the study of interstitial fauna. *Trans. Amer. Micros. Soc.*, 87, pp. 226-232.
- UHLIG, G., THIEL, H. and GRAY, J.s., 1973. — The quantitative separation of meiofauna: a comparison of methods. *Helgolander wiss. Meeres.*, 25, pp. 193-195.