

# FROM AYDIN MOUNTAINS, TURKEY AND THE ASSOCIATED LAND SNAIL FAUNA

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*Abstract* Twenty-one native species of land snails were recorded during a survey of the Aydın Mountains in the Province of Aydın, Turkey. *Idyla aydinensis* Örstan (Pulmonata: Clausiliidae) is described as a new species from an altitude of 1030 m. The new species is characterized by a narrow shell with closely spaced fine ribs and a long penis with a grooved pilaster. New records of *Turanena hemmeni*, *Zonites chloroticus*, *Xeropicta smyrnoretica* and *Helicigona matrella* are given, extending the ranges of these species.

*Key words* Gastropod, pulmonate, biodiversity, clausiliid

## INTRODUCTION

Turkey has a speciose land snail fauna with many endemics (Schütt, 2001). However, the land snail faunas of the high altitude mountains of Turkey have not been adequately studied. Recently, Hausdorf, Gümüş, & Yıldırım (2004) described two new *Metafruticicola* species from altitudes above 2000 m on the Taurus Mountains and Schütt (2005) described *Pseudochondrula maden* from an altitude of 2000 m in eastern Turkey. These findings suggest that the high Anatolian mountains still harbor undescribed species and point out the need for mountain surveys to fully describe the rich biodiversity of Turkey.

We present here the results of a land snail survey we conducted in the Aydın Mountains in western Turkey, including the description of a new species of a clausiliid snail.

## MATERIALS AND METHODS

The survey took place along the southern flank of the Aydın Mountains in the Province of Aydın (Fig. 1). The survey was conducted by all of the authors on 3 July 2004. Two of the authors (MZY and SC) collected additional specimens at station A56 on 18 March 2005. The UTM coordinates (for zone 35) and elevation of each station were measured with a GPS receiver with an accuracy of about 10 m. The following list gives

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the description and coordinates of each station (Fig. 1).

A51: Calcareous outcrops above fields along İkizdere Creek, North of İkizdere & İncirliova. UTM E566585 m, N4197030 m; elevation= 160 m.

A52: Non-calcareous outcrops on steep slope above road to Tire. UTM E564957 m, N4208674 m; elevation= 956 m.

A53: Calcareous outcrops on steep slope below road from Köşk to village of Karatepe. UTM E593194 m, N4193603 m; elevation= 300 m.

A54: Calcareous outcrops on steep slope below peak of Karatepe. UTM E594658 m, N4196672 m; elevation= 800 m.

A55: Non-calcareous outcrops between villages of Karatepe and Kızılcaköy. UTM E595938 m, N4199833 m; elevation= 830 m.

A56: Marble peak above village of Gökkişiş. UTM

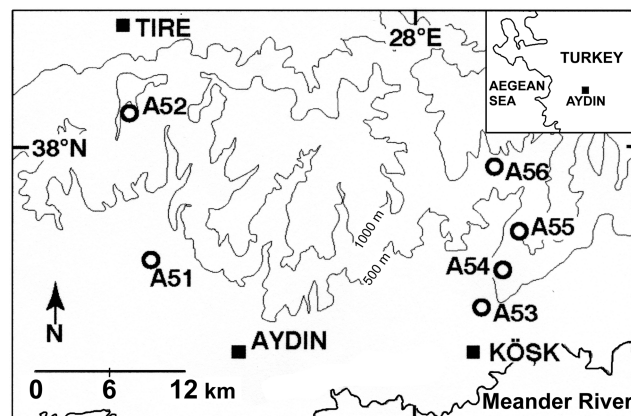


Fig. 1 Map of the survey area showing the principal towns and the locations of the collection stations.



**Fig. 2** The type location of *Idyla aydinensis* (station A56): the marble peak above the village of Gökkiriş, Aydın Mountains. The cuts (lighter areas) in the lower righthand corner of the peak were made several years ago during an attempt to mine the marble.

E593979 m, N4204834 m; elevation= 1030 m.

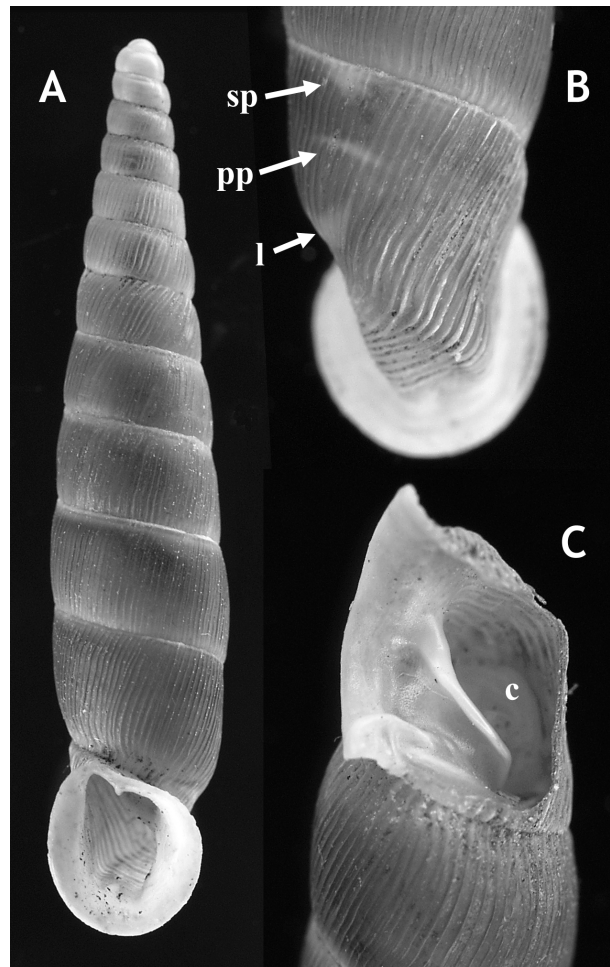
Surface collections were done at each station by three to five people. In addition, soil samples were taken from two stations, sieved and sorted for small shells. Fifteen lots have been deposited with the Carnegie Museum of Natural History, Pittsburgh, PA, U.S.A. (CM72149, CM72644-72651, CM73097-73101, CM73398). Additional lots are in the collection of the first author. Taxonomy and shell terminology for *Idyla* follows Nordsieck (2005). Samples of *I. bicristata kephissiae* (Roth) (FM208101) and *I. bicristata pikermiana* (Roth) (FM208067), both from northeast Peloponisos, Greece, were from the Field Museum of Natural History, Chicago.

#### ABBREVIATIONS

H height; D diameter; SD standard deviation; R number of ribs per 2 mm on dorsal penultimate whorl; ZMH Zoologisches Museum der Universität Hamburg.

#### RESULTS

We found 21 species of land snails during our survey (Table 1). In addition, slug shells were collected at stations A51 and A56, but these could be identified only to the family level (Reuse, 1983). Our records represent 14 pulmonate families. We consider all of the collected land snail species to be native to the survey area. One clausiliid from station A56 is described here as a new species.



**Fig. 3** *Idyla aydinensis*. **A, B** holotype (CM73398); **C** paratype with the palatal wall of aperture removed. Abbreviations: c clausilium; l lunella; pp principal plica; sp sutural plica.

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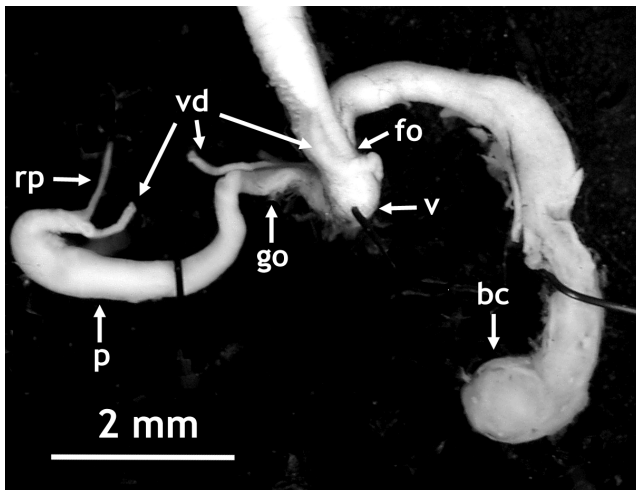
*Idyla (Idyla) aydinensis* Örstan, n. sp.

*Holotype* Adult sh (CM73398).

*Paratypes* 17 sp in alcohol and 24 sh (CM72149); 3 sh (ZMH37559); 4 sh (personal collection of AÖ). All paratypes were from the type locality.

*Type locality* Turkey, Province of Aydın, Aydın Mountains, marble peak above village of Gökkiriş (Fig. 2); UTM E593979 m, N4204834 m, 1030 m altitude (station A56).

*Measurements* Holotype, H=17.7 mm; D=3.5 mm; whorls=12.5; R=16. Sample collected 18-III-05 (N=25, including holotype), H=14.7-19.2



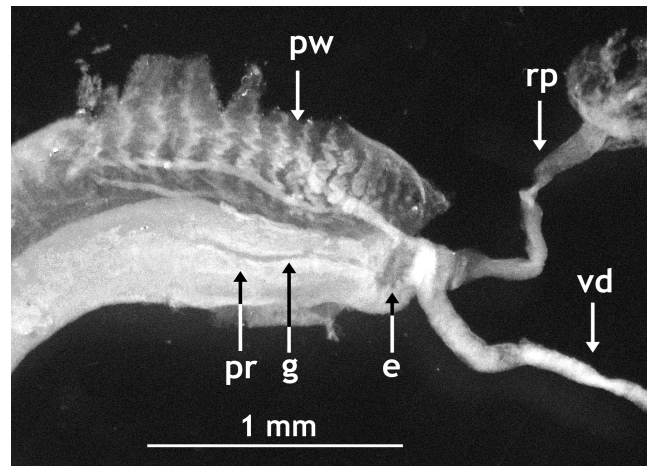
**Fig. 4** Genitalia of *Idyla aydinensis* (CM72149). Abbreviations: bc bursa copulatrix; fo free oviduct; go genital opening; p penis; rp retractor of penis; vd vas deferens; v vagina.

mm, mean H=16.55 mm, SD=1.08; D=3.1-3.5, mean D=3.2, SD=0.14; Whorls (N=7)=11-13; R (N=6)=16-18, mean=17.2.

**Diagnosis** Tall, narrow shell with closely spaced fine ribs.

**Description** Shell narrow, fusiform with an abruptly tapering apex (Fig. 3A). Fresh shells brown. Protoconch smooth, translucent; teleoconch with closely-spaced low, fine ribs becoming coarser on last quarter turn of body whorl. Suture slightly indented; suture line white. Basal and dorsal keels separated by shallow groove (Fig. 3B). Aperture elongated, narrow; lip white, broadly reflected. Parietalis low, short; columellaris protrudes into aperture; clausilial arrangement G-type. Lunella lateral, short; neck with short principal plica and sutural plica along suture (Fig. 3B). A short, white inconspicuous ridge on inside of upper palatal wall.

Penis without caecum, about three times longer than vagina (Fig. 4). Epiphallus forms small, indistinct sac (Fig. 5); no flagellum. Inside walls of penis with transverse zigzag ridges; long, prominent pilaster with longitudinal groove occupies penis cavity (Fig. 5). Vas deferens maintains same diameter throughout its length, attaches to epiphallus next to retractor muscle. Free oviduct about half as long as vagina. Bursa copulatrix without diverticulum. Vagina bends sharply below junction of free oviduct and bursa copulatrix (Fig. 4).



**Fig. 5** Inside of the proximal end of the penis of *Idyla aydinensis* mounted in glycerine jelly (CM72149). Abbreviations: e epiphallus; g groove; pr pilaster; pw, penis wall.

**Habitat** In crevices of exposed marble outcrops at 1030 m altitude.

**Geographic range** The new species is known only from the type location, but the actual range may be wider (see Discussion).

**Comparisons** Conchological and anatomical characteristics of the new clausiliid species from our station A56 agree with those of the genus *Idyla* (Nordsieck, 2005). The only other *Idyla* species known from Turkey is *I. bicristata bicristata* (Rossmässler), which has been recorded from the provinces of Bursa, Balıkesir, Çanakkale, Manisa and İzmir (Şeşen & Schütt, 2005). The shells of *I. bicristata bicristata* are relatively wider (Fig. 6) and smoother than those of *I. aydinensis*. Furthermore, the penis of *I. aydinensis* is about three times longer than its vagina (Fig. 4). In comparison, the penis of *I. bicristata bicristata* is about as long as its vagina (Neubert, 1995).

There are three described species in the genus *Idyla*: *I. (Idyla) bicristata*, *I. (Idyla) castalia* (Roth), each with several subspecies from mainland Greece, several Aegean islands and southwestern Bulgaria (Zilch, 1976; Gittenberger, 1993; Fauer, 1993; Gittenberger, 2002), and *I. (Strigilidyla) liebegottae* (Nordsieck) from mainland Greece. All of those taxa are geographically isolated from *I. aydinensis* by the intervening Aegean Sea and the mountains of northwest Turkey. We have compared the shell dimensions



of *I. aydinensis* with those of some subspecies of *I. bicristata* and *I. castalia* (Fig. 6). *Idyla aydinensis* is relatively narrower than all of the compared taxa. Furthermore, the ribs on the dorsal penultimate whorl of *I. aydinensis* are denser (mean  $R=17.2$ ) than those of *I. bicristata kephissiae* (mean  $R=15.3$ ) and *I. bicristata pikermiana* (mean  $R=13.0$ ). The ribs of *I. castalia yeruni* Gittenberger (2002) appear to be much finer than those of *I. aydinensis* and the dimensional range given for *I. castalia yeruni* also indicates that its shells are shorter and relatively wider than those of *I. aydinensis*. The dimensional range given for *I. bicristata acuticosta* (Fauer, 1993) coincides with the range for *I. aydinensis*; however, the shells of the former species have prominent white ribs that are more widely spaced than those of the latter.

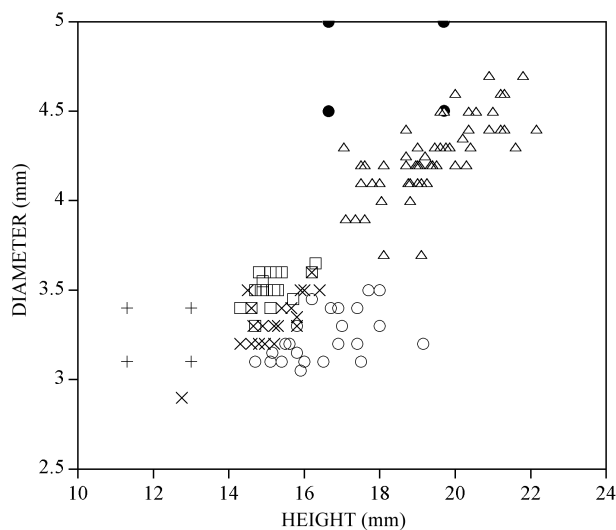
The proportions of the dimensions of penis and vagina of *I. aydinensis* appear similar to those of *I. castalia boschi* Nordsieck (Neubert, 1995). However, the shells of *I. castalia boschi* are shorter and relatively wider than those of *I. aydinensis* (Fig. 6) and have denser ribs (mean  $R=18.8$ ) (Nordsieck, 1973).

A sharp bend was present in the vaginas of two complete sets of genitalia removed from *I. aydinensis* specimens (Fig. 4). In comparison, the vaginas of *I. bicristata bicristata* and *I. castalia boschi* are more or less straight above the genital opening (Neubert, 1995). A similar sharp bend appears to be present in the vagina of *I. (Strigilidyla) liebegottae* (Nordsieck, 1994). The latter species, however, differs from *I. aydinensis* dimensionally (Fig. 6) and in having an apex that is not pointed (Nordsieck, 1994).

Below are additional notes on some of the other species found during our survey.

*Pyramidula cf. rupestris* The *Pyramidula* shells from station A56 have the conchological characteristics of both *P. pusilla* Vallot and *P. rupestris*. But, their relative spire heights lead us to identify them tentatively as *P. rupestris*.

*Turanena hemmeni* This species was described from the island of Samos (Bank & Butot, 1990) and has since been recorded from several locations along the southern coast of Turkey and from an inland location south of Denizli (Gittenberger & Menkhorst, 1993). Its empty shells appear to be scarce wherever they have been found (Gittenberger & Menkhorst, 1993). We found only one shell at station A51 that was 6.2 mm long and 3.2 mm wide.



**Fig. 6** Comparison of the variation of shell diameter and height in *Idyla aydinensis* (open circles), *I. (Strigilidyla) liebegottae* (closed circles), *I. bicristata bicristata* (triangles), *I. bicristata kephissiae* (squares), *I. bicristata pikermiana* (X) and *I. castalia boschi* (+). For *I. castalia boschi* and *I. (Strigilidyla) liebegottae* the respective symbols mark the boundaries of the diameter and height ranges specified by Nordsieck (1973; 1994).

*Zonites chloroticus* In recent years, this species has been recorded from around İzmir, Manisa, Kemalpaşa (east of İzmir), Ödemiş (southeast of İzmir) (Riedel, 1987) and Gazimir (south of İzmir) (Örstan, unpublished). Much earlier, Sturany (1902) gave a record from Aydın. Our record from station A52 confirms the existence of this species in the area and extends the present range of this species further southeast with respect to İzmir.

*Zonites casius* This species has been recorded from Aydın, Karacasu (southeast of Aydın) and Çivril (northeast of Denizli) (Riedel, 1987). We found it at four of our stations (Table 1). Our records suggest that the species is common in the mountains northeast of Aydın.

*Xeropicta smyrnoretica* This species has a circular umbilicus and a microsculpture of fine spiral lines (Germain, 1936). These characteristics help distinguish *X. smyrnoretica* from three widespread hygromiids, *Ceruella virgata* (Da Costa), *Xerocrassa cretica* (Férussac) and *Xeropicta krynickii* (Krynicky), that may be confused with it. Neither *C. virgata* nor *X. cretica* shells have microscopic spiral lines. Furthermore, unlike *X. smyrnoretica*, the shell of *X. cretica* has densely stacked radial ribs. The shell of *X. krynickii* does

have a microsculpture somewhat similar to that of *X. smyrnocretica*, but the former has an eccentric umbilicus unlike that of the latter.

*Metafruticicola proclivis* In identifying our specimens as *M. proclivis*, we followed Schütt (2001), who explained the conchological differences between this species and *M. redtenbacheri*.

*Oxychilus* cf. *samius* The tentative identification of this species was based on a single damaged subadult shell from station A56.

*Helicigona matrella* This species has been recorded from the vicinity of İzmir, Kemalpaşa and Selçuk (Subai, 1996) and from several locations south of Kuşadası (Örstan *et al.*, unpublished). In the Aydın Mountains, we found it only at station A56. This is the easternmost record of this species.

## DISCUSSION

We are not aware of a previously published land snail survey of the Aydın Mountains. The earliest records of land snails from the area are probably those given by Sturany (1902) based on a collection done in 1900 in "Aidin" (= Aydın) most likely in or near the city. Sturany listed *Retinella cypria* (*Oxychilus cyprius*), *Zonites chloroticus*, *Helix cincta*, *H. aspersa* and *H. variabilis* (*Ceruellia virgata*). The last two species are generally believed to be introduced to Turkey. We did not find any introduced species at our mountain locations.

The ranges of the snails in the genus *Idyla* appear to be restricted to calcareous areas and some *Idyla* taxa have been recorded only from relatively high altitudes (Zilch, 1976; Gittenberger, 1993; Fauer, 1993; Gittenberger, 2002). For example, Gittenberger (2002) noted that the ranges of the subspecies of *I. castalia* were restricted to altitudes above 900 m. Therefore, our record of *I. aydinensis* from 1030 m is not surprising.

The outcrops in the section of the Aydın Mountains that we surveyed consist of calcareous rocks isolated from each other by noncalcareous rocks (Karamanderesi & Helvacı, 2003). Although four of our stations had calcareous rocks, we found *I. aydinensis* at only one location, A56, which was also our highest station (Fig. 2). Station A56 appears to be located near the southern boundary of an approximately 3x5 km area of marble outcrops (Karamanderesi & Helvacı,

**Table 1** The land snail species collected in the survey area and the stations where each was found.

<i>Lauria cylindracea</i> (Da Costa): A56
<i>Orculella ignorata</i> Hausdorf: A51, A53, A56
<i>Pyramidula</i> cf. <i>rupestris</i> (Draparnaud): A56
<i>Granopupa granum</i> (Draparnaud): A53
<i>Truncatellina rothi</i> (Reinhardt): A51, A53, A54, A56
<i>Mastus etuberculatus</i> (Frauenfeld): A53
<i>Jaminia loewii godetiana</i> (Kobelt): A51
<i>Turanena hemmeni</i> Bank and Butot: A51
<i>Idyla aydinensis</i> Örstan, n. sp.: A56
<i>Cecilioides acicula</i> (Müller): A53
<i>Vitrea contracta</i> (Westerlund): A51, A54, A56
<i>Vitrea ephesina</i> Pintér: A56
<i>Oxychilus</i> cf. <i>samius</i> (E. Martens): A56
<i>Oxychilus hydatinus</i> (Rossmässler): A51, A56
<i>Zonites chloroticus</i> (L. Pfeiffer): A52
<i>Zonites casius</i> Martens: A53, A54, A55, A56
<i>Xeropicta smyrnocretica</i> (Germain): A51
<i>Metafruticicola proclivis</i> (Martens): A51, A52, A53, A54, A55, A56
<i>Monacha claustralis</i> (Mousson): A51
<i>Helicigona matrella</i> (Westerlund): A56
<i>Helix cincta</i> Müller: A52, A53, A54, A55, A56
Limacidae: A51, A56

2003, fig. 2). Therefore, since *I. aydinensis*, like other *Idyla* species, appears to be a calciphile, it is likely that its range extends further to the north of its type location. Furthermore, the absence of *I. aydinensis* from calcareous stations at lower elevations that we surveyed suggests that its range is also restricted to high altitudes.

Besides *Idyla* species, several other European species of land snails have been recorded only from high altitudes (for example, see Gittenberger, 1993). The exact reasons for the altitudinal limits on the ranges of some land snail species are unknown, but we would expect a complex interplay of geological history and evolutionary processes (for example, see Hausdorf, 2001).

If some species of land snails live only at high altitudes, we may also expect some species to be restricted to low altitudes and others to be indifferent to altitude. Therefore, if altitude is a limiting factor in the distributions of some land snail species, when everything else is equal, the compositions of land snail faunas should change

along altitudinal gradients. Our highest altitude station, A56, was at 1030 m. All species of land snails we collected at A56, except *I. aydinensis*, have also been recorded at much lower altitudes. However, we do not yet have enough data for a detailed analysis of the effect of altitude on the distributions of land snails on Turkish mountains. To better understand the processes behind the development of high altitude land snail faunas, we are now surveying additional mountains of western Turkey.

#### ACKNOWLEDGMENTS

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