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Slugs (Gastropoda: Pulmonata) of the Lakes Region (Göller Bölgesi) in Turkey

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Abstract: Three families (Limacidae, Agriolimacidae and Milacidae) and 7 species, (*Limacus flavus*, *Deroceras reticulatum*, *Deroceras berytensis*, *Mesolimax brauni*, *Mesolimax escherichi*, *Milax cf. altenai* and *Tandonia budapestensis*) were identified from Lakes Region (Isparta, Burdur, and Afyon provinces). These include 1 endemic genus with 2 species. In this study some new habitat information and morphological data of the species are given. Additionally, *Deroceras reticulatum*, *D. berytensis* and *Milax cf. altenai* are new records for the area.

Key Words: Slug, Göller Bölgesi, Turkey

Göller Bölgesi (Türkiye)'nin Sümüklü Böcekleri (Gastropoda: Pulmonata)

Özet: Göller Bölgesi'nde (Isparta, Burdur, ve Afyon illeri) 3 familyaya ait (Limacidae, Agriolimacidae ve Milacidae) 7 türün (*Limacus flavus*, *Deroceras reticulatum*, *Deroceras berytensis*, *Mesolimax brauni*, *Mesolimax escherichi*, *Milax cf. altenai* ve *Tandonia budapestensis*) yayılış gösterdiği belirlenmiştir. Bunların içinde iki türe sahip bir cins endemiktir. Bu çalışmada türlere ait bazı yeni habitat bilgileri ve morfolojik bilgiler verilmektedir. *Deroceras reticulatum*, *D. berytensis* ve *Milax cf. altenai* çalışma sahası için yeni kayıtlıdır.

Anahtar Sözcükler: Sümüklüböcek, Göller Bölgesi, Türkiye

Introduction

Slug is the common name for gastropods of various origins bearing no shells. The absence of a shell provides agility and space for organs, but also means dependence on humid places. They live on mostly omnivorous or herbivorous diets and certain species are considered serious agricultural pests, e.g., for vegetables, when numerous (Likharev and Rammelmeier, 1962; Kerney and Cameron, 1979).

The families Agriolimacidae and Milacidae possess more species than the remaining groups in the Palaeartic region; therefore these are of most taxonomic significance. The mediterranean area, in a broad sense, especially from the Balkans to the Caucasus, is thought to be the original range or at least a refugium for many taxa in all families concerned.

Forty-seven slug species belonging to 5 families were identified from Turkey. Although species richness is very high compared to that of many countries in the Palaeartic region, Turkey is among the least known in terms of its slug fauna and a lot more information is needed about its fauna (Simroth, 1899; Wiktor, 1971, 1983, 1984, 1987, 1994, 1996, 1997, 2000; Schütt, 2001).

Characteristics of the study area

The Lakes Region of south-western Turkey is surrounded to the south by the western ranges of the Taurus mountains, uplifting of which formed Antalya Bay in the south and the region in the north shifted northwards. Its topography is composed of narrow and long mountain ranges surrounding depression areas most of which have changed into lakes. These lakes are in a line

parallel to Lake Eğirdir. The altitude is relatively high, decreasing slightly in depression areas like Burdur and Eğirdir (Table).

The coordinates and altitudes of the locations are given in the Table.

Materials and Methods

The material consists of 97 specimens collected between 5.5.1993 and 5.2.2003 from the localities shown in Figure 1. Of the specimens examined, most were juveniles. Adult specimens were dissected and identified under a stereomicroscope. Standard collecting and dissection techniques were used (Kerney and Cameron, 1979; Wiktor, 2000). Sampling sites and dates are given within the locality information.

Results and Discussion

Seven species were identified: *Limacus flavus*, *Deroceras reticulatum*, *Deroceras berytensis*, *Mesolimax brauni*, *Mesolimax escherichi*, *Milax cf. altenai* and *Tandonia budapestensis*. Of these, the first, fourth, fifth and *Tandonia cretica* (SIMROTH 1885) were recorded from the area in previous studies. *Deroceras reticulatum*, *D. berytensis* and *Milax cf. altenai* are new records for the region. The habitats and morphology of local populations of *Mesolimax* spp. are described here for the first time.

Our results show that *Mesolimax brauni* and *escherichi* attain larger sizes than those in previous records.

Family Limacidae

Limacus flavus (LINNEAUS, 1758) (Figure 2.1)

Description: Length normally up to 120 mm in living and up to 80 mm in preserved specimens (largest measured as 85.74 mm in Isparta samples). Dorsum roundish, skin with fine wrinkles (ca. 22-23 between pneumostome and median line).

Penis curved like "s" or "c", not reaching half the body length. Spermatheca is attached to oviduct unlike the similar species *L. maculatus*.

Localities: Isparta: Eğirdir (vineyards) (n = 2, 12.03.1998), Eğirdir (İstasyon district) (n = 6, 12.03.1998), Pınargözü cave (n = 1, 07.05.1999), Sütçüler (n = 24, 18.10.1999), Kaplanlı village (n = 3, 14.06.1998), **Burdur:** Başpınar (n = 1, 10.06.2002), **Afyon:** Uzunpınar village (n = 1, 04.02.2003),

Distribution: This is a widespread European species recorded from Great Britain, Ireland, the Netherlands, France, Germany, the former Yugoslavia, Austria, Slovakia, Hungary, Italy, Poland, the western former Soviet Union and Caucasus, Romania, Bulgaria, Greece and Syria. In Turkey, it is the most widespread slug; previous records are from İstanbul (Üsküdar), İzmir, Bolu, Ankara (Hacılar), Zonguldak, Sinop, Muğla, Burdur,

Table. Approximate geographical coordinates and altitudes of localities.

	Localities	Latitude	Longitude	Altitude (m)
1	Başpınar	37° 10,43' N	30° 5,59' E	1566
2	Çandır	37° 21,65' N	30° 53,20' E	884
3	Eğirdir	37° 52' N	30° 51' E	916
4	Hüyüklü town	38° 13,71' N	31° 5,95' E	1062
5	Isparta-Dere district	37° 45,80' N	30° 32,83' E	1100
6	Isparta-İstasyon district	37° 46,11' N	30° 34,11' E	1083
7	Kaplanlı Village	37° 21,15' N	30° 53,58' E	1188
8	Kocapınar	37° 32,30' N	29° 59,04' E	1244
9	Pınargözü cave	37° 42,55' N	31° 23,41' E	1152
10	SDU campus	37° 51,13' N	30° 30,98' E	1026
11	Sütçüler	37° 29,10' N	30° 59,73' E	1244
12	Uluborlu	38° 4,24' N	30° 27,20' E	1031
13	Uzunpınar village	38° 22,27' N	30° 40,67' E	1168
14	Yakasinek village	38° 32,57' N	31° 10,53' E	1182

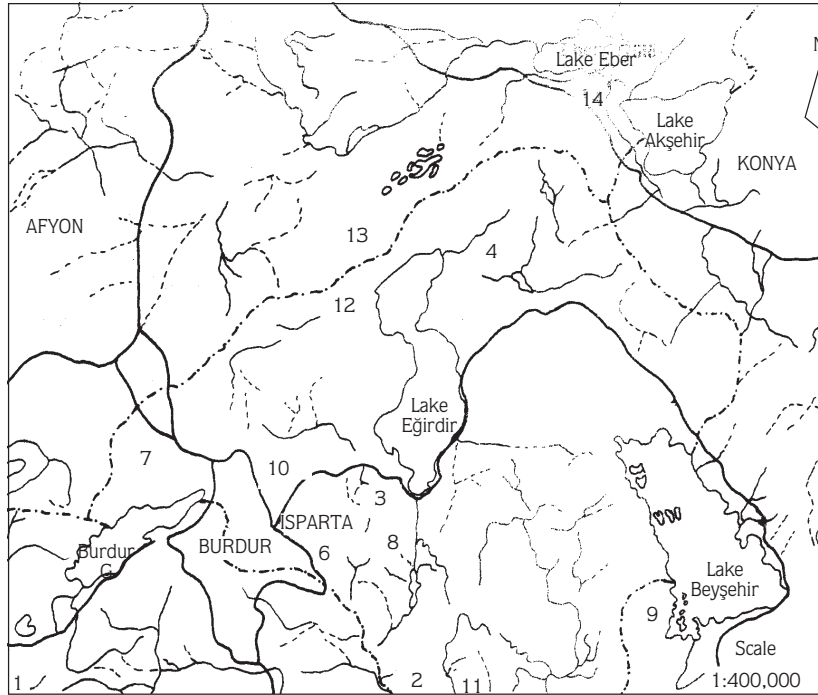


Figure 1. Locality map. (Localities are numbered in alphabetical order and their names are given in the Table).

Isparta (Eğirdir), Antalya, Adana, Kayseri, Zonguldak, Samsun, Trabzon (Derbent), Erzurum (Oltu), Diyarbakır, Mardin, Siirt and Bitlis (Wiktor, 1971, 2000; Schütt, 2001).

Habitat: Near human settlements: in cellars, woods, gardens, parks, and vineyards. In Turkey, it is found also in natural habitats; Turkey is thought to be a part of its original range.

Family Agriolimacidae

Deroceras reticulatum (MÜLLER, 1774) (Figure 2.5)

Description: Size up to 30.8 mm (on average ca. 24 mm). Body is light brown with small dark spots up to the dorsum and a reticulate pattern towards the sides of the back. Mantle in some examples chocolate brown, contrasting with light, broad marginal belt.

Genital system is highly variable penial in glands and penis. In general, penis sack-shaped with a median constriction lacking when immature. Penis upper edge is angular due to presence of the large conical stimulator. Penial glands, with 2 minute and 3 long, papillose branches, are present. Vas deferens is connected to the

rear side of the penis. Rectal caecum is 3 times longer than it is broad.

Localities: Isparta: Yalvac-Hüyüklü town (n = 6, 29.12.1997), Afyon: Yakasinek village (n = 5, 05.02.2003).

Distribution: As a synanthrope, it spreads throughout Europe (to the south synanthropism is becoming remarkable) and has been introduced in parts of the world (e.g., North America, Peru, Tasmania, New Zealand, Central Asia). Not exactly known in Turkey (Wiktor, 2000).

Habitat: A species of wide tolerance, found also during cold periods and in open habitats like fields, graveyards, and human settlements. It is absent from forests.

Deroceras berytensis (BOURGUIGNAT, 1852) (Figure 2.4)

Description: This is a very dark slug up to 32 mm in size, while maturity is observed to be attained when much smaller (see Figure 2.4). Body blackish, but may be much lighter; uniform brown or with irregular spots, underparts and sides being light brown. Specimens

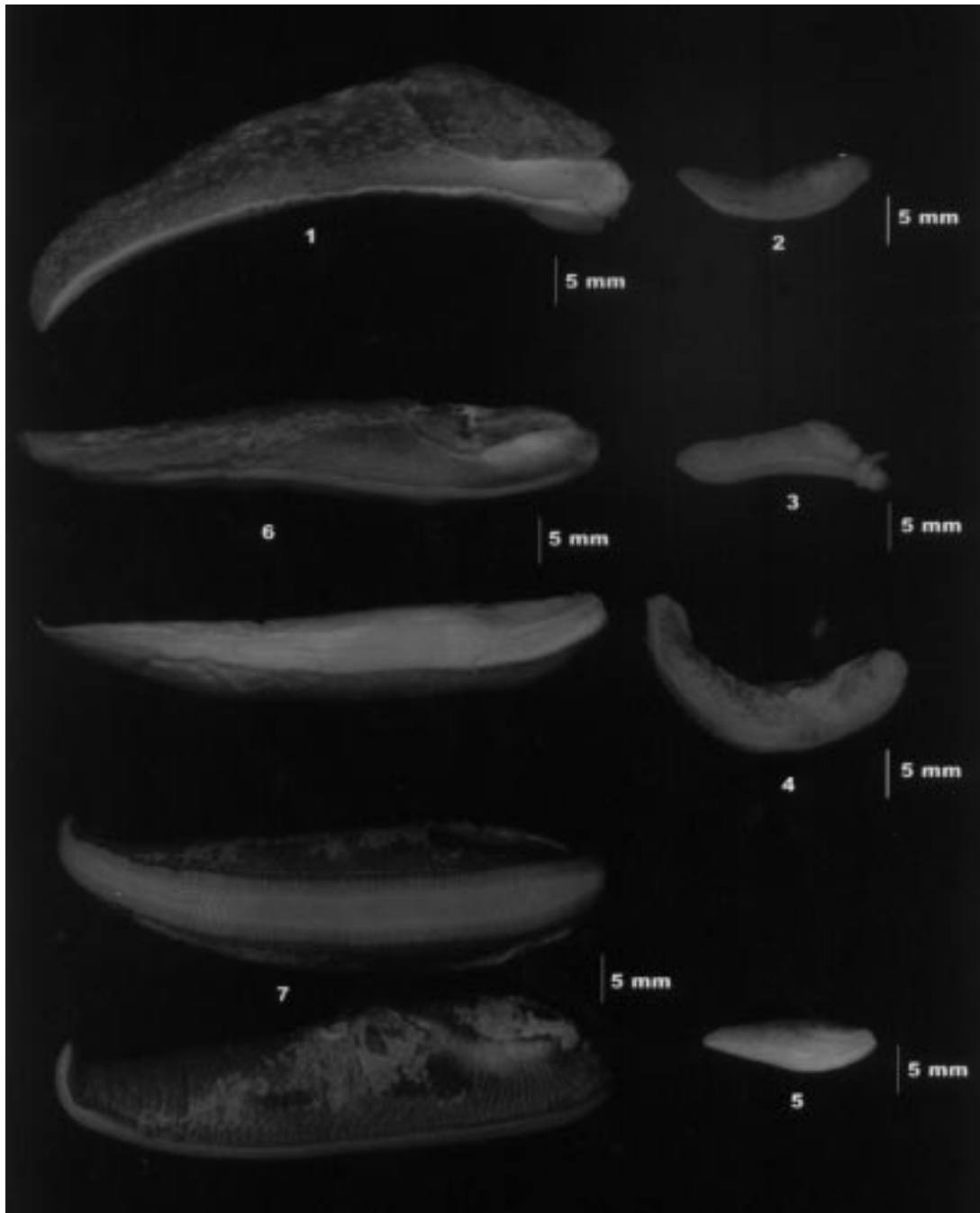


Figure 2. Slugs from Lakes region (Turkey) (1. *Limacus flavus*, 2. *Milax cf. altenai*, 3. *Tandonia budapestensis*, 4. *Deroceras berytensis*, 5. *Deroceras reticulatum*, 6. *Mesolimax brauni*, 7. *Mesolimax escherichi*).

studied were more slender and larger compared to specimens of the following congener.

Penis is oval and distended anteriorly, posterior part being quite narrow or indiscernible. There is a black blot next to the darkish penial gland with 2 long, undivided

branches. Specimens are quite variable in some respects (like caecum and rectum).

Localities: Burdur: Kocapınar spring (Kocapınar spring (n = 1, 13.01.1999), Isparta: SDU Campus (n =

1, 14.11.2002) and in Eğirdir (Istasyon district) (n = 4, 12.03.1998).

Distribution: Lebanon, Syria, Israel, Cyprus and Turkey. In Turkey: Aydın, Amasya, Kayseri, Samsun, Afyon, Çorum, Ankara (Kızılcahamam), Konya, Muğla (Ortaca), Antalya (Side, Manavgat, İncekum), İçel, Adana (Seyhan) (Wiktor, 1971, 1983, 1994, 2000; Schütt, 2001).

Habitat: May be found in open habitats as well as, aquatic habitats. One specimen was caught under a stone during cold weather (Nov. 2002).

***Mesolimax brauni* Pollonera, 1888 (Figure 2.6)**

Description: Largest among the Agriolimacid slugs, reaching 59.7 mm (largest known specimen) in (preserved) samples from Çandır. Body slender and roundish, mantle being smaller than 1/3 of body length (as *escherichi*) and darker (nearly black) contrasting with adjacent body parts. Only marginally darker lateral zones of the sole divided by 2 grooves. Body coloration is variable, with tones of brown (olive, dark brown etc.), but a yellowish area neighbouring the mantle laterally and frontally is constantly seen.

Penis is long and tube-shaped, but found undeveloped in many samples even large ones. A tubular membrane enveloping the basal part is present.

Localities: Burdur: Kocapinar spring (n = 6, 13.01.1999), Isparta: Pınargözü cave (n = 4, 07.05.1999), Isparta (Dere district) (n = 1, 17.03.2002), Çandır (n = 7, 15.5.2000), Sütçüler (n = 4, 15.5.1998), Çandır (n = 1, 25.5.2000)

Distribution: Whole south-western Turkey and Rhodes. Recorded from Izmir, Antalya, Burdur, Isparta, and İçel, also from the Sultan Dağları (Wiktor, 1994, 2000; Schütt, 2001).

Habitat: Species seems to be more adaptable than its congener. It is found in rock crevices, under stones or leaf litter close to the sea, near riverbanks, and also near human habitations (Dere district).

***Mesolimax escherichi* Simroth, 1899 (Figure 2.7)**

Description: Size close to that of previous species (up to 59 mm), but body more robust. Body is jet black except for the environs of the mantle. Lateral zone of sole divided by 4-5 longitudinal grooves dark in hue.

Penis and vas deferens are relatively shorter, and envelope is longer in comparison with those of *M. brauni*.

Localities: Isparta: Pınargözü cave (n = 4, 07.05.1999), Uluborlu (1 juv, 5.5.1993).

Distribution: Endemic to SW Anatolia; in Antalya, Isparta and the Sultan Dagh Mts. A record from Ankara is doubtful (Wiktor, 2000; Schütt, 2001).

Habitat: Not exactly known since the species is apparently rare (Wiktor, 2000). Found sympatrically in a locality with *L. flavus* and *M. brauni*. Tendency to water proximity (banks of streams etc.) is observed by authors.

Family Milacidae

***Milax* cf. *altenai* Forcart, 1972 (Figure 2.2)**

Description: Relatively small (20.8 mm) species, mantle being black mottled with light patches, dorsum blackish and sides lighter. There are 11 grooves between the dorsal keel and pneumostome. Caudal portion is narrow unlike *budapestensis*. Genitalia with a short atrium covered with accessory glands. Spermooviduct quite slender and long (ca. 3 times as long as the penis), connected to the vagina at the level of the accessory glands. Spermatheca is long, fairly exceeding the oviduct. Unlike *gagates*, it is small and bicoloured.

Localities: Afyon: Yakasinek village, (n = 6, 05.02.2003).

Distribution: Only in Rhodes, Karpathos, and Turkey (İzmir: Kuşçuburun, Antalya province, Alanya). Not recorded before in such an inland locality (Wiktor, 1994, 2000; Schütt, 2001).

Habitat: Specimens were collected from a graveyard down a slope, under stones.

***Tandonia budapestensis* (HAZAY, 1881) (Figure 2.3)**

Description: It is a slender example of the genus, its length being 60-70 mm in living and 30-40 mm in preserved specimens. Mantle smaller than 1/3 of the body length. In preserved specimens the habitus resembles an upturned ship with the keel reaching the mantle hind margin and cross-section hemispherically. Preserved specimens seem uniformly grey-brown while the dorsum is slightly darker. Thin black spots cover the body, more densely on the uppermost dorsum and mantle.

Penis has an asymmetrical juncture between the vas deferens and epiphallus, penis being rounded and penial papilla small.

Localities: Isparta: Eğirdir (İstasyon district) (n = 1, 12.03.1998), Isparta (Dere district) (n = 2, 17.03.2002), İstasyon (Isparta train station) (n = 3, 10.3.2002)

Distribution: Originally in central Europe (Austria to Transylvania). Introduced in many countries like Czech Republic, Poland, Belgium, U.K., Iceland, and Turkey. Known from a few provinces in Turkey (Istanbul, Isparta, Trabzon) where it is exclusively synanthropic (Wiktor, 1994, 2000; Schütt, 2001).

Habitat: Widely tolerant as specimens were collected from gardens, roadsides, ruins, and vast rocky areas.

Despite its higher altitude and colder climate compared with the southern coastal margins of Turkey, the area houses a considerable amount of Mediterranean fauna. The palaeogeographical and hydrogeographical status of the Lakes Region should be linked with it; this area, considered among the newest lands in Turkey, was formed by the withdrawal of the ancient lake of Anatolia.

Despite its short history, there are more than 25 gastropod taxa endemic to the area. These are remnants

of the lakes system, montane isolated species, or species with recent dispersal to the area. *M. escherichi* and *brauni* are the only endemic slugs of the area. These are restricted to SW Anatolia and Rhodes (only *brauni*). *Deroceras grossui* REISCHUTZ, 1972 (= *D. berytensis*, after Wiktor, 2000) was described from a locality between Afyon and Isparta.

Possibly other synanthropic species, or endemic taxa described in valleys in Antalya province (Rähle, 1998) exist in the area.

Species composition proves a high dispersal ability, considering the recent history of the area and high altitude. *Milax altenai*, *Deroceras berytensis*, *Mesolimax escherichi*, and *M. brauni* seem to migrate from coastal parts. Of these, *M. altenai* is found for the first time in an inland locality. It is not clear if it is isolated here or is widespread in western Turkey. *D. reticulatum* and *L. flavus* might have been introduced, but this is not very clear, as they are very widespread, unlike *T. budapestensis*, a synanthropic species in the area.

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