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Research Article

Ecological study of two gastropods species *Melanoides turbuculata* and *Melanopsis preaemorsa* from Euphrates river - Basrah, Iraq

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Abstract
Biological and taxonomic studies of snails in the waters of Iraq's desert have been enhanced through seasonal recording of them, and it is one of the means to follow their distribution and determine the density. Aiming to determine occurrence and density of two snails *Melanoides tuberculata* and *Melanopsi preaemorsa,* in two stations at the Euphrates river-Basrah, Governorate, in Al-Madina and Al-Qurna. Three replicates within each station were chosen for sample collection of these two species using the quadrate (25 × 25) cm. Many environmental factors including temperature, salinity, pH, dissolved oxygen (DO), and organic material in sediment were measured, 5,330 samples were obtained from the stations. The highest annual density was recorded by snail *M. turbuculata* with 2,745 and 1,072 ind/m² in two stations respectively, while *M. preaemorsa* with 912 and 601 ind/m² in (St.1 and 2), respectively. The densities of snail *M. turbuculata* from 480 ind./m^2, June 2019 at (St. 1) to 57 ind./m^2 in December 2019. And in (St. 2) from 256 ind./m^2 in May 2019 to 0 ind./m^2 in August - December 2019. While snail species *M. preaemorsa* (Linnaeus, 1758) in (St. 1) from 128 ind./m^2 in June and July to 0 ind./m^2 in January-February, November-December 2019 and in (St. 2) from 144 ind./m^2 in April to 0 ind./m^2 in August-December 2019. The statistical analysis found significant differences in DO, temperatures, and snail density in two stations. This is the first study in the region on these two species in particular, and their abundance.

Keywords: Aquatic gastropoda, Al-Madina city, Al-Qurna city, Basrah river, *Melanoides tuberculate. Melanopsi preaemorsa*

INTRODUCTION

Benthic invertebrates are aquatic communities that have been endemic for a long time because they have the advantage of the slow movement in their environment. Its density has an effect on the hydrological characteristics of its water quality. Conversely, any significant difference in hydrological characteristics or water quality may alter the density of benthic organisms, the number of taxonomic units of invertebrates in a site, as well as a number of individuals in each taxonomic unit, may provide good data for understanding hydrology and water quality in an environment (Strong *et al.,* 2008).

Gastropoda from most important basic taxa of benthic macroinvertebrates in coastal waters and is important in chain food (Strong *et al.,* 2008). It has a nutritional value that feeds on it for waterfowl and many carnivores and fish (Sitnikova *et al.,* 2010; Johnson, 2009). Some of them are also evidence of the presence of special types of pathogenic parasites of other organisms (Hann *et al.* 2001; Al-Ameen, 2018). Many environmental conditions affect the distribution and spread of living organisms, and some of them are a determining factor in the presence of some of these species or not (Johnson, 2009; Sitnikova *et al.,* 2010).

Most freshwater gastropods are animals that feed on bacterial membranes and algae (Sitnikova *et al.,* 2010), With a widespread environment that forms rocky bottoms and smooth surfaces for ponds and plants (Johnson, 2009). Aquatic leaves plants for snails provide a base layer laying eggs, provide shelter from

predators (De Ni, 1987), protection from high temperatures, and consequently increase oxygen levels (Van Schayck, 1985). In previous studies, the densities of snails are more prevalent in the aquatic environment on aquatic plants compared to their presence among the sediments (Hann *et al.,* 2001; Zêbek & Szymañska, 2014; Al-Ameen, 2018).

Various physicochemical conditions such as temperature, pH, dissolved oxygen, free carbon dioxide, plants, and substratum have effects on snails and their habitat (Salman & Nassar, 2013).

There is a lack of information related to gastropods, and a few researchers are devoted to studying the taxonomy and ecology of a few found in Iraqi waterbodies (Najim, 1959; Ahmed, 1975; Al-Dabbagh & Daoud, 1985; Plaziat & Younis, 2005; Atee, 2008; Mohammad, 2014; Al-Abbad *et al.*, 2015; Qazar *et al.*, 2015; Mirza & Nashaat, 2019). This study identifies the abundance occurrence of *Melanoides turbuculata* and *Melanopsis preaemorsa* in the Euphrates river, and the effect of environmental factors on the Euphrates River and its associated water bodies in Basra city, southern Iraq, from January to December 2019.

MATERIALS AND METHODS

The samples of freshwater snail *M. turbuculata* and *M. preaemorsa* with other gastropod snails were collected during this study from in some water bodies (two stations in Euphrates river) in Al-Madina city (St. 1) and Qurna city (St. 2), southern Iraq. The animal samples were collected in accordance with the ethics of the local Basra government (Fig. 1), using quadrate (25 × 25) cm between January to December 2019 by monthly intervals (December-February, March-May, June-August, and September-November). The first station was in Al-Madina city geographical coordinates: 31° 13' 26" North, 47° 20' 26" East. The second station was in Al-Qurna city geographical coordinates: 31° 0' 57" North, 47° 25' 50" East.

Specimens by handpicking different sizes of live specimens of freshwater snail *M. turbuculata* and *M. preaemorsa*, in 70% ethanol. The dissolved oxygen (DO), salinity, pH and water temperatures in the study stations were measured. Two snail species were:

Class Gastropoda

Family Milanopsidae Adam & Adam, 1854

Genus *Melanopsis* Ferussac, 1807

Melanopsis praemosa (Linnaeus, 1758).

Family Thiaridae Gill, 1871

Genus Melanoids Olivier, 1804

Melanoids tuberculatus (Muller, 1774).

Melanoids tuberculatus have a shell high spire, not having more than 12 whorls, its edge bearing 10-12 nipples. And *M. praemosa* has an elongated shell, more than 12 whorls, and a smooth edge (Ahmed,1975; Rao,1989; Gloer and Pesic, 2012; Amr *et al.,* 2014).

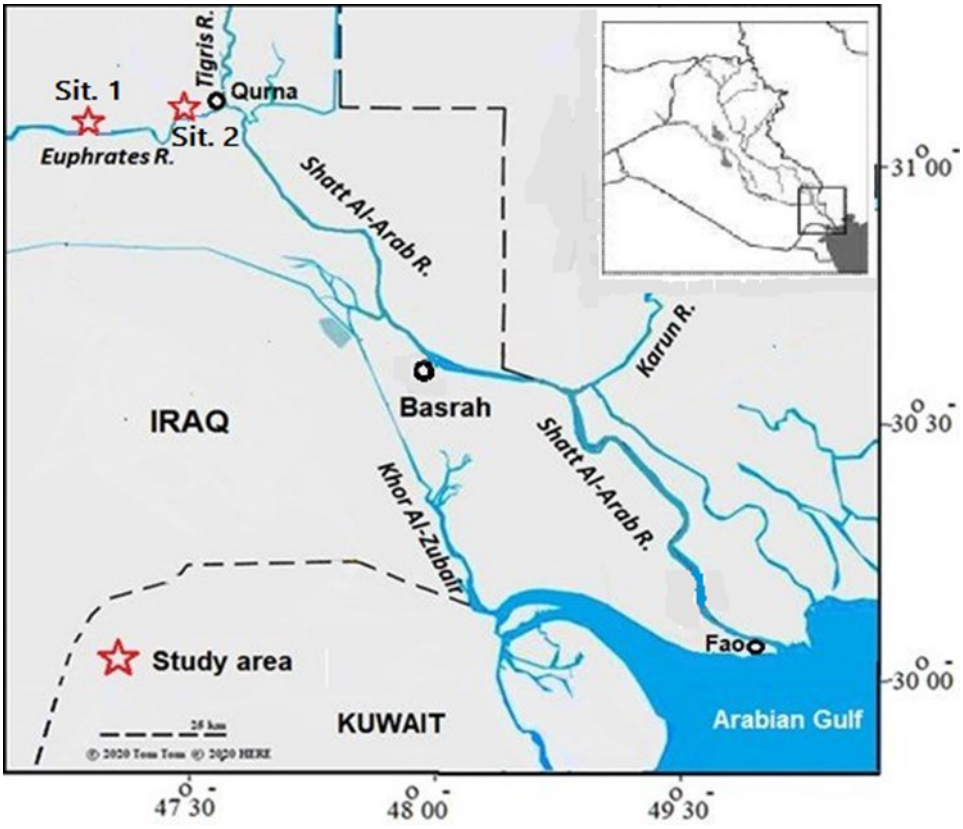

Fig. 1. *Map showing Al-Euphrates river in Basrah city indicated: St. 1: Al-Madina city St. 2: Al-Qurna city*

RESULTS AND DISCUSSION

The native species of gastropods are present in the ecosystem due to two reasons: their ability to adapt to environmental changes and their ability to parthenogenetic reproduction (Sirza *et al.,* 2020). The present study showed that water temperature at the two stations was similar. It ranged from 12 °C at (St.1) in the winter to 33 °C at (St.2) in the summer. Salinity changed from 0.41 ppt (St.1) in winter to 2.00 ppt (St.2) in autumn. DO (mg/L) varied from 5.4 (St.2) in the summer season to 10.4 (St.1) in the winter season. pH varied from 7.1 (St.1) in the winter season to 8.6 (St.1) in the autumn season (Table 1).

The two species of snails lived in a fairly wide range of spring and summer water temperatures, the banks of the intertidal zone of the Euphrates river had a relative range of temperatures of 12 to 32 °C.

As the water temperature drops sharply in the winter, each snail decreases its abundance, appearance, and descent into the intertidal zone. The results of statistical analysis showed a significant difference in DO between stations 1 and 2, while no differences were recorded between the two stations of the study. DO and temperature are determinants of snail abundance, while pH does not affect it (Oso and Odaibo, 2021; Nwoko et al., 2022).

The current study showed a checklist of occurrence and distribution of eleven aquatic snail species. St. 1 included (10 species) of aquatic snails while St. 2 included (9 species) (Table 2).

In agreement with other studies, many snails were recorded, and they were more prevalent than aquatic invertebrates (Usman et al., 2019; Manyangadze et al., 2021).

In this study *M. stuberculata* Műller, 1774 was more abundant aquatic snail species in St.1., difference from 480 ind./m^2 in June 2019 to 57 ind./m^2 in December 2019, and in St.2, and from 256 ind./m^2 in May 2019 to 0 ind./m^2 in August - December 2019. While, snail species *M. preaemorsa* (Linnaeus, 1758) in St. 1 its abundance varied from 128 ind./m^2 in June and July to 0 ind./m^2 in January, February, November, and December 2019, and in St. 2 ranging between 144 ind./m^2 in April to 0 ind./m^2 in August-December 2019 (Table 3).

Table 3 shows individuals of two snails in higher density in the Al-Euphrates river (St.1) at Al-Madina city, while in Al-Qurna city (St. 2), these specimens two species are dominant in a few density. Results may be related to a relatively low aquatic plants content and be affected by other factors in St. 2 as compared with St. 1, the more preferable habitat. This is almost by (Qazar, 2016), who found that some gastropod species are present mainly in water with high aquatic plants.

Table 1. Environmental conditions measured at two stations during four seasons at Euphrates river 2019

Season	W.T. (°C)		Salinity (ppt)		DO (mg/L)		pH	
	St. 1	St. 2	St. 1	St. 2	St. 1	St. 2	St. 1	St. 2
Winter (Dec. - Feb.)	12	14	0.41	0.42	10.4	8.8	7.1	7.2
Spring (Mar. - May)	24	25	0.83	0.92	9.6	8.2	7.6	7.2
Summer (Jun. - Aug.)	31	33	1.25	1.14	5.8	5.4	7.6	7.4
Autumn (Sept. - Nov.)	25	26	1.55	2.00	6.5	6.8	8.6	7.6

Table 2. Checklist for gastropod species distribution at two stations in 2019

Species	Family	St. 1	St. 2
Melanoides tuberculata Műller, 1774	Thiaridae	+	+
*Melanopsis nodosa*Férussac, 1874	Melanopsidae	+	+
M. costata Oliver, 1804	Melanopsidae	+	-
M. subtingitana Annandale,1918	Melanopsidae	+	-
M. preaemorsa (Linnaeus, 1758)	Melanopsidae	+	+
Bellamya bengalensis Lamark, 1822	Viviparidae	+	+
Bithynia badiella Kűster, 1852	Bithyniidae	+	+
Gyraulus convexiusculus Müller, 1774	Planorbidae	+	+
Lymnaea. (Radix) auricularia (Linnaeus,1758)	Lymnaeidae	+	+
Physa acuta Draparnaud 1805	Physidae	-	+
Theodoxus jordani Sowerby, 1832	Neritidae	+	+
Total		8	10	9

Table 3. Monthly densities (ind./m²) of *M. turbuculata* and *M. preaemorsa,* from two stations at Euphrates river during 2019

Species		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
M. turbuculata	St.1	256	272	304	352	400	480	144	112	128	144	96	57	2745
	St.2	112	128	160	176	256	160	80	0	0	0	0	0	1072
M. preaemorsa	St.1	0	0	80	144	112	128	128	112	112	96	0	0	912
	St.2	57	80	112	96	128	128	0	0	0	0	0	0	601
Total														5330

The number reached 5330 individuals in the current study, and the highest density of aquatic snail *M. tuberculata* was 2745 and 1.072 ind/m² in two stations, respectively, for *M. preaemorsa* species together, 912 and 601 ind/m² at two stations (Table 3).

The total annual density of the two snail's species in (St.1) in the present study was 3,817 because of the appropriate environmental conditions and the bottom (Khalaf, 2011; Al-Waaly *et al.,* 2014). The density of snails in (St. 1) can be attributed to being an important source for draining sewage water that contains fertilizers and insecticides, thus providing an environment for aquatic plants and other organisms (Qazar, 2016). The environment for the spread of these snails is slow-flowing stagnant water (De Ni, 1987; Qazar *et al*., 2015). The few densities recorded in the water of (St. 2) 1,513 may be due to disposing of waste from factories, other facilities and fishing boats. It is unsuitable for snails and is consideredas water polluted (Khalaf, 2011).

In correlation coefficient analysis, a positive (0.05 probability level) was found between temperature and density during the months of study for snail species. The water temperature was between 12-33 °C. The decrease in water temperature was associated with a decrease in aquatic plants and arthropods. Seasonal differences in water temperatures affected the numbers of snails, It was observed low in winter, reaching zero in the current study areas due to its intolerance to low temperatures and its positive relationship with large organisms whose disappearance was also observed. Snail reproduction is mostly reduced, and resting by definitive fish is increased with decreased macrophyte density (Qazar *et al.*, 2015; Qazar, 2016).

Conclusion

The present study on the occurrence and density of two snails *M. tuberculata* and *M. preaemorsa,* in two stations at the Euphrates river has brought information on their habitat. Although *M. tuberculata* and *M. preaemorsa* are herbivorous and aquatic, the two snails occupy the permanent water bodies in slow currents. All habitat adaptation appears to be consistent. Snail abundance *M. turbuculata* and *M. preaemorsa* showed a negative correlation with the temperature and the seasonally different levels of doing in St.1 and St.2. The abundance of gastropods awareness and the season affecting it have been identified. It is suggested to focus studies in this area to provide a database on diversity, especially related to benthic biology.

Conflict of interest

The authors declare that they have no conflict of interest.

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