CAVE AND SUBTERRANEAN SNAILS OF TURKEY

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Abstract. Cave and subterranean snails recorded from Turkey are listed and brief explanations about the taxa and their distributional records are given. Of 62 species and subspecies having been recorded according to literature data and field findings from caves and subterranean habitats in Turkey, 13 (20.96%) are found in subterranean habitats, 7 (11.29%) species are true cave inhabitants and the remaining 42 species (67.74%) are considered to be trogloxene.

Keywords: cave, subterranean, land snails, Turkey.

Rezumat. Melcii de peşteră şi subterani din Turcia. Sunt enumeraţi melcii subterani şi cavernicoli înregistraţi în Turcia şi se dau scurte explicaţii despre taxonii respectivi şi distribuţia lor. Din cele 62 specii şi subspecii raportate, 13 specii (20,96 %) se găsesc în habitate subterane, 7 specii (11,29 %) sunt cavernicole propriu-zise şi 42 de specii (67,74 %) sunt considerate specii trogloxene.

Cuvinte cheie: peşteră, subterani, melci tereştri, Turcia.

INTRODUCTION

Land snails tend to inhabit limestone crevices due to the need for extra moisture and freshwater snails can be found in water bodies fed by karstic aquifers; some of these species are adapted to caves or subterranean habitats. The troglofauna of the caves in Turkey is poorly known and the studies on cave snails are also insufficient. The study of BOETTGER (1957) is the only comparable one to the present study, in which he dealt with gastropod records from some caves in Turkey and described the only cave freshwater gastropods known to date from Turkey: *Pseudamnicola lindbergi* BOETTGER 1957 from Kahramanmaraş Province and *Belgrandiella cavernica* BOETTGER 1957 from Zonguldak Province. Roughly, three decades later, two pristiomatid taxa *Vitrea lodosi* RIEDEL, 1984 and *Lindbergia karainensis* RAHLE & RIEDEL, 1987 have been described, latter being the only land snail species exclusively known from caves in Turkey. Since then no other cave dwelling gastropod taxa have been discovered in Turkey.

To prevent confusions due to old taxonomy in previous papers and to give an updated view of the current knowledge about cave and subterranean land snails of Turkey, the following study is presented.

MATERIALS AND METHODS

Using available literature and field observations, cave and subterranean records of the land and freshwater snails of Turkey are evaluated and a list of the determined taxa was compiled.

RESULTS AND DISCUSSIONS

A total of 62 species and subspecies are compiled according to literature data and field findings from caves and subterranean habitats in the list of cave and subterranean snails of Turkey (Tables 1 and 2); 6 of these species are aquatic and the remaining 56 are terrestrial species. In the tables, each family to which the listed species belong is given a separate line and within a line, shading is used to clarify sequential separation between different sources.

Table 1. The cave dwelling aquatic snails in Turkey
(S: Stygobiont, empty cells in habitat column indicate stygoxenes, [E]: endemic).

	Species	Habitat	Source
1	*Theodoxus euxinus* (CLESSIN, 1885)		BOETTGER, 1957
2	*Pseudamnicola lindbergi* BOETTGER, 1957 **[E]**	S	
3	*Belgrandiella cavernica* BOETTGER, 1957 **[E]**		
4	*Galba truncatula* (MÜLLER, 1774)		
5	*Planorbis planorbis* (LINNAEUS, 1758)		
6	*Physella* (*Costatella*) *acuta* DRAPARNAUD, 1805		Original data

Of the 6 aquatic taxa, 3 species are prosobranchs and the remaining 3 are basommatophorans. According to the distributional patterns of the genus *Theodoxus* in Turkey, the record of *Theodoxus anatolicus* from Yarımburgaz Cave in the European part of Istanbul should be corrected as *T. euxinus*. Records of further two basommatophoran taxa which are recorded also by BOETTGER (1957), *Anisus spirorbis* (LINNAEUS, 1758) and *Gyraulus ehrenbergi* (BECK, 1837), are assumed to be dubious on the taxonomic grounds and thus they are not enlisted. *Physella acuta* observed in Kaklık cave (Denizli Province) is an additional record. The two hydrobiid species described by BOETTGER (1957), *Pseudamnicola lindbergi* BOETTGER 1957 from Kahramanmaraş Province and *Belgrandiella cavernica* BOETTGER 1957 from

Zonguldak Province, are the only stygobiont gastropod species discovered so far in Turkey. *B. cavernica* probably disappeared from its type locality as several visits to find the species revealed no results. *P. lindbergi* has not been relocated either.

Table 2. The cave dwelling and subterranean land snails in Turkey (C: Cave dwelling, ST: Subterranean, sST: semi-subterranean, empty cells in habitat column indicate probable trogloxenes, [E]: endemic).

	Species	Habitat	Source
1	*Pomatias elegans* (MÜLLER 1774)		BOETTGER, 1957
2	*Pomatias rivulare (*EICHWALD, 1829)		STROUHAL, 1971
3	*Orculella bulgarica bulgarica* (HESSE, 1915)		HAUSDORF, 1996
4	*O. sirianocoriensis sirianocoriensis* (MOUSSON, 1854)		
5	*Pagodulina pisidica* SCHÜTT, 1993 **[E]**		
6	*Pleurodiscus balmei* (POTIEZ & MICHAUD, 1838)		BOETTGER, 1957
7	*Pseudochondrula sebasteana* (FORCART, 1940) **[E]**		SCHÜTT, 2005
8	*P.blanda hedjinensis* (KOBELT, 1907) **[E]**		
9	*Chondrus tournefortianus* (FÉRUSSAC, 1821) **[E]**		BOETTGER, 1957
10	*C. zebrula zebrula* OLIVIER, 1801 **[E]**		
11	*Zebrina kindermanni kindermanni* (PFEIFFER, 1850)		STROUHAL, 1971
12	*Calaxis hierosolymarum* (ROTH, 1855)	ST	SCHÜTT, 2005
13	*Cecilioides* (*Cecilioides*) *acicula* (MÜLLER 1774)		
14	*C. (C.) minuta* (MOUSSON, 1874)		
15	*C. (C.) raddei* (BOETTGER, 1879)		
16	*C. (C.) subsaxana* (BOURGUIGNAT, 1856)		
17	*C.* (*C.*) *tumulorum* (BOURGUIGNAT, 1856)	ST	BOETTGER, 1957; SCHÜTT, 2005
18	*Vitrea contracta* (WESTERLUND, 1871)		SCHÜTT, 2005
19	*Vitrea ernesti* RIEDEL & SUBAI, 2004 **[E]**		RIEDEL, 1995; RIEDEL & SUBAI, 2004
20	*Vitrea lodosi* RIEDEL, 1984 **[E]**	C	RIEDEL, 1984, 1995
21	*Lindbergia karainensis* RAHLE & RIEDEL, 1987 **[E]**	C	RAHLE & RIEDEL, 1987
22	*Gollumia applanata* SCHÜTT, 2001 **[E]**		SCHÜTT, 2005
23	*Oxychilus* (*Ortizius*) *subeffusus* (BOETTGER, 1879)	ST	SCHÜTT, 2005
24	*O.* (*Longiphallus*) *deilus* (BOURGUIGNAT, 1857)		RIEDEL, 1995
25	*O.* (*Morlina*) *moussoni* (KOBELT, 1878) **[E]**		RIEDEL, 1959, 1984
26	*O.* (*M.*) *urbanskii* RIEDEL, 1963		RIEDEL, 1984; SCHÜTT, 2005
27	*O.* (*Mediterranea*) *hydatinus* (ROSSMÄSSLER 1838)		RIEDEL, 1984
28	*O.* (*Mediterranea*?) *aliatahani* RIEDEL, 1984 **[E]**		RIEDEL, 1984, 1995
29	*O.* (*Schistophallus*) *investigatus* RIEDEL, 1993	C	SCHÜTT, 2005
30	*O.* (*S.*) *kobelti* (LINDHOLM, 1910)	C	RIEDEL, 1972, 1984; SCHÜTT, 2005
31	*O.* (*S.*) *samius* (MARTENS, 1889)	C	RIEDEL, 1984; SCHÜTT, 2005
32	*O.* (*Hiramia*) *camelinus* (BOURGUIGNAT, 1852)		BOETTGER, 1957; RIEDEL, 1995
33	*O.* (*H.*) *cyprius* (PFEIFFER, 1847)		BOETTGER, 1957; RIEDEL, 1959
34	*O.* (*H.*) *nordsiecki* RIEDEL, 1999 **[E]**		BOETTGER, 1957; SCHÜTT, 2005
35	*O.* (*H.*) *paphlagonicus* RIEDEL, 1993 **[E]**		Original data
36	*O.* (*Retowskiella*) *crenimargo* RETOWSKI, 1889	sST	SCHÜTT, 2005
37	*Eopolita protensa tenerrima* (HESSE, 1914)		BOETTGER, 1957; RIEDEL, 1959, 1984, 1995)
38	*Discoxychilus lindholmi* RIEDEL, 1966	sST	SCHÜTT, 2005
39	*Daudebardia* (*Daudebardia*) *rufa rufa* (DRAPARNAUD, 1805)		RIEDEL, 1995
40	*Carpathica* (*Lotharia*) *wirthi* FORCART, 1971		RIEDEL, 1984

Table 2 (continued). The cave dwelling and subterranean land snails in Turkey (C: Cave dwelling, ST: Subterranean, sST: semi-subterranean, empty cells in habitat column indicate probable trogloxene, [E]: endemic).

	Species	Habitat	Source
41	*Turcozonites megistus* (ROLLE, 1894)		RIEDEL, 1995
42	*Drilolestes retowskii* (BOETTGER, 1884)		FORCART, 1983
43	*Nothoserrulina subterranea* NÉMETH & SZEKERES, 1995 **[E]**	ST	NÉMETH & SZEKERES, 1995
44	*Dobatia goettingi goettingi* (BRANDT, 1961)		NORDSIECK, 2004
45	*D. multidentifera anamurensis* NORDSIECK, 1994 **[E]**	ST	NORDSIECK, 1994
46	*D. m. multidentifera* NEUBERT, 1992 **[E]**	ST	NEUBERT, 1992
47	*Pravispira serrulosa* (RETOWSKI, 1889) **[E]**	ST	SCHÜTT, 2005
48	*Cristataria colbeauiana* (PFEIFFER, 1861) **[E]**		BOETTGER, 1957
49	*Strumosa strumosa strumosa* (PFEIFFER, 1848) **[E]**		BANK & MENKHORST, 1994
50	*S. s. meridiana* SCHÜTT, 2001 **[E]**		SCHÜTT, 2005
51	*Phrygica euxinaeformis* NORDSIECK, 1994 **[E]**		NORDSIECK, 1994
52	*Sprattia blissi blissi* (BOETTGER, 1899) **[E]**		NORDSIECK, 2004
53	*Euxina* (*Euxina*) *persica* (BOETTGER, 1879)		BANK & MENKHORST, 1994
54	*Elia* (*Elia*) *moesta (*ROSSMÄSSLER, 1839)		
55	*E.* (*Acroeuxina*) *huebneri huebneri* (PFEIFFER, 1848)		
56	*Metafruticicola proclivis* (MARTENS, 1889) **[E]**		SCHÜTT, 2005

Most of the land snails recorded are trogloxenes, in other words normally epigeic species that can enter caves (Table 2). The families Pomatiidae, Orculidae, Pleurodiscidae, Zonitidae, Trigonochlamydidae and Hygromiidae are represented only by trogloxene species.

The subfamily Gastrodontoidea s.s. is well represented in troglofauna and subterranean fauna of the Western Palearctic Region; similarly, most of the cave adapted land snail taxa in Turkey (n=23, 41%) belong to the families Pristilomatidae and Oxychilidae of the superfamily. *L. karainensis* is presumably troglobitic as it is exclusively reported from several caves in Antalya Province. Other species can be found outside caves as well. Among these, members of the subgenus *Schistophallus* and *Vitrea lodosi* are exceptional in their troglophilic tendencies. *Gollumia applanata*, which was described from the entrance of from Cennet Cehennem Caves, is probably also a troglophilic species.

All members of Ferussaciidae represented in Turkey have subterranean tendencies (SCHÜTT, 2005) and they are remarkable with their ability to dig deep in soil. The subterranean mode of life is also observed in some Oxychilidae species and typically in Clausilidae subfamily Serrulininae.

CONCLUSIONS

Of 62 land and freshwater snail species, which have been recorded from caves and subterranean habitats of Turkey, 7 species are cave adapted and 42 (67.74 %) are trogloxenous, while 13 species are found in subterranean habitats.

The present study will serve as a basis for future studies of cave research. Being among the dominant groups of subterranean and cave environment, gastropods can be important indicators of the ecological health in sensitive cave ecosystem and state of chemical cycles in soil. Most of the caves in Turkey is biologically unexplored and future studies may reveal actual diversity of cave snails in Turkey. Most troglofaunal elements and stygofauna in particular are very susceptible to human interference and the taxonomical exploration of the group may also contribute to their conservation studies.

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