Vol. 12(2), pp. 128-136, April-June 2020
DOI: 10.5897/IJBC2020.1389
Article Number: BE0EA5663921
ISSN 2141-243X

http://www.academicjournals.org/IJBC

ACADEMIC JOURNALS
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International Journal of Biodiversity and Conservation

Full Length Research Paper

Polymorphism of *Cyclops abyssorum mauritaniae* (Copepoda, Cyclopoidae) collected from Algeria water bodies

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Received 17 February, 2020; Accepted 20 May, 2020

Three morphotypes A, B and C were isolated after description of *Cyclops abyssorum mauritaniae* populations obtained from 46 Algerian water bodies. These are described based on their morphometric characters. Morphotype A found in six localities characterized the east of Algeria, morphotype B was collected in the west of Algeria, while morphotype C was collected in High Mountain in the North. After dissection of certain males and females, measurements of the different parts of the body illustrated by drawings were made for each morphotype. The size of morphotype B is intermediate between A and C. The outer side of the second article of the fifth thoracic leg presents a small bump only in morphotype A and C. Morphotype C is characterized by the convexity of its third, fourth and fifth thoracics anterior margin. Other differences were observed on ornamentations of the antenna basis and the coxa of the fourth leg. This subspecies, with common occurrence in the Eastern Region of Algeria and rare occurrence in the northern and western parts of the country indicates that it is dispersed in Algeria from the East to the West and North.

Key words: Algeria, Copepoda, *Cyclops abyssorum mauritaniae*, distribution, polymorphism.

INTRODUCTION

Cyclops abyssorum mauritaniae Lindberg 1950 is a Southern element of the Holarctic genus *Cyclops* O.F.Muller 1776. In North Africa, *C. abyssorum mauritaniae* was first reported from Morocco by Lindberg (1950) and was met for the first time in Algeria in 1992 (Akli, 1992). In Tunisia it was reported later by Toumi et al. (2013). Three populations from the Middle and High Atlas (Dayat Ifrah, Aguelmane de Sidi Ali, and Lake Ifni) have been compared (Dumont and Decraemer, 1977).

In accordance with its eurytopy, the species has been recorded as tolerating a variety of environmental conditions, such as acidic waters (Røen, 1962) and alkaline waters (Morgan, 1972). In Algeria shallow dams, this species was usually observed after eutrophication (Bidi et al., 2014). According to Krajicek et al. (2016), eutrophication represents a recent dispersion caused by man. Many morphotypes of *C. abyssorum* have been

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described by different authors. Einsle (1975) found that the planktonic populations react quickly to the environmental conditions changes with a change of morphometry of the different parts of the body.

MATERIALS AND METHODS

Sampling

A total of 46 water bodies (Table 1 and Figure 1) were sampled in different parts of Algeria with one sampling per water body except for three localities (9, 10 and 18). Samples were collected using plankton net of 50µm mesh size. The samples were fixed in 5% formalin solution. Samples were collected by the author.

Dissection

For preparation, the organisms were first placed in small dishes containing a mixture of formalin water and glycerin. The water evaporated in 1-2 days and then specimens were dissected in the concentrated glycerin. The cyclopoids were examined in dorsal view. Total body length and length of antennules in relation to the cephalothorax were measured. Other measurements on the caudal rami, the fourth and fifth thoracic legs were made after dissection and followed by drawings for each morphotype of *C. abyssorum mauritaniae*. Cyclopoids were identified using the key of Dussart (1969) (Table 2).

RESULTS AND DISCUSSION

Three Algerian morphotypes A, B and C of *C. abyssorum mauritaniae* were identified. The morphotype A which characterises the East Algeria water bodies was the most abundant, collected at different altitudes (25, 600 and 1090 m) in lakes and wadis. Only two females of morphotype B was sampled in West Algeria, in wadi at 86 m altitude, while morphotype C was collected in lake in the High Mountain (1200 m altitude), in the North. According to Holynska and Wyngaard (2019), *C. abyssorum* G. O Sars, 1863 occur in both low and high-altitude habitats. Morphotype A (Figure 2a) is the most robust one (2.2-2.3 mm); size of morphotype B (1.9- 2.1 mm) is intermediate between A and C (1.7-2 mm) (Figure 2b and c). Tunisian (1.6-2.2 mm) and Algerian specimens of *C. abyssorum mauritaniae* have relatively big size compared to Morocco specimens of Aguelmane de Sidi Ali (1.4-1.74 mm) and lake Ifni (1.24-1.29 mm). From Dayat Ifrah one adult female was isolated, suggesting a more robust form than the animals from Aguelmane de Sidi Ali, with shorter furcal rami (Dumont and Decraemer, 1977). Algerian specimens' first antenna reaches the posterior margin of the cephalothorax; those from Morocco have the first antenna that reaches the half of the second thoracic segment; those from Tunisia exceed it. Morphotype C shows a habitus that is close to the material of Aguelmane Sidi Ali with convexity of its third, fourth and fifth thoracic anterior margin (Figure 2c). Furcal rami in morphotype C (Figure 3c) are slightly shorter (5.6 -6.9 times as long as wide) than of morphotype A and B (6 -7 times as long as wide) (Figure 3a, b). Morphotype A shows furcal rami (Figure 3a) with thickened ridge in the dorsal side which is close to that of Dumont material of Dayat Ifrah (Dumont and Decraemer, 1977).

Differences between these three morphotypes were observed in spinule ornamentation of the antennary basipodite. The antennary basipodite in caudal view (Figure 4a, c and e) is shown in both morphotypes' proximal spinules; on the lateral rim, it is composed of 6 long spinules slightly incurved in morphotype A, 8 spinules in morphotype B and 3 little spinules in morphotype C. Oblique row of spinules next to proximal row on lateral rim is composed of 7 elongated spinules in morphotype A, 4 spinules in morphotype B and 7 spinules in morphotype C. Longitudinal row along lateral rim is arranged in one curved row of small spinules (10 spinules) of equal size in morphotype A and one continuous row of spinules (7spinules) in morphotype C, in morphotype B, longitudinal row along lateral rim is absent. Frontal spinule pattern of antennary (Figure 4b, f) consists of group of oblique spinules (4) near the base in morphotype A and C. frontal basipodite antenna without spinules (3d).

In all morphotypes, formula of exopodite 3 (P1-P4) is: 3- 4- 3- 3; the endopodite 3 of the fourth leg is 2 to 2.5 times as long as broad. The internal apical spine is 2 times as long as the external apical spine (Figure 5a, b and c). Caudal spinule ornamentation of P4 coxopodite (Figure 6a, b and c) composed of intermittent row of spinules along distal rim is arranged differently in both morphotypes; (4+5) in morphotype A, (11+1) in morphotype B and (4+4) in morphotype C. Along proximal rim of P4 coxopodite, spinules are arranged in two rows with different size, consisting of 17 spinules in morphotype A, 22 spinules in morphotype B and 16 spinules in morphotype C. On lateral rim, a row of numerous fine spicules comb like exists only in morphotype A. The connecting plate of P4 carries two rows of long hair; it is an ornamentation which is identical to all the morphotypes. The outer side of the second article of the fifth thoracic leg presents a small bump in morphotype A and C (Figure 7a and c) with 4 to 5 small spines for morphotype A (Figure 7a) and 3 to 4 small spines for morphotypes B and C (Figure 7b and c).

Conclusion

In the 46 water bodies sampled, *C. abyssorum mauritaniae* existed only in eight localities with considerable morphological plasticity. Morphological characters of morphotype A are stable in all its localities; for morphotype C, any morphological differences in

Table 1. List of localities with altitude and dates of sampling.

S/N	Locality
1	Terni wadi (Tlemcen). 867 m. 18/01/1989.
2	Tafna source (Tlemcen). 800 m. 18/01/1989.
3	Sebkha (Oran). 110 m. 19/01/1989.
4	Lake of Gharabes (Oran). 109 m. 19/01/1989.
5	Swamp of Lamacta (Oran). 0 m. 19/01/1989.
6	Saida wadi (Saida). 980 m. 20/01/1989.
7	Dam of Oued El Fodda (Ech Chellif). 200-235 m. 7/11/1990
8	Chellif wadi (Ech Chellif). 86 m.3/04/1990.
9	Mazafran wadi (Tipasa). 12 m. 10/10/1990, 5/11/1990.
10	Chiffa wadi (Blida). 92 m. 8/6/1990, 9/11/1990.
11	Dam of Ghrib (Medea). 559 m. 5/11/1990.
12	Dam of Boughzoul. (Medea). 600 m. 6/11/1990.
13	Sebkha of Boughzoul. (Medea). 600 m. 6/11/1990.
14	Lake of Reghaia (Alger). 4-35 m. March, July 1989.
15	Dam of Hamiz (Boumerdes). 300 m. 15/05/1989.
16	Dam of Cap Djenet (Boumerdes). 121 m. June 1990.
17	Basins of Djurdjura (Bouira). 2308 m. 06/12/1989.
18	Black lake (Bouira). 1200 m. 16/05/1990, 5/06/1990.
19	Soummam wadi (Bejaia). 1 m. September, 1990.
20	Ziama Mansouria wadi (Jijel). 15 m. 25/11/1989.
21	Dam of Bordj –Bou-Arreridj (Bordj –Bou-Arreridj). 900 m. 21/11/1989.
22	Rhumel wadi (Constantine). 1090 m. 21/11/1989.
23	Boumerzoug wadi (Constantine). 506 m. 21/11/1989.
24	Charef wadi (Guelma). 621 m. 22/11/1989.
25	Benazouz wadi (Skikda). 17 m. 24/11/1989.
26	Ain Barbar wadi (Annaba). 900 m. 24/11/1989.
27	Seybouse wadi (Guelma). 0 m. 22/11/1989.
28	Dam of Cheffia (El Taref). 337 m. 22/11/1989.
29	Lake of Melah (El Taref). 60 m. 23/11/1989.
30	Lake of Oubeira (El Taref). 25 m. 23/11/1989.
31	Lake of Tonga (El Taref). 589-1061 m. 23/11/1989.
32	Blue lake (El Taref). 60 m. 23/11/1989.
33	Messida wadi (El Taref). 1 m. 23/11/1989.
34	Swamp (El-Harrach, Algiers). 0-178 m. 14/11/1990.
35	Bethah wadi (Annaba). 600 m. 24/11/1989.
36	Basins (Tasslemt, Tissemssilt). 900 m. 17/01/1989.
37	Swamp between Ain El Hadid and Rosfa (Tiaret). 911 m. 17/01/1989.
38	Basins (Tamezguida, Medea). 1604 m. 9/11/1990.
39	Sebkha between Hassi- Bahbah and Djelfa. 750-850 m. June.1990.
40	Dame of Blidet Amor (Touggourt). 93 m. 10/05/1990.
41	Segger wadi (Biskra). 87 m. 9/05/1990.
42	Lake of Ain Saadane (El Biodh Sidi Cheich, El Bayad). 744 m. 17/05/1989.
43	Source of Ain EL Hammam (Brezina- El Bayad). 849 m. 18/05/1989.
44	Dam of Sidi Okba (Biskra). 54 m. 9/05/1990.
45	Lake of Gue of Arsaouet ((El Biodh Sidi Cheich, El Bayad). 744 m. 17/05/1989.
46	Source of El Goleita (Brezina- El Bayad). 849 m. 18/05/1989.

samples taken at different time were found. These suggest that morphotypes character differences are not local neither temporal, and are due to fragmented dispersion of *C. abyssorum mauritaniae.* This subspecies

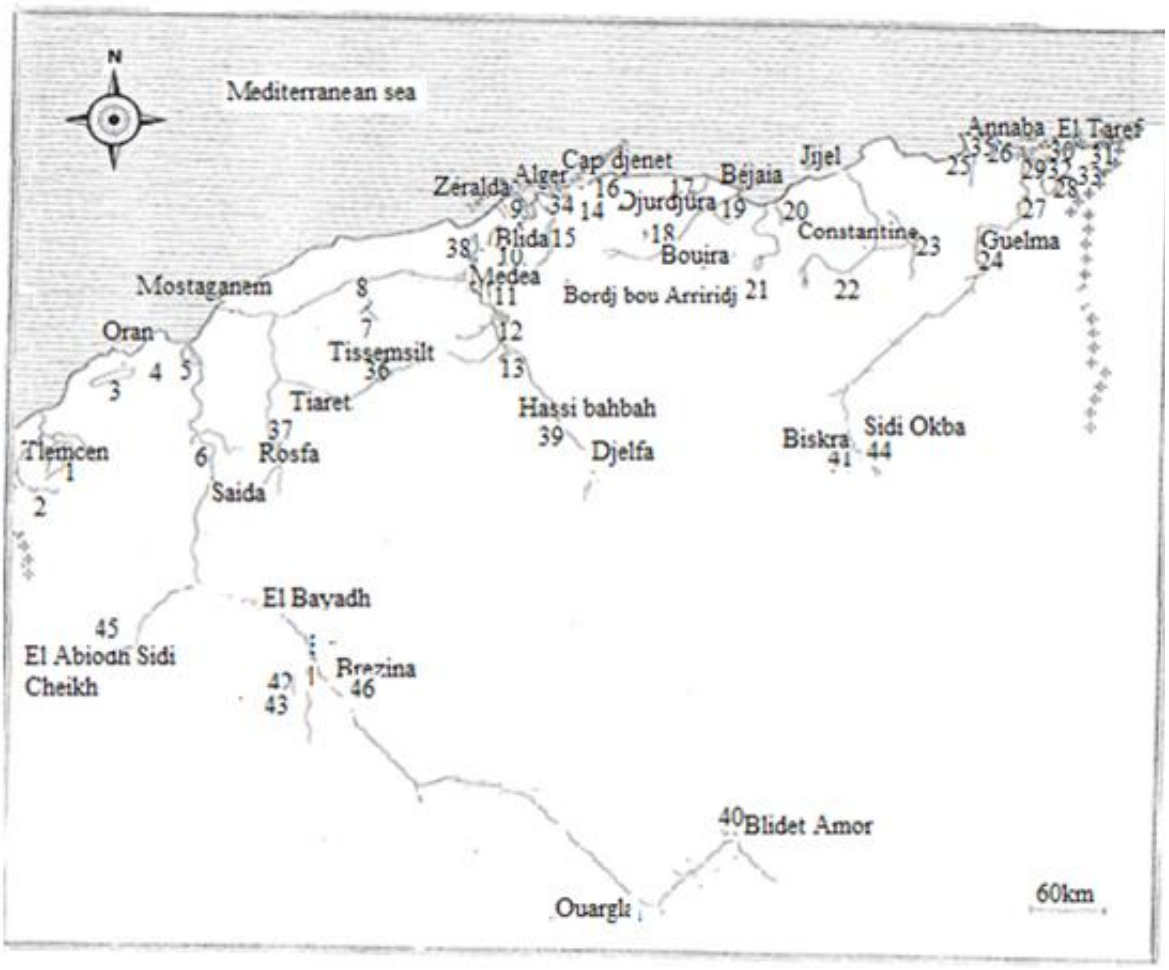

Figure 1. Sampled localities (numbers) in water bodies of Algeria.

Table 2. Material examined (Number(s) refer to the localities.

***Cyclops abyssorum mauritaniae* (Morphotype A)**	
22	Several males, several females.
23	Several males, several females.
24	Several males, several females, copepodites.
30	One female.
31	One female, copepodites.
35	Several males, several females
***Cyclops abyssorum mauritaniae* (Morphotype B)**	
8	Two females
3-*Cyclops abyssorummauritaniae* (Morphotype C)	
18	One male, several females

is well represented in the Eastern Region of Algeria and rare in the North and West regions, indicating that it originated in the East and began spreading to north and west Algeria taking different forms. *C. abyssorum*

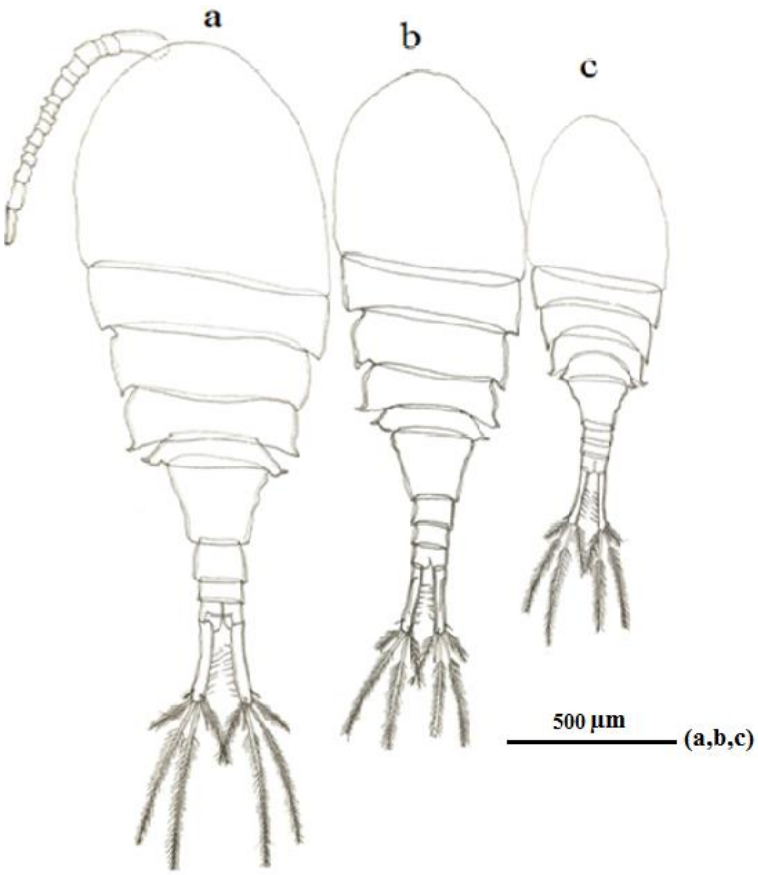

Figure 2. *C. abyssorum mauritaniae* Lindberg 1950. Habitus: a: morphotype A; b: morphotype B; c: morphotype C.

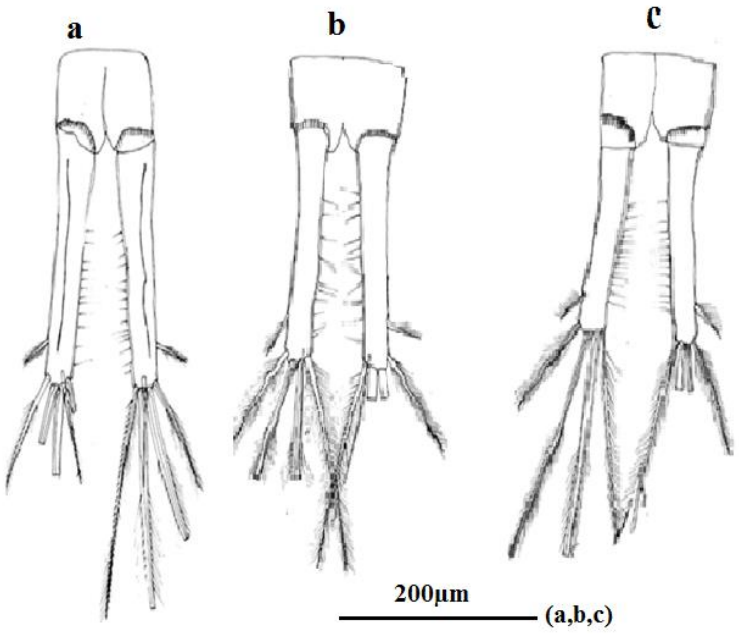

Figure 3. *C. abyssorum mauritaniae* Lindberg 1950. Furca: a: morphotype A; b: morphotype B; c: morphotype C.

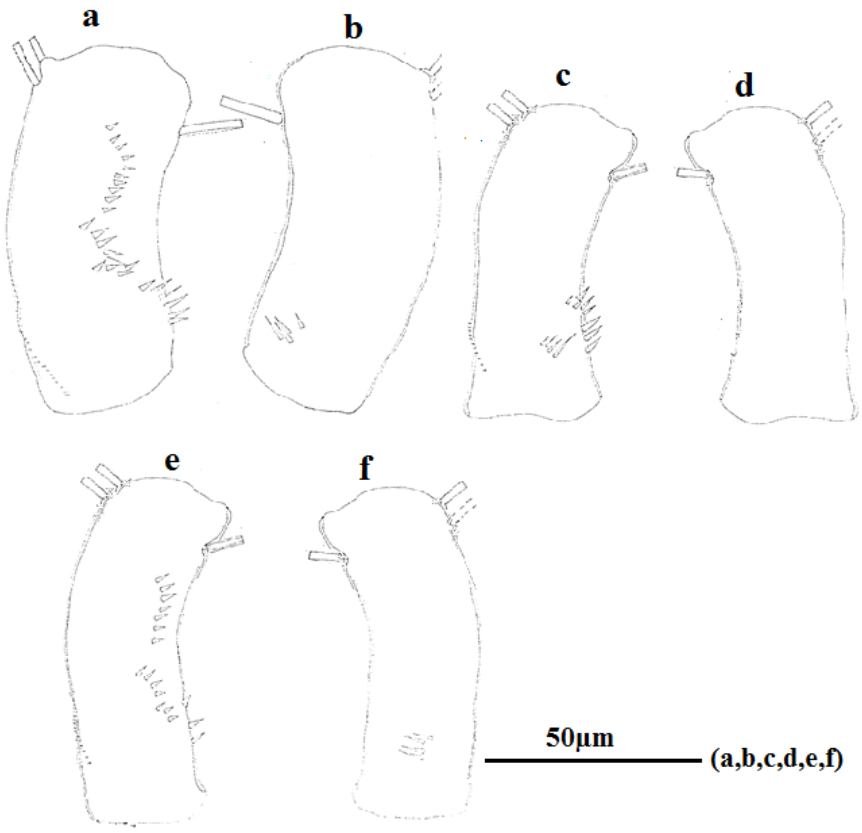

Figure 4. *C. abyssorum mauritaniae* Lindberg 1950. Surface ornamentation of antennal basis: Caudal surface (a) and frontal surface (b) of morphotype A, caudal surface (c) and frontal surface (d) of morphotype B; caudal surface (e) and frontal surface (f) of morphotype C.

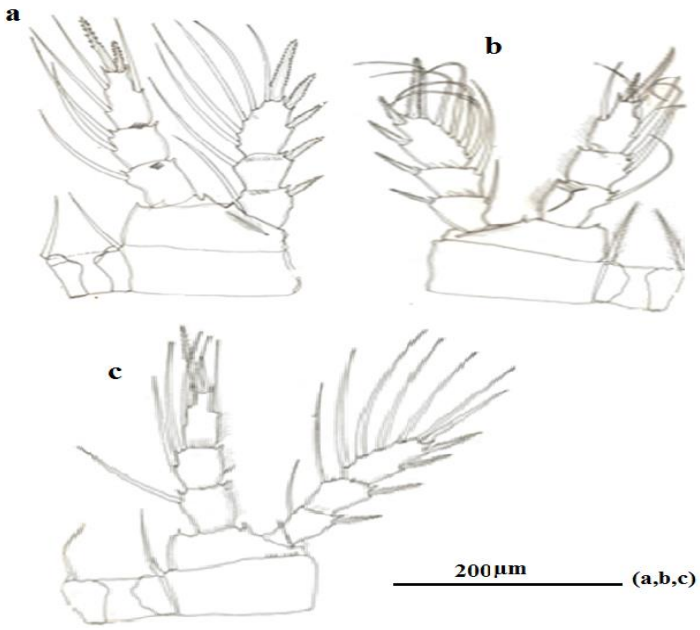

Figure 5. *C. abyssorum mauritaniae* Lindberg 1950. Fourth leg (P4): a, morphotype A; b: morphotype B; c: morphotype C.

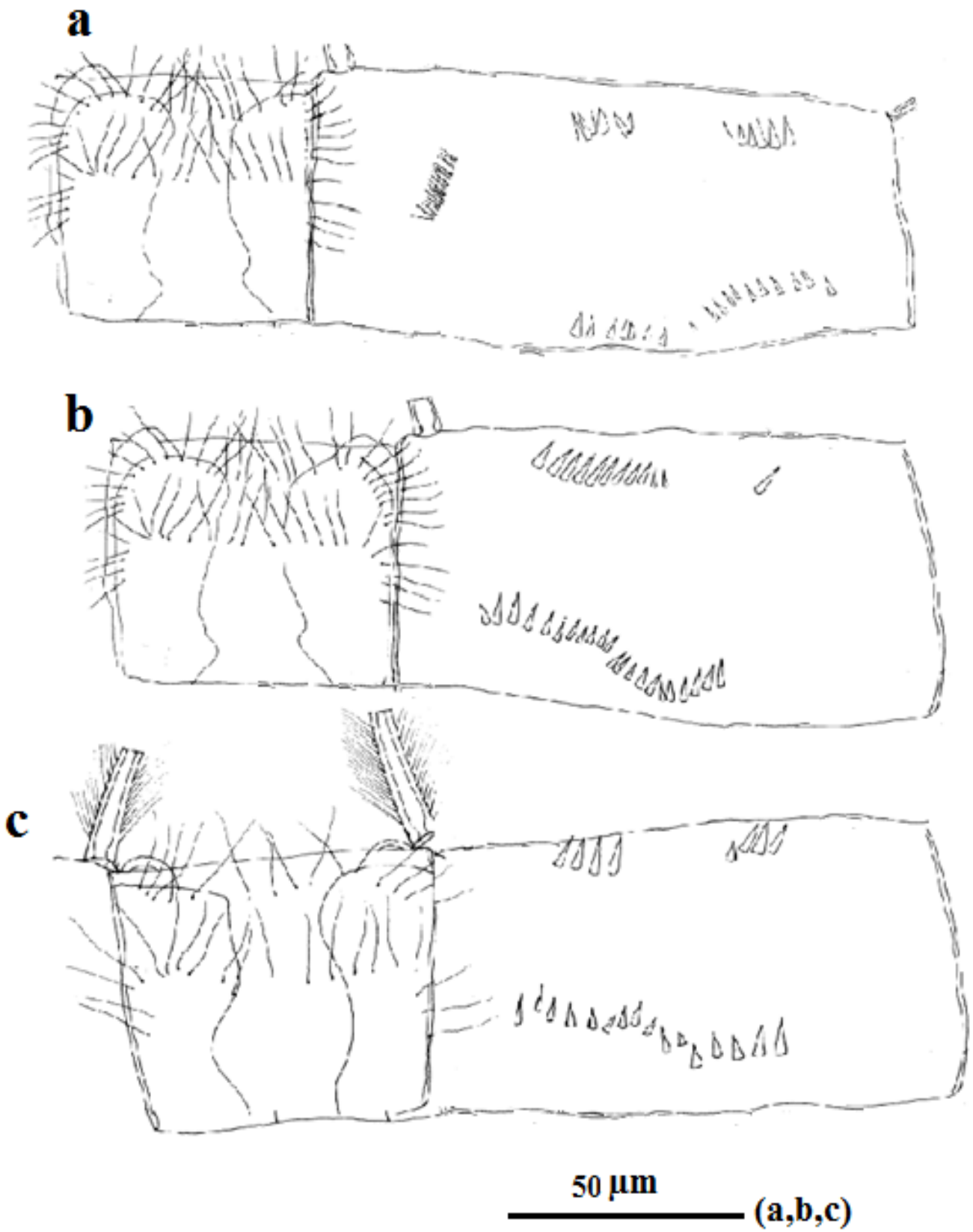

Figure 6. *C. abyssorum mauritaniae* Lindberg 1950. Caudal surface ornamentation of P4 coxa and connecting plate of the fourth legs (P4): a: morphotype A; b: morphotype B; c: morphotype C.

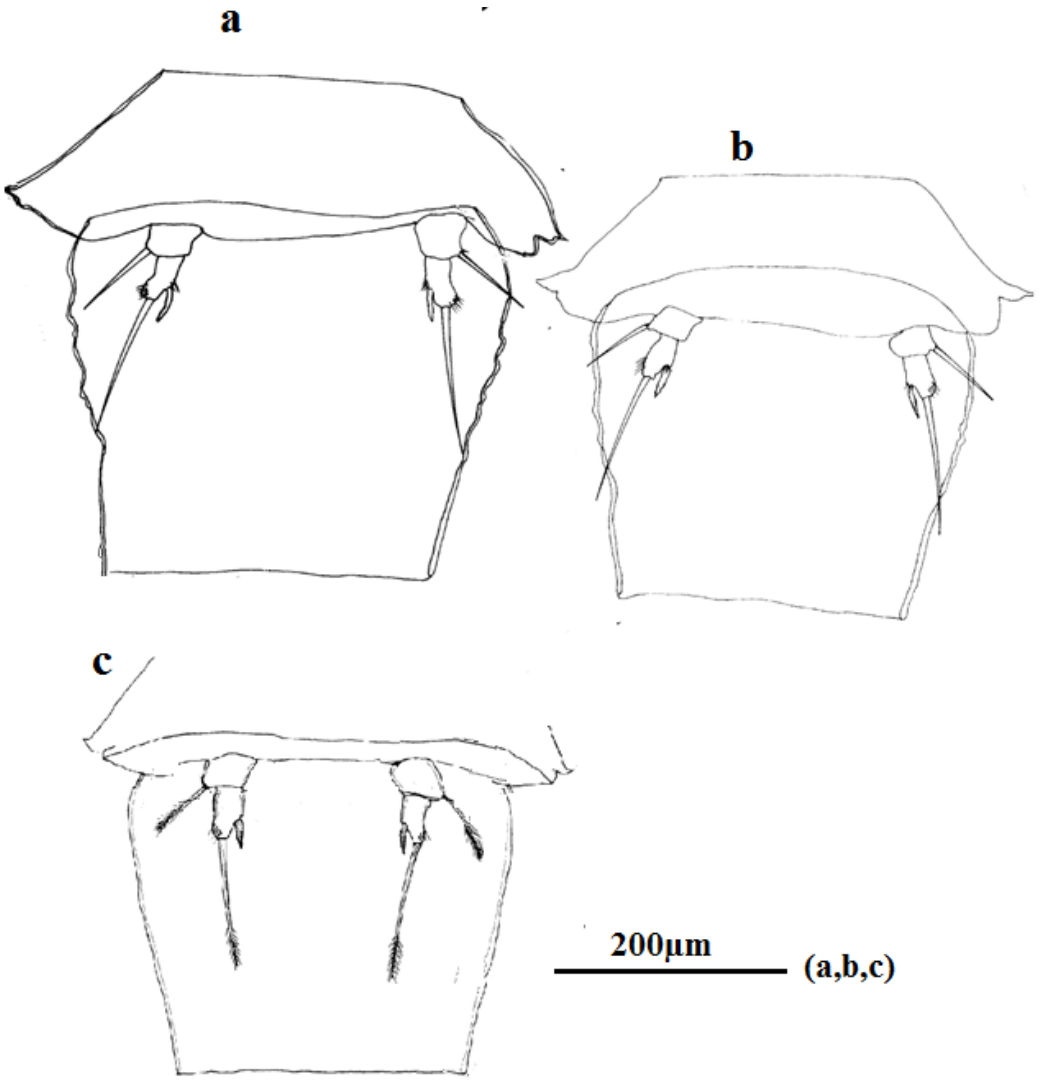

Figure 7. *C. abyssorum mauritaniae* Lindberg 1950. Fifth thoracic segment (Th5), fourth leg (P5) and genital segment: a: morphotype A; b: morphotype B; c: morphotype C.

mauritaniae is one of the relatively poorly known representatives of the Holarctic genus Cyclops. A study on the geographic variation of the morphological characters in this North African taxon might have been a very interesting.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The authors are grateful to Professor H. DUMONT for welcoming them in his laboratory and to Dr. S. MAAS for her availability and helping to confirm the species copepods.

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