

**Records of Free-living Ciliates in Saudi Arabia.  
I. Marine Interstitial Ciliates of the  
Arabian Gulf Islands of Al-Bātinah and Abū Ali\***

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**ABSTRACT.** Thirty eight species of marine interstitial ciliates have been identified from collections made from the coastlines and salt-marshes of the Saudi Arabian Gulf Islands of Al-Bātinah and Abū Ali. The species reported belonged to 31 genera and 22 families, all represent new records of the fauna of The Arabian Gulf and Saudi Arabia and seven of them were present at all collection sites. The distribution of each species around the two islands was recorded.

Recently the Iraqis released millions of tons of crude oil from the Kuwaiti oilfields into the waters of the Arabian Gulf during the 1991 Gulf War crisis, causing huge environmental pollution. A very important indication of the degree of such pollution is obtained by biological monitoring of contamination in marine organisms. Such monitoring is necessary for protection of human health too, as several seafood organisms can become directly contaminated by pollutants, or can accumulate toxic substances by feeding on other contaminated organisms. The mussel, *Mytilus edulis* was shown to accumulate sufficient toxicants to cause food poisoning in mice when fed with contaminated phytoplankton (Unsal 1982).

Protozoa are widely distributed in aquatic environments, and because of their position near the bottom of the food chain, they serves as food for many aquatic higher animals. Thus, any toxic damage to those micro-organisms should herald harmful changes in higher animals in the food web. Such change is also a potential

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threat to human health. With rapid growth and normal species succession, low levels of pollution can shift dominance in protozoan communities towards resistant forms, rather than causing a general decrease in productivity. Amongst these, ciliated protozoans are most sensitive to pollutants and can be assayed as biological indicators through their disappearance from protozoan communities according to exposure time and toxic concentration (AL-Rasheid 1992). Benthic and interstitial protozoa, including ciliates, are subjected to greater pollution stresses than the planktonic forms, and will have higher concentrations of pollutants than the sediment, because their uptake will be from both the sediment and the surrounding water (AL-Rasheid and Sleight 1994). Both planktonic and benthic protozoa tend to be severely affected by contamination of the aquatic environment since they have only a plasma membrane and a permeable outer covering between their living cytoplasm and their environment (Burbank and Spoon 1967). Hence, great attention has been paid to the distribution of interstitial ciliates in sediments of coastal and estuarine localities and many surveys have been undertaken worldwide (Fauré-Fremiet 1950, Dragesco 1963a,b, Fenchel 1969, Wilbert and Kahan 1981, Ricci *et al.* 1982, AL-Rasheid 1992, Santangelo and Lucchesi 1992, El-Serehy 1993, and AL-Rasheid and Sleight 1995).

In Saudi Arabia, however, all previous protozoological studies have, so far, concentrated on parasitic protozoa, except for a few surveys on the foraminifera (Bokhary 1987). Interstitial and sand-dwelling ciliates are yet to be investigated, not only in Saudi Arabia, but also throughout the Arabian Gulf. Hence, a research program has been established to survey those ciliates and their distribution in selected sites on the Arabian Gulf coastline of Saudi Arabia and its offshore islands to establish qualitative baseline information of interstitial ciliates to assist in the future studies of the recovery of Saudi Arabian beaches, and to contribute to the knowledge of these organisms in the Gulf.

The present paper is a checklist of the interstitial ciliate fauna of Al-Bātinah and Abū Ali offshore Arabian Gulf Islands of Saudi Arabia, which represent a portion of the Fauna of Saudi Arabia and of the Arabian Gulf at large.

### Materials and Methods

Sediment samples were collected between August 1994 and July 1995 from six localities on Al-Bātinah and Abū Ali Islands (Fig. 1). Both are low-lying islands off a peninsula north-east of Al-Jubail Industrial City on the Arabian Gulf. All six sampling sites are sandy beaches, but site C, is a salt marsh rich in cyanobacteria belonging to the genera *Lyngbya*, *Microcoleus*, *Phormidium* and *Schizothrix*

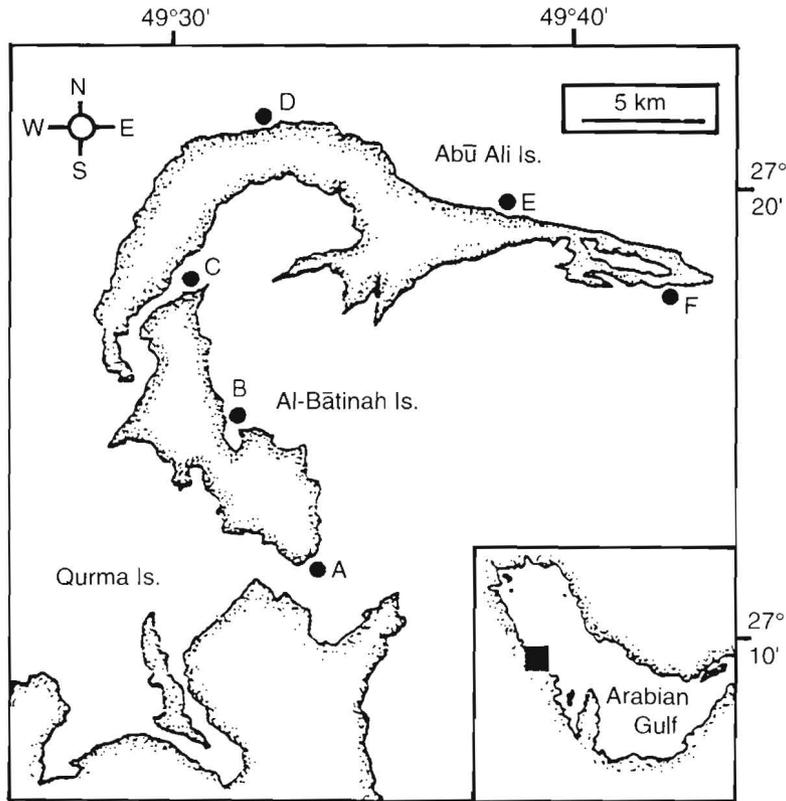


Fig. 1. Map of the Arabian Gulf showing the Saudi Arabian Islands of Al-Bātinah and Abū Ali and the sampling sites A-F.

(Hoffmann 1994). Dwarf mangrove (*Avicennia marina*) was present only at sites A, B and C with the highest concentration at the latter site, which shelters a great diversity of macro and meiofauna. The sediment in all sampling sites is slightly gravely sand with median grain size between 200 and 400  $\mu\text{m}$ . The salinity of the study sites (39-67 ‰ at the height of the summer) was measured with a refractometer and their surface temperature (16-37 °C) was also estimated. Undisturbed samples were obtained at low tide from the topmost 1-3 cm of submerged areas of the sites between high and low tide marks by the sediment core method of Fenchel (1969, 1987). Cores were transferred undisturbed to slightly larger plastic collecting containers lined with nylon mesh (Carey and Maeda 1985). Subsamples were also taken from the cores and placed into 50 mm deep petri dishes and briefly (not more than 48 h) subcultured with rice grains as food for the bacteria

according to the method outlined by AL-Rasheid (1992). Interstitial ciliates were extracted from the collecting containers by pipetting a small volume of sediment into a watch-glass containing millipore-filtered (pore size 0.22  $\mu\text{m}$ ) sea water collected from the same site (Hartwig and Parker 1977). Then the sediment particles were dispersed with a fine needle, and individual ciliates were isolated under a stereomicroscope using micropipettes. They were then identified and photomicrographed using high power bright-field and phase-contrast light microscopy. On several occasions, the ciliates were mounted on microscope slides with glycerin albumin, fixed in Schaudinn's acetic acid, stained with Protargol stains (Lynn 1992) and examined. The characteristics of each organism were then compared to its description in the publications of Carey (1992), Corliss (1979), Kahl (1930-5), Patterson *et al.* (1989) and Small and Lynn (1985).

## Results and Discussion

The present study revealed the presence of 38 taxa new to records of the fauna of Saudi Arabia and of the Arabian Gulf at large. The following is a checklist of the recorded species arranged according to Corliss (1979), each species is followed by a brief description according to Carey (1992). The status of the species is indicated, if it were present at all sites. Moreover, species not truly interstitial are also highlighted. The distribution of the species in the study area is presented in Table 1. Photomicrographs of each species are presented in Figs. 2-4.

Phylum: Ciliophora Doflein 1901

Class: Kinetofragminophorea de Puytorac *et al.* 1974

Subclass: Gymnostomatida Bütschli 1889

Order: Prostomatida Schewiakoff 1896

Suborder: Haptorina Corliss 1974

Family: Enchelyidae Ehrenberg 1838

**1. *Chaenea vorax*** Quennerstedt 1867 (Fig. 2a)

Vermiform, 400  $\mu\text{m}$  in length, twisted, with kineties spiraling. On contraction body corkscrews. Macronucleus of many small parts distributed throughout body.

**2. *Lacrymaria maurea*** Dragesco 1965 (Fig. 2b)

Cylindrical with pointed tail, 300  $\mu\text{m}$  in length. Snout region with nematodesmata. Macronucleus with two ovoid bodies separated by single micronucleus. Cuticle with fusiform trichocysts and bundles of trichites. Contractile vacuole terminal.

**Table 1.** Distribution of the species of interstitial ciliates in the Saudi Arabian Gulf islands of Al-Bātinah and Abū Ali

Species*	Sampling sites**					
	A	B	C	D	E	F
1. <i>Chaenea vorax</i>	-	-	+	-	-	-
2. <i>Lacrymaria maurea</i>	-	+	-	+	+	-
3. <i>Amphileptus marina</i>	+	+	-	-	-	-
4. <i>Litonotus anguilla</i>	-	-	+	-	-	-
5. <i>Litonotus loxophylliforme</i>	-	-	+	-	-	-
6. <b><i>Loxophyllum pseudosetigrum</i></b>	+	+	+	+	+	+
7. <i>Trachelocerca cylindricolis</i>	-	-	-	-	-	+
8. <i>Trachelonema lanceolata</i>	-	-	+	-	-	-
9. <i>Remanella margaritifera</i>	-	-	+	-	+	-
10. <i>Scaphidiodon navicula</i>	-	+	-	+	-	-
11. <i>Chlamydodon major</i>	-	-	+	-	-	-
12. <i>Chlamydodon pedarius</i>	-	-	+	-	-	-
13. <i>Paramecium woodruffi</i>	-	-	+	-	-	-
14. <i>Frontonia marina</i>	-	-	+	+	-	-
15. <b><i>Aristerostoma marinum</i></b>	+	+	+	+	+	+
16. <b><i>Protocruzia depressa</i></b>	+	+	+	+	+	+
17. <i>Pleuronema coronatum</i>	-	+	-	+	+	+
18. <i>Cristigera setosa</i>	+	+	-	+	+	+
19. <i>Carchesium</i> sp.	-	-	-	+	-	+
20. <i>Vorticella</i> sp.	+	+	+	+	-	-
21. <i>Cothurina marina</i>	-	+	-	+	+	-
22. <i>Cothurina oblonga</i>	+	+	-	-	-	-
23. <i>Blepharisma dileptus</i>	+	-	-	-	-	-
24. <i>Condylostoma nigra</i>	-	-	+	-	-	-
25. <i>Condylostoma patens</i>	+	+	+	-	-	-
26. <i>Condylostoma remanei</i>	-	-	+	-	-	-
27. <i>Fabrea salina</i>	-	-	+	-	-	-
28. <i>Peritromus faurei</i>	-	+	-	-	-	-
29. <b><i>Strombidium calkinsi</i></b>	+	+	+	+	+	+
30. <i>Stichotricha oculata</i>	+	-	-	-	-	-
31. <i>Urostrongylum caudatum</i>	-	-	+	-	-	-
32. <i>Keronopsis rubra</i>	-	+	+	-	-	-
33. <i>Oxytricha discifera</i>	-	-	+	-	-	-
34. <i>Oxytricha marina</i>	-	+	+	+	-	-
35. <b><i>Diophrys appendiculata</i></b>	+	+	+	+	+	+
36. <i>Euplotes mutabilis</i>	-	-	+	+	+	+
37. <b><i>Euplotes vannus</i></b>	+	+	+	+	+	+
38. <b><i>Uronychia setigera</i></b>	+	+	+	+	+	+
Totals	14	19	26	17	13	12

\*Species present at all sites are in boldface.

\*\*Shown in Fig. 1.

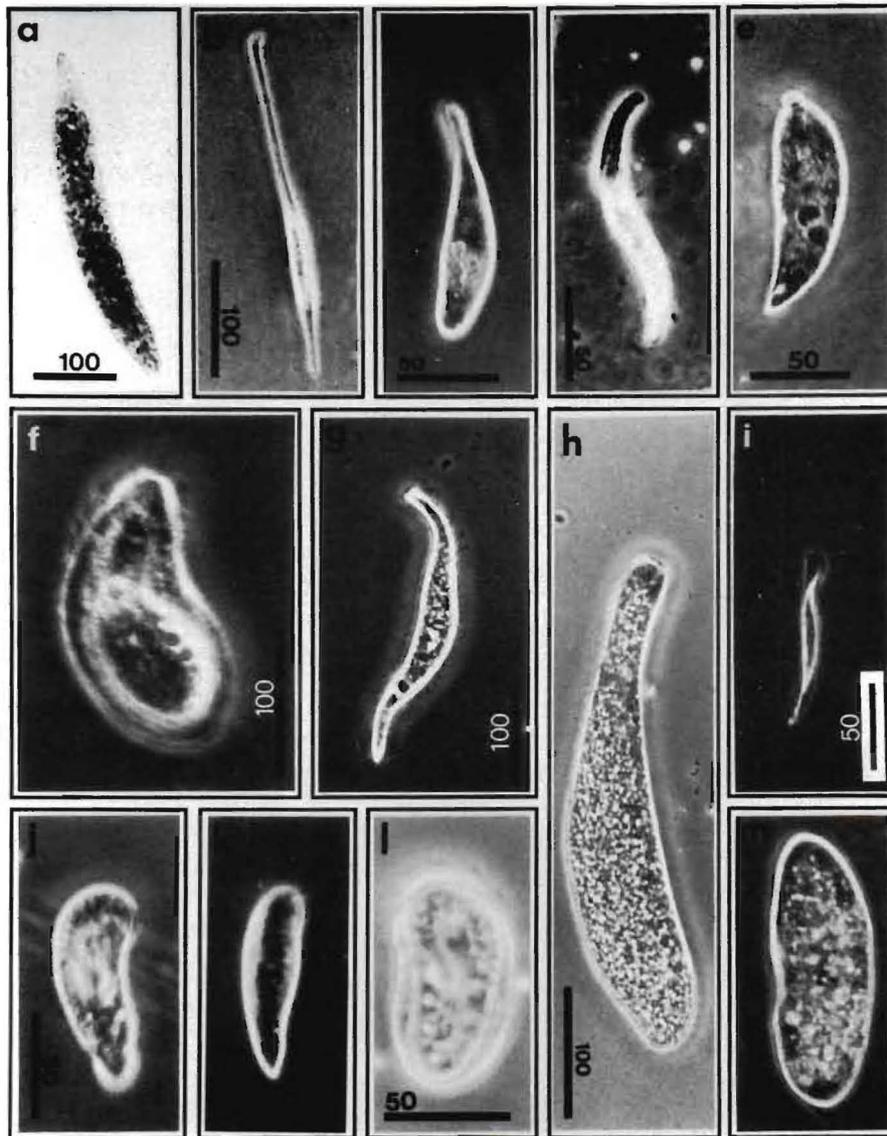


Fig. 2. Phase-contrast photomicrographs of live (unless otherwise stated) ciliate species reported from the Saudi Arabian Islands of Al-Bāṭinah and Abū Ali Islands. a) *Chaenea vorax*, fixed specimen, Protargol stained and bright-field photomicrographed; b) *Lacrymaria maurea*; c) *Amphileptus marina*; d) *Litonotus anguilla*; e) *Litonotus loxophylliforme*; f) *Loxophyllum pseudosetigrum*; g) *Trachelocerca cylindricolis*; h) *Trachelonema lanceolata*; i) *Remanella margaritifera*; j) *Scaphidiodon navicula*; k) *Chlamydodon major*; l) *Chlamydodon pedarius*; m) *Paramecium woodruffi*. All bars are in  $\mu\text{m}$ .

Order: Pleurostomatida Schewiakoff 1896

Family: Amphileptidae Bütschli 1889

**3. *Amphileptus marina*** (Kahl 1928), Carey 1992 (Fig. 2c)

*Hemiophrys marina* Kahl 1928

Large, broad, 135  $\mu\text{m}$  in length. Buccal area occupies whole length of neck region. Two macronuclei with intercalated micronucleus. With five lateral contractile vacuoles.

**4. *Litonotus anguilla*** (Kahl 1930), Carey 1992 (Fig. 2d)

*Lionotus anguilla* Kahl 1930

Elongate with long curving neck and pointed tail. Body 150  $\mu\text{m}$ , undergoes spiral contorsions. Longitudinal kineties stretch from pole to pole, not converging. Single contractile vacuole, macronucleus of two parts, micronucleus intercalated.

**5. *Litonotus loxophylliforme*** (Dragesco 1960), Carey 1992 (Fig. 2e)

*Hemiophrys loxophylliforme* Dragesco 1960

Elongate, 120  $\mu\text{m}$  long. Oral area with large trichocysts. Two spherical macronuclei, mucocysts between kineties. Without contractile vacuole.

**6. *Loxophyllum pseudosetigerum*** Dragesco 1954 (Fig. 2f)

Broad, 200  $\mu\text{m}$  in length, almost oval with wide flattened band and trichocysts on both sides. Peribuccal papillae present. Several sharply pointed bristles fused with normal ciliature. Many spherical macronuclei, with single contractile vacuole (present at all sites).

Order: Karyorelictida Corliss 1974

Family: Tracheolocercidae Kent 1880-1882

**7. *Trachelocerca cylindricolis*** Lepsi 1962 (Fig. 2g)

Neck and body distinct, 300  $\mu\text{m}$  long. Head not expanded, tail small, rounded. Multimacronucleated, without contractile vacuole.

**8. *Trachelonema lanceolata*** Raikov 1962 (Fig. 2h)

Elongate, flask-shaped, with expanded head and small pointed tail, 380  $\mu\text{m}$  long. Cytopharynx terminal, slit-like. Macronuclei 14, ovoid, occur in line in body.

Family: Loxodidae Bütschli 1889

**9. *Remanella margaritifera*** (Kahl 1933), Dragesco 1960 (Fig. 2i)

Elongate, 120  $\mu\text{m}$  in length. Body rather crescentic with pointed tail.

Pigmentation around buccal region. Müller's bodies 2-5. Macronuclei 2, large. Micronucleus intercalated.

Subclass: Hyposotomatia Schewiakoff 1896

Superorder: Nassulidea Jankowski 1967

Order: Synhymeniida de Puytorac *et al.* 1974

Family: Scaphidiodontidae Deroux 1978

**10. *Scaphidiodon navicula*** (Stein 1859), Dragesco 1965 (Fig. 2j)

Ovoid, 100  $\mu\text{m}$  in length, slightly expanded anteriorly, slightly projecting leftward. With large podite originating from ventral surface, projects beyond edge of body. Cytopharyngeal basket with 20 large nematodesmata. Hypostomial fringe from left side to just past cytostome. Macronucleus single, avoid, contractile vacuoles 4-6.

Superorder: Phyllopharyngidea de Puytorac *et al.* 1974

Order: Cyrtophorida Fauré-Fremiet in Corliss 1956

Suborder: Chlamydodontina Deroux 1976

Family: Chlamydotidae Stein 1859

**11. *Chlamydoton major*** (Kahl 1931), Carey 1992 (Fig. 2k)

*Chlamydoton triquetrus* var. *major* Kahl 1931

Elongate, 100  $\mu\text{m}$  long, dorsoventrally flattened. Anterior bent leftward, tail region with distinct point. Oral aperture oval, large. Macronucleus single, contractile vacuoles numerous.

**12. *Chlamydoton pedarius*** Kaneda 1953 (Fig. 2-1)

Reniform, flattened, 100  $\mu\text{m}$  long. Rounded anterior and posterior. Dorsum not overhanging ventrum, band of trichites semi-circular. Oral aperture large, oval. Cytopharyngeal basket curved, large, with large nematodesmata. Macronucleus large, centrally located, contractile vacuoles 5-12.

Class: Oligohymenophorea de Puytorac *et al.* 1974

Subclass: Hymenostomatida Delage and Hérouard 1896

Order: Hymenostomatida Delage and Hérouard 1896

Suborder: Peniculina Fauré-Fremiet in Corliss 1956

Family: Parameciidae Dujardin 1840

**13. *Paramecium woodruffi*** Wenrich 1928 (Fig. 2m)

Ovoid, rather than elongate, 150  $\mu\text{m}$  long; with anterior transversely truncate, posterior rounded. Oral groove wide, extends into posterior third of body. Contractile vacuoles 2. Macronucleus ovoid, micronuclei 4. Tuft of caudal cilia present.

Family: Frontoniidae Kahl 1926

**14. *Frontonia marina*** Fabre-Domergue 1891 (Fig. 3a)

Elongate, 350  $\mu\text{m}$  long. Anterior wider than posterior, dorso-ventrally flattened. Oral aperture small. Macronucleus large, micronuclei 2. Single, small, centrally-located contractile vacuole. Trichocysts numerous, fine.

Order: Scuticociliatida Small 1967

Suborder: Philasterina Small 1967

**15. *Aristerostoma marinum*** Kahl 1931 (Fig. 3b)

Small, ovoid, 30  $\mu\text{m}$  in length, pointed anteriorly, rounded posteriorly. Somatic kineties extend longitudinally from pole to pole. Dorsal surface domed, flattened ventrally. Buccal region small almost traverse body, with at least 1 membranelle. Macronucleus single, centrally-placed. Contractile vacuole posterior (present at all sites).

**16. *Protocruzia depressa*** Ammermann 1968 (Fig. 3c)

Ovoid, 50  $\mu\text{m}$ , apex pointed. Somatic ciliation sparse dorsally, resembles spiral kineties ventrally. Macronucleus large, micronuclei variable in number (present at all sites).

Suborder: Pleuronematina Fauré-Fremiet in Corliss 1956

Family: Pleuronematidae Kent 1880-1882

**17. *Pleuronema coronatum*** Kent 1880-2 (Fig. 3d)

*Pleuronema coronata* var. *marina* Kahl 1928

Ovoid, slightly reniform, 85-90  $\mu\text{m}$  long. Undulating membrane very large, almost encircling cytostome posteriorly. Caudal cilia present. Macronucleus large, ovoid; contractile vacuole large; trichocysts large, few.

Family: Cyclidiidae Ehrenberg 1838

**18. *Cristigera setosa*** Kahl 1928 (Fig. 3e)

Ovoid, 30  $\mu\text{m}$  in length. Buccal apparatus very large, extending three-quarters of body. Ciliation dense anteriorly, reduced to few long rigid cilia posteriorly. Macronucleus single.

Subclass: Peritricha Stein 1859

Order: Peritrichida Stein 1859

Suborder: Sessilina Kahl 1933

Family: Vorticellidae Ehrenberg 1838

**19. *Carchesium*** sp. Ehrenberg 1830 (Fig. 3f)

Bell-shaped colony, individuals contract separately, 90  $\mu\text{m}$  long, not truly interstitial.

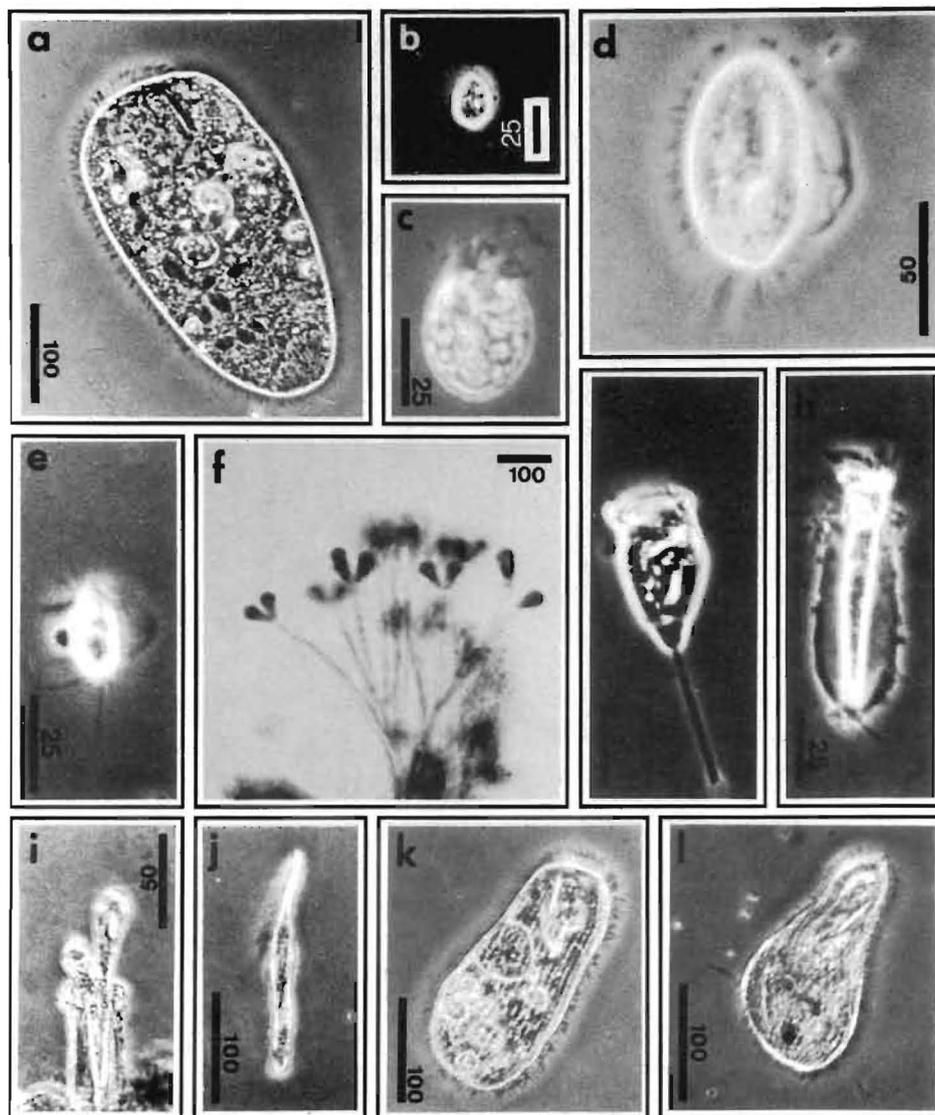


Fig. 3. Phase-contrast photomicrographs of live (unless otherwise stated) ciliate species reported from the Saudi Arabian Islands of Al-Bāṭinah and Abū Ali Islands. a) *Frontonia marina*; b) *Aristerstoma marinum*; c) *Protocruzia depressa*; d) *Pleuronema coronatum*; e) *Cristigera setosa*; f) *Carchesium* sp., bright-field photomicrograph; g) *Vorticella* sp.; h) *Cothurina marina*; i) *Cothurina oblonga*; j) *Blepharisma dileptus*; k) *Condylostoma nigra*; l) *Condylostoma patens*. All bars are in  $\mu\text{m}$ .

**20. *Vorticella* sp.** Linnaeus 1767 (Fig. 3g)

Bell-shaped body, contracted unbranched stalk, 100-120  $\mu\text{m}$  long, not truly interstitial.

Family: Vaginicollidae de Fromental 1874

**21. *Cothurina marina*** Andrussowa 1886 (Fig. 3h)

Lorica clear, 70  $\mu\text{m}$ , attached to surfaces via short stalk. Body 90  $\mu\text{m}$  long, not truly interstitial.

**22. *Cothurina oblonga*** Kahl 1930-5 (Fig. 3i)

Lorica clear, 75  $\mu\text{m}$ , attached to surfaces via short stalk. Body 120  $\mu\text{m}$  long, not truly interstitial.

Class: Polyhymenophorea Jankowski 1967

Subclass: Spirotrichia Bütschli 1889

Order: Heterotrichida Stein 1859

Suborder: Heterotrichina Stein 1859

Family: Spirostomidae Stein 1867

**23. *Blepharisma dileptus*** Kahl 1928 (Fig. 3j)

Elongate, vermiform, 215  $\mu\text{m}$  in length, long and thin anteriorly. Peristome occupies half body length. Undulating membrane long, conspicuous. Macronucleus moniliform, occur in posterior half of body.

Family: Condylomatidae Kahl in Doflein and Reichenow 1927-9

**24. *Condylostoma nigra*** Dragesco 1960 (Fig. 3k)

Distinctly ovoid, both ends rounded, 250  $\mu\text{m}$  in length. With large undulating membrane, peristome small. Macronucleus moniliform; contractile vacuoles present. Abundant mucocysts, pigmented dark blue; dark coloured.

**25. *Condylostoma patens*** Dujardin 1841 (Fig. 3-1)

Elongate, 500  $\mu\text{m}$  in length (200  $\mu\text{m}$  contracted), spatulate anteriorly, broad, rounded posteriorly. Peristome wide, macronucleus moniliform. Contractile vacuole present with long canal running forward to equatorial region.

**26. *Condylostoma remanei*** (Spiegel 1928), Kahl 1930-5 (Fig. 4a,b)

*Condylostoma caudatum* Spiegel 1928

*Condylostoma remanei* var. *oxyoura* Dragesco 1960

Elongate, broad, with spatulate anterior, expanding to mid-body, terminating in sharp pointed tail. Attains 1 mm in length. Peristome wide, deep. Macronucleus moniliform. Contractile vacuole absent.

Family: Climacostomidae Repak 1972

**27. *Fabrea salina*** Henneguy 1890 (Fig. 4c)

Ovoid, 450  $\mu\text{m}$  in length, pointed anteriorly. Peristome prominent, large, with adoral zone of membranelles (AZM), spirals from apex to deeply-set cytostome. Macronucleus long, vermiform. Contractile vacuole terminal. Pigment spots various.

Family: Peritromidae Stein 1867

**28. *Peritromus faurei*** Kahl 1930-5 (Fig. 4d)

Distinctly ovoid, 150  $\mu\text{m}$  in length. Peristome from left to right anteriorly. Somatic ciliation lacks spines. Dorsal protuberance, prominent, with warts and spines. Macronuclei 2, spherical.

Order: Oligotrichida Bütschli 1887

Suborder: Oligotrichina Bütschli 1887

Family: Strombidiidae Fauré-Fremiet 1970

**29. *Strombidium calkinsi*** Fauré-Fremiet, 1932 (Fig. 4e)

Ovoid, 40  $\mu\text{m}$  long., Anterior projects forward into blunt rostrum or peristomial collar. Posterior rounded, with polysaccharide plates and distinct equatorial cleft. Dorsal membranelles 2, long, about same length of body, may anchor organism temporarily to substrate. Long AZM, curves obliquely towards dorsal surface. Macronucleus single, ovoid (present at all sites).

Order: Hypotrichida Stein 1859

Suborder: Stichotrichina Fauré-Fremiet 1961

Family: Spirofilidae Gelei 1929

**30. *Stichotricha oculeata*** Wrzesnioski 1884 (Fig. 4f)

Spindle-shaped, elongate, with posterior rounded, neck thin, long. Ca 100  $\mu\text{m}$  in length. Peristome extends half body. Contractile vacuole anteriorly located. Macronuclei 2, ovoid.

Family: Strongylidiidae Fauré-Fremiet 1961

**31. *Urostrongylum caudatum*** Kahl 1930-5 (Fig. 4g)

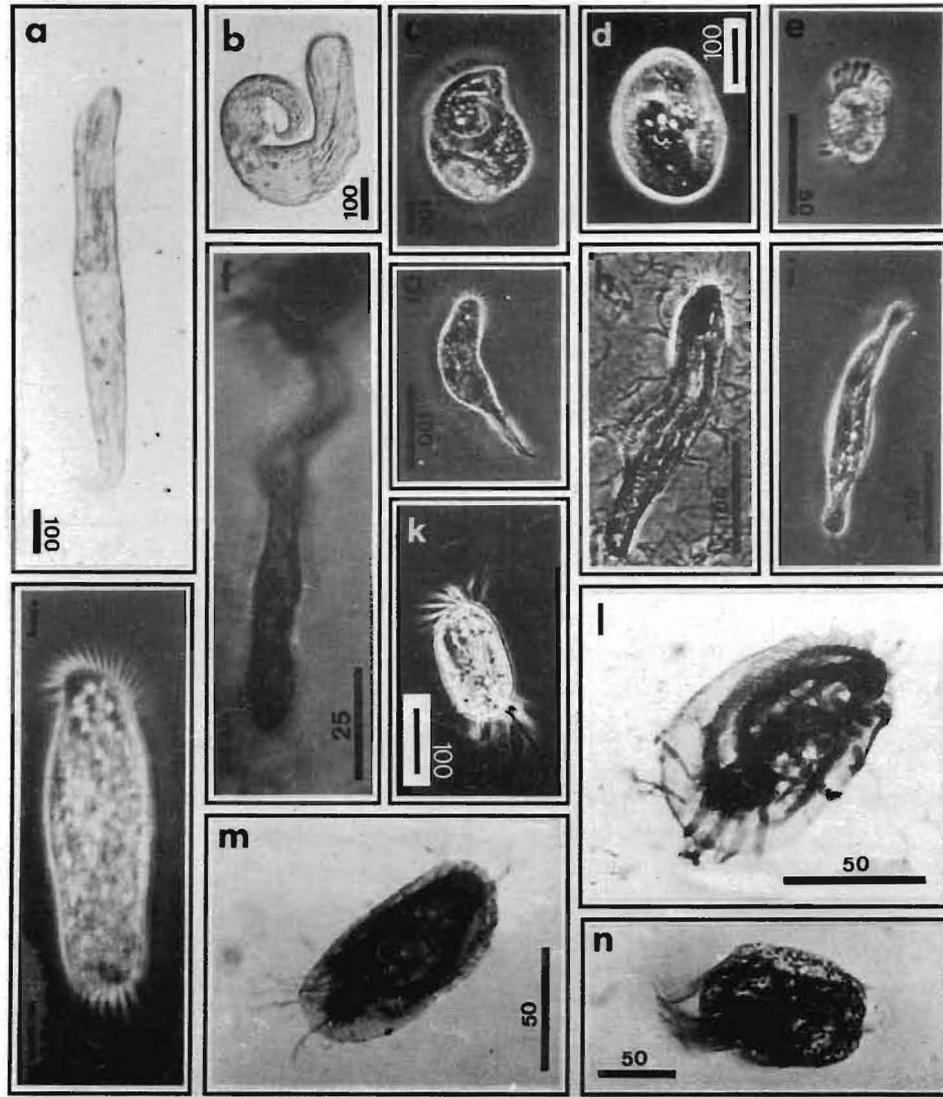
Cylindrical, 220-250  $\mu\text{m}$  long, with long tail. Three short frontal cirri overshadowed by first 4 large membranelles of AZM. Peristome short, occupying less than one quarter of body. Somatic cirri spiral around body. Macronuclei 2.

Family: Holostichidae Fauré-Fremiet 1961

**32. *Keronopsis rubra*** (Ehrenberg 1838), Kahl 1930-5 (Fig. 4h)

*Oxytricha rubra* Ehrenberg 1838

*Holosticha flavorubra* Entz 1884



**Fig. 4.** Phase-contrast photomicrographs of live (unless otherwise stated) ciliate species reported from the Saudi Arabian Islands of Al-Bātinah and Abū Ali Islands. a,b) *Condylostoma remanei*, bright-field photomicrographs of a: relaxed and b: contracted specimens; c) *Fabrea salina*; d) *Peritromus faurei*; e) *Strombidium calkinsi*; f) *Stichotricha oculeata*, bright-field photomicrograph; g) *Urostrongylum caudatum*; h) *Keronopsis rubra*; i) *Oxytricha discifera*; j) *Oxytricha marina*; k) *Diophrys appendiculata*; l) *Euplotes mutabilis*; m) *Euplotes vannus*; n) *Uronychia setigera*, fixed specimens, Protargol stained and bright-field photomicrographed. All bars are in  $\mu\text{m}$ .

Elongate, 250-300  $\mu\text{m}$  in length, rounded anteriorly, blunt posteriorly. Peristome occupies quarter of body. True frontal cirri absent. Macronuclei many, small, ovoid. Red to orange in colour.

Suborder: Sporadotrichina Fauré-Fremiet 1961

Family: Oxytrichidae Ehrenberg 1838

**33. *Oxytricha discifera*** Kahl 1930-5 (Fig. 4i)

Elongate, cylindrical, 240-250  $\mu\text{m}$  in length, with distinctive broad head region. AZM almost entirely confined to anterior region. Macronuclei 2, ovoid.

**34. *Oxytricha marina*** Kahl 1930-5 (Fig. 4j)

Elongate, cylindrical, 120  $\mu\text{m}$  long. AZM occupying quarter of body. Anterior and posterior ends rounded.

Family: Euplotidae Ehrenberg 1838

**35. *Diophrys appendiculata*** (Ehrenberg 1838), Kahl 1930-5 (Fig. 4k)

*Stylonychia appendiculata* Ehrenberg 1838

Ovoid, ca 100  $\mu\text{m}$  long. Anterior rounded with well-developed AZM occupying ca. half body. Posterior lateral concavity not ornamented, with 3 caudal cirri. Frontoventral cirri 7-8, transverse 5, left marginals 1-3. Macronuclei 2 (present at all sites).

**36. *Euplotes mutabilis*** Tuffrau 1960 (Fig. 4-l)

Ovoid, 95-100  $\mu\text{m}$  in length with large AZM. Dorsal surface ornamented with 5 longitudinal ridges. Ventral surface heavily sculptured with 7 ridges. Peristome extends ca. two-thirds of the length of body. Frontoventral cirri 10, transverse 5, caudal 4. Macronucleus 3-shaped.

**37. *Euplotes vannus*** (Müller 1786), Minkjewicz 1901 (Fig. 4m)

Ovoid, 100  $\mu\text{m}$  in length. Body curved slightly to right, not ornamented. Peristome large, extends two-thirds length of body. Frontoventral cirri 19, transverse 5, caudal 4. Macronucleus C-shaped (present at all sites).

**38. *Uronychia setigera*** Calkins 1902 (Fig. 4n)

Ovoid, 50-60  $\mu\text{m}$  long. Peristome large, occupying over half body length with 2-3 flagella-like cirri and 2 paroral membranes. Undulating membranes wide. Transverse cirri 4-5; marginal cirri 2, large; right caudal cirri, 2, curved, dorsally attached; satellite cirrus thin, long. Dorsal ridges 3-4. Macronucleus single, spherical (present at all sites).

Most of the species reported herein are typical interstitial ciliates and many of them are distributed worldwide. However, *Carchesium*, *Vorticella* and *Cothurina* species which are found attached to algae and substrates have been considered as not truly interstitial because they do not live between, among, or in the interstices of sand grains (Hartwig 1980). Seven species are recorded from all sampling sites, which might indicate their great diversity at the various habitats around the two islands. The sampling site C (see Table 1) showed the highest species diversity and was in an area which is not directly exposed to wave action, hence it is rich in detrital materials derived from the algal mats of the site, constitute an extra food source for the ciliates to flourish on. Sampling site B is second to C, probably due to the same reasons. On the other hand, sampling sites D, E and F, which are exposed to direct wave action, showed lower species diversity than the former, more sheltered sites. The detrimental effect of increasing wave action on ciliates inhabiting sandy beaches is well documented (Hartwig and Parker 1977, and Carey and Maeda 1985). Despite the fact that the Saudi shorelines have been cleaned from most of the oil spills five years ago, and the tar layer on the seabed and the intertidal zone have nearly been entirely covered with sand, future quantitative and qualitative studies are of great importance to monitor the recovery of the Arabian Gulf by observing the abundance and diversity of interstitial ciliates, especially those recorded in the present study.

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# سجل الأوليات الهدبية حرة المعيشة في المملكة العربية السعودية

## ١ - الهدبيات البين رملية البحرية في جزيرتي الباطنة وأبو علي في الخليج العربي

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تعتبر الأوليات وخاصة الهدبيات من أدق المقاييس الحيوية لمستوى التلوث في البيئات المائية . فإن لإختفاء الهدبيات من مجاميع الأوليات في مدى زمني معين يعتبر مؤشراً حساساً لمستوى تراكم الملوثات السامة في البيئة المائية ، لهذا فلقد أجريت دراسات في أماكن عديدة من العالم لتحديد أنواع الهدبيات البين رملية في الشواطئ والبيئات المختلفة .

أما في المملكة العربية السعودية فلقد كان التركيز في الأبحاث على الأوليات منصباً على الأوليات الطفيلية مع بعض المسح الذي تم على المثقبات من الأوليات ولم تجر حتى الآن أي دراسة لافي المملكة العربية السعودية ولا في الخليج العربي بصورة عامة على التواجد الحيواني للأوليات حرة المعيشة ، رغم الأهمية الكبرى للهدبيات حرة المعيشة كمقاييس حيوي حساس لمستوى التلوث البحري . وبعد حرب الخليج عام ١٩٩١م وما صار فيها من إفراغ ملايين الأطنان من الزيت الخام من حقول النفط الكويتية في مياه الخليج العربي بواسطة العراقيين ، أصبحت الحاجة ماسة جداً لتحديد أنواع الهدبيات البين

رملية في مواقع عديدة من ساحل الخليج العربي والجزر السعودية المختلفة فيه لإستعمالها كمؤشر لمستوى التلوث البحري في تلك الأماكن . وعليه فلقد تم تخطيط برنامج بحثي متكامل لتحديد أنواع الهدبيات حرة المعيشة ضمن التواجد الحيواني للمملكة العربية السعودية بصورة خاصة وللخليج العربي بصورة عامة . والبحث الحالي جزء من ذلك البرنامج ويحدد أنواع الهدبيات البين رملية البحرية في جزيرتي الباطنة وأبو علي السعوديتين في الخليج العربي .

لقد تم في الدراسة الحالية جمع ووصف ٣٨ نوعاً من الهدبيات البين رملية البحرية (المتعلقة بالرمال القاعية) من شواطئ وسبخات جزيرتي الباطنة وأبو علي الواقعتان قبالة شاطئ المملكة العربية السعودية شمال شرقي مدينة الجبيل الصناعية . والأنواع التي تم تسجيلها تنتمي إلى ٣١ جنساً في ٢٢ فصيلة من فصائل الهدبيات ، وهي تسجل لأول مرة كأنواع ضمن التواجد الحيواني لكل من المملكة العربية السعودية والخليج العربي . كما أوضحت الدراسة أن سبعة من تلك الأنواع هي دائمة الإقامة في هاتين الجزيرتين . هذا وقد تم توضيح التوزيع الجغرافي لكل نوع من الأنواع الموصوفة ضمن الجزيرتين .