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# FIRST RECORD OF THE OCCURENCE OF *PSEUDODIAPTOMUS MARINUS* (COPEPODA: CALANOIDA: PSEUDODIAPTOMIDAE) IN THE BLACK SEA (SEVASTOPOL BAY)

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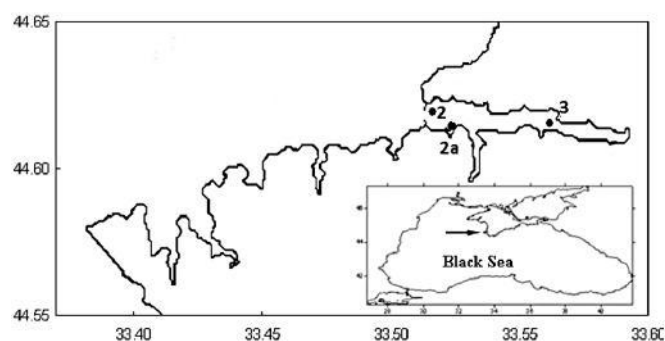
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*Pseudodiaptomus marinus* Sato, 1913 was described for the first time from the coastal area of Northern Japan. The species was thought to be native to the Northwestern Pacific Ocean [1], but now it shows a wide distribution all over the world. Brylinski (2012) described in details its distribution in the World's oceans [2]. Recently *P. marinus* has been found in the Atlantic Ocean, in the North Sea [2] and in the Mediterranean Sea [3–5].

*P. marinus* was initially discovered at the end of September 2016 in a sample taken during a long-term plankton survey of Sevastopol Bay started in 2002 (fig. 1).

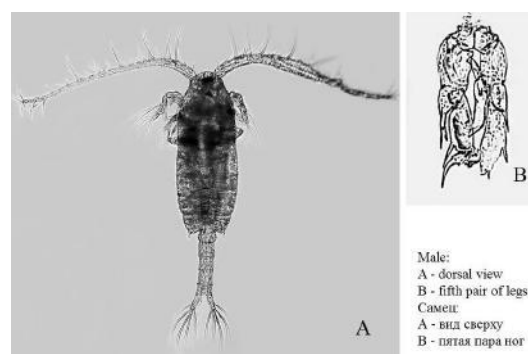


**Рис. 1.** Схема станций отбора проб в Севастопольской бухте

**Fig. 1.** Sampling stations in Sevastopol Bay

Zooplankton samples were collected biweekly at two permanent stations located within Sevastopol Bay by vertical hauls through the whole water column (from bottom to the sea surface) using a Juday plankton net (mouth area 0.1 m<sup>2</sup> and mesh size 150 µm), filtered water volumes were 1 m<sup>3</sup> at the St. 2 and 0.9 m<sup>3</sup> at the St. 3. Samples were not collected in October 2016 due to technical reasons (fig. 1). We found 6 females and 12 copepodites (I–V stages) of *P. marinus* at

the center of Sevastopol Bay (St. 3) on September 22; at the mouth of Bay (St. 2) the species was not found (fig. 3, table 1). Both females and copepodite stages I–V of *P. marinus* were found in Station 3 and 2 (mouth of Bay) on November 11 (table 1). Density values of *P. marinus* increased to 1236 individuals in sample (1373 ind./m<sup>3</sup>) at the center of the Bay. Moreover, two individuals of *P. marinus* nauplii identified accordingly to Sazhina [6] were found in this sample. At the mouth of the Bay the density of the invasive species reached 103 individuals in sample (103 ind./m<sup>3</sup>). The same species as early copepodite stages was found by Leonid Svetlichny in the samples collected on October 24, 2016 opposite to the mouth of Sevastopol Bay (St. 2a). Sampling procedure was described in [7]. These copepodites were successfully cultivated in the laboratory up to adult females and males [3] (fig. 2). Thus, our findings are confirmed by the direct proof, i. e. laboratory development of copepodites to adult *P. marinus*.



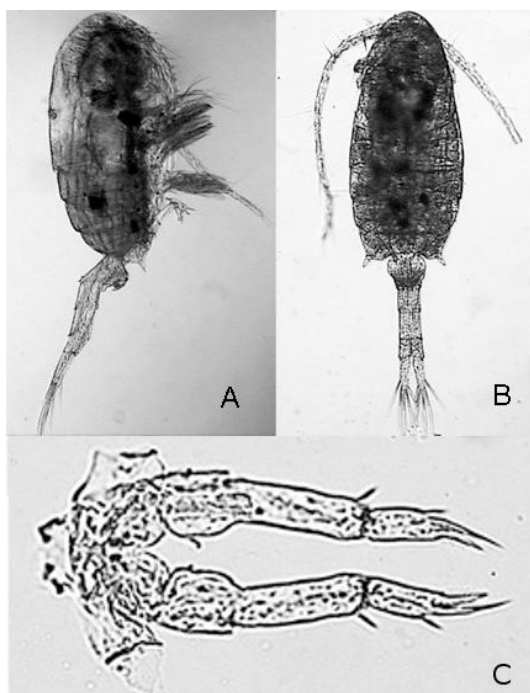
**Рис. 2.** *Pseudodiaptomus marinus* Sato, 1913, самец из Севастопольской бухты, выращенный в культуре Светличным Л. (фото 2А — Светличного Л.)

**Fig. 2.** *Pseudodiaptomus marinus* Sato, 1913, male from Sevastopol Bay cultivated by Svetlichny L. (photo 2A by Svetlichny L.)

**Таблица 1.** Экологические параметры и особенности *Pseudodiaptomus marinus*, собранного в Севастопольской бухте, Чёрное море. Показано количество особей в пробе (N), пол или стадия (F: самка; M: самец; c1–c5: копеподитные стадии), размер (общая длина, мм) и температура воды (T)

**Table 1.** Environmental parameters and characteristics of *Pseudodiaptomus marinus* collected in the Sevastopol Bay of the Black Sea. The number of individuals per sample (N), sex or stage (M: male; F: female; c1–c5: copepodite, size (total length, mm) and water temperature (T) are depicted

| Station | Date       | T, °C | Salinity, ppt | N, ind.   | Sex/Stage | Size (TL, mm) |
|---------|------------|-------|---------------|-----------|-----------|---------------|
| 2       | 22.09.2016 | 22.3  | 17.6          | not found | F         |               |
|         |            |       |               | not found | M         |               |
|         |            |       |               | not found | c4–c5     |               |
|         |            |       |               | not found | c1–c3     |               |
| 3       | 22.09.2016 | 22.5  | 17.47         | 6         | F         | 1.25–1.45     |
|         |            |       |               | not found | M         |               |
|         |            |       |               | 5         | c4–c5     | 0.8–1.15      |
|         |            |       |               | 7         | c1–c3     | 0.5–0.7       |
| 2       | 09.11.2016 | 14.2  | 17.71         | 1         | F         | 1.25–1.3      |
|         |            |       |               | not found | M         |               |
|         |            |       |               | 59        | c4–c5     | 0.85–1.15     |
|         |            |       |               | 43        | c1–c3     | 0.5–0.8       |
| 3       | 09.11.2016 | 14.3  | 17.68         | 2         | F         | 1.4–1.5       |
|         |            |       |               | not found | M         |               |
|         |            |       |               | 817       | c4–c5     | 0.8–1.1       |
|         |            |       |               | 417       | c1–c3     | 0.5–0.7       |



**Рис. 3.** *Pseudodiaptomus marinus* Sato, 1913, самка из Севастопольской бухты (ст. 3). Самка: А — вид сбоку; В — вид сверху; С — пятая пара ног

**Fig. 3.** *Pseudodiaptomus marinus* Sato, 1913, female from Sevastopol Bay (St. 3). Female: A — lateral view; B — dorsal view; C — fifth pair of legs

*P. marinus* is a typical estuarine coastal copepod, living in shallow eutrophic inshore waters [8]. It is tolerant to a wide range of salinity (2.5–35 ppt) and temperature (5–28 °C) and has the highest invasive potential [4]. Thus, the species is suitably adapted to relatively low salinities and winter temperatures of the Black Sea. Copepodite stages at both stations indicate the existence of reproducing populations. Thus, very likely *P. marinus* is the new established species in coastal area of the Black Sea. As is the case with the other recent pelagic invaders, such as the copepods *Acartia tonsa* Dana 1849, *Oithona davisae* Ferrari F. D. & Orsi 1984, ctenophores *Mnemiopsis leidyi* A. Agassiz, 1865 and *Beroe ovata* Bruguier, 1789, it is postulated that *P. marinus* has been brought into Sevastopol Bay in the ballast water of ships.

Long-term studies at basin scale are needed to estimate the structural changes in the Black Sea zooplankton community.

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**Первое сообщение о находке *Pseudodiaptomus marinus* (Copepoda: Calanoida: Pseudodiaptomidae) в Чёрном море (Севастопольская бухта) О. А. Гарбазей, Е. В. Попова, А. Д. Губанова, Д. А. Алтухов.** Институт морских биологических исследований им. А. О. Ковалевского РАН, Севастополь, Россия. *Pseudodiaptomus marinus* Sato, 1913 впервые для Чёрного моря зарегистрирован в пробе из Севастопольской бухты, собранной в конце сентября 2016 г. в рамках многолетних регулярных наблюдений прибрежного планктона, которые проводятся с 2002 г. Мы нашли 6 самок и 12 копепоидитных стадий с 1–с5 этого вида на станции в центре бухты (ст. 3). У входа в бухту (ст. 2) в это время *P. marinus* не зарегистрирован. 11 ноября на обеих станциях были обнаружены самки и копепоидитные стадии *P. marinus*. Численность его популяции на ст. 3 возросла до 1236 экземпляров в пробе (1373 экз./м<sup>3</sup>), на ст. 2 — составляла 103 экземпляра в пробе (103 экз./м<sup>3</sup>). Этот нативный вид Северо-Западной части Тихого океана широко распространился по всему миру и в последние годы был отмечен в Атлантическом океане, в Северном и в Средиземном морях. Он обитает в мелководных прибрежных районах, встречается в бухтах и заливах, толерантен к широкому диапазону солёности (2.5–35 ppt) и температуры (5–28 °C) и имеет высокий инвазивный потенциал. Наличие в пробах всех стадий развития свидетельствует о том, что популяция *P. marinus* размножается. Таким образом, весьма вероятно, что это новый вселенец копепод в Чёрном море. По всей видимости, как и другие пелагические виды-вселенцы (копепоиды *Acartia tonsa* Dana, 1849 и *Oithona davisae* Ferrari F. D. & Orsi, 1984; ктенофоры *Mnemiopsis leidyi* A. Agassiz, 1865 и *Beroe ovata* Bruguere, 1789), он был занесён в Чёрное море с балластными водами кораблей. Для оценки структурных изменений в сообществе зоопланктона Чёрного моря многолетние регулярные наблюдения необходимы и актуальны.

**Ключевые слова:** виды-вселенцы, Copepoda, *Pseudodiaptomus marinus*, Чёрное море, Севастопольская бухта