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Snail populations in Dakahlia Governorate, Egypt, with special reference to lymnaeids

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Abstract

Freshwater molluscs are one of the most threatened groups of freshwater taxa. They are essential to the maintenance of wetland ecosystems. They also act as vectors for many trematodes, including *Fasciola* spp. Estimation of snails density especially lymnaeids and their natural infection with *Fasciola* spp. was carried out in Dakahlia Governorate, Egypt. Monthly collection of snails from fixed stations along the River Nile (Damietta branch) and one of the major drains was carried out, in addition to estimation of temperature, pH, salinity and ammonia levels in the water bodies. Examination of natural infection of lymnaeid snails with *Fasciola* spp. immature stages was done by shedding and crushing techniques. *Fasciola* spp. immature stages were recovered in 16.8% of lymnaeids. We recorded decreased density of the snail population including lymnaeids than previous records in Dakahlia.

Keywords: Snails, Lymnaeids, *Fasciola*, Dakahlia, Egypt

Introduction

Healthy freshwater ecosystems are essential to the rich biodiversity they support. One threatened component of this ecosystem is populations of freshwater snails, essential to the maintenance of wetlands, primarily because of their contribution to water quality, nutrient cycling through algal grazing and as a food source to other animals. Some species play a vectoring role in the transmission of human and livestock parasites (Vaughan *et al.* 2004, 2008). The prevalence of human fascioliasis was recorded by El-Shazly *et al.* (2001) to be 7.4% in Dakahlia Governorate (Egypt). Triclabendazole administration has been widely used to treat fascioliasis since 1998 (WHO 2007).

Animal fascioliasis is an important zoonotic disease causing great losses of livestock (Bernardo *et al.* 2011). El-Shazly *et al.* (2002a) recorded the overall rates of fascioliasis in Dakahlia livestock as follows: cows (12.3%), buffaloes (9.7%), sheep (17.8%) and goats (5.4%). Surveys on animal and human fascioliasis in Qena Governorate (Egypt) revealed an overall prevalence of 30.3% in animals, including cows (28.6%) buffaloes (33.7%) and sheep (17.2%), but no human infections were detected (Hussein & Khalifa 2010).

Our aim in this study was to document the current density of the malacological fauna of Dakahlia, especially the lymnaeid snails.

Materials & Methods

Snails were collected every month from September 2010 to September 2011 at two fixed stations along the River Nile (the Damietta branch at the villages of Meet Korama and Meet Anter) and one of the major drains (at the villages of El-Taweela and Sherbin). At each station, we selected four sites, ten metres apart, and at each site samples were taken from the littoral and mid-water stream by dip net. Ten dip-net samples were taken from each site on each sampling occasion (WHO 1965). The snails recovered were examined and collected in labelled jars filled with water from the same source, covered with muslin and transported to the

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laboratory in the Parasitology Department, Faculty of Medicine, Mansoura University, where they were identified and counted. The standard keys given by Frandsen (1983) and Ibrahim *et al.* (1999) were adopted for identification. According to Correa *et al.* (2010) *Lymnaea natalensis* (synonym = *Lymnaea cailliaudi*) should be placed in the subgenus *Radix*; *Lymnaea (Galba) truncatula* represents a branch of an American clade that reached the Old World, where it has evolved and diverged from its American sister species.

Lymnaeid snails were individually examined for natural infection with the immature stages of *Fasciola* spp using two techniques: shedding and crushing (Madsen & Monrad 1981). For the shedding technique, each snail was placed in a 200-ml beaker containing fresh dechlorinated water and exposed to artificial lamp light for 72 h (to activate the release of *Fasciola* cercariae): no feeding was allowed. We then repeatedly examined the sample for emerged stages using a hand lens and a stereo-binocular dissecting microscope. After the shedding technique, the crushing method was done by removing the shell, dislodging the soft tissues and compressing them between two glass slides to examine them under the binocular microscope to look for the presence of any parasite developmental stages.

Water temperatures were taken just below the surface of the water near the shore at each site using a thermometer (Mousa & Abou El-Hassan 1972). Ammonia levels were estimated calorimetrically using Nessler's reagent (El-Hassan 1974). The estimation of NaCl concentrations (salinity) was done via titration determination using commercial kits (bio-Merieux laboratory reagent and product, France).

Results

The results (Tables 1 & 2) show that lymnaeids are relatively uncommon, with other taxa (*Lanistes bolteni*, *Cleopatra* and *Biomphalaria*) being much more common. At the Nile station, three lymnaeids were infected (9%), while at the Drain station only a single snail was infected (7.7%).

	Station	
	Nile	**Drain**
Snail taxa		
Lymnaea spp.	33	13
L.(Radix) natalensis	19	8
L.(Galba) truncatula	7	2
L. stagnalis	6	2
L. columella	1	1
Biomphalaria spp.	45	27
Bulinus truncatus	11	7
Helysoma duryi	20	11
Physa acuta	37	28
Cleopatra spp.	56	44
Melania tuberculata	19	11
Vivipara unicolor	40	26
Lanistes bolteni	60	51
Total number	**321**	**218**
Infected lymnaeids		
by shedding	2	0
by crushing	3	1
pH range of values	7.7- 8	7.8-8.2
Salinity (‰)	0.22	0.35
Ammonia levels (mg l^{-1})	0.26	0.37

Table 1: Snails collected, their infectivity and the physiochemical properties of water at the station

Season	No. of snails	Water temperature (°C)
Autumn	17	22.0 (18-25)
Winter	13	11.7 (10-14)
Spring	5	15.3 (11-20)
Summer	11	26.3 (22-32)

Table 2: Number of lymnaeids collected in different seasons during one year.

Discussion

In the present study, there was a marked reduction in snail populations compared with previous records from Dakahlia (El-Shazly *et al.* 1990, 2002b). El-Shazly *et al.* (2002b) collected 1341 lymnaeids from the Damietta branch of the Nile and three 3 major canals and their drainages, clearly a much larger number. In this study, four lymnaeid species were collected from both stations, but only in small numbers. The relative numbers of these lymnaeids is consistent with the previous data of El-Shazly *et al.* (2002b), where *L.(R.) natalensis* (64%) was much more common than *L.(G) truncatula* (16%), *L. stagnalis* (12%) and *L. columella* (3%).

Lymnaeid snails act as intermediate hosts for *Fasciola* spp (Mas-Coma 2005). *Fasciola gigantica* and *Fasciola hepatica* have been proven to exist in Egypt (Amer *et al.* 2011). *L.(Radix) natalensis* is considered to be the major intermediate host for *Fasciola gigantica* in Africa (Ahmed & Ramzy 1999; Hussein & Khalifa 2008), and a potential intermediate host of *F. hepatica* in Egypt (Dar *et al.* 2010). In the present work, examination for infection with *Fasciola* immature stages revealed natural infection in two *L.(R.) natalensis*, one *L.(G.) truncatula* and one *L. stagnalis* snails. Previous study in Dakahlia showed natural infection rates of 5.5% of *L.(R.) natalensis* and 3.1% of *L.(G.) truncatula* (El-Shazly *et al.* 2002b).

The monthly pattern of snail distribution in the irrigation canals showed changeable relative densities. The abundance of *L.(R.) natalensis* during December and February was consistent with other studies (Salem *et al.* 1993; Ahmed & Ramzy 1999). Overall, fewer snails were caught when water temperatures were low, suggesting a negative correlation. From recovery of *Fasciola* immature stages from infected lymnaeids, the shedding of cercariae was restricted to spring and autumn, consistent with the ideas of Farag *et al.* (1993) and in agreement with the appearance of infected cases in summer.

pH is an important variable in water quality assessment as it influences many biological and chemical processes within a water body (Chapman & Kimstach 1996). The pH values here ranged from 7.7 to 8.2, and although pH changed from one month to another, it was generally around 8 throughout the whole year in both the main Nile branch and the drain. The survival and egg-laying capacity of *Fasciola* are better at pH values between 7 and 9 (Farag *et al.* 1993). The average salinity in this study was higher in the drain than in the main Nile branch, but both were acceptable values. Increased salinity in rivers is a risk factor for aquatic organisms including molluscs (Donnelly *et al.* 1983). Although ammonium itself (NH_4^+) is relatively harmless to macro-invertebrates, its products ammonia (NH_3^+) and nitrite (NH_2^-) can be extremely toxic to various aquatic species including snails (Wicks *et al.* 2002; Alonso & Camargo 2003). The current average level of ammonia was slightly higher in the drain than in the main Nile branch, consistent with the observed reduction in snail densities. However, in Egypt the guidelines for ammonia as set by Article 60 of Law 48/1982 specify the maximum allowable limit of ammonia in water bodies as 0.5 mg/l (NAWQAM, 2003), so the recorded levels were within the allowed limit.

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الملخص العربي

حصر لقواقع المياه العذبة في محافظة الدقهلية, مصر- مرجع خاص لل lymnaeids

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تم إجراء حصر لقواقع المياه العذبة في فرع النيل (فرع دمياط) المار بقرية ميت الكرما وميت عنتر بالاضافة إلى قناة للصرف المارة بقرية الطويلة وشربين في الفترة من سبتمبر 2010 وحتى سبتمبر 2011.
وقد أظهرت النتائج وجود 14 نوع منها 9 أنواع تنتمي لتحت صف بروسوبرانكيا (Prosobranchia) و 5 أنواع تحت صف بلموناتا (Pulmonata) وكلاهما يتبع صف جاستروبودا (Gastropoda).
وكان عدد القواقع المجمعة 321 من الفرع الرئيسي و 218 من المصرف.
تم حصر 4 أنواع تنتمي لل lymnaeids: *Radix natalensis* بنسبة 58.7% *Galba truncatula* بنسبة 19.6%, *Lymnaea stagnalis* بنسبة 17.4% و *L. columella* بنسبة 4.3% وقد تم تجميع أكبر عدد منها في فصل الخريف.
تم فحص قواقع ال lymnaeids للإصابة بالأطوار الغير ناضجة لدودة الفاشيولا *Fasciola* spp. وقد وجدت في 16.8% من القواقع.
وقد تم تسجيل درجة حموضة ومتوسط درجة الملوحة ومتوسط درجة الأمونيا في الفرع الرئيسي و المصرف.