NAT. CROAT. | VOL. 16 | No 3 | 189–199 | ZAGREB | September 30, 2007

short communication/kratko priopćenje

# THE FIRST RECORD OF *CYCLOPS BOHATER* KOZMINSKI (COPEPODA, CYCLOPOIDA) IN CROATIA AND THE BALKAN PENINSULA

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**Stanković, I. & Ternjej, I.: The first record of *Cyclops bohater* Kozminski (Copepoda, Cyclopoida) in Croatia and the Balkan peninsula. Nat. Croat., Vol. 16, No. 3., 189–199, 2007, Zagreb.**

The species of freshwater Cyclopoida *Cyclops bohater* Kozminski 1933 was recorded during collection of zooplankton in one of the three Čingi-Lingi Lakes in August and September 2004. This is the first record for the Croatian fauna and also for the Balkan Peninsula. The Čingi-Lingi Lake is a gravel pit in the Podravina area of NW Croatia.

**Key words**: *Cyclops bohater*, Čingi-Lingi, freshwater zooplankton, gravel pit

**Stanković, I. & Ternjej, I.: Prvi nalaz vrste *Cyclops bohater* Kozminski (Copepoda, Cyclopoida) u Hrvatskoj i na Balkanskom poluotoku. Nat. Croat., Vol. 16, No. 3., 189–199, 2007, Zagreb.**

Prilikom uzorkovanja zooplanktona u jednom od tri jezera Čingi-Lingi u kolovozu i rujnu 2004. godine zabilježena je vrsta slatkovodnih Cyclopoida *Cyclops bohater* Kozminski 1933. Ovo je prvi nalaz za hrvatsku faunu, a i za Balkanski poluotok. Jezero Čingi-Lingi je šljunčara u SZ dijelu Hrvatske u Podravini.

**Ključne riječi**: *Cyclops bohater*, Čingi-Lingi, slatkovodni zooplanktona, šljunčara

## INTRODUCTION

The Croatian freshwater crustacean fauna has been systematically investigated since the end of the 19th century. To date, 69 species of Cyclopoida have been determined (TERNJEJ & STANKOVIĆ, 2007). *C. bohater* was recorded for the first time in Croatia as a result of zooplankton sampling in one of the three Čingi-Lingi Lakes in the Podravina area in NW Croatia. Sampling was conducted in August and September 2004. Here we present determination characteristics of *C. bohater*. We also present a comparison to *Cyclops abyssorum divergens* (Lindberg, 1936) as described by PANDOURSKI (1997) and MOSCHENKO (1974), as these two species can be easily mistaken.

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# MATERIAL AND METHODS

## *Research area*

Čingi-Lingi Lakes are man-made gravel pits. They are located in the Podravina area in NW Croatia, near the village of Molve (Fig. 1). They belong to the Drava Valley region (C7) according to NIKOLIĆ *et al*. (1998) and the Pannonian biogeographic region according to BOXSHALL (2004). The investigation was conducted only in one of the three lakes, as gravel extraction processes are still ongoing in the other two lakes.

**Tab. 1.** Comparison of determination characteristics of females from the literature (EINSLE, 1996) and measured individuals marked with numbers from 1 to 4. 1. Body length (mm); 2. Antennule with 17 segments; 3. Antennule reaching end of the second pedigerous somite; 4. Length : width of caudal rami; 5. Inner caudal rami margin with hair setae; 6. Terminal accessory seta : caudal rami; 7. Terminal accessory seta : body length; 8. Inner terminal seta : terminal accessory seta; 9. Inner terminal seta : body length; 10. Outer terminal seta : caudal rami; 11. Outer terminal seta % body length; 12. Posterolateral seta : terminal accessory seta; 13. Posterolateral seta : caudal rami; 14. Dorsal seta longer then posterolateral seta; 15. Spine formula; 16. First segment of the antenna has several groups of spines.

| Index No. | Einsle, 1996 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1. | 2,1 – 2,6 | 2,5 | 2,2 | 2,2 | 2,3 |
| 2. | + | + | + | + | + |
| 3. | + | + | + | + | + |
| 4. | 4,5:1 – 6,5:1 | 6,3:1 | 6,2:1 | 6,8:1 | 6,8:1 |
| 5. | + | + | + | + | + |
| 6. | 1,14:1 – 1,18:1 | 1,3:1 | 1,4:1 | 1,3:1 | 1,3:1 |
| 7. | 15% | 15,7 | 16,7 | 16,1 | 16,6 |
| 8. | 2,3:1 – 2,4:1 | 1,9:1 | 1,9:1 | 1,9:1 | 1,8:1 |
| 9. | 31 | 30 | 31,1 | 30,2 | 30 |
| 10. | 2:1 | 2:1 | 2,3:1 | 2,1:1 | 2:1 |
| 11. | 26% | 25% | 27% | 27% | 26% |
| 12. | 0,5:1 | 0,5:1 | 0,5:1 | 0,5:1 | 0,5:1 |
| 13. | 0,6:1 | 0,6:1 | 0,7:1 | 0,6:1 | 0,6:1 |
| 14. | + | + | + | + | + |
| 15. | 3433 | 3433 | 3433 | 3433 | 3433 |
| 16. | + | + | + | + | + |

The investigated lake is oligotrophic with an occasional transition to mesotrophic during the summer. The lake has a surface of 107 296 $m^2$ and volume of 825 000 $m^3$. It is at an altitude of 119 m and its maximum depth is 19 m. It is supplied by water from underground flow of the Drava River, which is located 750 m from the lake. Geographic coordinates of the sampling point are N46°08'11" and E17°03'11".

### *Sampling and determination*

Specimens were collected on 1 August 2004, 16 August 2004 and 2 September 2004 at a depth of 16 m by means of vertical hauls using plankton net with a mesh size of 67 μm. Samples were preserved in 4% formaldehyde. For the purpose of determination and measurement, four adult females were dissected in glycerol and analysed under an Olympus microscope. Determination was carried out according to EINSLE (1993), EINSLE (1996) and KIEFER (1978). All terms for body structure are used from HUYS & BOXSHALL (1991).

## RESULTS

### *Cyclops bohater* Kozminski 1933

**Determination characteristics of *C. bohater* compared with Einsle (1996) (Tab. 1).**

Female. Body length is 2,2 to 2,5 mm. The antennule is with 17 segments (Fig. 2), reaching end of second pedigerous somite, this latter strikingly wide with large lateral lobi. Ends of fourth and fifth pedigerous somites are wide and pointed outward, but no »wings« are present (Fig. 3). The caudal rami have a length:width proportion 6,2 – 6,8:1, divergent, the inner margin with hair-setae (Fig. 4). The terminal accessory seta is longer than the caudal rami (1,3 – 1,4:1), long compared with body length (~16%). The inner terminal seta is twice the length of the terminal accessory seta, 1,8 – 1,9:1, in proportion to the caudal ramus and 30 – 31% of body size. The outer terminal seta is twice the length of the caudal rami and about 27% of body length. The posterolateral seta is half the length of the terminal accessory seta and 0,6:1 in proportion to the caudal ramus.

Spine formula is 3433 (Fig. 5 – 8). First segment of the antenna has several groups of spines, variable (Fig. 9). Seta on the basis of swimming leg 1 is reaching end of the second endopodal segment. Intercoxal sclerite of swimming leg 4 is without setae, humps surpass margin (Fig. 10). Coxa of swimming leg 4 has all groups of spines (A to F) (Fig. 11). Distal segment of swimming leg 5 is slender, inner lateral spine inserting at middle, shorter than segment (Fig. 12).

NAIDENOV & PANDOURSKI (1992) made an incorrect determination of *Cyclops bohater ponorensis* n. ssp. so PANDOURSKI (1997) renamed it as *C. a. divergens*. For the correct determination, we present a comparison of characteristic determination proportions of adult females from the literature and measured individuals (Tab. 2). In

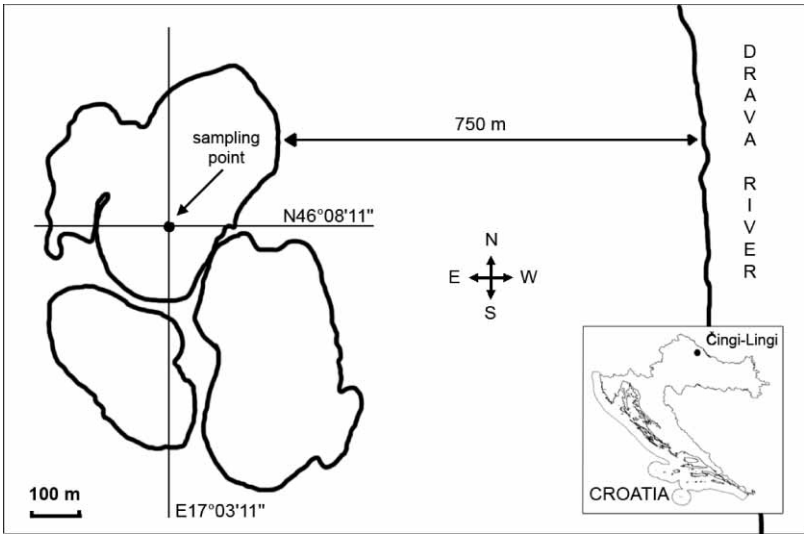


**Fig. 1.** Geographic location of Čingi-Lingi Lake and position of sampling point.


**Fig. 2.** Antennule with its 17 segments.

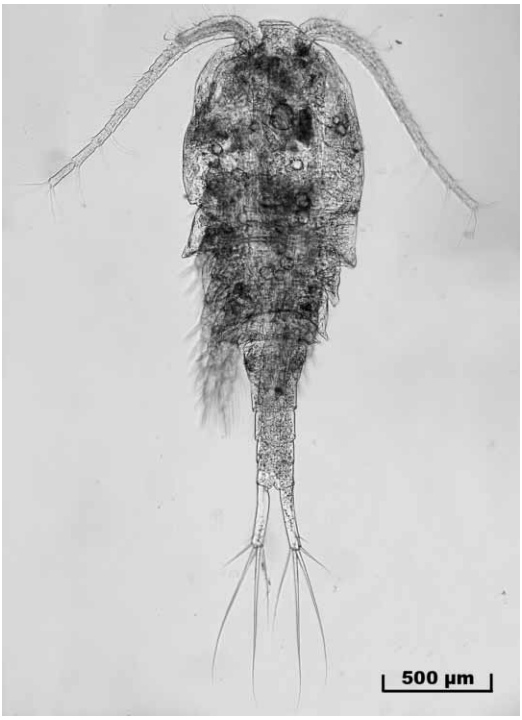


**Fig. 3.** Female of *C. bohater,* dorsal view.

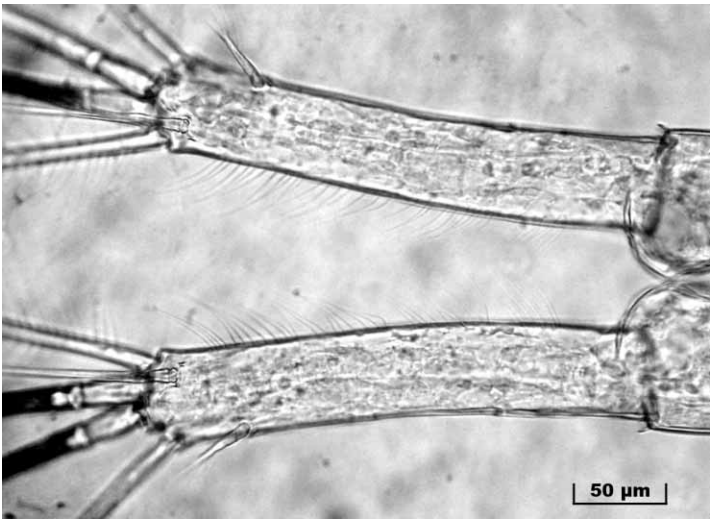


**Fig. 4.** Inner margin of caudal rami with hair-setae.

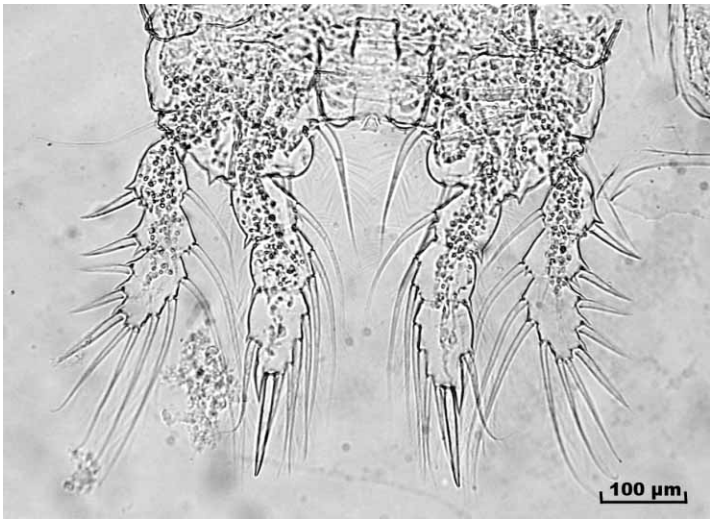


**Fig. 5.** Swimming leg 1.

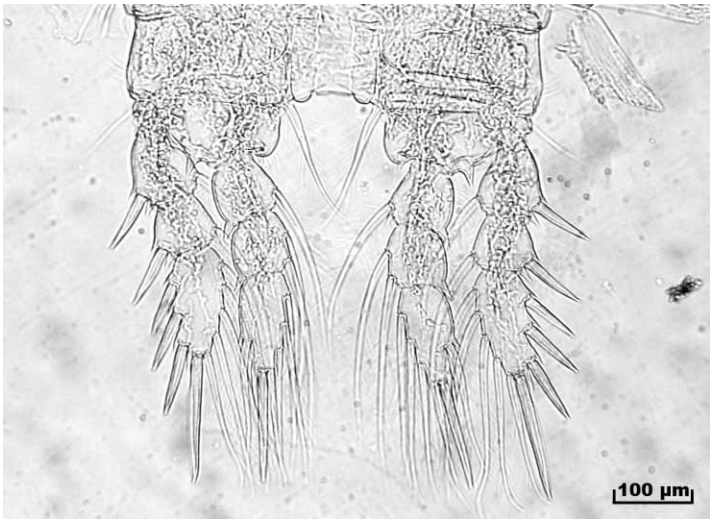


**Fig. 6.** Swimming leg 2.

the absence of adult female individuals in the samples, four animals were measured and used for calculations. It is evident that our individuals are very different from the species *C. a. divergens* described by other authors.

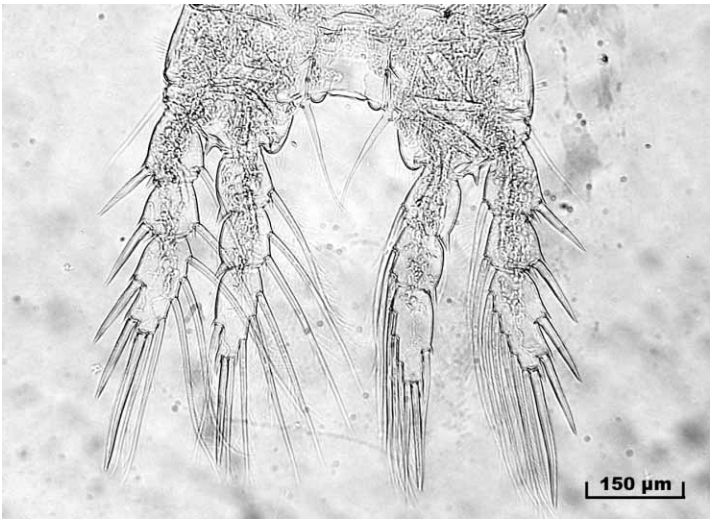


**Fig. 7.** Swimming leg 3.

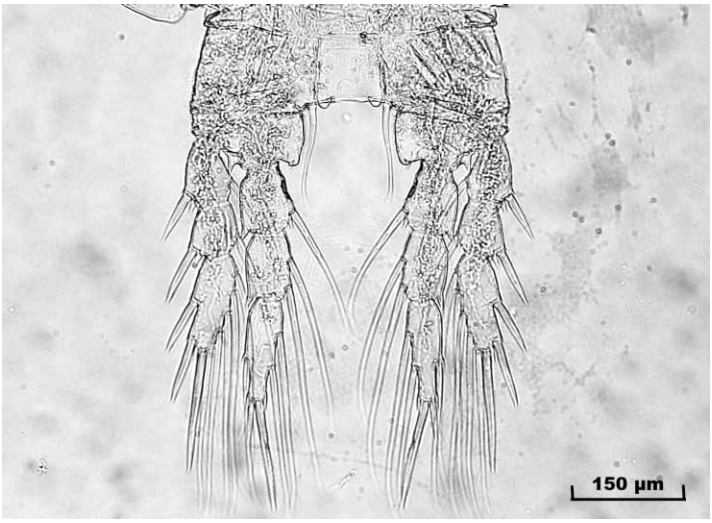


**Fig. 8.** Swimming leg 4.

**Remarks**: *C. bohater* has been recorded in Austria, Switzerland, Czech Republic, Germany, Estonia, France, Italy and Poland (BOXSHALL, 2004). This is the first record of freshwater Cyclopoida *C. bohater* in Čingi-Lingi Lake in Podravina and in

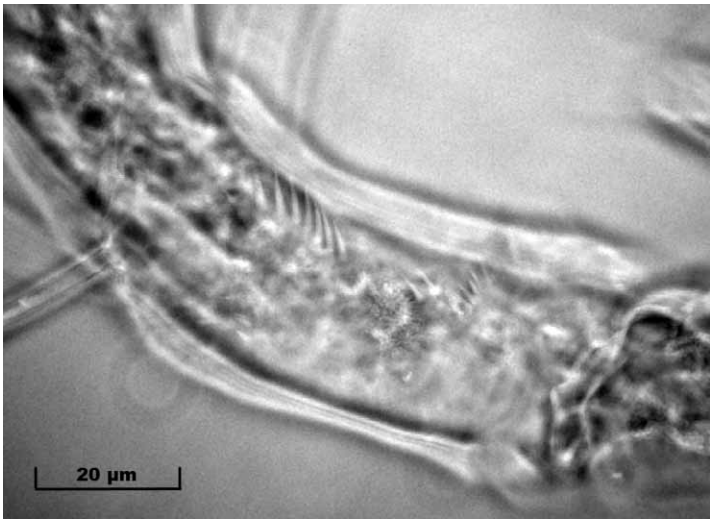


**Fig. 9.** First segment of antenna with several groups of spines.

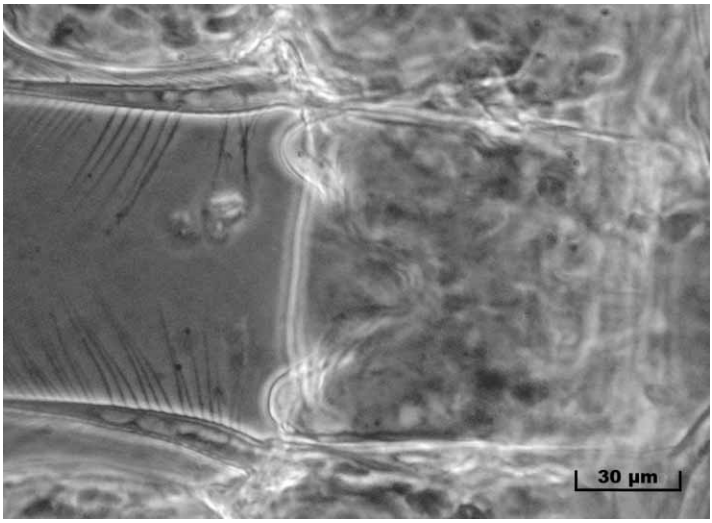


**Fig. 10.** Intercoxal sclerite of swimming leg 4.

Croatia. It is also the first record for the entire Balkan Peninsula. However, this is likely the first record for the Croatian fauna due to the fact that this part of Croatia has not been investigated in detail in the past (TERNJEJ & STANKOVIĆ, 2007). Further studies on the taxonomy and ecology of the species are expected.

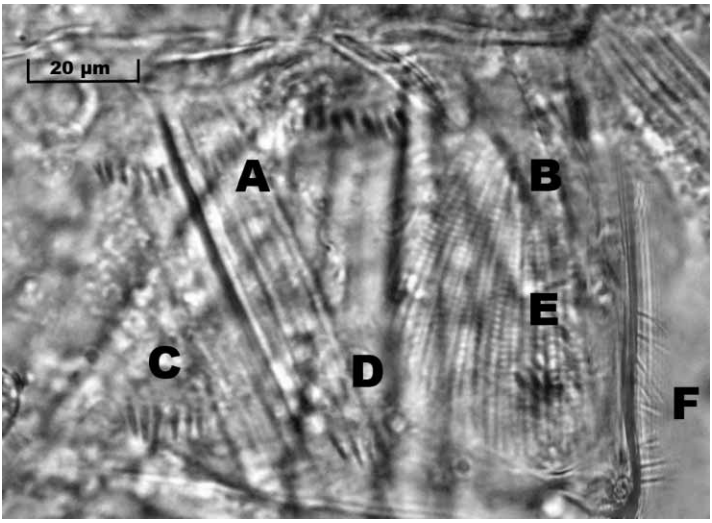


**Fig. 11.** Coxa of swimming leg 4 with all groups of spines from A to F.


**Fig. 12.** Leg 5.

**Tab. 2.** Comparison of characteristic determination proportions of females from the literature and measured individuals. 1. Urosome length % prosome length; 2. Fourth pedigerous somite width ‰ body length; 3. Fifith pedigerous somite width ‰ body length; 4. Caudal ramus width % caudal ramus length; 5. Caudal ramus length ‰ body length; 6. Dorsal seta % caudal ramus length; 7. Dorsal seta % posterolateral seta; 8. Posterolateral seta ‰ body length; 9. Posterolateral seta % caudal ramus length; 10. Terminal accessory seta ‰ body length; 11. Terminal accessory seta % caudal ramus length; 12. Terminal accessory seta % posterolateral seta; 13. Inner terminal seta ‰ body length; 14. Inner terminal seta % caudal ramus length; 15. Inner terminal seta % terminal accessory seta.

| | **Čingi-Lingi Lake** | | **Pandourski (1992)** | | **Moschenko (1974)** | |
|---|---|---|---|---|---|---|
| **Index No.** | **min – max** | **mean** | **min – max** | **mean** | **min – max** | **mean** |
| 1. | 40,9 – 46,5 | 43,6 | – | 45,0 | 36,7 – 45,8 | 38,1 |
| 2. | 200,7 – 236,1 | 214,2 | 218,0 – 242,0 | 227,0 | – | – |
| 3. | 160,5 – 180,0 | 172,0 | 168,7 – 192,8 | 176,1 | – | – |
| 4. | 14,7 – 16,3 | 15,4 | 11,7 – 14,5 | 13,1 | 14,3 – 16,7 | 15,6 |
| 5. | 114,3 – 128,2 | 122,4 | 134,1 – 166,5 | 145,3 | 137,0 – 157,0 | 150,0 |
| 6. | 53,7 – 63,8 | 59,9 | 36,7 – 39,5 | 38,6 | 37,1 – 40,6 | 39,9 |
| 7. | 94,4 – 101,9 | 97,2 | 80,6 – 88,6 | 84,5 | 76,8 – 86,7 | 83,7 |
| 8. | 69,4 – 77,8 | 75,3 | 61,3 – 81,0 | 67,2 | 67,9 – 87,0 | 76,7 |
| 9. | 100,6 – 100,7 | 100,6 | 41,4 – 48,7 | 45,8 | 46,9 – 63,4 | 51,3 |
| 10. | 156,6 – 166,7 | 162,5 | 118,4 – 146,1 | 127,9 | 130,0 – 154,0 | 139,0 |
| 11. | 125,3 – 145,9 | 133,0 | 82,3 – 93,4 | 87,4 | 90,7 – 100,0 | 93,5 |
| 12. | 206,5 – 225,8 | 216,1 | 180,2 – 200,0 | 191,1 | 150,0 – 200,0 | 184,0 |
| 13. | 295,1 – 311,2 | 302,2 | 255,3 – 321,4 | 286,3 | 242,0 – 279,0 | 257,0 |
| 14. | 235,8 – 272,3 | 247,5 | 172,5 – 210,3 | 191,9 | 167,0 – 182,0 | 173,0 |
| 15. | 177,8 – 191,5 | 186,1 | 209,5 – 225,2 | 218,2 | 181,0 – 191,0 | 185,0 |

## ACKNOWLEDGMENTS

We are extremely grateful for the perceptive comments and helpful suggestions of the referees and the improvements they enabled us to make to our original manuscript.

*Received March 29, 2007*

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## SAŽETAK

### Prvi nalaz vrste *Cyclops bohater* Kozminski (Copepoda, Cyclopoida) u Hrvatskoj i na Balkanskom poluotoku

I. Stanković & I. Ternjej

Prilikom uzorkovanja zooplanktona u jednom od tri jezera Čingi-Lingi u kolovozu i rujnu 2004. godine zabilježena je vrsta slatkovodnih Cyclopoida *Cyclops bohater* Kozminski 1933. To je prvi nalaz za faunu Hrvatske i ujedno prvi nalaz za Balkanski poluotok. Jezero Čingi-Lingi je šljunčara oligotrofno-mezotrofnog karaktera i nalazi se u SZ dijelu Hrvatske u Podravini. Vodom se prihranjuje podzemnim tokovima iz rijeke Drave u čijoj je neposrednoj blizini.