

***Delavalia longifurca* (Sewell, 1934) (Copepoda: Harpacticoida)
from the Southern Iraqi Marshes and Shatt Al-Arab River,
Basrah, Iraq**

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Abstract: A marine harpacticoid copepod, *Delavalia longifurca* was found in some parts of the southern Iraqi marshes and the Shatt Al-Arab river during the period 2006-2009. The highest occurrence density was 231 ind./ m³ in Al-Burga marsh during April 2006, whereas a density of 92 ind./ m³ was found in Al-Qurna town (Shatt Al-Arab river) during July 2009. The species was photographed and illustrated and some remarks on their occurrence were given. The specimens of *D. longifurca* from Basrah were rather distinct from those described earlier from India.

Keywords: *Delavalia longifurca*, Copepoda, Marshes, Shatt Al-Arab river, Basrah, Iraq.

Introduction

The marshes and Shatt Al-Arab river are large freshwater bodies covering large area in southern Iraq. Several studies on zooplankton were carried out in Shatt Al-Arab river and the southern Iraqi marshes and were focusing on the abundance and distribution of the different groups of zooplankton (Mohammad, 1965; Khalaf & Smirnov, 1976; Al-Saboonchi et al., 1986; Ajeel, 2004; Ajeel et al., 2006; Salman et al., 2014).

Environment of Southern Iraq was subjected to some significant changes in salinity and temperature, especially in the last few years which led to substantial variation in species composition and abundance of many organisms. Such changes also caused the intrusion of many marine species into Shatt Al-Arab river and the marshes. The first published records of the intrusion of such species is that of Mohammed (2011) who reported the occurrence of the calanoid *Pseudodiaptomus ardjuna* in Shatt Al-Arab river, and the second report is that of Mohammed et al. (2014) who observed an invasive cyclopoid copepod *Limnoithona tetraspina* in Shatt Al-Arab river. These two species are considered as marine species and their occurrence in Shatt Al-Arab river indicates their wide tolerance to salinity, as this region is an oligohaline brackish water.

Huys & Mu (2008) recognized 53 species of the genus *Delavalia*; of which they enlisted *Delavalia longifurca* (Sewell, 1934) within the group II. For the time being, the genus *Delavalia* includes 54 accepted species and six unaccepted species (WoRMS, 2017).

Stenhelia (Delavalia) longifurca was reported from the Arabian Gulf (salinity 25.5 psu), Al-Fao town (salinity 1.36 psu) and Al-Seeba town (salinity 0.96 psu) which are stations of the lower reaches of Shatt Al-Arab river (Al-Zubaidi, 1998). But no data are available from the upper reaches of Shatt Al-Arab river and the marshes which is most likely due to lack of sampling in these areas. However, during April 2006 to January 2007, sampling in these areas revealed the presence of this species in these areas occurring in water of low salinity (range between 1.1-1.5 psu).

The present article aims at reporting the occurrence of the marine *Delavalia longifurca* in brackish water areas of Shatt Al-Arab river and the southern Iraqi marshes.

Materials and Methods

Specimens of *D. longifurca* were collected monthly during a zooplankton monitoring program carried out in the southern Iraqi marshes during April 2006 to January 2007, and from Shatt Al-Arab river, during September 2008 to August 2009 using a plankton net of 120 μm mesh size and 40 cm ring diameter. A flow meter was mounted to the mouth of the net, plankton samples were fixed with 4% formaldehyde solution. Specimens were mounted in glycerine and examined under a Wild dissecting microscope. Two stations were selected from each marsh, Al-Hammar marshes (station 1: 30° 40' 33" N, 47° 28' 01"E at Al-Burga) and (station 2: 30° 45' 57" N, 47° 31' 13" E at Al-Nagara region) and Al-Hawiza marshes (station 3: 31° 22' 23" N, 47° 27' 47" E at Um Al-Naag region) and station 4: 31° 38' 16" N, 47° 35' 05"E at Um Al-Wared region), together with four regions from Shatt Al-Arab river. These were Al-Qurna (station 5: 31° 1' 00" N, 47° 29' 00" E), Al-Hartha (station 6: 30° 40' 00" N, 47° 50' 00" E), Al-Sindibad island (station 7: 30° 33' 00" N, 47° 50' 00" E) and Al-Kornish (station 8: 30° 26' 00" N, 47° 58' 00"E) as indicated in Figure 1.

The specimens were identified according to Coule (1976) and Reddy & Radhakrishna (1980). Some of the body parts were drawn using camera Lucida, and the images were taken with the aid of a digital camera.

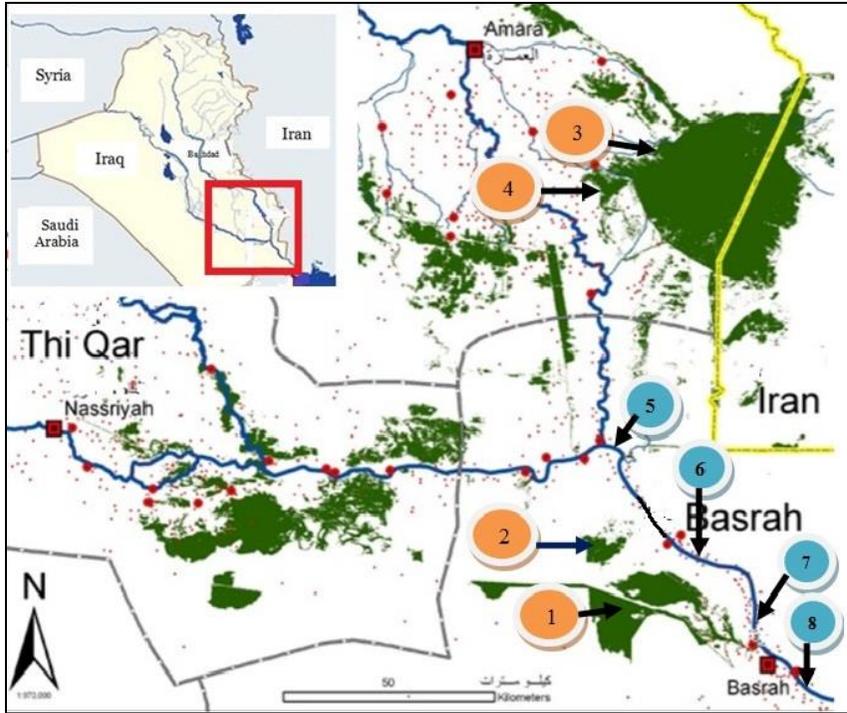


Figure 1: Map of study area and sampling stations.

Results and Discussion

The following is a description and distribution of *Delavalia longifurca* found in the present study.

Species: *Delavalia longifurca* (Sewell, 1934)

Synonym: *Stenhelina longifurca* Sewell, 1934

Synonym: *Stenhelina (Delavalia) longifurca* Sewell, 1934

Specimens Examined

Specimens examined included five females and three males from Al-Burga marsh (station 1) in August 2006, two females from Al-Kornish (station 8) in December 2008, two females and one male from Al-Qurna (station 5) in September 2008, nine females and five males from Al-Sindibad island (station 7) in January 2009 and two females and one male from Al-Hartha (station 6) in May 2009. The densities of *D. longifurca* from stations of the Southern Iraqi marshes are shown in Table (1) while those from Shatt Al-Arab river are shown in Table (2).

Table 1: Density (ind./ m³) of *D. longifurca* in the stations of Southern Iraqi marshes during April 2006 to January 2007.

Month	Station 1	Station 2	Station 3	Station 4
April 2006	231	185	-	-
May	46	-	-	-
June	-	41	-	-
July	32	19	-	-
August	73	93	-	-
September	-	-	3	-
October	-	-	-	-
November	-	-	-	-
December	-	36	-	-
January 2007	14	-	-	-

Table 2: Density (ind./ m³) of *D. longifurca* in stations of Shatt Al-Arab river during September 2008 to August 2009.

Month	Station 5	Station 6	Station 7	Station 8
September 2008	53	-	-	-
October	-	-	-	-
November	-	-	-	21
December	-	-	87	19
January 2009	-	-	-	-
February	-	2	-	-
March	-	-	20	-
April	-	-	-	-
May	-	4	19	-
June	10	9	7	-
July	97	7	8	-
August	-	7	-	-

Description

Female (Figure 2): Total length 0.5-0.7 mm. (Plate 1).

Leg 1 coxa longer than those of other legs, with six rows of fine spinules, basis with a row of spinules on outer distal margin, each of the segments of endopod with a row of strong spinules along its length. Distal segment about half width of proximal one, and with a pair of apical spiniform setae, outer one about $\frac{3}{4}$ length of inner seta (Figure 2E). Leg 5 exopod, nearly spatulate with six setae; two external, three apical and one internal seta. Reddy & Radhakrishna (1980) measurement of setae were longer than those given here (Figure 2G). Caudal rami, symmetrical, long and slender about 4.37 times as

long as width and covered by minute spinules, proximal inner margin of furca with minute spinules (Figure 2D; Plate 3). Ovigerous female with two egg sacs, each egg sac with 6-8 eggs. Setal formulae of endopods of legs 1-4 were similar to these reported by Reddy & Radhakrishna (1980).

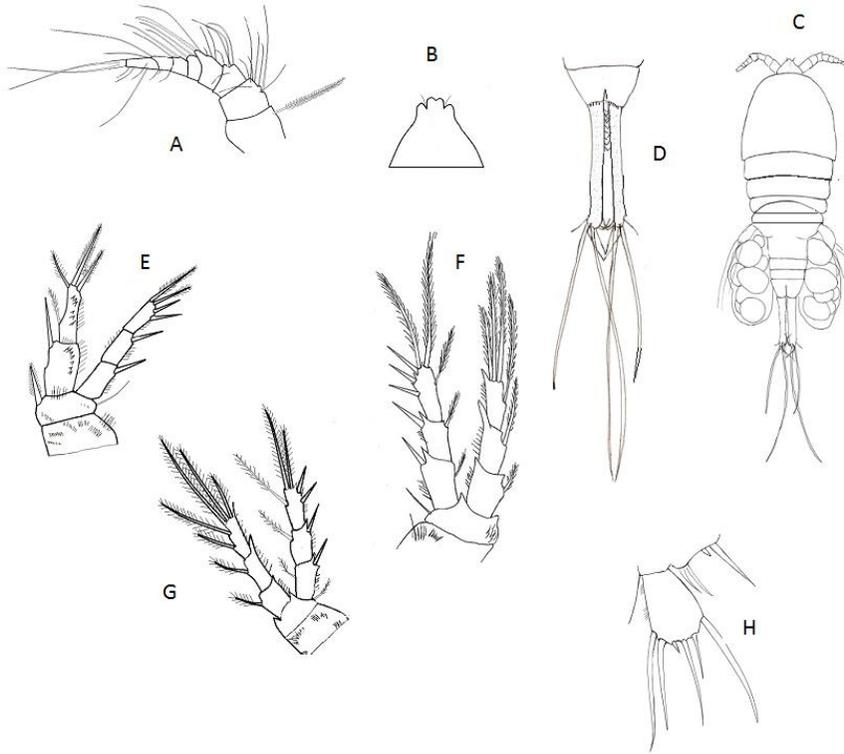


Figure 2: *Delavalia longifurca* female, (A) antennule, (B) rostrum, (C) ovigerous female, (D) furca, (E) leg 1, (F) leg 2, (G) leg 3 and (H) leg 5.

Male (Figure 3): Total length 0.4-0.5 mm. (Plate 2).

Coxa of leg 2 with oblique row of spinules towards outer distal region, proximal segment of endopod at leg 2, with rows of spinules around segment (Figure 3C), distal segment of exopod with two setae; innermost slightly longer than outer and shorter than length of exopod, whereas in Raddy & Radhakrishna (1980) specimens, the outer seta about half length of inner one, and inner seta longer than exopod. Distal segment about four times as long as width. Furca without proximal inner marginal spinules (Figure 3D). Caudal rami six times as long as wide.

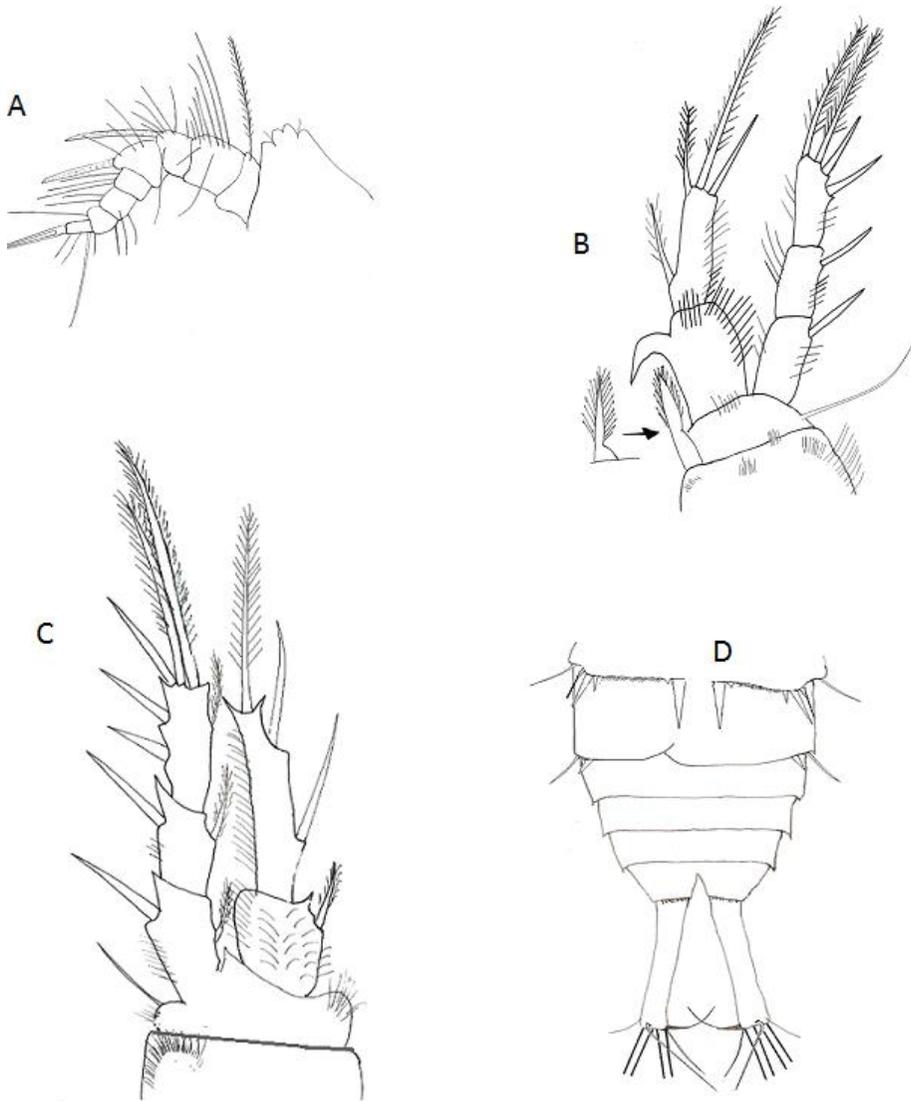


Figure 3: *Delavalia longifurca* male, (A) antennule, (B) leg 1, (C) leg 2, (D) legs 5, 6 and furca.



Plate 1: *D. longifurca*, female (length 0.57 mm.) from Shatt Al-Arab river.

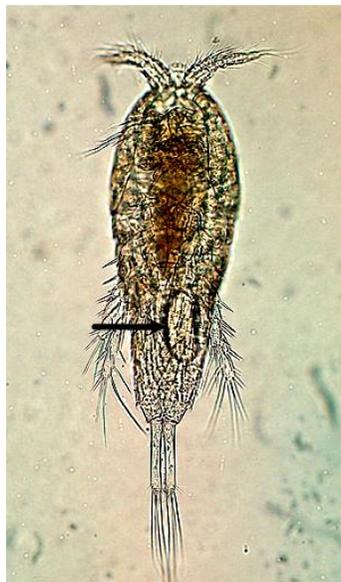


Plate 2: *D. longifurca*, male (length 0.48 mm.) from Shatt Al-Arab river. The spermatophore (arrow) is quite apparent.

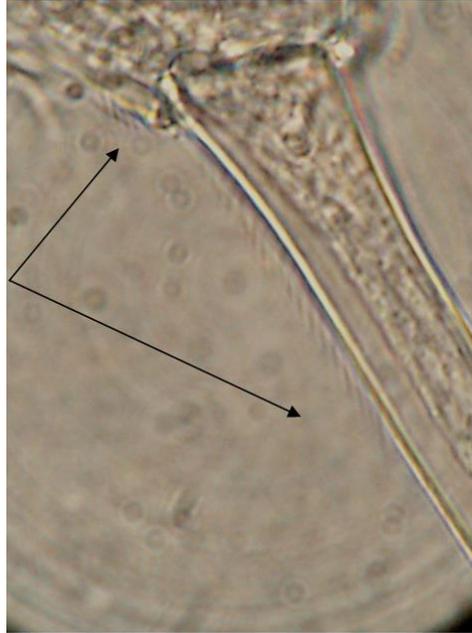


Plate 3: Spines in the inner margin of the furca in female *D. longifurca*.

Distribution

D. longifurca (Sewell, 1934) is known as a marine species (WoRMS, 2017) but has been recorded from a freshwater reservoir at the University of Nagarjuna, India, as well as from lake Kolleru, India, which is a freshwater lake, indicating that it is a euryhaline species (Reddy & Radhakrishna, 1980).

Results of the zooplankton survey in the Kuwaiti coastal waters revealed no occurrence of this species (Al-Yamani & Prusova, 2003; Al-Yamani et al., 2011). On the other hand, this species has been recorded from all stations investigated by Al-Zubaidi (1998) along the Shatt Al-Arab river during 1993-1995. Al-Zubaidi (1998) identified the species as *Stenhelia (Delavalia) longifurca* and reported a high density of 177 ind./ m³ at Al-Fao (salinity 1.36 psu throughout the entire period of sampling), followed by Al-Seebah station, further north to Al-Fao town, with a density of 159 ind./ m³ (salinity of 0.96 psu), whereas, at Ras Al-Beesha, south of Al-Fao town, the density was 126 ind./ m³ (salinity 7.32 psu), and 90 ind./ m³ were recorded further south at the Outer Bar (19.02 psu), only three specimens were observed from the station of the Gulf proper (salinity 25.5 psu).

The species was not observed from any of the stations extended from Shatt Al-Arab river to the marine waters of the Gulf (Salman et al., 2012). In this region of the world, *D. longifurca* is behaving quite extraordinarily as it was more abundant in the less saline water and started to disappear in the true marine water of the Arabian Gulf. Therefore, it may be considered as an

estuarine species, or the species might represent a different taxon and need to be compared with the holotype or the para types to confirm its identity. In the present study, *D. longifurca*, was recorded from all stations with variable densities but was very rare at station 3 and absent at station 4 located in the southern parts of Al-Huwaiza marsh. This may be attributed to the very low salinity in this region which represents unfavorable conditions for the species.

Climate change and high salinity in Shatt Al-Arab river and Iraqi marshes during recent years seem to be the major factors behind remarkable change in biodiversity where several native species disappeared and more alien species appeared. This situation calls for substantial effort to preserve biodiversity in this ecologically important ecosystem.

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