

The State of Terrestrial and Freshwater Biodiversity in Jordan: Invertebrates (Annelida and Mollusca)

Zuhair S. Amr

Department of Biology, Jordan University of Science and Technology, Irbid, Jordan

Received: May 2, 2024; Revised: May 20, 2024; Accepted: May 25, 2024

Abstract: Comprehensive lists of recorded species of both phyla Annelida and Mollusca from Jordan are provided. Phylum Annelida includes three classes with a total of twenty-four species, with two new species described from Jordan. Phylum Mollusca contains forty-three species of terrestrial land snails and twenty-five species of freshwater snails.

Introduction

The geographical location of Jordan as the last frontier for Palearctic region allowed for the introduction of species originating from Eurasia and Europe, and those of Arabian affinities that penetrated northwards. Besides, the Levant as a zoogeographical entity enjoys a rich endemic fauna that is restricted either to the Levant or sometimes localized to its southern limit. This is exemplified by several species of earthworms of which two species and a subspecies were described from Jordan (Csuzdi and Pavliček, 2005, Szederjesi *et al.*, 2013). Land snails on the other hand, include several species that are confined to Jordan and Palestine (e.g. *Truncatellina haasi*, *Calaxis hierosolymarum*, *Buliminus marsabensis*, *Euchondrus saulcyi*).

The purpose of this work is to summarize the current knowledge of the invertebrate fauna of Jordan, covering two major phyla: Annelida and Mollusca. All the known species reported in published papers or books are listed and their scientific names are updated. The intention of listing all the known species is to familiarize and provide field biologists and researchers with up-to-date information.

Phylum Annelida

Class Hirudinea

Leeches are of medical and veterinary

importance. Four species of leeches have been recorded from Jordan (Table 1). A list published by Bromley (1994) included records from the Jordan River as well as previous records made by Dia (1983), Kinzelbach and Ruckert (1984), and Ruckert (1985). Damati and Abo-Shehada (1990) reported on six cases of human infestation by leeches in different parts of the country.

Class Oligochaeta

Twenty species and subspecies of earthworms have been recorded from Jordan (Rosa, 1893; Csuzdi and Pavliček, 2005, Pavliček and Csuzdi, 2006; Szederjesi *et al.*, 2013;). Eight species are thought to be introduced. The family Lumbricidae is represented by twelve species, while the families Acanthodrilidae and Ocnerodrilidae are represented by one species for each. *Dendrobaena orientalis karak* (Csuzdi and Pavliček, 2005), *Dendrobaena alexandrii* and *Dendrobaena transjordanica* (Szederjesi *et al.*, 2013) were described from Jordan (Table 2).

Phylum Mollusca

Class Gastropoda

Land snails

The land snails of Jordan have been studied on numerous occasions. Schütt (1983) based his study on a collection made by Dr. Bandel, a geologist who was stationed in Jordan. It includes records for twenty-one species. Petney and Huset (1992) presented the results of a master's thesis prepared by Huset on the land snails of Jordan. Their list includes a total of thirty-one species, mostly from northern Jordan. Recently, Ben-Ami and Sivan (2000) have conducted a survey on the land snails of southern Jordan and included

*Corresponding author: amrz@just.edu.jo

Table 1. Hirudinea species recorded from Jordan.

Family	Species	Reference
Hirudinidae	<i>Limnatis nilotica</i> (Savigny, 1822)	Ruckert (1985)
	<i>Limnatis paluda</i> (Tennent, 1859)	Kinzelbach and Ruckert (1984), Ruckert (1985)
Erpobdellidae	<i>Dina lineata concolor</i> (Annandale, 1913)	Ruckert (1985)
	<i>Trocheta bykowskii</i> Gedroye, 1913	Ruckert (1985)

Table 2. Oligochaeta species recorded from Jordan.

Family	Species	Reference
Lumbricidae	<i>Aporrectodea caliginosa</i> (Savigny, 1826)	Rosa (1893), Csuzdi and Pavliček (2005); Pavliček and Csuzdi (2006), Szederjesi <i>et al.</i> (2013)
	<i>Aporrectodea jassyensis</i> (Michaelsen, 1891)	Rosa (1893), Csuzdi and Pavliček (2005)
	<i>Aporrectodea rosea</i> (Savigny, 1826)	Csuzdi and Pavliček (2005), Pavliček and Csuzdi (2006), Szederjesi <i>et al.</i> (2013)
	<i>Bimastos parvus</i> (Eisen, 1874)	Pavliček and Csuzdi (2006)
	<i>Dendrobaena alexandrii</i> Szederjesi <i>et al.</i> 2013	Szederjesi <i>et al.</i> (2013)
	<i>Dendrobaena byblica</i> (Rosa, 1893)	Csuzdi and Pavliček (2005), Szederjesi <i>et al.</i> (2013)
	<i>Dendrobaena negevis</i> Csuzdi & Pavliček, 1999	Pavliček and Csuzdi (2006), Szederjesi <i>et al.</i> (2013)
	<i>Dendrobaena orientalis karak</i> Csuzdi & Pavliček, 2005	Csuzdi and Pavliček (2005)
	<i>Dendrobaena semitica</i> (Rosa, 1893)	Rosa (1893), Csuzdi and Pavliček (2005), Pavliček and Csuzdi (2006), Szederjesi <i>et al.</i> (2013)
	<i>Dendrobaena transjordanica</i> Szederjesi <i>et al.</i> 2013	Szederjesi <i>et al.</i> (2013)
	<i>Dendrobaena veneta veneta</i> (Rosa, 1886)	Csuzdi and Pavliček (2005), Pavliček and Csuzdi (2006), Szederjesi <i>et al.</i> (2013)
	<i>Eisenia ftida</i> (Savigny, 1826)	Csuzdi and Pavliček (2005)
	<i>Eiseniella neapolitana</i> (Örley, 1885)	Rosa (1893), Csuzdi and Pavliček (2005), Szederjesi <i>et al.</i> (2013)
	<i>Eiseniella tetraedra</i> (Savigny, 1826)	Csuzdi and Pavliček (2005), Szederjesi <i>et al.</i> (2013)
	<i>Healyella syriaca</i> (Rosa, 1893)	Szederjesi <i>et al.</i> (2013)
	<i>Helodrilus patriarchalis</i> (Rosa, 1893)	Rosa (1893), Csuzdi and Pavliček (2005), Szederjesi <i>et al.</i> (2013)
	<i>Metaphire californica</i> (Kinberg, 1867)	Pavliček and Csuzdi (2006)
	<i>Octodrilus transpadanus</i> (Rosa 1884)	Csuzdi and Pavliček (2005), Szederjesi <i>et al.</i> (2013)
Acanthodrilidae	<i>Microscolex dubius</i> (Fletcher, 1887)	Csuzdi and Pavliček (2005), Pavliček and Csuzdi (2006)
Ocnerodrilidae	<i>Ocnerodrilus occidentalis</i> Eisen, 1878	Csuzdi and Pavliček (2005)

records of ten species from southwestern Jordan. Waitzbauer and Petutschnig (2004) presented a zoogeographical analysis of the so far known species from Jordan. They indicated that most of the snail fauna of Jordan is Mediterranean, with few species adapted to arid environments. A brief note on a collection of land snails deposited at the Hebrew University was published by Mienis (1978). The most comprehensive study was undertaken by Neubert *et al.* (2015) with a total of forty-three terrestrial

land snails (Table 3) belonging to fifteen genera in seventeen families (Chondrinidae, Cochlicellidae, Enidae, Ferussaciidae, Helicidae, Hygromiidae, Limacidae, Oxychilidae, Pristilomatidae, Punctidae, Pupiliidae, Pyramidulidae, Spineterochilidae, Subulinidae, Succineidae, Trissexodontidae, and Vertiginidae). Figures (1 and 2) show some land snail species collected from Jordan.

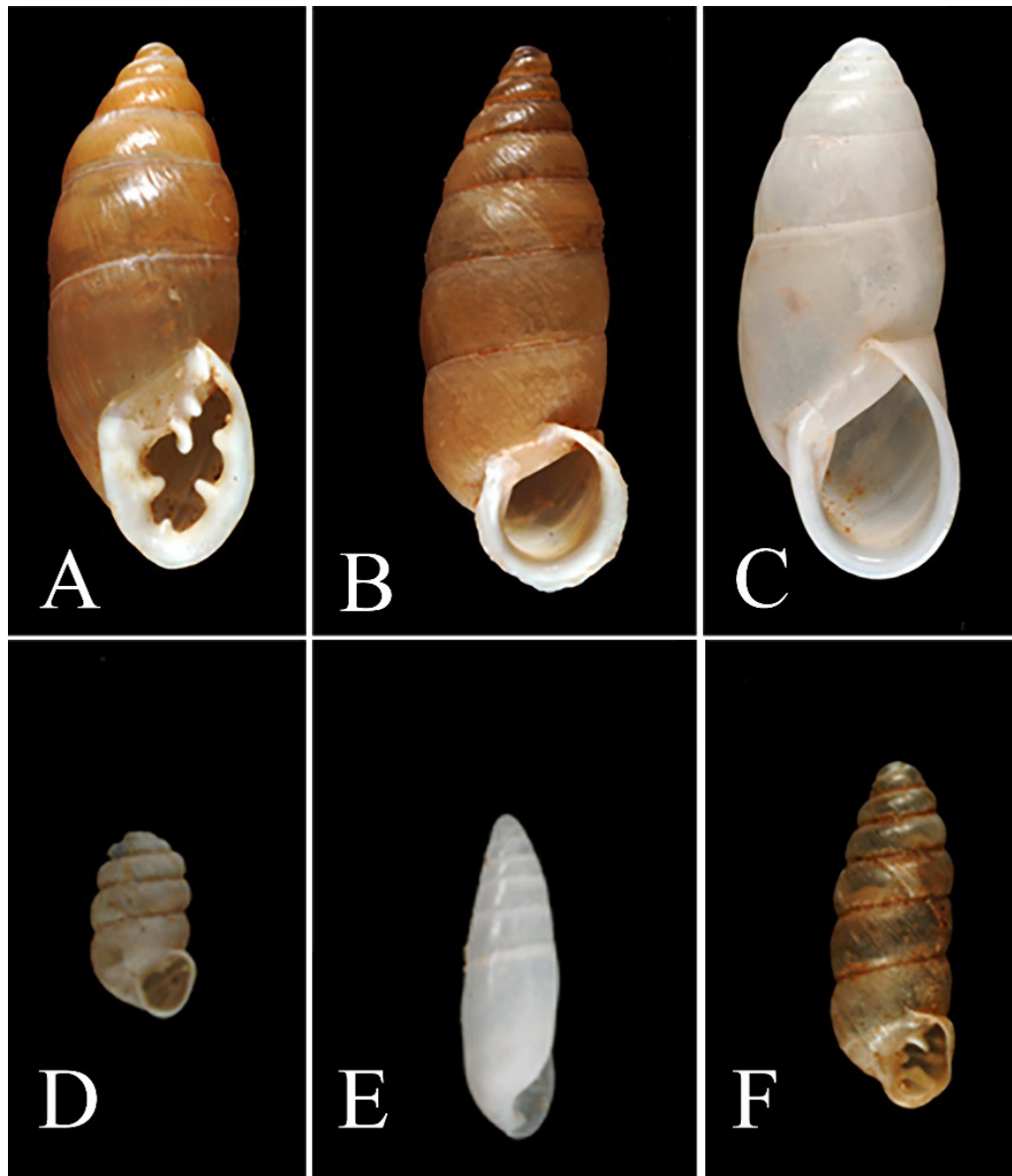


Figure 1. Land snails of Jordan. A. *Euchondrus septemdentatus*. B. *Paramastus episomus*. C. *Buliminus jordani*. D. *Truncatellina haasi*. E. *Calaxis hierosolymarum*. F. *Granopupa granum*.

Freshwater snails (Caenogastropoda and Pulmonata)

Due to their medical importance in disease transmission, the freshwater snails of Jordan have received much attention (Abdel-Azim and Gismann, 1956; Saliba *et al.*, 1976, Burch *et al.*, 1989; Arbaji *et al.*, 1998; Amr *et al.*, 2004 and 2014; Nasarat *et al.*, 2014). The freshwater snail fauna of Jordan consists of twenty-five species (Table 4) belonging to two subclasses of the class Gastropoda (Prosobranchia and Pulmonata). Prosobranchians includes seven families (Bithyniidae, Cochliopidae,

Hydrobiidae, Neritidae, Melanopsidae, Thiaridae and Valvatidae) with eleven genera (*Bithynia*, *Heleobia*, *Falsipyrghula*, *Melanoides*, *Melanopsis*, *Ovatella*, *Plotia*, *Pseudamnicola*, *Pyrgophorus*, *Theodoxus*, and *Valvata*) representing nineteen species. Pulmonates are represented by three families (Lymnaeidae, Physidae and Planorbidae) within six genera and six species. Figures (3 and 4) show some freshwater snail species from Jordan.

Noteworthy records include *Falsipyrghula barroisi* that was reported from the north of King Abdullah Canal (Alhejoj *et al.*, 2017), and *Ovatella myosotis* that was reported

Table 3. Land snail species recorded from Jordan.

Family	Species	Reference
Succineidae	<i>Oxyloma elegans</i> (Risso, 1826)	Neubert <i>et al.</i> (2015)
Pupillidae	<i>Pupoides coenopticus</i> (Hutton, 1834)	Hart (1891), Neubert <i>et al.</i> (2015)
Pyramidulidae	<i>Pyramidula rupestris</i> (Draparnaud, 1801)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
Chondrinidae	<i>Granopupa granum</i> (Draparnaud, 1801)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Rupestrella rhodia</i> (Roth, 1839)	Neubert <i>et al.</i> (2015)
Vertiginidae	<i>Truncatellina haasi</i> Venmans, 1957	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
Enidae	<i>Buliminus jordani</i> (Charpentier, 1847)	Petney and Huset (1992), Ben-Ami and Sivan (2000), Neubert <i>et al.</i> (2015)
	<i>Buliminus diminutus</i> (Mousson, 1861)	Heller (1975), Neubert <i>et al.</i> (2015)
	<i>Buliminus marsabensis</i> Westerlund, 1887	Schütt (1983), Petney and Huset (1992), Ben-Ami and Sivan (2000), Neubert <i>et al.</i> (2015)
	<i>Buliminus negevensis</i> Heller, 1970	Neubert <i>et al.</i> (2015)
	<i>Buliminus sinaiensis</i> Heller, 1970	Neubert <i>et al.</i> (2015)
	<i>Pene bulimoides</i> (L. Pfeiffer, 1842)	Petney and Huset (1992)
	<i>Paramastus episomus</i> (Bourguignat, 1857)	Petney and Huset (1992)
	<i>Euchondrus septemdentatus</i> (Roth, 1839)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Euchondrus saulcyi</i> (Bourguignat, 1852)	Haas (1955), Neubert <i>et al.</i> (2015)
	<i>Euchondrus michonii</i> (Bourguignat, 1853)	Petney and Huset (1992), Ben-Ami and Sivan (2000), Neubert <i>et al.</i> (2015)
	<i>Euchondrus chondriformis</i> (Mousson, 1861)	Petney and Huset (1992)
Ferussaciidae	<i>Calaxis hierosolymarum</i> (Roth, 1855)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Cecilioides genezarethensis</i> Forcart, 1981	Neubert <i>et al.</i> (2015)
	<i>Cecilioides acicula</i> (O. F. MÜLLER, 1774)	Neubert <i>et al.</i> (2015)
	<i>Cecilioides judaica</i> (MOUSSON, 1861)	Neubert <i>et al.</i> (2015)
Subulinidae	<i>Rumina decollata</i> (Linnaeus, 1758)	Neubert <i>et al.</i> (2015)
Punctidae	<i>Paralaoma servilis</i> (Shuttleworth, 1852)	Neubert <i>et al.</i> (2015)
Pristilomatidae	<i>Vitrea contracta</i> (Westerlund, 1871)	Petney and Huset (1992)
Oxychilidae	<i>Eopolita protensa jebusitica</i> (Roth, 1855)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Oxychilus (Hiramia) renanianus</i> (Pallary, 1939)	Neubert <i>et al.</i> (2015)
	<i>Oxychilus (Hiramia) sanctus</i> (Bourguignat, 1852)	Neubert <i>et al.</i> (2015)
Limacidae	<i>Limax flavus</i> Linnaeus, 1758	Neubert <i>et al.</i> (2015)
	<i>Limax ceconii</i> Simroth, 1906	Neubert <i>et al.</i> (2015)
Sphincterochilidae	<i>Sphincterochila prophetarum</i> (Bourguignat, 1852)	(Mienis, 1978), Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Sphincterochila fimbriata</i> (Bourguignat, 1852)	Neubert <i>et al.</i> (2015)
	<i>Sphincterochila zonata zonata</i> (Bourguignat, 1853)	(Petney and Huset (1992), Ben-Ami and Sivan (2000), Mienis, 1978), Neubert <i>et al.</i> (2015)
	<i>Sphincterochila zonata filia</i> (Mousson, 1861)	Bar (1975), Neubert <i>et al.</i> (2015)
	<i>Sphincterochila cariosa</i> (Olivier, 1804)	Neubert <i>et al.</i> (2015)
Cochlicellidae	<i>Cochlicella acuta</i> (O. F. Müller, 1774)	Neubert <i>et al.</i> (2015)
Trissexodontidae	<i>Caracollina lenticula</i> (Michaud, 1831)	Neubert <i>et al.</i> (2015)
Hygromiidae	<i>Monacha obstructa</i> (L. Pfeiffer, 1842)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Monacha crispulata</i> (Mousson, 1861)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Xerocrassa seetzenii</i> (L. Pfeiffer, 1847)	Mienis (1978), Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Xerocrassa simulata</i> (Ehrenberg, 1831)	Petney and Huset (1992), Ben-Ami and Sivan (2000), Neubert <i>et al.</i> (2015)
	<i>Xerocrassa langloisiana</i> (Bourguignat, 1853)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)

Helicidae	<i>Xerocrassa tuberculosa</i> (Conrad, 1852)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Xeropicta krynickii</i> (Krynicky, 1833)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Levantina caesareana</i> (Mousson, 1854)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Levantina lithophaga</i> (Conrad, 1852)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Helix (Pelasga) engaddensis</i> Bourguignat, 1852	Petney and Huset (1992), Neubert <i>et al.</i> (2015)
	<i>Massylaea vermiculata</i> (O. F. Müller, 1774)	Petney and Huset (1992), Neubert <i>et al.</i> (2015)

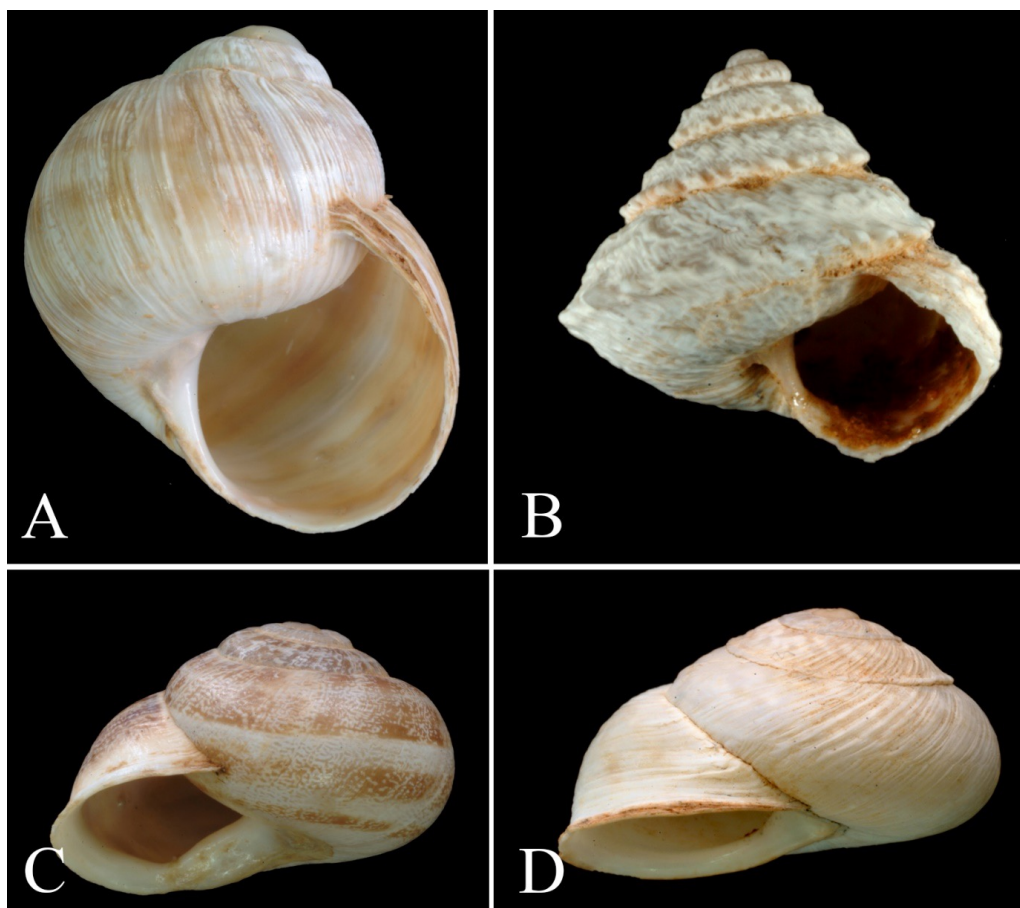


Figure 2. Land snails of Jordan. **A.** *Helix (Pelasga) engaddensis*. **B.** *Xerocrassa tuberculosa* **C.** *Massylaea vermiculata*. **D.** *Levantina caesareana*.

from brackish water spring near Madaba, and from around springs near the Dead Sea (Schütt, 1983).

Class Bivalvia

This class is represented by the Unionidae family in Jordan. So far, four species have been recorded from Jordan (Table 5). Alhejoj *et al.* (2017) studied the freshwater mollusca of the Jordan Valley. (Schütt, 1983) listed few records from Jordan in his comprehensive study on the freshwater mollusca of the Levant. *Unio terminalis* (Bourguignat, 1852) was collected from King Abdullah Canal in the Jordan Valley as well as from the

sediments of the Jordan River (Alhejoj *et al.*, 2017). *Unio semirugatus* (Lamarck, 1819) is a Circum-Mediterranean species. *Corbicula fluminalis* (Müller, 1774) is very common in King Abdullah Canal. It is confined to the Jordan Vally and was not encountered elsewhere in the country. It is believed that *Corbicula*, a south-east Asian species, has been introduced to Jordan only recently (Alhejoj *et al.*, 2017). *Pisidium casertanum* (Poli, 1795) was recorded from Wadi Hisban spring and near the Zarqa River (Schütt, 1983). Nelson (1973) described *Pisidium* sp. from the Azraq Oasis. It seems to be very common in King Abdullah Canal near Abu Habil Mosque and SharHabili (Alhejoj *et al.*, 2017).

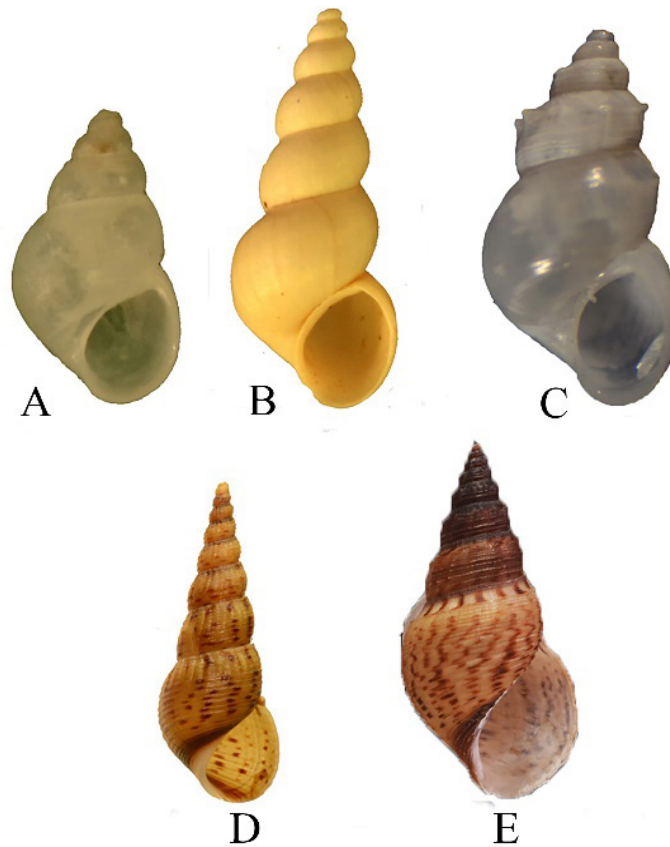


Figure 3. Freshwater snails of Jordan. A. *Heleobia contempta*. B. *Heleobia longiscata*. C. *Pyrgophorus coronatus*. D. *Melanoides tuberculata*. E. *Plotia scabra*.

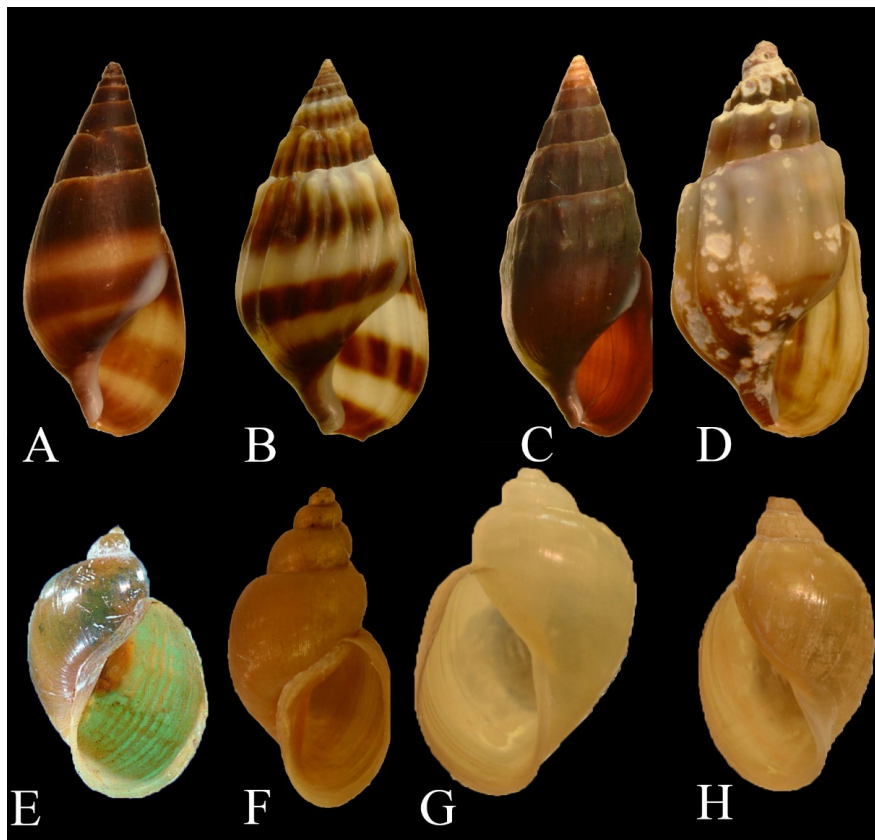


Figure 4. Freshwater snails of Jordan. A. *Melanopsis ammonis*. B. *Melanopsis costata jordanica*. C. *Melanopsis saulcyi*. D. *Melanopsis costata obliqua*. E. *Lymnaea natalensis*. F. *Galba truncatula*. G. *Bulinus truncatus*. H. *Haitia acuta*.

Table 4. Freshwater snail species recorded from Jordan.

Family	Species	Reference(s)
Neritidae	<i>Theodoxus jordani</i> (Sowerby 1844)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Theodoxus macrii</i> (Sowerby 1844)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Valvatidae	<i>Valvata saulcyi</i> Bourguignat 1853	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Bithyniidae	<i>Bithynia philalensis</i> (Conrad 1852)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Hydrobiidae	<i>Falsipyrghula barroisi</i> (Dantzeuberg, 1894)	Alhejoj <i>et al.</i> (2017)
	<i>Globuliana gaillardotii</i> (Bourguignat, 1856)	Burch <i>et al.</i> (1989)
	<i>Pseudamnicola solitaria</i> Tchernov 1971	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Cochliopidae	<i>Heleobia contempta</i> (Dautzenberg 1894)	Burch <i>et al.</i> (1989)
	<i>Heleobia longiscata</i> (Bourguignat, 1856)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Pyrgophorus</i> cf. <i>coronatus</i> (L. Pfeiffer, 1840)	Nasarat <i>et al.</i> (2014)
Thiaridae	<i>Melanoides tuberculata</i> (Müller, 1774)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Plotia scabra</i> (Müller, 1774)	Nasarat <i>et al.</i> (2014)
Ellobiidae	<i>Phytia myosotis</i> (Draparnaud, 1801)	Schütt (1983), Alhejoj <i>et al.</i> (2017)
Melanopsidae	<i>Melanopsis ammonis</i> Tristram, 1865	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Melanopsis buccinoidea</i> (Olivier, 1801)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Melanopsis saulcyi</i> (Bourguignat, 1853)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Melanopsis costata jordana</i> (Roth, 1839)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Melanopsis costata obliqua</i> (Bourguignat, 1884)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Melanopsis costata lampra</i> Bourguignat, 1884	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Lymnaeidae	<i>Galba truncatula</i> (O.F. Müller, 1774)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Lymnaea natalensis</i> Krauss, 1848	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Physidae	<i>Haitia acuta</i> (Draparnaud, 1805)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
Planorbidae	<i>Bulinus truncatus</i> (Audouin, 1827)	Saliba <i>et al.</i> (1976), Burch <i>et al.</i> (1989), Arbaji <i>et al.</i> (1998), Amr <i>et al.</i> (2014)
	<i>Gyraulus piscinarium</i> (Bourguignat, 1852)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)
	<i>Planorbis planorbis</i> (L. 1758)	Burch <i>et al.</i> (1989), Amr <i>et al.</i> (2014)

Table 5. Freshwater bivalves recorded from Jordan.

Family	Species	Reference(s)
Unionidae	<i>Unio terminalis</i> Bourguignat, 1852	Alhejoj <i>et al.</i> (2017)
	<i>Unio semirugatus</i> Lamarck, 1819	Alhejoj <i>et al.</i> (2017)
	<i>Corbicula fluminalis</i> (Müller, 1774)	Alhejoj <i>et al.</i> (2017)
	<i>Pisidium casertanum</i> (Poli, 1795)	Nelson (1973), Schütt (1983), Alhejoj <i>et al.</i> (2017)

References

- Abdel Azim, M. and Gismann, A. 1956. Bilharziasis survey in south- western Asia: Covering Iraq, Israel, Jordan, Lebanon, Sa'udi Arabia, and Syria: 1950-51. *Bull World Health Organization*, **14**:403- 456.
- Alhejoj, I., Bandel, K. and Salameh, E. 2017. Aquatic mollusks: Occurrences, identification and their use as bioindicators of environmental conditions (Salinity, trace elements and pollution parameters) in Jordan. **In: Water Resources in Arid Areas: The Way Forward.** Abdalla, O., Kacimov, A., Chen, M., Al-Maktoumi, A., Al-Hosni, T. and Clark, I. (Eds.), Springer International Publishing AG O.
- Amr Z.S. and Abu Baker, M. 2004. Freshwater snails of Jordan. *Denisia*, **14**:221-227.

- Amr, Z.S., Nasarat, H. and Neubert, E. 2014. Notes on the current and past freshwater snail fauna of Jordan. *Jordan Journal of Natural History*, **1**:83-115.
- Arbaji, A., Amr Z.S., Abbas, A.A., Al-Oran, R.M., Alkharabsheh, S. and Al-Melhim, W.N. 1998. New sites of *Bulinus truncatus* and indigenous cases of urinary schistosomosis in Jordan. *Parasite*, **5**:379-382.
- Bar, Z. 1975. Distribution and habitat of the Genus *Sphincterochila* in Israel and Sinai. *Argamon, Israel Journal of Malacology*, **5**:1-19.
- Ben-Ami, F. and Sivan, N. 2000. A survey of landsnails from southwestern Jordan. *Israel Journal of Zoology*, **46**:181-191.
- Bromley, H.J. 1994. The freshwater leeches (Annelida, Hirudinea) of Israel and adjacent areas. *Israel Journal of Zoology*, **40**:1-24.
- Burch, J.B., Bruce, J.I. and Amr, Z. 1989. Schistosomiasis and malacology in Jordan. *Journal of Medical & Applied Malacology*, **1**:139-163.
- Csuzdi, C. and Pavlíček, T. 2005. The earthworms (Oligochaeta) of Jordan. *Zoology in the Middle East*, **34**:71-78.
- Damati, M.T. and Abo-Shehada, M.N. 1990. Nose and throat leech infestation: A report of six cases from Jordan. *Annals of Saudi Medicine*, **10**:573-575.
- Dia, A. 1983. Recherches sur l'écologie et la biogéographie des cours d'eau du Liban Méridional. Ph.D. thesis, University of Marseille. 302 pp.
- Kinzelbach, R. and Ruckert, F. 1984. Annelida of Saudi Arabia. The leeches (Hirudinea) of Saudi Arabia. *Fauna of Saudi Arabia*, **6**:155-161.
- Mienis, H. K. 1978. Note on a small collection of landsnails from Jordan. *Levantina*, **16**:183.
- Nasarat, H., Amr, Z.S. and Neubert, E. 2014. Two new invasive freshwater snails to Jordan. *Zoology in the Middle East*, **60**:46-49.
- Nelson, B. 1973. **Azraq: Desert Oasis**. Penguin Books, London.
- Neubert, E., Amr, Z.S., Waitzbauer, W. and Al Talafha, H. 2015. Annotated checklist of the terrestrial gastropods of Jordan (Mollusca: Gastropoda). *Archiv für Molluskenkunde*, **144**:169-238.
- Pavlíček, T. and Csuzdi, C. 2005. Earthworm fauna of Jordan - A review. In: **Advances in Earthworm Taxonomy II (Annelida: Oligochaeta)**. Proceedings of the 2nd International Oligochaeta Taxonomy Meeting dedicated to Victor Pop. 4-8 September 2005, pp. 183-188.
- Szedzerjesi, T., Pavlíček, T. and Csuzdi, C. 2013. New earthworm species from Jordan (Oligochaeta, Lumbricidae). *Acta Zoologica Academiae Scientiarum Hungaricae*, **59**: 391-400.
- Petney, T.N. and Huset, H.C. 1992. A species and distribution list of landsnails of Jordan. *Argamon, Israel Journal of Malacology*, **10**:1-14.
- Rosa, D. 1893. Viaggi del Dr. E. Festa in Palestina nel Libano e regioni vicine. *Bollettino del Museo regionale di Scienze Naturali Torino*, **8**(160):1-14.
- Ruckert, F. 1985. Egel aus den Levante-Ländern (Clitellata: Hirudinea). *Senckenbergiana Biol.*, **66**:135-152.
- Saliba, E., Masadeh, A. and Tawfeek, M. 1976. First record of *Bulinus truncatus* in Jordan, *Annals Tropical Medicine & Parasitology*, **70**:369-370.
- Schütt, H. 1983. Die Molluskenfauna der Süßgewässer im Einzugsgebiet des Orontes unter Berücksichtigung benachbarter Flußsysteme. *Archiv für Molluskenkunde*, **113**:1-91. Frankfurt a.M
- Schütt, H. 1983. Die bisher aus Jordanien bekannten süßwasser- und landbewohnenden Mollusken anhand der Aufsammlungen von Dr. Bandel 1978. *Natur und Mensch*, **1983**: 49-64.
- Waitzbauer, W. and Petutschnig, B. 2004. Die Landschnecken Jordaniens (Mollusca, Gastropoda, Stylommatophora). *Denisia*, **14**:229- 236