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FULL LENGTH ARTICLE

Community structure of molluscans in River Nile and its branches in Assiut governorate, Egypt

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Abstract The present work aims to survey the benthic mollusc communities in River Nile and its branches in Assiut governorate, Egypt. Twenty-six species were recorded from the collecting sites during the period from March 2010 until March 2012. These species belong to fifteen families; eleven families of Gastropoda and four families of Bivalvia. The constant species in this survey were five species: *Cleopatra bulimoides*, *Lanistes varicus*, *Lanistes carinatus*, *Melanoides tuberculata* and *Caelatura aegyptiaca*. The accessory species were seventeen species: *Mutela rostrata*, *Pila wernei*, *Sphaerium* sp., *Pila ovata*, *Bithynia connollyi*, *Lymnaea natalensis*, *Corbicula fluminalis*, *Theodoxus niloticus*, *Unio teretiusculus*, *Bellamya unicolor*, *Hydrobia aponensis*, *Pseudosuccinea columella*, *Valvata nilotica*, *Biomphalaria alexandrina*, *Bulinus truncates*, *Physa acuta* and *Gabbiella senaariensis* and the accidental species were four species: *Helisoma duryi*, *Succinea cleopatra*, *Corbicula fluminea* and *Gyraulus ehrenbergi*. The species richness and diversity of molluscan community reach the maximum level in spring and summer months.

Introduction

Freshwater mollusc communities are important in terms of biodiversity and ecosystem health. They play significant roles in the public and veterinary health and thus need to be scientifically explored more extensively (Supian and Ikhwanuddin, 2002). A lot of researchers studied the ecology and population dynamics of the gastropods which play an important role in the health of man and his livestock (Barbosa and Barbosa, 1994; Utzinger et al., 1997; Kloos et al., 2001; Ahmed and Elaa, 2003; Karimi et al., 2004; Cañete et al., 2004; Mageed, 2006; Kazibwe et al., 2006; Mostafa, 2009).

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Fishar and Ali (2006) illustrated that molluscs are suitable candidates to be used in biomonitoring surveys of Lake Qarun in Egypt.

On the other hand freshwater bivalves provide many ecological services to aquatic systems including benthic–pelagic coupling (Vaughn et al., 2004; Spooner and Vaughn, 2006), structure for other invertebrates (Strayer et al., 1994), and sediment stabilization (Zimmerman and de Szalay, 2007). These large invertebrates can be considered metabolic reactors because they transfer nutrients and energy from water to sediments by filtering, biodeposition of faeces and pseudofaeces, nutrient mineralization (Spooner and Vaughn, 2006) stimulating the production across trophic levels (Vaughn and Spooner, 2006).

Ibrahim et al. (1999) reported that fresh water molluscs in Egypt have been studied over a long time, but most studies are focused towards the principal snail groups which transmit diseases to man and demotic animals. However, they play an important role in the fresh water ecosystem and some of their local members were recently incriminated in transmitting serious human diseases. Therefore, the present work is a step forward in surveying the benthic mollusc communities in River Nile and its branches in Assiut governorate, Egypt. Specific objectives are to provide a species record of molluscs at the sampling sites and determine the diversity and composition of molluscs in different months.

Materials and methods

158 random qualitative samples were collected from different cities of Assiute governorate, Egypt (lying between 27°14¯N and 31°11¯E) (Fig. 1). Molluscans were located visually and collected by hand. The sampling was carried out along a period of 2 years; from March 2010 until March 2012. The collections were preserved in 7% neutral formalin solution (fixation) for a maximum of 5 days before identification.

In laboratory, specimens were examined under a binocular microscope equipped with an ocular eye piece micrometer. A digital camera was used to take the photos of the collected species. The following published papers and keys were used to identify the molluscs Walker (1959), Soliman (1972), Abdel Aal (1979), Brown (1980), Flemming (1983), Brown et al. (1984), Ali (1989) and Ibrahim et al. (1999). The recorded molluscan species were divided into frequency classes according to the system adopted by Weis-Fogh (1948) as the following: constant species – present in more than 50% of the samples; accessory species – present in 25–50% of the samples; and accidental species – present in less than 25% of the samples. Identified specimens are deposited in Educational Museum of Egyptian Fauna, Zoology Department, Faculty of Science, Assiut University, Egypt. Shannon Wiener diversity index (H') was calculated to show the Molluscan diversity within the monthly collected communities by using Shannon–Wiener equation $H' = -\sum pi\,(\ln pi)$, where pi is the proportion of individuals belonging to the ith species. Molluscan richness of these communities was calculated.

Results and discussion

Abundance and species composition of the molluscan community

Twenty-six molluscan species were recorded from the collecting sites during the period of investigation. These species belong to fifteen families; eleven among them are Gastropoda and four are Bivalvia (Table 1). The recorded species were divided into constancy classes, the constant species in this survey were five species: *Cleopatra bulimoides* (Olivier) (frequency = 129, constituting 82% of the samples), *Lanistes varicus* (Müller) (frequency = 120, constituting 76% of the samples), *Lanistes carinatus* (Olivier) (frequency = 119, constituting 75% of the samples), *Melanoides tuberculata* (Müller) (frequency = 90, constituting 57% of the samples) followed

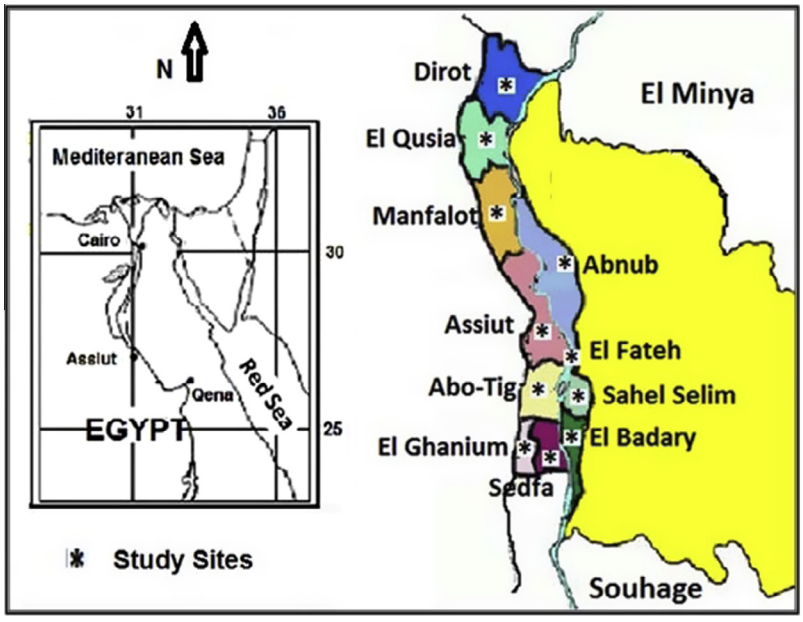

Figure 1 Map showing study sites in Assiut, Egypt.

Table 1 Molluscan species of the River Nile and its branches in Assiut governorate, Egypt with their percentages of frequency. Constant species (a), accessory species (b), accidental species (c).

Class	Family	Genus and species	Frequency (%)
Gastropoda	Neritidae	*Theodoxus niloticus* (Reeve)b	33
	Viviparidae	*Bellamya unicolor* (Olivier)b	30
	Ampullariidae	*Lanistes carinatus* (Olivier)a	75
		Lanistes varicus (Müller)a	76
		Pila ovata (Olivier)b	36
		Pila wernei (Olivier)b	39
	Valvatidae	*Valvata nilotica* (Jickeli)b	27
	Bithyniidae	*Gabbiella senaariensis* (küster)b	25
		Bithynia connollyi (Gardner)b	34
	Thiaridae	*Melanoides tuberculata* (Müller)a	57
		Cleopatra bulimoides (Olivier)a	82
	Hydrobiidae	*Hydrobia aponensis* (Martens)b	29
	Lymnaeidae	*Lymnaea natalensis* (Krauss)b	34
		Pseudosuccinea columella (Say)b	29
	Succineidae	*Succinea cleopatra* (Pallary)c	13
	Planorbidae	*Biomphalaria alexandrina* (Ehrenberg)b	27
		Gyraulus ehrenbergi (Beck)c	2
		Helisoma duryi (Wetherby)c	22
		Bulinus truncatus (Audouin)b	27
	Physidae	*Physa acuta* (Draparnaud)b	27
Bivalvia	Unionidae	*Caelatura aegyptiaca* (Cailliaud)a	50
		Unio teretiusculus (Philippi)b	32
	Mutelidae	*Mutela rostrata* (Rang)b	40
	Corbiculidae	*Corbicula fluminalis* (Müller)b	34
		Corbicula fluminea (Mueller)c	13
	Sphaeriidae	*Sphaerium* sp.(Scopoli)b	37

by *Caelatura aegyptiaca* (Cailliaud) (frequency = 79, constituting 50% of the samples). The accessory species were seventeen species: *Mutela rostrata* (Rang) (frequency = 63, constituting 40% of the samples), *Pila wernei* (Olivier) (frequency = 62, constituting 39% of the samples), *Sphaerium* sp.(Scopoli) (frequency = 58, constituting 37% of the samples), *Pila ovata* (Olivier) (frequency = 57, constituting 36% of the samples), *Bithynia connollyi* (Gardner), *Lymnaea natalensis* (Krauss), *Corbicula fluminalis* (Müller) (frequency of each of them = 54, constituting 34% of the samples), *Theodoxus niloticus* (Reeve) (frequency = 52, constituting 33% of the samples), *Unio teretiusculus* (Philippi) (frequency = 51, constituting 32% of the samples), *Bellamya unicolor* (Olivier) (frequency = 48, constituting 30% of the samples), *Hydrobia aponensis* (Martens), *Pseudosuccinea columella* (Say) (frequency of each of them = 46, constituting 29% of the samples), *Valvata nilotica* (Jickeli), *Biomphalaria alexandrina* (Ehrenberg), *Bulinus truncatus* (Audouin), *Physa acuta* (Draparnaud) (frequency of each of them = 42, constituting 27% of the samples) and *Gabbiella senaariensis* (küster) (frequency = 39, constituting 25% of the samples). The accidental species were four species: *Helisoma duryi* (Wetherby) (frequency = 34, constituting 22% of the samples), followed by *Succinea cleopatra* (Pallary) and *Corbicula fluminea* (Mueller) (frequency of each of them = 20, constituting 13% of the samples), followed by *Gyraulus ehrenbergi* (Beck) (frequency = 3, constituting 2% of the samples.

To the best of the present author's knowledge, previous studies on Egyptian molluscs showed lower species numbers than the present investigation. El-kady et al. (2000) revealed the occurrence of twelve species of freshwater snails belonging

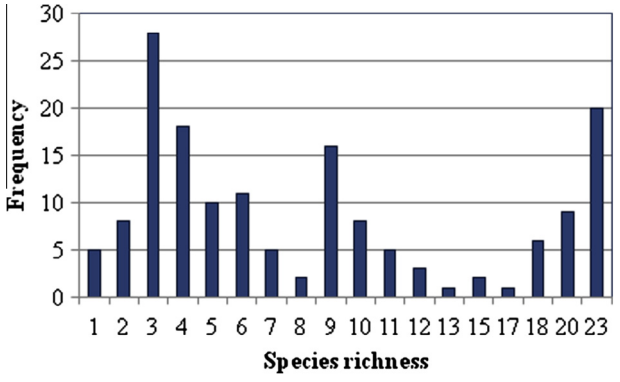

Figure 2 Frequency of the species richness of molluscan communities collected from different study sites during the investigation period.

to nine families of Gastropoda in the El-Abtal village situated on the east of the Ismailia governorate. All of these species were recorded in the present work except *Lymnaea truncatula*. It is worth to say that in their study they mention *P. columella* by its synonymy *Lymnaea columella*. Ramadan et al. (2000) recorded twenty species of Mollusca (fourteen gastropods and six bivalves) between Esna and El-Kanater El Kharia. Fisher and Williams (2006, 2008) recorded nineteen species of molluscs at the River Nile from Aswan to Cairo. Iskaros and El Dardir, (2010) recorded three species at Lake Nasser, Egypt. El-Khayat et al. (2011) recorded thirteen species of snails in different water courses in seven governorates (Greater

Table 2 Seasonal variation of the frequency of molluscan species collected from River Nile and its branches.

Molluscans species	January		February		March		April		May		June		July		August		September		October		November		December	
	F	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%	*F*	%
T niloticus	7	54	6	67	7	50	7	41	6	40	9	39	2	13	–	–	8	67	–	–	–	–	–	–
B. unicolor	1	8	–	–	8	57	9	53	8	53	10	43	9	60	–	–	2	17	–	–	–	–	1	10
L. carinatus	11	85	–	–	8	57	14	82	8	53	19	83	12	80	9	100	11	92	11	100	9	90	7	70
L. varicus	11	85	3	33	11	79	12	71	11	73	14	61	11	73	9	100	10	83	10	91	9	90	9	90
P. ovata	1	8	–	–	7	50	9	53	7	47	6	26	7	47	1	11	7	58	6	55	0	0	6	60
P. wernei	1	8	–	–	6	43	7	41	6	40	8	35	7	47	6	67	7	58	2	18	6	60	6	60
V. nilotica	6	46	6	67	6	43	9	53	9	60	7	30	–	–	–	–	–	–	–	–	–	–	–	–
G. senaariensis	–	–	–	–	6	43	6	35	7	47	6	26	7	47	–	–	1	8	6	55	–	–	–	–
B. connollyi	6	46	6	67	6	43	8	47	6	40	10	43	6	40	–	–	6	50			–	–	–	–
M. tuberculata	10	77	6	67	8	57	11	65	9	60	9	39	7	47	6	67	8	67	7	64	3	30	6	60
C. bulimoides	11	85	3	33	11	79	14	82	12	80	14	61	14	93	9	100	11	92	11	100	10	100	9	90
H. aponensis	–	–	–	–	9	64	7	41	9	60	9	39	6	40	–	–	6	50	–	–	–	–	–	–
L. natalensis	1	8	6	67	7	50	10	59	9	60	7	30	7	47	–	–	6	50	1	9	–	–	–	–
P. columella	–	–	–	–	6	43	8	47	7	47	7	30	6	40	–	–	–	–	–	–	6	60	6	60
S. cleoptera	–	–	–	–	–	–	1	6	1	7	–	–	6	40	–	–	–	–	6	55	6	60	–	–
B. alexandrina	–	–	–	–	7	50	7	41	7	47	9	39	6	40	–	–	6	50	–	–	–	–	–	–
G. ehrenbergi	–	–	–	–	–	–	–	–	1	7	1	4	1	7	–	–	–	–	–	–	–	–	–	–
H. duryi	–	–	–	–	6	43	8	47	6	40	7	30	6	40	–	–	1	8	–	–	–	–	–	–
B. truncatus	1	8	–	–	6	43	7	41	7	47	8	35	6	40	–	–	7	58	–	–	–	–	–	–
P. acuta	2	15	–	–	7	50	8	47	7	47	8	35	2	13	–	–	7	58	1	9	–	–	–	–
C. aegyptica	3	23	–	–	8	57	8	47	8	53	12	52	10	67	6	67	8	67	7	64	6	60	3	30
U. teretiuscula	–	–	–	–	6	43	8	47	7	47	9	39	7	47	0	0	7	58	7	64	–	–	–	–
M. rostrata	–	–	–	–	6	43	7	41	6	40	10	43	7	47	5	56	6	50	6	55	5	50	5	50
C. fluminalis	5	38	1	11	6	43	5	29	6	40	7	30	5	33	5	56	6	50	1	9	1	10	5	50
C. fluminea	3	23	–	–	–	–	3	18	3	20	5	22	4	27	–	–	2	17	1	9	–	–	–	–
Sphaerium sp.	5	38	5	56	5	36	5	29	6	40	7	30			5	56	5	42	5	45	5	50	5	50

Cairo, Giza, Qalioubiya, Ismailiya, Baheria, Damietta and El-Menia). All of their species were recorded in the present study except *Planorbis planorbis*. Hussein et al. (2011) recorded thirteen species in Qena Governorate. All of Qena species were witnessed in the present study. The relatively high number of the collected molluscs species in the present study may be due to successive monthly collection for 2 years in the present work.

The five dominant species in the present study are recognized as widespread species with no known widespread threats; *C. bulimoides* (Ghamizi et al., 2012), *L. varicus* (Van Damme and Ghamizi, 2010a), *L. carinatus* (Lange and Van Damme, 2010), *Melanoides tuberculatus* (Madhyastha, 2012) and *C. aegyptiaca* (Van Damme and Ghamizi, 2010b). Ibrahim et al. (1999) has recorded *L. varicus* from Upper Egypt recently, where it is rare. This is a new location, but may not have been surveyed there for some time before. It is possibly spread by birds (Van Damme and Ghamizi, 2010a). Van Damme and Ghamizi (2010b) illustrated that the taxonomy of *C. aegyptiaca* needs revision. According to Graf and Cummings (2007) the name probably represents a species group. They not recognize these species, and intend to do a study of genetics to sort this out.

In consideration of that each sample represents molluscan community, species richness (i.e., the number of species present in each sample) was calculated to present species composition of the community. The percentage of frequency of each species composition (species richness) to the total samples was calculated. The species composition of the community ranged from one to twenty three species. The frequency of species richness of molluscan communities represented in Fig. 2. Table 2 shows the seasonal variation of frequency of mollusan species collected during the investigated period. The species composition of monthly molluscan community ranged between nine species in February and twenty-six species in May (Fig. 3). In general the species richness and diversity of molluscan community reach the maximum level in spring and summer months.

The increased numbers of present collected molluscs during spring and summer may be due to favourable conditions of environmental factors during this period of the year which includes physical, chemical and biological factors. The present results agree with El-Kady et al. (2000); they stated that April, May and June showed the highest number of snails in Sinai Peninsula, and partially agrees with Diab (1993) who reported that the snail abundance was high in spring and low in summer in the Beheira Province. On the contrary, Hussein et al. (2011) reported that the snail population was high in autumn. In general, Ngqulana (2012) illustrated that in an aquatic ecosystem; the seasonal changes play a major role in structuring the benthic community.

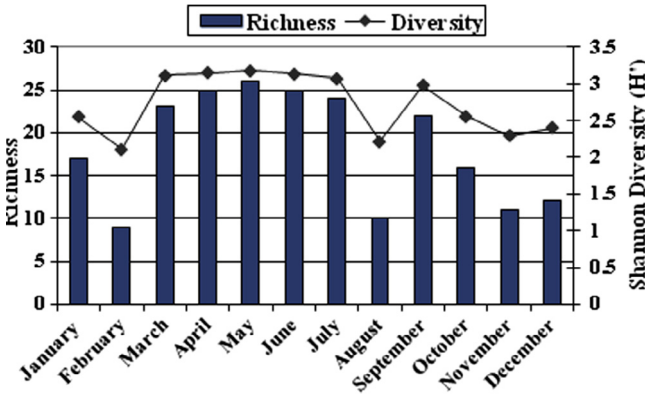

Figure 3 Monthly fluctuation of species richness and Shannon diversity of the collected molluscans.

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