

## Population Dynamics of *Theodoxus jordani* Snails in Yarmouk River, Jordan and Seasonal Infection with Larval Trematodes\*

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**ABSTRACT.** Studies on the population dynamics of *Theodoxus jordani* (Sowerby 1836) in two localities, Makhadah (M) and South of Makhadah (SM) at Yarmouk River, North Jordan over a 14 month period revealed a higher density at SM than at M particularly during January, 1983. The effect of flooding which occurred during February, 1983 was more drastic on snails at the SM than at M station. The appearance of young snails during September, 1983 and January, 1984 indicates that *T. jordani* reproduces twice a year. The overall infection rate of *T. jordani* collected from the two stations with two types of cercariae (tailless and microcercous cercariae) was found to be 2.7% and 1.7%, respectively. Peak infection rates with the two types of cercariae occurred during September - October and December - January at both stations.

*Theodoxus jordani* (Sowerby 1836) is a prosobranch freshwater snail which is widely distributed in the Palaearctic region (Heller 1979; Tchernov 1975). In Jordan, it is abundant in springs, ponds, rivers, and streams, where it inhabits rocks and cobbles (Schütt 1983). Therefore, it is to be expected that it may act as an intermediate host for diagenetic trematodes. Abdel-Hafez and Ismail (1983) described two cercariae from *T. jordani* collected from Yarmouk River. They were a tailless cercaria and a microcercous cercaria. This paper describes the population dynamics of *T. jordani* in Yarmouk River, North Jordan, and the seasonal variations in its infection with larval trematodes.

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## Materials and Methods

A total of 1743 *Theodoxus jordani* snails were collected from two stations near El-Maqaren at Yarmouk River, Makhadah (M) and South of Makhadah (SM). A locality map and habitat description of both stations are given by Ismail and Abdel Hafez (1987). Snails were collected quantitatively using a 0.1M<sup>2</sup> quadrat. A total of 5-10 samples were collected periodically from each station during 1982 (May, Sept., Oct.), 1983 (Jan., March, May through Dec.), and 1984 (Jan. through March).

The length of each snail collected was measured, using a caliper, to the nearest mm on the same day of sampling. A grid drawn on a plastic petri dish was used to measure small sized snails. Snails were examined for cercariae as described by Saliba *et al.* (1978). Observations, measurements, and examination of larval trematodes recovered from these snails were made as described by Ismail and Abdel-Hafez (1983).

## Results

### Density

Figure 1 shows the density of *T. jordani* snails at both M and SM stations during 1983 and 1984. The density of snails was much higher at SM than M during Jan. 1983. However, the heavy rains and floodings during Feb. 1983 appeared to have eliminated this snail from SM. Thus, no snail was found at SM during the period from Feb-June 1983. Snails started to appear at SM during July 1983. The density increased after July 1983 but did not reach to the pre-flooding levels. The highest density (14.9 snails per 0.1M<sup>2</sup>) was found during Jan. 1984. On the other hand, the effect of flooding on this snail at M station was not as drastic as at SM. Thus, the density of snails at M station increased to the pre-flooding levels as of May 1983. The highest density was during June 1983, while the lowest was during March 1984 (13.2 and 5.1 snails per 0.1M<sup>2</sup>, respectively).

### Population Dynamics

The relative abundance of various size classes of *T. jordani* snails collected from both stations in El-Maqaren, Yarmouk River has been examined during the period from May 1983 to March 1984 (Fig. 2). The length of snails ranged from 1-20 mm. About 74-84% of these snails measured 6-13 mm during May-August 1983. A group of young snails (6 mm or less) appeared during September 1983 and represented about 48% of the total population. As *T. jordani* snails grew in size, the peak size increased from 4 mm during September 1983 to 6, 9, and 11 mm during October, November, and December 1983, respectively. The peak size

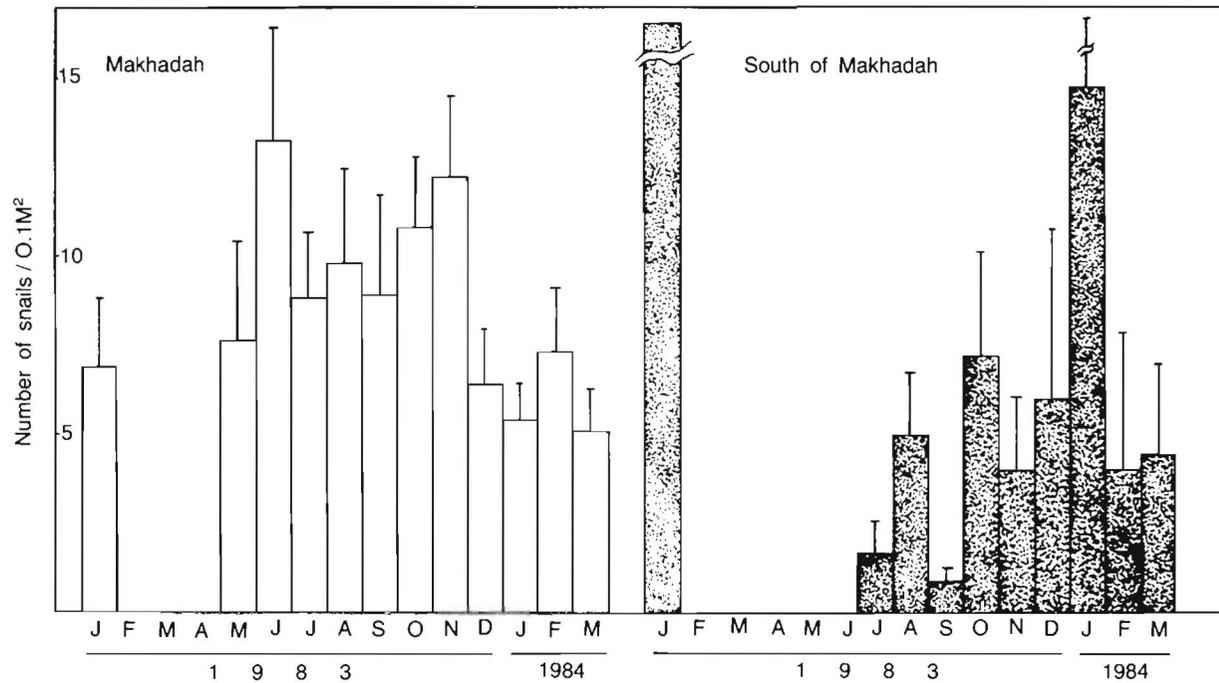


Fig. 1. Density of *Theodoxus jordani* snail at Makhadah and South of Makhadah stations, Yarmouk River during 1983 and 1984.

Note: Flooding occurred during February 1983. Bar above each column indicates standard errors.

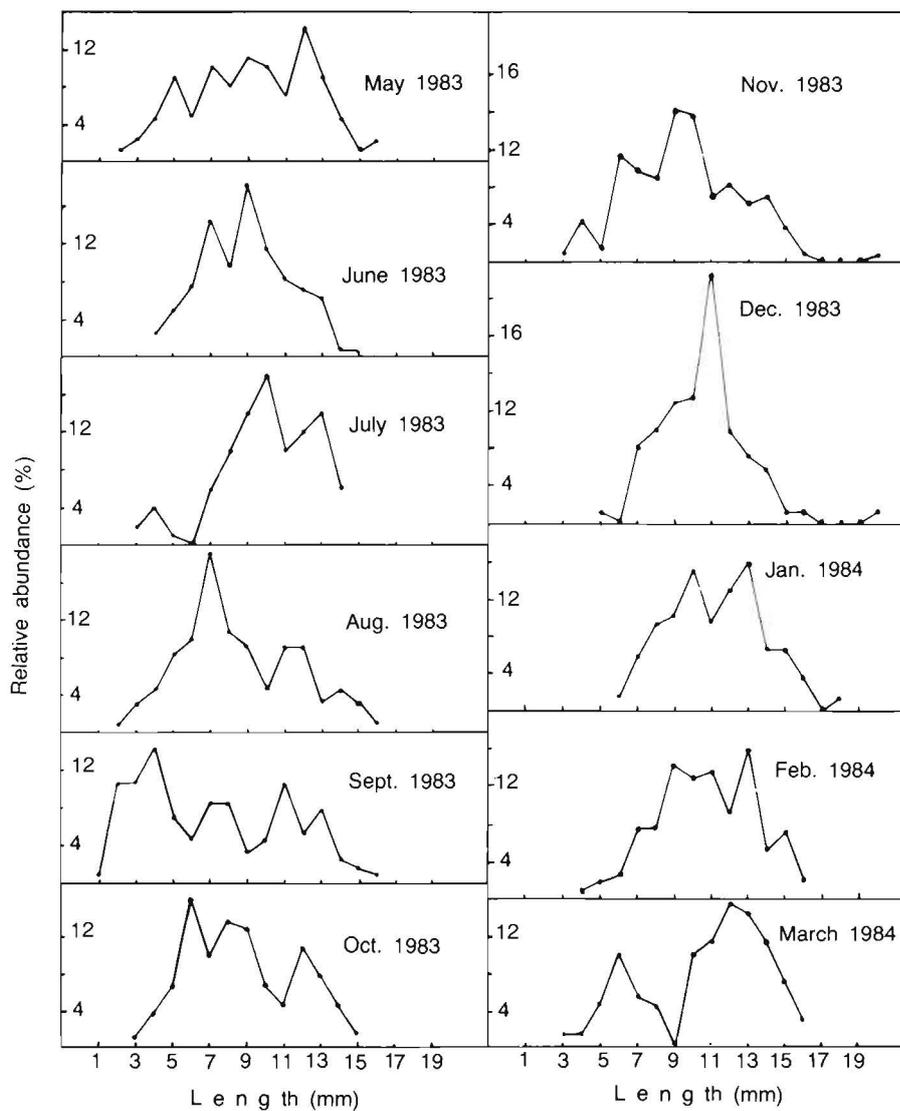


Fig. 2. Relative abundance of various size classes of *Theodoxus jordani* snails collected from El-Maqaren, Yarmouk River during 1983 and 1984.

during January and February 1984 was 13 mm. An additional group of young snails (6 mm or less) reappeared during March 1984 and represented about 17% of the total population.

### Larval Trematodes

A total of 1743 snails were collected from both stations. Of these, 39 (2.2%) were infected with larval trematodes of *T. jordani*. Two different types of cercariae were recovered from this snail: A tailless cercaria and a microcercous cercaria. These were named by Abdel-Hafez and Ismail (1983) as *Cercaria theodoxi* I and II, respectively. Although the overall infection rate was higher at M (2.7%) than SM (1.7%), the difference in infection rate was not statistically significant. The highest infection rate with both cercariae was 17.1% at M during October 1984 (Fig. 3).

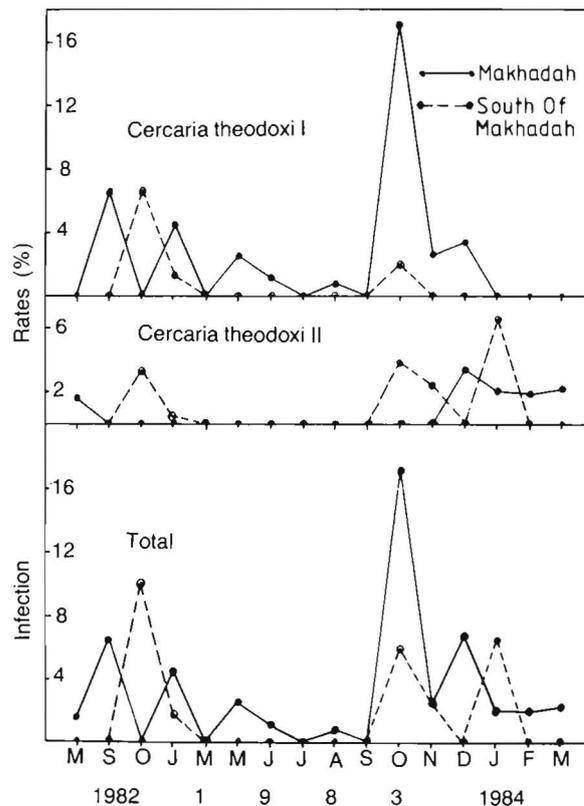


Fig. 3. Seasonal variation of infection rates of *Theodoxus jordani* with larval trematode.

Moreover, infection rates as high as 6% occurred during September 1982 and December 1983 at the same station. At SM, however, high infection rates of 10.0, 5.9, and 6.5% were found during October 1982, October 1983, and January 1984, respectively.

At M station the overall infection rate of *T. jordani* snails with *C. theodoxi* I (2.1%) was significantly higher ( $P < 0.01$ ) than the infection rate of *T. jordani* with *C. theodoxi* II (0.6%). However, at SM the overall infection rates with *C. theodoxi* I and II were similar (0.8% and 0.9%, respectively).

High infection rates of *T. jordani* with *C. theodoxi* I (more than 6%) were found during September 1982 and October 1983 at M and during October 1982 at SM (Fig. 3). In contrast, the infection rates of *T. jordani* with *C. theodoxi* II at both stations did not exceed 6% except during January 1984 at SM.

## Discussion

### *Population Dynamics*

The density of *T. jordani* snails was significantly higher at SM than M during January 1983 (Fig. 1). This is probably due to the fact that big cobbles, which provide large surface area for snails, are abundant at SM. At M, however, the edge is rocky and no big cobbles were seen. Tchernov (1975) reported that *T. jordani* is an exclusive herbivore which feeds on epiphytic algae and its populations are largest where the aquatic vegetation is most luxuriant. The occurrence of epiphytic algae on big cobbles at SM may explain the large population of *T. jordani* at this station. The heavy rains and flooding during February 1983 eliminated *T. jordani* population at SM. The effects of flooding on snails at M were less drastic. This is probably due to the fact that the current velocity at SM is twice as fast as at M (Ismail and Abdel-Hafez, in press). Thus, no *T. jordani* snails were found at SM until July 1983. Moreover, the density of *T. jordani* at SM during July 1983 to March 1984 was less than that at M, except during January 1984 (Fig. 1).

The appearance of young *T. jordani* snails measuring 6 mm long or less during September 1983 and January 1984 indicates that *T. jordani* reproduces twice a year (Fig. 2). Tchernov (1975) reported that *T. jordani* in Lake Tiberias lay eggs twice a year, early April and August. However, the number of eggs recovered during August was low. This may suggest that the young snails which appeared during September 1983 had developed from eggs laid 5 months earlier during April 1983, while young snails which appeared during March 1984 had developed from eggs laid 6 months earlier during August 1983. The slower development of *T. jordani* snails during August to March than April to September is probably due to the fact that the water temperature was less than 18°C during December 1983 to March

1984, while it was more than 22°C during May to September 1983 (Ismail and Abdel-Hafez, in press).

### **Larval Trematodes**

Two peaks in the level of infection of *T. jordani* by larval trematodes have been observed at both M and SM stations (Fig. 3). The first was during September-October and the second during December-January. Many workers (as reviewed by Erasmus 1972) have reported two periods of high level of infection with cercarial stages in both marine and freshwater snails, one during late spring (May) and the other during late summer (September-October). The absence of high incidence during spring in the present study is probably due to the fact that the flooding during February 1983 has drastically affected the snail density. Thus, none of the snails was found at M during the same period. The reappearance of young, uninfected *T. jordani* snails during September may explain the high infection rate which was found during December-January.

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## ديناميكية الجماعة السكانية لقواقع ثيودوكسس جورداني (سويربي ١٨٣٦) في نهر اليرموك بالأردن ومدى إصابتها الموسمية بيرقات الديدان المفلطحة

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أجريت دراسات حول ديناميكية الجماعة السكانية لقواقع ثيودوكسس جورداني في محطتي المخاظة وجنوب المخاظة الواقعتين على نهر اليرموك في شمال الأردن وعلى مدى أربعة عشر شهراً. وقد تبين أن الكثافة السكانية لهذا القواقع قد كانت أعلى منها في محطة جنوب المخاظة عنها في المخاظة وخصوصاً أثناء شهر كانون ثاني عام ١٩٨٣ م. وقد كان أثر فيضان النهر أثناء شهر شباط ١٩٨٣ أكثر خطورة على القواقع الموجودة في محطة جنوب المخاظة منه في المخاظة. ويشير ظهور القواقع الصغيرة أثناء شهري أيلول ١٩٨٣ وكانون ثاني ١٩٨٤ إلى أن لقواقع ث. جورداني دورتي تكاثر سنويا. وتبين أن معدل الإصابة الإجمالية لهذا القواقع في كلتي المخاضتين بضربين من ضروب السركاريا (السركاريا عديم الذيل والسركاريا ذات الذيل الصغير) هو ٧,٢٪ و ١,٧٪ على الترتيب. وقد وجد أن أعلى معدل للإصابة بهذين الضربين من السركاريا قد كان أثناء فترتي أيلول - تشرين أول وكانون أول - كانون ثاني.