

Introduction

The Parishan Lake area covers an area of about 42.6 km² and is located in the Southwest of Iran. Few studies exist on the freshwater molluscs of Parishan Lake. The most comprehensive survey of Parishan Lake was conducted by Mansoorian (1992). Other literature on freshwater molluscs of this lake is restricted to Schistosomiasis surveys (Massoud *et al*, 1979; Mansoorian, 1992).

The present study is aimed at documenting the taxonomy of molluscs in the major permanent freshwater areas of the Parishan Lake because freshwater snails are known play a significant role in public and veterinary health and so need to be more extensively explored scientifically (Supian and Ikhwanuddin, 2002).

Materials and Methods

Snail collections were made at monthly intervals, with sampling carried out from January 1999 to December 2002. Five stations were surveyed (Southeastern (1), central (2), Northeastern (3), Northwestern (4), and the paddy fields located in the Southwestern parts of the lake (5)) and were selected in an area of about 42.6 square kilometers. Specimens were collected with a hand net and by hand. Soil samples from the Parishan Lake bed, containing living and decaying aquatic weeds and algal mats, were also brought to the laboratory. The molluscan specimens were picked out and washed with clean water. Shells were put into plastic jars and labelled and were dried at room temperature (Pennak, 1953). Living animals were first killed in boiling water then transferred into 70% ethanol. Labelling included the following information: collectors name, location name and collecting date. The identification of species collected was done according to Wright, 1963; Brown and Wright, 1980; and Brown and Gallagher, 1985. All the snails collected were preserved in the Agricultural Research Zoology Department of the Plant Pests and Diseases Research Institute, Tehran,

Iran. Size variation among the molluscan populations collected was highly pronounced. The dimensions given represent the average of the largest 5-10 individuals of each species.

Results

According to present findings from 20 species recorded so far from this lake, eight species are new records while others have been reported earlier from this lake (Massoud *et al*, 1979; Tagalipour, 1982; Mansoorian, 1992) (Tables 1-3). Their taxonomy, identification and distribution in the different stations surveyed are as follows.

Family Thiariidae

Five species belonging to two genera are recorded from this snail family. The main characteristics for identification of this species were small to large in shell body size, dextral shells usually with a higher spire versus aperture, frequency, thick-walled, strongly sculptured, operculum ovate and horny with paucispiral sculpture.

Genus: *Melanoides* Olivier, 1804

M. tuberculata Annandale and Prashad, 1919

Only one species is collected and the size of its shell recorded at between 13.5 × 46.5 mm. The shell is dextral with an oval shape (smaller aperture and slender body whorl). The height of the aperture is smaller than one-third of the length the shell. The height of the shell is almost equal to or greater than three times of its width. Fully grown shells consist of up to 14 whorls. A spiral ridge is present on body whorl. This mollusc was collected from all the Parishan Lake stations.

Genus *Melanopsis* Ferussac, 1807

Four species were identified from this genus. Shell size was medium and reaching 36 mm in height with a thick-walled shell, smooth or strongly sculptured and a notch present at the columellar margin, the

operculum ovate and horny. Radula long versus *Melanoides* spp.

***Melanopsis costata* Brot, 1879**

Shell size is between 7.8 × 17.2 mm, dextral, medium sized, with a sharp apex and transverse ribs on the whorls. Smooth, brownish and banded. Notch present at columellar margin. This taxon was collected from stations 1, 2, 3 and 4 in Parishan Lake.

***Melanopsis doriae* Annandale, 1918**

Shell size is between 8.3 × 17.6 mm, dextral, medium sized, smooth, brownish and banded. Fully grown shells comprise 7-8 flat whorls with a sharp apex. Notch present at columellar margin. This taxon was collected from stations 1, 2, 3 and 4 in Parishan Lake.

***Melanopsis nodosa* Mousson, 1874**

Shell size is recorded between 7.6 × 16.8 mm. Shell similar to preceding species, but with sculptures and nodules on its surface. This species was collected from stations 1, 2, 3 and 4 in Parishan Lake.

***Melanopsis praemorsa* (Linne, 1758)**

Shell size for this species was recorded at between 11.4 × 18.7 mm. Most of its characters is similar to the preceding species, but apex eroded and shells vary in colours with smooth surface. This taxon was collected from 1, 2, 3 and 4 stations in Parishan Lake.

Family Bithyniidae

The fully grown shell is small to medium sized and varying from globose to conical in shape. Operculum is calcarous and concentric with a nucleus. The female oviparous and male with an appendage on its penis. Central tooth with basal denticles. Two species are found from this family in Parishan Lake.

Genus *Bithynia* Leach, 1518

***Bithynia badiella* Annandale, 1919**

Shell size for this species is recorded at between

4.6 × 4.8 mm. The snail is less than 6 mm in height and its shape is almost globose. This species was collected at stations 2 and 3 of Parishan Lake.

***Bithynia tentaculata* (Linne, 1758)**

The size of the shell is recorded at between 6.2 × 4.8 mm. The shell is medium, dextral and conical and includes 5-6 convex whorls. This species was collected at stations 2 and 3 of Parishan Lake.

Family Planorbidae

Six species, of a small to medium sized of snail, with slender tentacles and reddish blood which contains haemoglobin. Central tooth bicuspid. Shell shapes and anatomical characters are very diverse.

Genus *Bulinus* O.F. Muller, 1781

***Bulinus truncatus* (Audouin, 1827)**

Shell size is recorded at between 9.4 × 14.8 mm. Adult shells are sinistral and conical, and rarely reach 15 mm in height. No fold on columellar region. Neither a renal ridge nor rectal ridge present. Mesocone of lateral tooth arrow-shaped. Transverse rows of radula slightly curved. This taxon was only found at station 1 of Parishan Lake.

Genus *Planorbis* Muller, 1774

***Planorbis planorbis* (Linne, 1758)**

Shell size is between 2.6 × 12.8 mm. Diameter and height of the shell rarely reach 20 mm and 3 mm, respectively. Adult shells bear 5-6 whorls. If there is a carination, it will be lateral on aperture view. *P. planorbis* bears 35-37 diverticula. This taxon was found in all of the Parishan Lake stations.

***Planorbis carinatus* Muller, 1774**

Adult shells have almost the same size as the preceding species, but they consist of 4-5 whorls. The prepher angel is nearly in the midline of aperture view and the prostate has 21-31 diverticula. This mollusc was collected at stations 1 and 2 of Parishan Lake.

Table 1. Parishan Lake gastropod diversity in the present survey (January 1999 - December 2002).

Family	Genera	Species
Bithynidae	1	2
Planorbidae	3	6
Lymnaeidae	1	5
Thiaridae	2	5
Physidae	1	1
Neritidae	1	1
Total	9	20

Table 2. Freshwater snails observed in Parishan Lake (January 1999 - December 2002).

Species	Station 1	Station 2	Station 3	Station 4	Station 5
* <i>Bitbynia badiella</i>	-	+	+	-	-
<i>Bitbynia tentaculata</i>	-	+	+	-	-
* <i>Bulinus truncatus</i>	+	-	-	-	-
<i>Gyraulus convexiusculus</i>	+	+	+	+	+
<i>Gyraulus euphraticus</i>	+	+	+	+	+
* <i>Lymnaea auricularia</i>	+	+	-	-	-
<i>Lymnaea gedrosiana</i>	+	+	+	+	+
* <i>Lymnaea pereger</i>	+	+	+	+	-
* <i>Lymnaea stagnalis</i>	+	+	+	+	-
<i>Lymnaea truncatula</i>	+	+	+	+	+
<i>Melanoides tuberculata</i>	+	+	+	+	+
<i>Melanopsis costata</i>	+	+	+	+	-
<i>Melanopsis doriae</i>	+	+	+	+	-
* <i>Melanopsis nodosa</i>	+	+	+	+	-
<i>Melanopsis praemorsa</i>	+	+	+	+	-
* <i>Planorbis carinatus</i>	+	+	-	-	-
* <i>Planorbis intermixtus</i>	+	+	+	+	+
<i>Planorbis planorbis</i>	+	+	+	+	+
<i>Physa acuta</i>	+	+	+	+	+
<i>Theodoxus euphraticus</i>	+	+	-	-	-
Total	18	19	16	14	8

* Species reported for the first time from Parishan Lake.

Table 3. Distribution of freshwater snails at various stations of Parishan Lake.

Name of species	Station 1	Station 2	Station 3	Station 4	Station 5	Remarks
Family Bithyniidae						
<i>Bithynia badiella</i>	-	+	+	-	-	Shell with animal
<i>Bithynia tentaculata</i>	-	+	+	-	-	Shell with animal
Family Planorbidae						
<i>Bulinus truncatus</i>	+	-	-	-	-	Empty shells
<i>Gyraulus convexiusculus</i>	+++	+++	+++	+++	+	Shell with animal
<i>Gyraulus euphraticus</i>	+++	+++	+++	+++	+	Shell with animal
<i>Planorbis carinatus</i>	+	+	-	-	-	Shell with animal
<i>Planorbis intermixtus</i>	+++	+++	+++	+++	+	Shell with animal
<i>Planorbis planorbis</i>	+++	+++	+++	+++	+	Shell with animal
Family Lymnaeidae						
<i>Lymnaea auricularia</i>	+	+	-	-	-	Shell with animal
<i>Lymnaea gedrosiana</i>	+++	+++	+++	+++	+	Shell with animal
<i>Lymnaea pereger</i>	++	++	++	++	-	Shell with animal
<i>Lymnaea stagnalis</i>	++	++	++	++	-	Shell with animal
<i>Lymnaea truncatula</i>	+++	+++	+++	+++	+	Shell with animal
Family Thiariidae						
<i>Melanooides tuberculata</i>	+++	+++	+++	+++	+	Shell with animal
<i>Melanopsis costata</i>	++	++	++	++	-	Shell with animal
<i>Melanopsis doriae</i>	++	++	++	++	-	Shell with animal
<i>Melanopsis nodosa</i>	++	++	++	++	-	Shell with animal
<i>Melanopsis praemorsa</i>	++	++	++	++	-	Shell with animal
Family Physidae						
<i>Physa acuta</i>	+++	+++	+++	+++	+	Shell with animal
Family Neritidae						
<i>Theodoxus euphraticus</i>	+	+	-	-	-	Shell with animal

- = Absent
 + = Rare (1-5)
 ++ = Abundant (6-50)
 +++ = Most abundant (more than 50)

***Planorbis intermixtus* (Linnaeus, 1758)**

Shell size for this species was recorded at between 2.6 × 12.8 mm. The diameter and height of the shell rarely reach 20 mm and 3 mm, respectively. Adult shells have 5-6 flat whorls, sometimes with a lateral carination. This taxon is collected only from stations 1 and 2.

Genus *Gyraulus* Agassiz in Oharpenier, 1837
***Gyraulus euphraticus* (Mousson, 1874)**

The diameter and height of the adult shells are less than 7 mm and 2 mm, respectively. Fully grown shells bear 3½-4¾ whorls. The shell surface smooth and no sculpture is visible. Stylet is present on the tip of the penis. Vergic sheath as long or little larger than praeputium. This taxon is collected from all the stations.

***Gyraulus convexiusculus* (Hutton, 1849)**

The diameter and height of the adult shells are 5 mm and 1.2 mm respectively. The shell is small, flattened and the whorls do not increase in diameter as rapidly as in *Gyraulus costulatus*. The species has a weak angulation near the middle of the early whorls. The last whorl is almost evenly curved. There is a somewhat coarse spiral sculpture on most of the specimens (Wright, 1963; Brown and Wright, 1980). This taxon is collected from all the stations.

Family Physidae

The adult shell is medium, sinistral and glossy with a shallow suture. Neither haemoglobin nor pseudobranch is present. Transverse rows of V shaped radula and central tooth multicuspid.

Genus *Physa* Draparnaud, 1801
***Physa acuta* Draparnaud, 1805**

Shell size is between 9 × 15 mm. Adult shells bear a sharp apex and shallow suture. Transverse rows of V-shaped radula. Small preputial gland present (in contrast to *physa fontinalis* and *Aplex* spp). This taxon

was collected from all the stations of Parishan Lake.

Family Lymnaeidae

Shell dextral, small to large, two flat triangular tentacles and unicuspid central tooth are characteristic of this family. There is only one genus, namely *Lymnaea*, with 5 species in Parishan Lake.

Genus *Lymnaea* Lamarck, 1799

***Lymnaea truncatula* (Muller, 1774)**

Shell size is between 4.5 × 9 mm. Adult shell rarely reaches 10 mm in height and consists of a blunt apex, 5-6 convex whorls, a deep suture and a fold on columella and umbilicus. Penial sac is shorter than prepatium. This Lymnid gastropod is present in all the stations of Parishan Lake.

***Lymnaea stagnalis* (Linne, 1757)**

Shell size is between 29 × 54 mm. Adult shells are large with a sharp apex, slender spire and imperforate body whorl. Fully grown shells also consist of 7-8 whorls, a bulgy body whorl and ear-shaped aperture. This gastropod is collected from stations 1, 2, 3 and 4 of Parishan Lake.

***Lymnaea pereger* (Muller, 1774)**

Shell size is between 8.5 × 15 mm. Shell is medium with a longer spire and smaller aperture compared with the *L. auricularia* group. The best criterion for discrimination is the short duct of the seminal receptacle (in contrast to a long duct for *L. auricularia* complex). The animal is collected from stations 1, 2, 3 and 4 of Parishan Lake.

***Lymnaea auricularia* group**

This group of snails are very similar in shell shape and anatomical features and are as follows.

***Lymnaea auricularia* (Linne, 1758)**

Shell size is between 14.5 × 18.2 mm, medium with a small spire and sharp apex, large body whorl,

sometimes ear-shaped aperture. This species was collected from stations 1 and 2 of Parishan Lake.

***Lymnaea gedrosiana* Annandale and Prasad, 1919**

Shell size is between 8 x 13.4 mm. The adult shell resembles *L. pereger* and *L. auricularia* and can be differentiated by dissection and observing the long duct of the seminal receptacle. It is settled at all of the sites on Parishan Lake.

Discussion

There are approximately 5000 species of freshwater snails that inhabit Lakes, ponds and streams worldwide (Abbott, 1950). Most are members of the subclasses Pulmonata and some of the subclass Prosobranchia.

Both subclasses belong to the class Gastropoda (Thompson, 1984). In Iran, the freshwater snail fauna appears to be poor in species. According to the literature, the number of species so far recorded from different regions of Iran comprises 59 species while its population in Parishan Lake reaches nearly 34% of this number. This paucity of freshwater mollusc species is probably due to a lack of habitat diversity or perhaps also to lack of research. Analysis of the fauna shows that *Lymnaea gedrosiana*, *L. truncatula*, *Physa acuta*, *Cyraulus euphraticus*, *G. convexiusculus*, *Planorbis intermixtus*, *P. planorbis* and *Melanoides tuberculata* are the most widespread species recorded in all the localities sampled, followed by *Lymnaea pereger*, *L. stagnalis*, *Melanopsis costata*, *M. doriae*, *M. nodosa* and *M. praemorsa*, recorded in 45%, 51%,

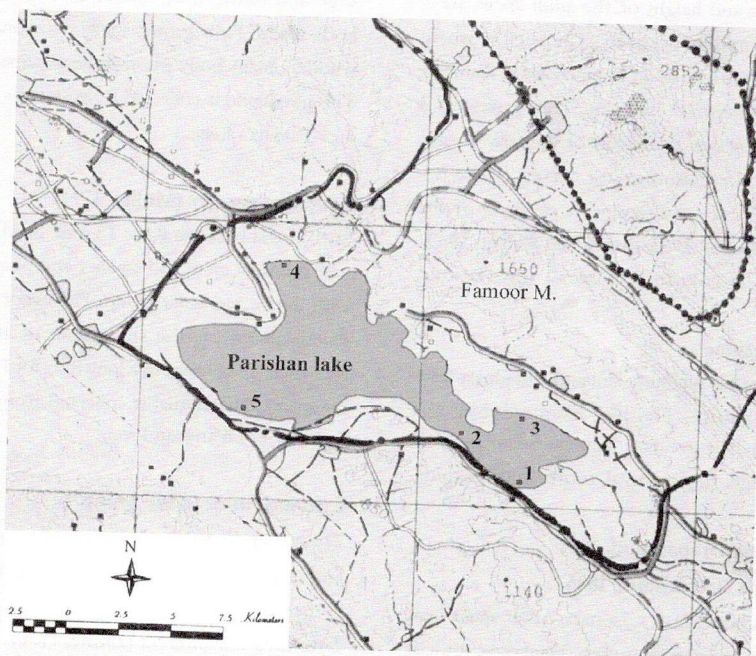


Figure 1. Localities samples in Parishan lake

60%, 57%, 52% and 48% of these species sampled at station 1, 2, 3 and 4 respectively. The other species are rather limited in distribution, occurring in less than 35% of the stations 1, 2 and 3 sampled. The rare species found are as follows: *Theodoxus euphraticus*, *Planorbis carinatus*, *Lymnaea auricularia*, *Bithynia badiella*, *B. tentaculata* and *Bulinus truncatus*.

Of the species recorded, two species are considered intermediate hosts for schistosomiasis: *M. tuberculata* for *S. mansoni* and *B. truncatus* for *S. haematobium* (Brown and Wright, 1980). In addition, *L. auricularia* and *L. truncatula* have been recognized as probable intermediate hosts for *Fasciola* (College of Veterinary Studies, Tehran University).

Station 5 was mostly polluted by pesticide and direct sewage disposal, therefore the distribution and diversity of mollusca were sporadic is whereas a rich molluscan fauna is reported from Station 2 which has the least pollution.

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