

TERATOLOGICAL CHANGES OF CYCLOPS VICINUS  
ULYANIN, 1875 (COPEPODA, CYCLOPOIDA) FROM VAYA  
LAKE (BULGARIA)

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**Abstract:** The zooplankton of Vaya Lake (Bulgaria) was investigated in 2005 and a specimen of *C. vicinus* was found with teratological changes concerning shortening of the furca and changing in the number of bristles on it. This type of change was first reported in zooplankton forms in Vaya Lake, which during the study period had a discontinuous connection to the sea and was influenced by increased anthropogenic pressure, especially in its western and northern parts.

## INTRODUCTION

Reports on external teratological morphology of lower crustaceans worldwide are scarce. Monchenko (1974) described the teratology of the second and fourth pair of floating feet in *Diacyclops languidoides clandestinus* (Kiffer, 1926). Plesa (1961) observed two teratological cases in the fourth pair of floating feet in *Acanthocyclops propinquus* (Plesa, 1957). Cases of teratological morphology of three cyclopoid species and one calanoid species from Iceland have been reported in the literature (Pandourski and Evtimova, 2005). In cyclops, anomalies mainly affect the branches of furca and their ornamentation. Cases of teratology have been reported in lower crustaceans of the Calanoida and Cyclopoida (Copepoda) orders, as well as of Diplostraca (Branchiopoda) from subpolar and polar regions (Pandourski and Evtimova, 2009). Such teratological aberrations were noted at the 5th pair of legs at Calanoida, the back of the body at Cyclopoida, and at the right antenna of *Bosmina longispina* Leydig, 1860. As probable cause, the authors indicated the expression of genetically unstable morphological

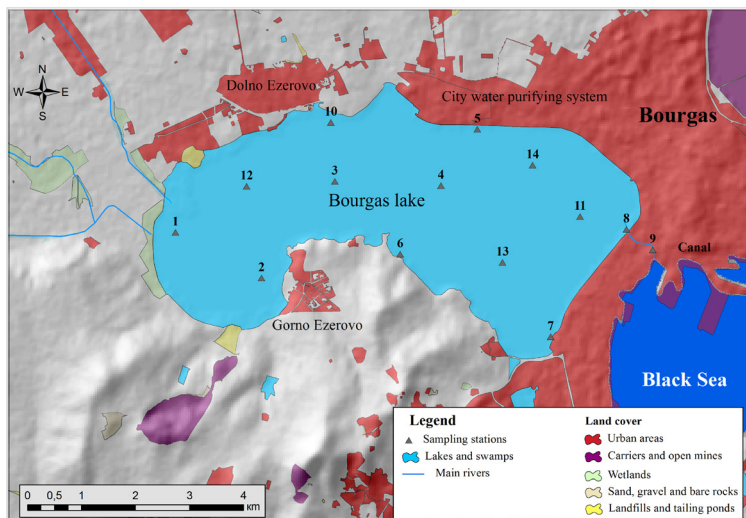
characteristics under the combined effect of polar abiotic factors. More recent generalizations on aberration in four types of harpacticoids have been associated with teratological abnormalities related to asymmetry of the body, changes in the shape of morphological structures, and outward manifestation of transsexual mutations (Kochanova and Fefilova, 2017). The authors cited the geographical isolation of the population and the impact of various environmental factors as probable cause. Teratological features of the sea snail *Bittium reticulatum* (Da Costa, 1778) along the Varna coast have been reported by Mitov (2014), who observed an anomaly in the length of the left tentacle.

This study presents data on the teratological changes of *C. vicinus* in the strongly anthropogenically influenced Vaya (Burgas Lake).

## MATERIALS AND METHODS

Zooplankton was collected seasonally in 2005 using an Apstein type net with an inlet size of 16 cm and "eyes" diameter of 55  $\mu\text{m}$  from 14 permanent stations. The location of the stations is shown on the map of Lake Vaya (Fig. 1). The station coordinates are determined with the Etrex Summit GPS Receiver (GARMIN): 1 (N42°29.655, E27°20.925); 2 (N42°29.194, E27°22.085); 3 (N42°30.160, E27°23.082); 4 (N42°30.113, E27°24.518); 5 (N42°30.674, E27°25.013); 6 (N42°29.428, E27°23.961); 7 (N42°28.593, E27°25.988); 8 (N42°29.665, E27°27.021); 9 (N42°29.458, E27°27.376); 10 (N42°30.750, E27°23.032); 11 (N42°29.796, E27°26.394); 12 (N42°30.114, E27°21.888); 13 (N42°29.340, E27°25.344) and 14 (N42°30.312, E27°25.758).

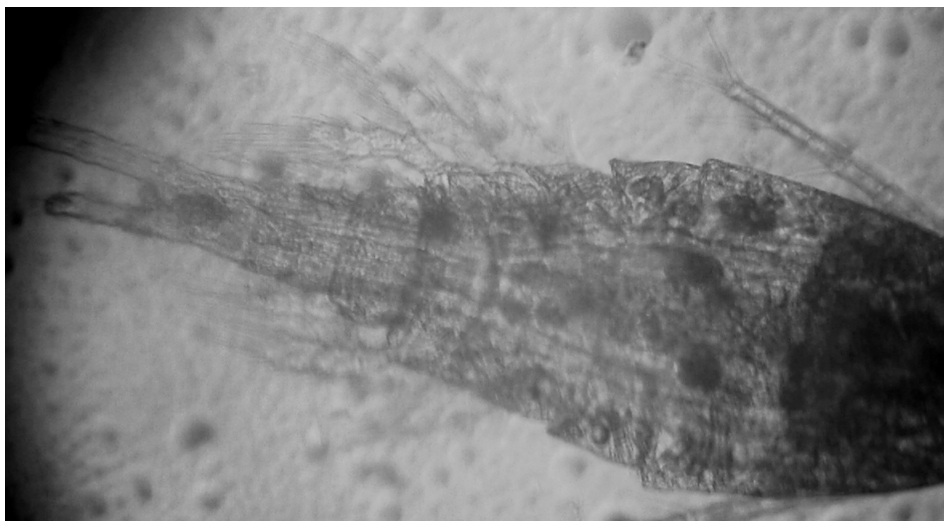
Planktonic samples were collected and fixed in 4% formaldehyde. They were determined to a species, and when this was not possible, to a genus.



**Fig. 1.** Vaya Lake with the location of the stations.

## RESULTS AND DISCUSSION

In 2005, a total of 56 quality plankton samples were collected. A specimen of the species *C. vicinus* discovered in Station 1 in May 2005 was found to be teratologically altered (Fig. 2, Fig. 3). There is a shortening of one branch of the furca and a reduction in the number of bristles on it.



**Fig. 2.** Teratological changes in *C. vicinus* (general view).



**Fig. 3.** Teratological changes in the one branch of the furca of *C. vicinus*.

During the study, serious chemical contamination was reported in the lake, such as elevated concentrations of petroleum products, cadmium, lead etc. ("Environmental Conservation and Restoration Program 2002-2005") which may have influenced the changes in the morphological features of *Cyclops vicinus*. Such teratological alteration in *C. vicinus* morphology may be due to mutations occurring as a result of specific abiotic environmental factors (Pandourski and Evtimova, 2005) and environmental stress (Cuesta et al. 2002; Miličić et al. 2013). According to Miles (1961), a suspected cause of morphological abnormalities is genetic or abnormal tissue regeneration after a mechanical traumatic event. Reports on morphological abnormalities also exist for *Eurytemora velox* (Richard, 1889) (Kiefer, 1978). *Eurytemora velox* is the only European species of the six species of the genus *Eurytemora* (Giesbrecht, 1881) with teratology of exopod 1 of P5. Kiefer (1978) interpreted similar morphological aberrations as a result of possible hybridization between *E. velox* and *E. affinis* (Poppe, 1880). In the populations of two the species of cyclops from the Kamchatka Peninsula (Ishida, 1998) - *Eucyclops speratus* (Lilljeborg, 1901) and *Diacyclops bicuspidatus* (Claus, 1857), a teratological change was observed in antennas and P5 in females. According to Gaviria & Forro (2000), the change in P5 morphology of teratological females in the Danube River (Austria and Hungary) is due to the established high mercury concentration in the river.

## CONCLUSION

The introduction of various pollutants of domestic and industrial character - petroleum

products, cadmium, lead and more, especially in the western and northern parts of Vaya Lake, has led to a strong anthropogenic load on the lake waters. These factors contributed to the serious morphological changes observed in the morphology of some organisms, as is the case with *Cyclops vicinus*. Serious measures are needed to improve the environmental status of the lake.

The author declares no conflict of interest.

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