

The genus *Tsoukatosia* GITTENBERGER 2000 (Gastropoda, Clausiliidae, Phaedusinae) in the Parnon Mountains (Greece, Peloponnesos).-

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Abstract

The occurrence of the genus *Tsoukatosia* in the Parnon Mts., southeastern Peloponnesos (Greece), is reported with the description of *T. brandstetteri* nov. spec., *T. feheri* nov. spec., *T. liae dragoumiensis* nov. subspec., *T. liae excelsa* nov. subspec., and *T. liae parnonica* nov. subspec. The distribution and habitat preferences of the genus are discussed.

Zusammenfassung

Es wird über die Verbreitung der Gattung *Tsoukatosia* im Parnon-Gebirge, südöstlicher Peloponnes (Griechenland), berichtet. *T. brandstetteri* nov. spec., *T. feheri* nov. spec., *T. liae dragoumiensis* nov. subspec., *T. liae excelsa* nov. subspec., und *T. liae parnonica* nov. subspec. werden neu beschrieben. Die Verbreitung und Habitatpräferenzen der Gattung werden diskutiert.

Introduction

The Parnon Oros (Parnonas or Malevos) is a mountain range of about 60 km length in the southeastern part of the Peloponnesos, east of the Laconian Plain and the Evrotas Valley. The western part is in Laconia, whereas the northeastern part is in Arcadia Prefecture. Its highest peaks are Megali Tourla (1,935 m) and Psaris (1,836 m). The molluscan fauna of this mountain complex is one of the best known in Greece (GITTENBERGER 1993, 1994; NEUBERT 1998; NORDSIECK 2007).

The first representative of the genus *Tsoukatosia* GITTENBERGER 2000 was discovered only at the very end of the 20th century (GITTENBERGER 2000). Since then further seven of its species have been described (A. & P. L. REISCHÜTZ 2003, 2014; HUNYADI & SZEKERES 2009; A., N. & P. L. REISCHÜTZ 2012; A. & P. L. REISCHÜTZ & SZEKERES 2016), making this by now the most species-rich genus of the European Phaedusinae. Field trips by Peter Subai in 2011, and particularly those of Alexander Reischütz, Nicole Steiner-Reischütz and Peter L. Reischütz (hereafter: A., N. & P. L. Reischütz) in 2016 and 2017, revealed the widespread presence of the genus in the Parnon Mts., from where no former records had been known. The *Tsoukatosia* of this mountain range belong to new taxa that are described below.

The type material of the new species and subspecies can be found in the collections of the Naturhistorisches Museum, Wien (NHMW), as well as the private collections of A. and P. L. Reischütz, Horn (RE) and M. Szekeres, Szeged (SZ).

Taxonomic part

Tsoukatosia liae GITTENBERGER 2000 (Figure 2a)

The nominotypical subspecies of *T. liae* (Figure 2a) is known only from its locus typicus southeast of Leonidio (Figure 1, Nr. 1), ca. 4 km toward Tsitalia from the junction at the Leonidio to Plaka road (GITTENBERGER 2000), at 37°8'35" N 22°52'47" E, 310 m. In the Parnon Mts. three further subspecies have been discovered. These all share with *T. l. liae* the stout,

densely costate shell with broad apex, the long, in front view well visible basal furrow, and the obliquely descending, at its end smoothly bending lamella inferior.

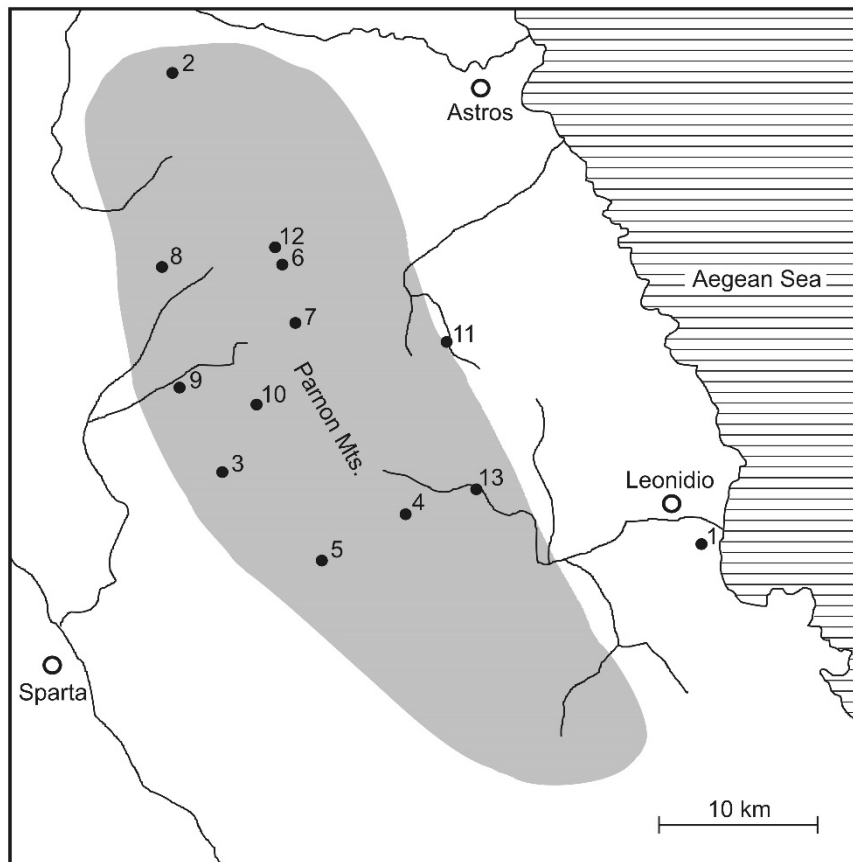


Figure 1: *Tsoukatosia* localities in the southeastern Peloponnesos:

Occurrences of *Tsoukatosia liae liae* (1), *Tsoukatosia liae dragoumiensis* nov. subspec. (2), *Tsoukatosia liae parnonica* nov. subspec. (3, 4, 5), *Tsoukatosia liae excelsa* nov. subspec. (6, 7), *Tsoukatosia feheri* nov. spec. (8, 9, 10), *Tsoukatosia brandstetteri* nov. spec. (11), unidentified *Tsoukatosia* (12, 13).

Tsoukatosia liae dragoumiensis nov. subspec.
(Figure 2b)

Diagnosis: Medium-size subspecies with basal furrow that is well visible in front view. Neck densely costate, end of lamella inferior often fused to strong upward-bending plica. Parietal peristome margin smooth or indistinctly serrate.

Description: The densely costate shell with broad apex consists of $8\frac{1}{3}$ whorls. The 10 to 11 ribs at the last quarter whorl are somewhat stronger, but not wider-spaced than the preceding ones. The basal furrow reaches up an entire whorl, so that it is well visible in front view. The relatively large peristome (shell height/aperture height 4.60-4.72) bends gradually back toward the basis. There are strong plicae at the interlamellar region of the peristome, but the parietal margin is either smooth or only indistinctly serrate at its lower half. The lamella superior is not much more emerged than the interlamellar plicae. The visible part of the retracted lamella inferior descends obliquely along a straight line, and then turns smoothly toward the aperture and reaches the margin above the lower third of the peristome height. The end of the inferior is often fused to a strong, upward-bending interlamellar plica. The also marginal lamella subcolumellaris ends well below the inferior, separated from that by one or two major plicae.

The clausilial apparatus does not differ from that of the nominotypical subspecies (see GITTENBERGER 2000). Dimensions of the holotype: shell height (Hs) 12.1 mm, shell width (Ws) 3.1 mm, aperture height (Ha) 2.8 mm, aperture width (Wa) 1.9 mm, and of the paratypes: Hs 13.7 mm Ws: 3.1-3.2 mm, Ha 2.8-2.9 mm, Wa 1.9 mm.

Locus typicus: Parnon Mts., cliffs along the Tripoli to Agios Petros road 3.5 km N of Dragoumi (37°24'21" N 22°30'17" E), 900 m (Figure 1, Nr. 2).

Type material: Holotype (from the locus typicus, leg. A., N. & P. L. REISCHÜTZ 5.2016): NHMW 112133. Paratypes: RE/1 + 29 body whorls, SZ/3 body whorls (same data).

Derivatio nominis: The subspecies is named after Dragoumi, the village near the locus typicus.

Remarks: The new subspecies differs from *T. l. liae* by its larger size, stronger neck ribs, and the mostly serrate parietal margin of the peristome. The locus typicus, situated 45 km NW of that of the nominotypical subspecies, is the northernmost among the known occurrences of *T. liae*. The relatively rich material consists mainly of fragments and only two intact shells, all strongly eroded.

Tsoukatosia liae parnonica nov. subspec.
(Figure 2c)

Diagnosis: Medium-size subspecies with basal furrow which is well visible in front view. Neck densely costate, lamella inferior ends close to the subcolumellaris. Parietal peristome margin indistinctly serrate even inside the sinulus.

Description: The shell with broad apex is comprised of $8\frac{1}{3}$ to $8\frac{2}{3}$ whorls. The surface is finely and densely costate, the neck ribs (11 to 13 over the last quarter whorl) do not show increased strength or spacing. The basal furrow is clearly visible in front view. The peristome is relatively large (Hs/Ha 4.48-4.60), its rim bends smoothly back toward the basis. The peristome margin is serrate all around, strongly at the interlamellar part, and indistinctly along the parietal side and in the sinulus. At the margin the lamella superior is not more emerged than the adjacent plicae of the columellar side. The lamella inferior is retracted, its end part descends obliquely before bending gradually toward the aperture. It terminates marginally at one third of the aperture height, close to the end of the lamella subcolumellaris, from which it is separated by one or two strong plicae. The clausilial apparatus could not be examined. Dimensions of the holotype: Hs 11.5 mm, Ws 3.0 mm, Ha 2.5 mm, Wa 1.7 mm, and of the paratypes: Hs 11.2-11.5 mm, Ws: 2.5 mm, Ha 2.4-2.5 mm, Wa 1.7-1.8 mm.

Locus typicus: Parnon Mts., 10 km from Polydroso toward Kallithea, 1 km N of the Agriani junction (37°8'2" N 22°36'34" E), 980 m (Figure 1, Nr. 5).

Type material: Holotype (from the locus typicus, leg. A., N. & P. L. REISCHÜTZ 5.2017): NHMW 112134. Paratypes: RE/2 + 6 body whorls, SZ/1 + 1 body whorl (same data).

Additional material: Parnon Mts., gorge NE of Vasaras (37°10'59" N 22°32'26" E), 900 m (Figure 1, Nr. 3), leg. A., N. & P. L. REISCHÜTZ 5.2017; Parnon Mts., 2 km toward Polydroso from the Kosmas to Platanaki road (37°9'36" N 22°40'7"E), 1080 m (Figure 1, Nr. 4), leg. A., N. & P. L. REISCHÜTZ 5.2017.

Derivatio nominis: This subspecies is named after the Parnon Mts.

Remarks: This subspecies differs from *T. l. liae* by the larger size and the circularly serrate peristome, whereas from *T. l. dragoumiensis* nov. subspec. by the finer neck ribs and the presence of plicae all along the parietal peristome margin. The shells of the three localities, which are next to each other along the southwestern part of the Parnon Mts., do not show appreciable morphological differences.

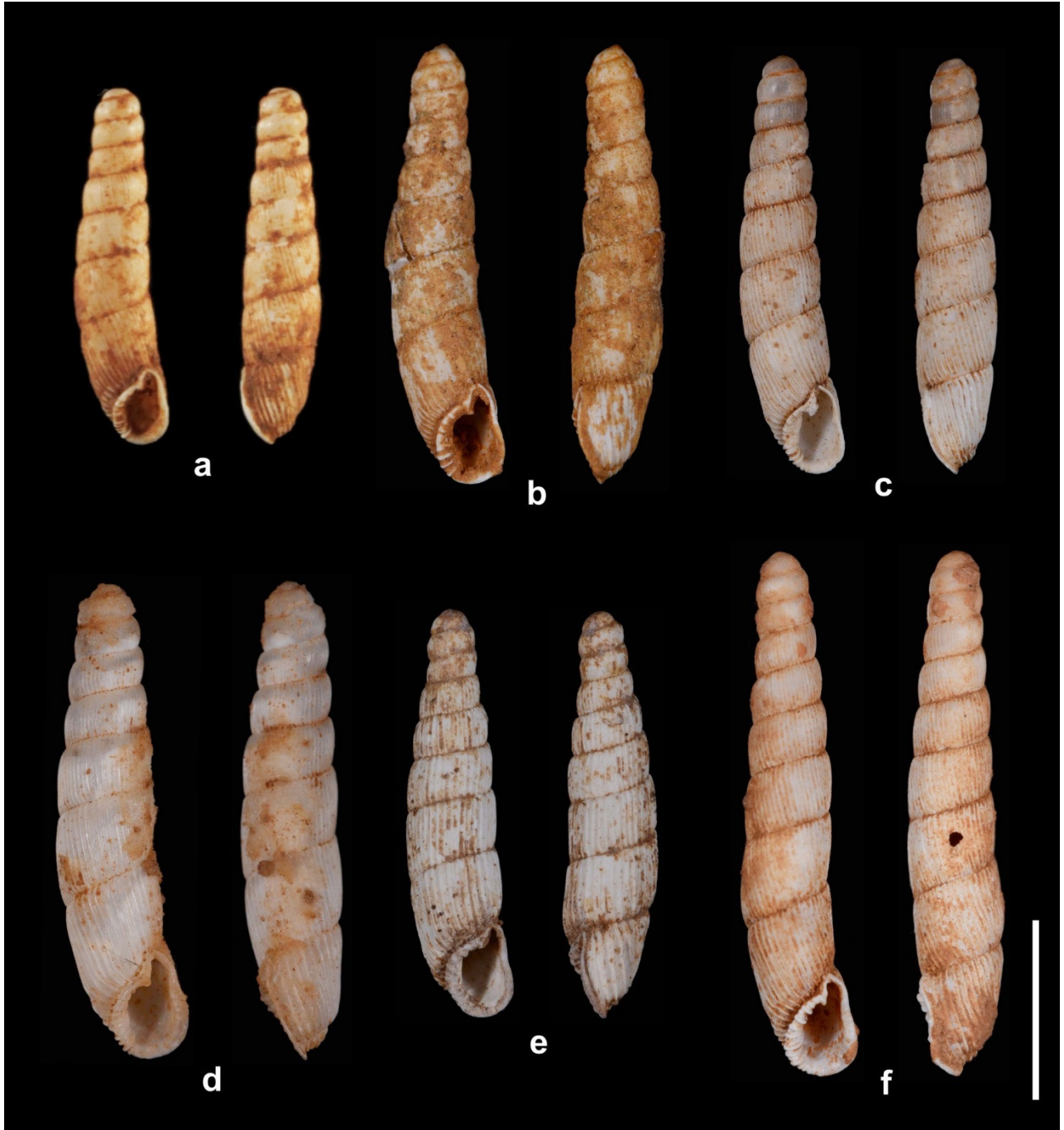


Figure 2: *Tsoukatosia* taxa of the Parnon Mts. and the surrounding areas:

a: *Tsoukatosia liae liae* (from the locus typicus), b: *Tsoukatosia liae dragoumiensis* nov. subspec. (holotype, NHMW 112133), c: *Tsoukatosia liae parnonica* nov. subspec. (holotype, NHMW 112134), d: *Tsoukatosia liae excelsa* nov. subspec. (holotype, NHMW 112135), e: *Tsoukatosia feheri* nov. spec. (holotype, NHMW 112136), f: *Tsoukatosia brandstetteri* nov. spec. (holotype, NHMW 112137). Scale bar corresponds to 5 mm.

Tsoukatosia liae excelsa nov. subspec.

(Figure 2d)

Diagnosis: Large subspecies with very broad apex and in front view well visible basal furrow. Neck densely costate, parietal peristome margin indistinctly serrate up to the sinulus.

Description: The robust shell of 8 to 9 whorls has very broad apex. The whorls are densely costate, the strength and spacing of the ribs toward and at the neck (9 to 11 over the last quarter whorl) show gradual increase. The basal furrow, well visible in front view, extends to the entire last whorl. The lower part of the relatively large peristome (Hs/Ha 4.33-4.48) bends smoothly backward. The interlamellar region is strongly, the parietal margin weakly, indistinctly serrate. There are no plicae in the sinulus. The lamella superior at its end is not higher emerged than the interlamellar plicae. The lamella inferior is retracted, its visible part descends obliquely, and then turns smoothly before reaching the margin. Its end at about the lower third of the aperture height is close to that of the lamella subcolumellaris, from which it is separated by one or two major plicae. The half-whorl-long plica principalis initiates at the lateral side, somewhat deeper than the adjacent, short plica superior. The lunella is rudimentary. Dimensions of the holotype: Hs 13.0 mm, Ws 3.7 mm, Ha 3.0 mm, Wa 2.1 mm, and of the paratypes: Hs 12.4-16.0 mm, Ws: 3.6-3.9 mm, Ha 3.0-3.4 mm, Wa 2.1-2.3 mm.

Locus typicus: Parnon Mts., Agios Petros to Katafigio Paronos road 1 km N of the Bogreika Kalyvia Spring (37°17'54" N 22°34'55" E), 1040 m (Figure 1, Nr. 6).

Type material: Holotype (from the locus typicus, leg. A., N. & P. L. REISCHÜTZ 5.2017): NHMW 112135. Paratypes: RE/17, SZ/3 (same data).

Additional material: Parnon Mts., Agios Petros to Katafigio Paronos road 1.5 km N of the junction toward the refuge of the Hellenic Alpine Club (37°15'58" N 22°35'28" E), 1270 m (Figure 1, Nr. 7), leg. A., N. & P. L. REISCHÜTZ 5.2017.

Derivatio nominis: The name *excelsus*, -a, -um (Latin, meaning high, magnificent) refers to the grand stature of this subspecies.

Remarks: This subspecies differs from all the others of *T. liae* by its much larger, strongly built shell. Its two localities are next to one another, in the central part of the Parnon Mts.

Tsoukatosia feheri nov. spec.

(Figure 2e)

Diagnosis: Medium-size *Tsoukatosia* with strongly costate shell and in front view barely visible basal furrow. Neck ribs distant and sharp, end of lamella inferior deep, almost vertically descending. Parietal peristome margin finely and densely serrate.

Description: The strongly costate shell of 8½ whorls has relatively narrow apex. The last whorl is visibly wider than the penultimate, the strength and spacing of its ribs (7 to 8 at the last quarter) gradually increase. The weak basal furrow is barely visible in front view. The peristome is relatively large (Hs/Ha 4.31), its margin bends backward smoothly toward the basis. The interlamellar region has strong plicae, but those of the parietal margin are very fine and dense, not reaching the sinulus. The lamella superior at its end is not more emerged than the adjacent interlamellar plicae. The deep lamella inferior descends almost vertically, and then turns horizontal just before terminating at the margin around the lower third of the peristome height.

It is separated from the lower ending lamella subcolumellaris by one or two strong plicae. The clausilial apparatus could not be examined. Dimensions of the holotype: Hs 11.2 mm, Ws 3.0 mm, Ha 2.6 mm, Wa 1.9 mm, and of the paratypes: Ws: 2.9-3.0 mm, Ha 2.6-2.7 mm, Wa 1.9 mm.

Locus typicus: Parnon Mts., Vamvakou to Katafigio Parnonos road, 2.3 km NW of the Polydroso junction (37°13'20" N 22°33'51" E), 1170 m (Figure 1, Nr. 10).

Type material: Holotype (from the locus typicus, leg. A., N. & P. L. REISCHÜTZ 5.2016): NHMW 112136. Paratypes: RE/1 + 1 body whorl, SZ/1 body whorl (same data); RE/2 body whorls (same locality, leg. A., N. & P. L. REISCHÜTZ 5.2017).

Additional material: Parnon Mts., road from Karies toward Agios Petros (37°17'51" N 22°29'53" E), 930 m (Figure 1, Nr. 8), leg. A., N. & P. L. REISCHÜTZ 5.2017; Parnon Mts., 1 km from the Vresthena to Megali Vrisi road toward the Agios Konstantinos Church (37°13'50" N 22°30'37" E), 870 m (Figure 1, Nr. 9), leg. A., N. & P. L. REISCHÜTZ 5.2017.

Derivatio nominis: The new species is named after Zoltán Fehér, dedicated researcher of the Balkan malacofauna and a valued friend.

Remarks: With its strongly costate shell *Tsoukatosia feheri* nov. spec. differs from the other species of the genus except *T. christinae* A. & P. L. REISCHÜTZ 2003 and *T. pallgergelyi* A. & P. L. REISCHÜTZ & SZEKERES 2016, from which it is distinguished by its smaller, less slender shell, weaker basal furrow, and only finely serrate parietal margin of the peristome. The three localities of this species are next to each other along the W side of the Parnon ridge.

Tsoukatosia brandstetteri nov. spec.
(Figure 2f)

Diagnosis: Large, slender, densely costate *Tsoukatosia* with strong, in front view well visible basal furrow. Peristome abruptly backward-bent at the basis, its parietal margin is strongly serrate.

Description: The relatively large and slender shell with narrow apex consists of 9¹/₂ whorls. The surface is densely costate, the neck ribs (11 to 12 at the last quarter whorl) are somewhat sharper but not wider-spaced than the preceding ones. The strong basal furrow, reaching up an entire whorl, is well visible in front view. The peristome is relatively small (Hs/Ha 5.18), its basal part bends backward at an angle. The peristome margin is strongly serrate all around, only the sinulus is free of plicae. The weak lamella superior is as much emerged as the adjacent plicae. The lamella inferior is very retracted, its visible end part descends almost vertically, and then turns smoothly toward the peristome to reach its margin horizontally. The lamella subcolumellaris ends just underneath, separated from the inferior by one strong plica. The short plica principalis initiates dorsolaterally, the clausilium plate is narrow with parallel sides. The rest of the clausilial apparatus could not be examined. Dimensions of the holotype: Hs 14.5 mm, Ws 3.2 mm, Ha 2.8 mm, Wa 2.0 mm, and of the paratypes: Ha 2.8-2.9 mm, Wa 2.0 mm.

Locus typicus: Parnon Mts., Voskina to Kastanitsa road, cliffs at the Prastos junction (37°15'22" N 22°41'53" E), 560 m (Figure 1; Nr. 11).

Type material: Holotype (from the locus typicus, leg. A., N. & P. L. REISCHÜTZ 5.2016): NHMW 112137. Paratypes: RE/1 body whorl, SZ/1 body whorl (same data).

Derivatio nominis: The new species is dedicated to Clemens M. Brandstetter, secretary of the 'Erste Vorarlberger Malakologische Gesellschaft', a keen researcher of the Limacidae and friend of the authors.

Remarks: Within the genus the strongly elongate shell and high (>5) Hs/Ha index of the new species is shared only with *T. arabatzis* A. & P. L. REISCHÜTZ 2014, *T. christinae*, and *T. pallgergelyi*. However, *T. brandstetteri* nov. spec. can clearly be distinguished from *T. arabatzis* by its larger size and strongly serrate parietal peristome margin, from *T. christinae*, and *T. pallgergelyi* by the weaker and denser sculpture, whereas from all these three species by the very deep positioned, almost vertically descending lamella inferior. The locus typicus is at the foothills of the Parnon Mts., NE of the main ridge.

Unidentified samples

The taxonomic status of the following two *Tsoukatosia* samples, containing only apices, could not be ascertained:

(1) Parnon Mts., 7 km SE of Agios Petros along the road to Katafigio Paronos (37°18'30" N 22°34'39" E), 1000 m (Figure 1, Nr. 12), leg. P. SUBAI 20.5.2011 (P. SUBAI personal communication). The site where two apices were found is only about 1 km north-northwest of the type locality of *T. liae excelsa* nov. subspec.

(2) Parnon Mts., 1 km from Paleochori toward Agios Vasileios (37°10'26" N 22°43'8" E), 760 m (Figure 1, Nr. 13), leg. A., N. & P. L. REISCHÜTZ 5.2017. A single apical fragment of only 3¹/₂ whorls, representing the easternmost *Tsoukatosia* record from the Parnon Mts.

In 2016 two intact shells were found at a locality that had been mentioned earlier only as a site with an unidentified *Tsoukatosia* (A. & P. L. REISCHÜTZ & SZEKERES 2016). This clausiliid, from the Taigetos Mts., cliffs along the Longanikos to Agoriani road (37°13'13" N 22°15'28" E, 800 m), could now be identified by means of complete shells as *T. christinae*.

The distribution of *Tsoukatosia*

The title of the paper that described the first *Tsoukatosia* envisioned that "there may be more" members of this genus awaiting discovery (GITTENBERGER 2000). In the years that followed this prediction became justified by numerous findings that resulted from combining well designed collecting methods with tedious field work. Whereas most of the currently available data are from the Peloponnesos, suggesting that further occurrences may be expected all over the peninsula, there are also records from Central Greece, just north of the Bay of Corinth, and from the Athos Peninsula in Greek Macedonia (A. & P. L. REISCHÜTZ & SZEKERES 2016). Considering that *Tsoukatosia* species, as all European Phaedusinae, are regarded Tertiary relicts (NORDSIECK 1978), the current localities can be viewed as fragmented remnants of a once vast geographical range of the genus.

The available data reveal that, unlike the members of the genus *Sciocochlea* C. R. BOETTGER 1935 which also live in shallow subterranean habitats, the occurrence of *Tsoukatosia* species is not restricted to narrow, 30 to 40 km wide coastal strips. Whereas the near-coastal *T. arabatzis*, *T. argolica* A. & P. L. REISCHÜTZ & SZEKERES 2016 and *T. l. liae* are found at altitudes between 100 and 300 m, more inland localities of the Peloponnesos are at higher elevations, up to 1400 m, that can likely ensure sufficient all year round humidity. Remarkably, there is some apparent correlation between the size of *Tsoukatosia* taxa and the altitude where they occur. Namely, those near the coast tend to be small (Hs <12 mm), while *T. pallgergelyi* and *T. liae excelsa* nov. subspec. that occur above 1000 m are the largest (Hs 16.0 and up to 16.0 mm, respectively). Despite the increasing knowledge there are still important questions about this genus that need

answers. As no live *Tsoukatosia* has ever been found, it remains unclear which samples may have originated from extant populations and which ones from subfossil remnants. Furthermore, obtaining live material could provide invaluable information on the exact habitat requirement and taxonomic position of these snails.

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