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Abstract: The studies on the marine interstitial testate amoebas are briefly reviewed. A characteristic of the marine supralittoral as a specific habitat is given. So far, 144 species of testate amoebas and 13 monothalamous foraminifera have been reported in the marine interstitial habitat of the World Ocean. A total of 47 interstitial testate amoebas have been reported in the Bulgarian Black Sea coast. Of these, 32 are psammobiotic, 11 are psammophilic, and 4 are psammoxenic. Eleven new genera and over 20 unknown species of psammobiotic marine interstitial testate amoebas and foraminifera have been described for the first time in the Bulgarian Black Sea coast. The morphological adaptations and some ecological preferences of the interstitial marine testate amoebas and foraminifera are discussed.

1 Introduction

About 35 years ago, a new taxocoenosis of testate amoebas inhabiting the underground water of the marine sand supralittoral was observed and described in the Black Sea (Golemansky, 1969). Until then the testate amoebas were known mainly from freshwater habitats (lakes, rivers, and marshes), mosses, humid soils, etc. Earlier, Schulze (1874), Gruber (1884), Möbius (1889), Buchinski (1895, 1897), Sovinski (1902), Awerintzew (1903) and others published some records on testate amoebas observed in the marine sand littoral. However, all of the cited authors considered them to be freshwater inhabitants, which were imported occasionally into the sea through fresh waters.

Wailes (1927) was the first researcher who conducted a special study of the testate amoebas in the sand supralittoral in the region of British Columbia (the Pacific coast of Canada). He found testate amoebas in the underground waters of the sandy beach on Camp Island. One of these species he described as a new taxon, Corythion acutum. Wailes did not suppose that he had observed a new marine psammobiotic testate amoeba and concluded that: “Although found on the sea-shore, as described below, it is in all probably a freshwater or moss-inhabiting species”. Wailes identified other observed amoebas as Cyphoderia ampulla (Ehrenberg) and

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Euglypha laevis Perty. He suggested that they were also carried in the mosses by the continental fresh waters. Twenty-five years later, Valkanov (1954) observed Corythion acutum for the second time in the underground water of some sand beaches of the Bulgarian Black Sea coast at a salinity of 15‰. Ten years later, Valkanov & Marinov (1964) found a second testate amoeba in the same habitat, Trinema enchelis Penard. Valkanova (1964) reported the observation of the monothalamous foraminifera Rhabdogromia flexilis (= Micatuba flexilis) there.

Our investigations on the protists of the Black Sea have started in 1966 and allowed the description of many new and unknown testate amoebas inhabiting the underground waters of the marine sand beaches. These studies revealed the presence of a rich taxocoenosis of testate amoebas and monothalamous foraminifera, which is specific for the marine sandy supralittoral, and especially of the mixing zone of the sea water and the continental underground fresh water (Golemansky, 1969). In the following years, this specific taxocoenosis was studied in many other seas and oceans and its Cosmopolitan distribution was proved (Golemansky, 1970a, 1970b, 1970c, 1970d, 1971, 1976a, 1976b; Chardez, 1972, 1977; Sudzuki, 1977, 1979, etc.).

2 The Marine Supralittoral as a Habitat

The marine supralittoral is a zone of the boundary between the sea and the continent situated above the seawater level but periodically flooded by the waves. According to Pérès and Picard (1958), this zone is also addressed as mediolittoral or eulittoral. Its inhabitants are mainly of marine origin and possess different morphological and biological adaptations to survive the specific ecological conditions. Swedmark (1964) considered this zone to be a zone of transition between the submarine littoral sand and the continental underground freshwater.

The supralittoral sand strip is relatively constant on the seashores where tidal ebb and flow are weakly expressed. There, permanent mixing of the underground continental freshwater and seawater takes place (Fig. 1). The salinity of the water in the mixing zone varies at a large scale: from 30–35‰ in the sea littoral water to 1.04‰ in the outlying sand beach strips (Fig. 2). The quantity of the oxygen also varies considerably, with a general tendency of decreasing from the sea to the continent and from the surface to the deeper zones (Pennak, 1951, Jansson, 1966). In the Bulgarian Black Sea coast, oxygen content in the supralittoral zone varies from 4.50–5.50 mg/l (at the distance of 1 m from the sea and at the depth of 0.25 m) to 0.20–0.40 mg/l (at the distance of 15 m from the sea and at the depth of 1.20 m).

The marine supralittoral psammal is a specific habitat with variable ecological conditions. It is a labile biotope with permanent fluctuations of the main ecological factors (salinity, O₂, pH, temperature, water movement, granulometry of sand, etc.), which influence its interstitial inhabitants.