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Densities and Occurrence of Three Annelids with Description of the Species *Enchytraeus albidus* Henle, 1837 (Oligochaeta: Enchytraeidae) in Two Different Marine Regions South of Basrah Province, Iraq

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ABSTRACT

This study's samples were collected from two stations monthly from January to December 2024. The first station represents the south of Shatt al-Basra River, west of Basrah Governorate, and the second station, Al-Faw, represents the estuary of Shatt al-Arab River, south of Basrah Governorate. Samples were collected using a 25*25cm square core for quantitative samples and by directly picking with forceps for qualitative samples. Three species of annelids were recorded, one of which belongs to the class Oligochaetes and two to the class Polychaetes. The highest density recorded at Al-Faw station was for the species *Enchytraeus albidus*, which reached 25 ind/m², while the highest density recorded at Shatt al-Basrah station was for the species *Namalycastis indica*, reaching 35 ind/m². References differed on the lengths of the Enchytraeidae worms, but in this study, they ranged between 10-17mm, their color was whitish to yellowish, and the number of body segments ranged from 37-39. The setae are straight or slightly curved between 3-5 in a bundle; pharyngeal gland 3 pairs in segments 4/5-6/7, yellowish blood. Clitellum gland cells were irregularly scattered. Chloragogen cells started from V but formed a dense layer from VI. The brain was slightly concave posteriorly. This study would provide a comprehensive data on the Annelid worms tolerating the Iraqi polluted environmental conditions while breaking down these pollutants.

INTRODUCTION

The family Enchytraeidae, mostly white in color except for some colored species, live mostly in terrestrial habitats, but some species live in wet soil in fresh or marine water. This family is characterized by short simple pointed chaetae in variable numbers **(Timm, 2012)** between 1-16 and mostly between 2-8 per bundle. However, the genus Achaeta and some species of the genus Marionina, the chaetae are absence, and in other species, these chaetae are present in each segment as four bundles, two dorsal and two ventral and started from the segment II **(Schmelz & Collado, 2010)**. The fixed specimens cannot be relied upon for the identification of species because morphological characters are insufficient alone without examining the internal organs. These features are more evident in live worms, and the depending organs for identification include the structures of the spermathecae, the male funnel, the male gonoduct, the pharyngeal gland, oesophageal appendages, brain, coelomocytes, nephridia and clitellum **(Semernoy & Timm, 2009)**. The maximum length of the enchytraeid worms ranges between 2-30mm while they are 0.1-1mm in width, and the body consists mostly of 20-70 segments.

Most Enchytraeids are inhabitants of soils and above-ground habitats, others are commonly found in freshwater habitats, wet peat lands and bogs, and a number inhabit littoral or marine habitats **(Rota, 1995)**. The Shatt al-Arab River is the most important aquatic habitat in the southeast of Iraq. It is formed by the confluence of the Tigris and Euphrates rivers, northern Basrah City center, and extends about 193km before emptying in the Arabian Gulf in the south at Al-Faw City **(Al-Saad *et al*., 2015)**. However, the Oligochaeta fauna of the Shatt al- Arab River includes little number of tubificid and Naidid species, which were recorded by different studies. These included *Tubifex tubifex, Limnodrilus hoffmeisteri*, *L. claparedianus*, *L. profundicola*, *Potamothrix hammoniensis*, *P. bavaricus*, and *Psammoryctides moravicus* **(Jaweir *et al*., 2012; Al-Abbad, 2014; Al-Abbad *et al*., 2015)**. On the other hand, there is no enchytraed species that has previously been recorded from Iraq. **Okash (2022)** described the study areas as being high in organic and industrial pollutants and animal waste.

The present work aimed to compare densities of Annelids in two rivers and record and describe an additional species of Oligochaets worms from the Shatt al-Arab River and Shatt al-Basrah River south of Iraq

MATERIALS AND METHODS

The samples were collected monthly from January to December 2024, from Shatt al- Basrah station (st.1) and Al-Faw station (st.2) at different sites along the bank (Fig. 1).

The samples were collected by plunging the corer tube to a depth of 5cm in the sediment. Additionally, worms were sometimes captured directly by using forceps from sediment and under rocks; worm samples were brought to the laboratory in plastic containers. Live worms were isolated from the sediments using 75μm mesh size sieves. Then, the worms were sorted and picked up under a dissecting microscope. The worms were kept alive for several days until the examination time. For these purposes, it was submerged in water (from the same collecting area). The procedure of preparation and examination of worms was conducted according to the method of **Schmelz and Collado (2010)** by examining them alive immediately after isolation under the compound microscope in a drop of water. Used magnifications were 4x, 10x, and 40x. The measurements were taken by an ocular micrometer. The used equipment included glass Petri dishes, slides, coverslips, tissue paper, needles, and forceps.

Many drops of water were applied on a slide. Worms were picked up from the water with a curved needle and were placed into the water on the slide. A coverslip was gently placed over the worms. Excess water was removed with tissue paper. To release the pressure, a drop of water was placed at the edge of the coverslip. The worms were slightly pressed to reduce movement and to illustrate the inner structures. The worms were preserved in 70% ethanol for further morphological studies.

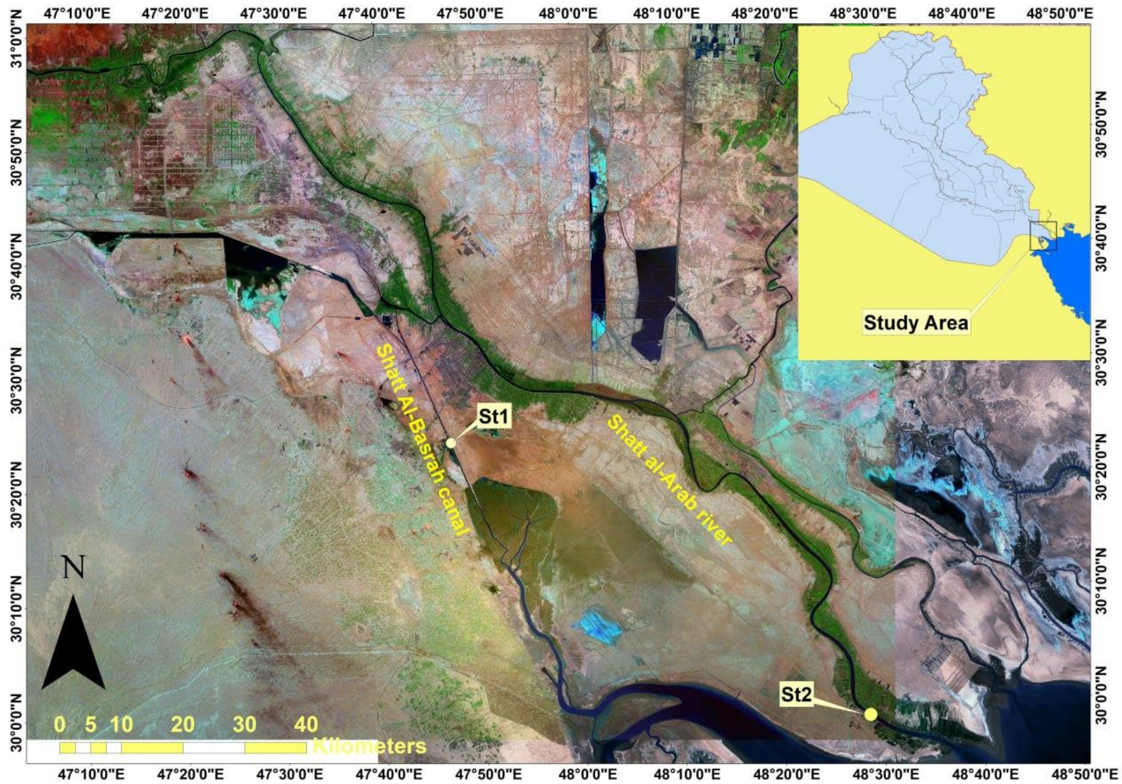

Fig. 1. The stations of samples collecting

Photographs of live specimens were taken with a digital camera mounted on an Olympus microscope. The setae of specimens and other features were drawn by the aid of a camera Lucida. Many references **(Timm, 2009; Schmelz & Collado, 2010; Erséus *et al.*, 2019)** were used for the identification of worms.

Quantitative samples were sieved by a 1mm sieve and were preserved in 70% ethanol and identified by **Brinkhurst (1971)** and **Brinkhurst and Jamieson (1971)**.

RESULTS

Table (1) illustrates the occurrence of species during the monthly samples of the study. Data indicate the absence of the oligochaete *E. albidus* during the summer months at both stations. In addition, Table (1) reflects the absence of the species *D. heteropoda* at the Shatt al-Basra station during the entire study period. While, the species *N. indica* was recorded to occur in all months and at both stations.

Fig. (2) illustrates the densities of Annelids worms in the Shatt al-Basrah station from January to December 2024, as the highest densities recorded for the species *E. albidus* during December reached 25 ind/m².

Fig. (3) illustrates the densities of Annelids worms at Al-Faw station from January to December 2024, as the highest densities were recorded for the species *N. indica* in January, reaching 35 ind/m².

Table 1. The occurrence of the three species of worms during the study period

	Jan.		Feb.		Mar.		Apr.		May.		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.	
Rank	*1	*2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Oligochaeta																								
Enchytraeus albidus	+	+	+	+	+	+	+	-	+	-	+	-	-	-	-	-	-	+	-	+	+	+	+	+
Polychaeta																								
Dendronereides heteropoda	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Namalycastis indica	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

***1=st.1 2=st.2**

The two stations differed in the density of annelids and occurrence, as the species *D. heteropoda* did not occur in all months at the Shatt al-Basrah station, while its occurrence was recorded in all months at the Al-Faw station.

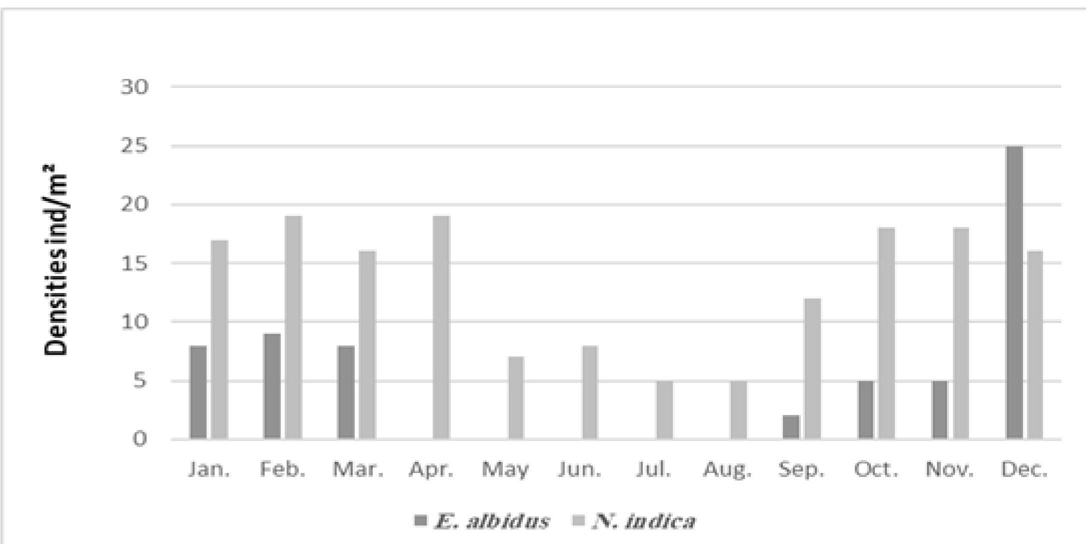

Fig. 2. Monthly densities of Annelids at Shatt al-Basrah station

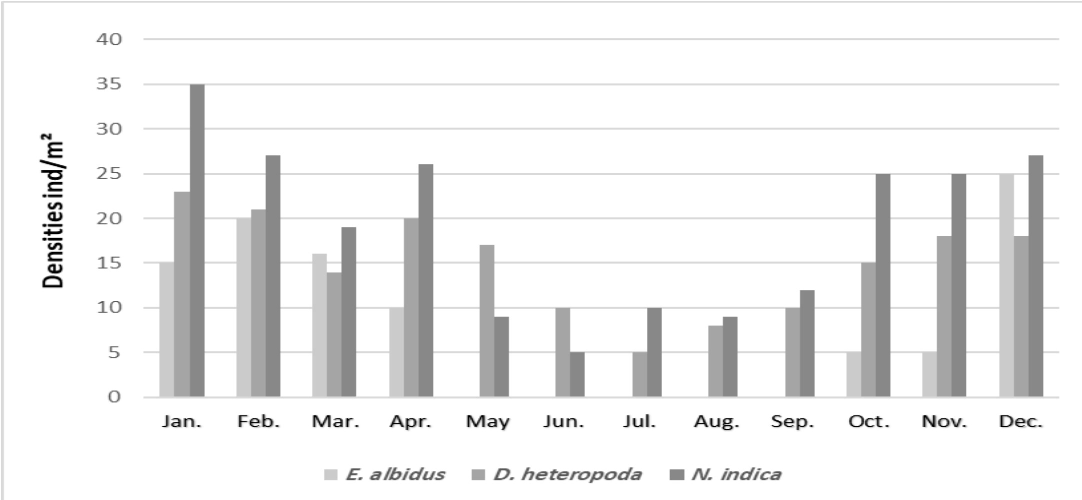

Fig. 3. Monthly densities of Annelids at Al- Faw station

Table 2. Densities of Annelids species at the two stations during the study period

Month (A)	Al-Faw			Shatt al-Basrah			Mean A
	E. albidus	*D.heteropoda*	*N. indica*	*E. albidus*	*D.heteropoda*	*N. indica*	
Jan.	21	32	48	8	-	17	21
Feb.	29	31	40	9	-	19	21.33
Mar.	33	29	39	8	-	16	20.83
Apr.	18	36	46	-	-	19	19.83
May	-	65	35	-	-	7	17.83
Jun.	-	67	33	-	-	8	18
Jul.	-	33	67	-	-	5	17.50
Aug.	-	47	53	-	-	5	17.50
Sep.	-	45	55	2	-	12	19
Oct.	11	33	56	5	-	18	20.50
Nov.	10	38	52	5	-	18	20.50
Dec.	36	26	39	25	-	16	23.67
Al-Faw				Shatt al-Basrah			
33.42				6.17			
R-LSD 0.05	Months(A)	Station(B)	Species(C)	A*B	A*C	B*C	A*B*C
	0.48	0.20	0.24	0.68	0.84	0.34	1.18

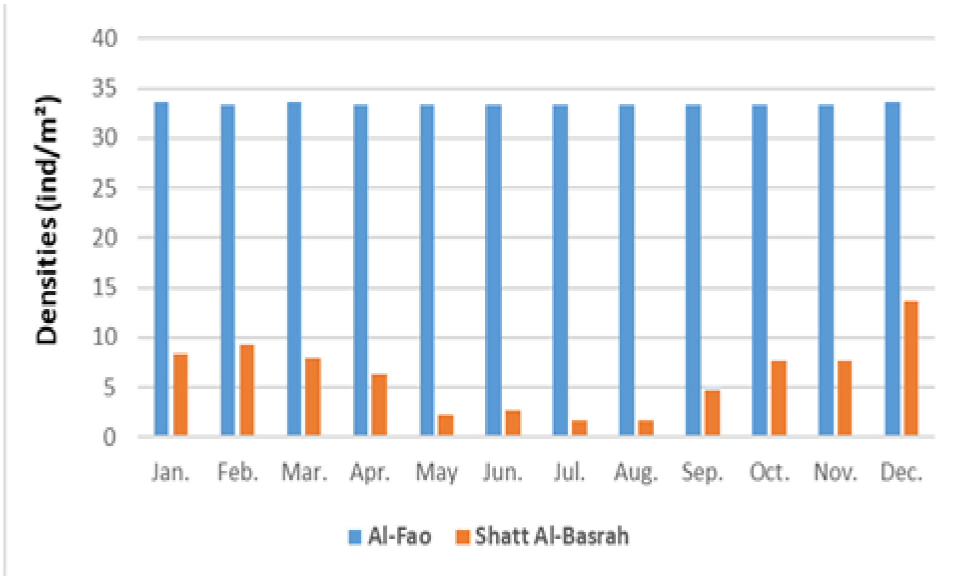

Fig. 4. Effect of interaction between month and station on worms' density (R-LSD0.05= 0.68)

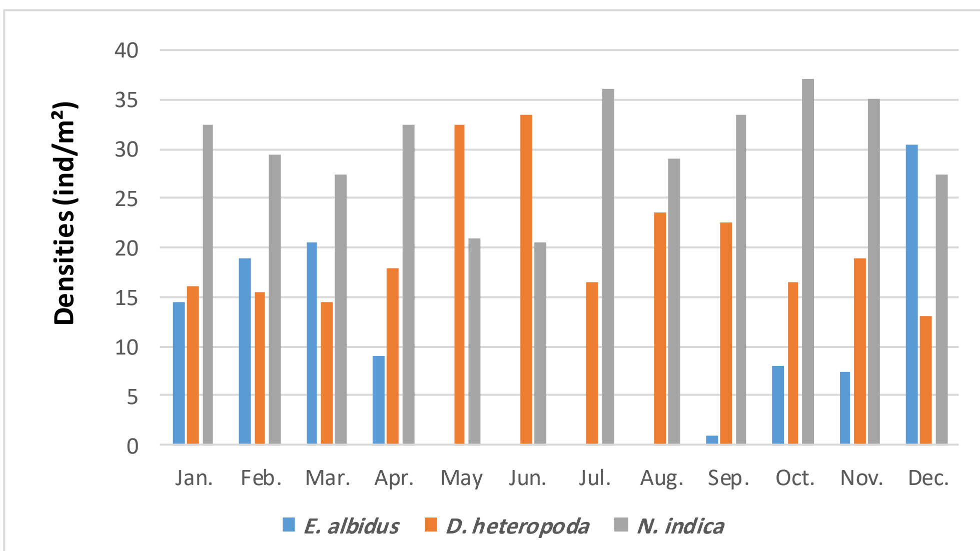

Fig. 5. Effect of interaction between months and species on worms' density (R-LSD0.05= 0.84)

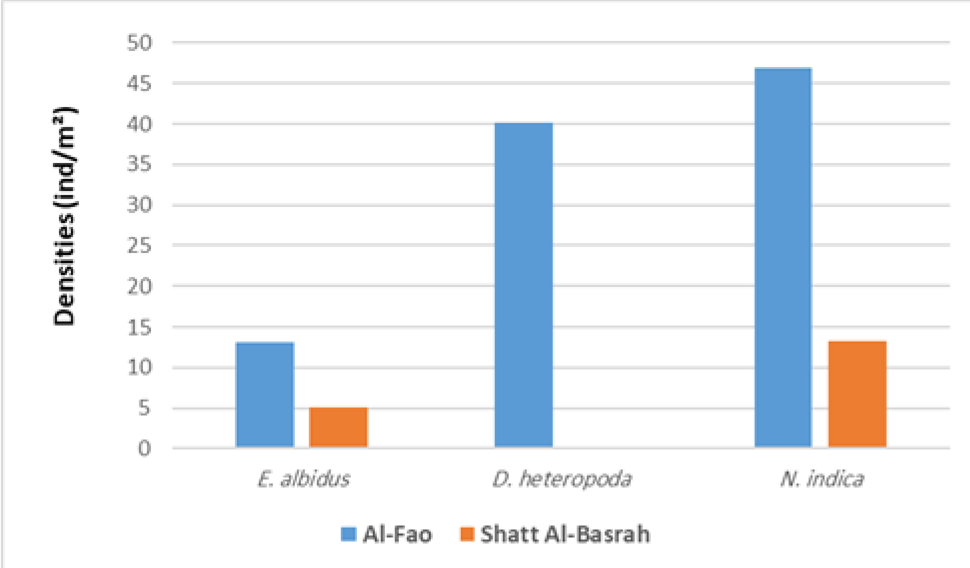

Fig. 6. Effect of interaction between station and species on worms density (R-LSD0.05= 0.34)

The study's results revealed significant differences in the densities of Annelids between the months of collection (Fig. 4) and also recorded significant differences between the species during the study months (Fig. 5). Fig. (5) illustrates the significant differences in the species of worms observed at the stations during the study.

During the present study, one species of the family Enchytraeidae, *Enchytraeus albidus*, was recorded for the first time in Iraq.

Kingdom: Animalia
Phylum: Annelida
Class: Cltitellata
Subclass: Oligocheata
Order: Enchytraeida
Family: Enchytraeidae
Species: *Enchytraeus albidus* **Henle,1837**

Description of the species *Enchytraeus albidus*

Medium-sized worm, 10-17mm in length, whitish-yellowish, segments 37-39. Setae straight or slightly curved: 3-5 – 3 : 3-5 – 3, 67-112µm long. Pharyngial gland 3 pairs on 4/5-6/7, all united dorsally, and four pairs of preclitellar nephridia in 6/7 - 9/10. Nephridial anteseptal consisting of funnel only. Blood yellowish. Clitellum gland cells are irregularly scattered. Chloragogen cells started from V but form a dense layer from VI. The brain is slightly concave posteriorly. The seminal vesicle is large and extends to segment IX. The sperm funnel is cylindrical, about five times longer than width, as well as longer than the body diameter of the worm. The collar being of the same width as the funnel itself. The sperm duct is very long, irregularly coiled, and extends behind the ciltellum region. The ectal duct of the spermathecal is covered by different sizes of glands as a dense fused layer. coelomocytes of one type, mucocytes (Fig. 7).

Remarks

Three primary references recorded different measurements of length and number of segments for the worm: **Nielson and Christensen (1959)** reported 20-35mm long and 46-65 segments, **Timm (2009)** reported 10-30mm long and 46-74 segments, **Schmelz and Collado (2010)** mentioned 20-30mm long and 40-65 segments and **Najy *et al.* (2023)** reported 15.5-20.8mm long and 58-65 segments. The present study also recorded different measurements (10-17mm long and 37-39 segments). The setae formula reported either in **Nielson and Christensen (1959)** and **Schmelz and Collado (2010)** is 2-4 – 2-3 : 3-5 – 2-4. Additionally, the range of setae reported in **Timm (2009)** is 2-5. For our specimens, the number of setae ranged from 3-5. **Erséus *et al.* (2019)** identified two main features for distinguishing *E. albidus* sensu stricto from other species within the complex they studied: the proportions of the sperm funnels and the morphology of the copulatory organs. These two features were checked, and we found them to be identical (Fig. 8).

Fig. 7. *Enchytraeus albidus* A. Yellowish blood, B. bundle of straight to slightly curved setae

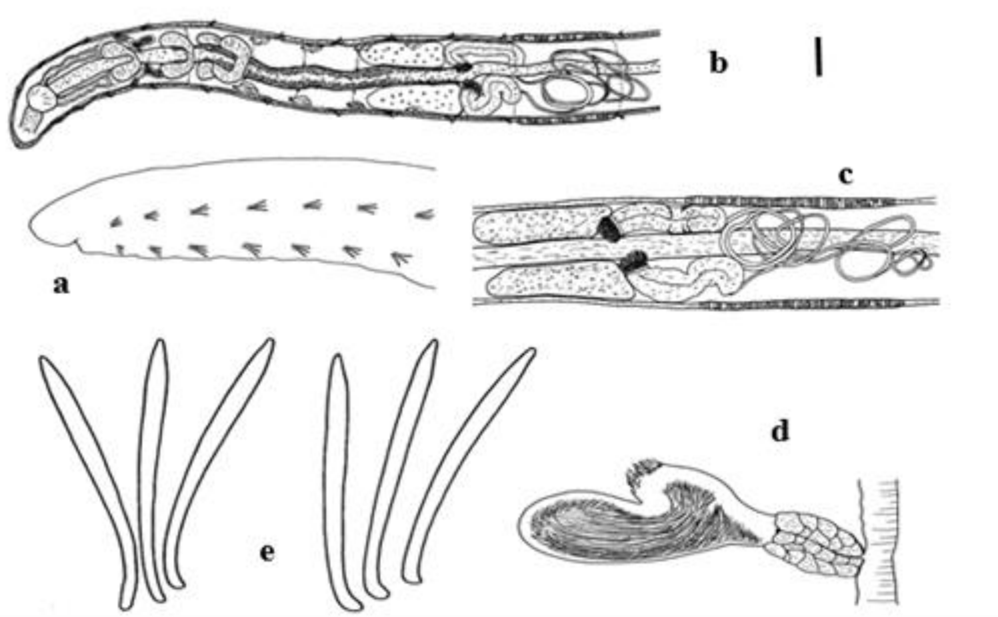

Fig. 8. *Enchytraeus albidus*: a- forebody of individual, b-segments 0-13, c-segments 9-13, d-spermatheca, e-bundles of chaetae. Scale: a) 0.4mm, b) 0.39mm, c) 0.24mm, d) 55µm

DISCUSSION

Estuaries are characterized by fluctuations in the percentage of salts between high and medium salinities, which are related to the periodic rise and fall of the tide. However, despite this fluctuation, many organisms have been able to live in these complex environments; one of these organisms is the annelids, which are considered important inhabitants of these environments due to their role in supporting the food chain, as well as their role in purifying sediments **(Ratsak & Verkuijlen, 2006)**. Al-Faw station was characterized by its organic pollution, resulting from hydrocarbons originating from fishing vessels **(Al-Saad, *et al.*, 2009)**, while the Shatt al-Basrah station was characterized by organic pollution from the sewage water of the Basrah Governorate **(Okash, *et al.*, 2022)**, which had an impact on the distribution and density of worms throughout the year.

The species *Enchytraeus albidus* was recorded for the first time in Iraq with a description of the species in this study, as previous studies included inserting the family Enchytraeidae only without identifying the species, including **Jaweir and Albayati (2016)** study of Annelida communities in palm forests in the middle of the Euphrates, as **Nielson and Christensen (1959)** and **Timm (2009)** indicates that the species is cosmopolitan and widespread **(Schmelz & Collado, 2010)**. The worm occurs in decaying seaweed and algae **(Erséus *et al.*, 2019)**. In addition, they are found in soil, decaying waste, on seashores **(Timm, 2009)**, and in marine littoral **(Schmelz & Collado, 2010)**.

From previous studies and the results of the current study, it can be said that the family Enchytraeidae and polychaetes are tolerant to Iraqi environmental conditions and require further studies on their role in treating pollutants and their ability to break down these pollutants, as they feed on the organic materials surrounding the soil particles.

CONCLUSION

The current study demonstrated the types of Annelid worms capable of living in environments polluted with organic hydrocarbons and sewage water and forming the basis of the food chain in sediment environments.

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