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Zoogeographical origin of the polychaete fauna of the Black and Azov seas

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Abstract: Zoogeogeographical analysis of polychaete species from the Black and Azov seas shows the dominance of the Atlanto-Mediterranean species (37%), followed by the Cosmopolitan species (29%), the Arctic-Boreal species (13%), the Boreal-Tropical species (8%), the Boreal species (7%), the Mediterranean species (3%), the Ponto-Caspian relics (1%), the Indo-Pacific species (1%) and the Endemic species (1%).

Résumé : *Origine zoo-géographique de la faune de polychètes de la Mer Noire et de la Mer d'Azov.* L'analyse zoogéographique des Annélides Polychètes de la Mer Noire et de la Mer d'Azov a montré une dominance des espèces Atlantico-Méditerranéennes (37%), suivies par les espèces Cosmopolites (29%), les espèces Arctiques-Boréales (13%), les espèces Boréales-Tropicales (8%), les espèces Boréales (7%), les espèces Méditerranéennes (3%), les reliques Ponto-Caspiennes (1%), les espèces Indo-Pacifiques (1%) et les espèces Endémiques (1%).

Keywords Polychaeta • Black Sea • Azov Sea • Zoogeography

Introduction

From the point of view of marine zoogeography, the Black and Azov seas are regarded as annexes of the Mediterranean Sea which form a separate *Ponto-Azovic province*, belonging to the *Sarmatic subregion* of the *Mediterranean-East Atlantic region* (de Lattin, 1967).

The zoogeography of the polychaete fauna of the Black and Azov seas was analysed by a number of authors (Vinogradov, 1947 & 1949; Rullier, 1963; Vinogradov et al., 1967; Bacescu et al., 1971; Marinov, 1977). However, the continuous accumulation of new data regarding the geographical distribution of species allows to critically re-evaluate the zoogeography of polychaetes of the Ponto-Azovic area.

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Materials and Methods

The study was based exclusively on literature data. Polychaete species were assigned to zoogeographical categories according to their distribution, as suggested by Uschakov (1955), Day (1967) and Hartmann-Schröder (1996): (1) species originating from the ancient Sarmatic Sea are referred to as Ponto-Caspian Relics (R); (2) species present only in the Black Sea have been considered as Endemic (E); (3) species confined only to the Mediterranean basin, including the Black Sea, have been considered as Mediterranean (M); (4) species common in the temperate waters of the eastern North Atlantic and the Mediterranean have been regarded as Atlanto-Mediterranean (AM); (5) species occurring in the North Atlantic, in the Mediterranean, in the Arctic seas and in the North Pacific have been considered as Arctic-Boreal species (AB); (6) species distributed in the North Atlantic and North Pacific but missing in the Arctic seas have been considered as Amphiboreal or Boreal species (B); (7) species which have been recorded from boreal waters to the tropics have been considered as Boreal-Tropical (BT); (8) species which inhabit almost all oceans of the world and adjacent seas and those with disjunct distribution have been considered as Cosmopolitan (C) and (9) species originating from Red Sea, Indian Ocean and Western Pacific Ocean have been considered as Indo-Pacific (IP).

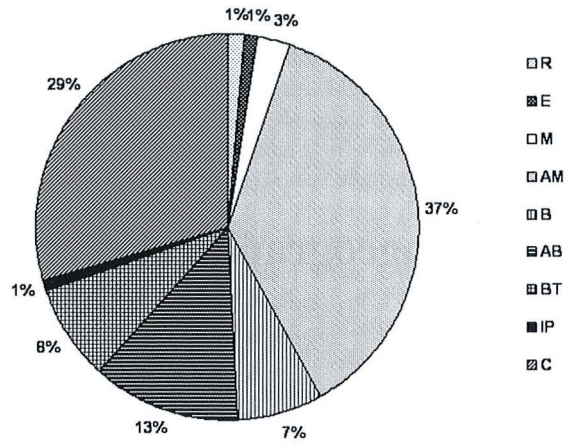

Figure 1. Zoogeographical composition of the polychaete fauna of the Black and Azov seas (R - Ponto-Caspian Relics; E - Endemic species; M - Mediterranean species; AM - Atlanto-Mediterranean species; B - Boreal species; AB - Arctic-Boreal species; BT - Boreal-Tropical species; IP - Indo-Pacific species; C - Cosmopolitan species).

Figure 1. Composition zoo-géographique de la faune des Annélides Polychètes de la Mer Noire et de la Mer d'Azov (R - Reliques Ponto-Caspiennes ; E - Espèces endémiques ; M - Espèces Méditerranéens ; AM - Espèces Atlantico-Méditerranéennes ; B - Espèces Boréales ; AB - Espèces Arctiques-Boréales; BT - Espèces Boréales-Tropicales ; IP - Espèces Indo-Pacifiques ; C - Espèces Cosmopolites).

Results and Discussion

A total of 214 polychaete species has been reported from the Black and Azov seas (Mordukhai-Boltovskoi, 1960; Surugiu, 2002; Kisseleva, 2004). This number represents only 21% of the polychaete species known from the entire Mediterranean basin (Simboura & Nicolaidou, 2001). The relative scarcity of Ponto-Azovic fauna compared to that of the Mediterranean seems to be a consequence of the reduced water salinities (17-18 mean superficial salinity of the Black Sea compared to 35-37 in the Mediterranean Sea), the extremely low water temperatures during winter and the presence of hydrogen sulphide below 180-200 m depth (see Zenetos et al., 2000). The zoogeographical origin of the polychaetes of the Ponto-Azovic region, as well as of its entire fauna, is a reflection of the long geological evolution of this region (Fig. 1).

The most ancient group of polychaetes is composed of **Ponto-Caspian relics** (1% of the Black Sea polychaetes), which includes two ampharetid species, namely *Hypania invalida* (Grube, 1860) and *Hypaniola kowalewskii* (Grimm, 1877), and the sabellid *Manayunkia caspica* Annenkova, 1929. As a result of the opening of the Bosphorus Strait, some 5000 years ago, the salinity of the Black Sea began to rise, so that these brackish-water organisms retreated into the waters with reduced salinities, such as river estuaries and littoral lagoons. According to Zenkevich (1963) and Manoleli (1975), *Hypania invalida* and *Hypaniola kowalewskii* can be regarded as remnants of the old Tethyan fauna, while *Manayunkia caspica* probably belongs to the Arctic relic complex, which migrated from the north during the postglacial period.

There are only two species (or 1% of the Black Sea polychaete fauna) that had a temporary status of **endemic species of marine origin** for the Black Sea. These include the dubious record of *Xenosyllides violacea* Perejaslawzewa, 1891, cited for the Bay of Sevastopol and *Vigtorniella zaikai* Kisseleva, 1992, which so far has been reported only from the oxic-anoxic layer of the Black Sea.

The majority of polychaete worms inhabiting the Black Sea are **neoeuxinic immigrants** which entered the Black Sea after the establishment of the connection with the Mediterranean through the Dardanelles, Marmora Sea and the Bosphorus. The bulk of these immigrants (76 species, or 37% of the total polychaete fauna) are **Atlanto-Mediterranean species**. This category includes species such as *Nereiphylla paretti* Blainville, 1828, *Sphaerosyllis*

bulbosa Southern, 1914, *Nephtys hombergii* Savigny, 1818, *Protodorvillea kefersteini* (McIntosh, 1869), *Aonides paucibranchiata* Southern, 1914, *Spio decoratus* Bobretzky, 1870, *Capitella minima* Langerhans, 1880, *Melinna palmata* Grube, 1870, *Pomatoceros triqueter* (Linnaeus, 1767).

The **Arctic-Boreal species** are represented by 26 species (or 13% of the Ponto-Azovic polychaete fauna) such as *Harmothoe imbricata* (Linnaeus, 1767), *Pholoe inornata* Johnston, 1839, *Phyllodoce maculata* (Linnaeus, 1767), *Nereis zonata* Malmgren, 1867, *Hediste diversicolor* (O.F. Müller, 1776), *Pectinaria koreni* (Malmgren, 1866), *Terebellides stroemii* M. Sars, 1835, *Fabricia stellaris* (O.F. Muller, 1774).

There are 17 **Boreal-tropical species**, constituting about 8% of the entire Black Sea polychaete fauna. This category includes *Neanthes succinea* (Frey & Leuckart, 1847), *Perinereis cultrifera* (Grube, 1840), *Platynereis dumerilii* (Audouin & M.-Edwards, 1833), *Glycera tridactyla* Schmarda, 1861, *Scolelepis squamata* (O.F. Müller, 1789).

The **Boreal species** number 15 species (or 7% of the Black and Azov seas polychaetes) and include *Pterocirrus macroceros* (Grube, 1860), *Micronephthys stammeri* (Augener, 1932), *Prionospio (Minuspio) multibranchiata* Berkeley, 1927, *Microspio mecznikowianus* (Claparède, 1868), *Saccocirrus papillocercus* Bobretzky, 1872, *Polycirrus caliendrum* Claparède, 1868.

Some of the neoeuxinic immigrants with boreal affinities, which settled in the Black Sea through the Mediterranean, subsequently became extinct in the latter, but survived in the Black Sea, where the hydrological regime and climatic conditions are closer to that of the Northern Atlantic than to that of the Mediterranean. Similarly, the Black Sea selected all cold-water forms that had remained here since the Ice Age, but are extinct or poorly represented in the Mediterranean (Vinogradov, 1947 & 1949; Zenkevich, 1963). The major cause for the gradual extinction of these cold-water species from the Mediterranean is probably the global warming and the temperature rise of the Mediterranean. These forms are the so-called **Arctic relics** in the fauna of the Black Sea. Vinogradov (1949) ascribed to this category no fewer than 26 species. However, some of these were subsequently recorded in the Mediterranean Sea. Currently, only *Microphthalmus sczelkowii* Mecznikow, 1865, *Nephtys ciliata* (O.F. Müller, 1776), *N. longosetosa* Oersted, 1842 and *Ophelia limacina* (Rathke, 1843) can be attributed to this category of glacial relics and which represents 2% of the Black Sea polychaetes.

The **Mediterranean species** are poorly represented in the Black Sea, accounting for 3% of the total number of the Ponto-Azovic polychaetes. They include only the following 6 species: *Phyllodoce vittata* Ehlers, 1864, *Nereiphylla nana* Saint-Joseph, 1906, *Hesionura coineaui* (Laubier, 1962), *Namanereis pontica* (Bobretzky, 1872), *Notomastus lineatus* Claparède, 1870 and *Euclymene palermitana* (Grube, 1840).

A species-rich group (61 species, or 29% of the Ponto-Azovic polychaetes) is represented by the **cosmopolitan species**. They include *Haplosyllis spongicola* (Grube, 1855), *Syllis gracilis* Grube, 1840, *Syllis hyalina* Grube, 1863, *Eunice vittata* Delle Chiaje, 1829, *Laonice cirrata* (M. Sars, 1851), *Heteromastus filiformis* (Claparède, 1864), *Capitella capitata* (Fabricius, 1780), *Owenia fusiformis* Delle Chiaje, 1842, *Serpula vermicularis* Linnaeus, 1767.

The construction of the Suez Canal had permitted the immigration into the Black Sea, through the Red Sea and Mediterranean, of some species from Indo-West Pacific region. In the Black Sea there are only two **Indo-Pacific species** - *Protocirrineris chrysoderma* (Claparède, 1868) and *Capitellethus dispar* (Ehlers, 1907). These species are also referred to as **Lessepsian migrants.**

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