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New data on genus *Acicula* Hartmann, 1821 (Gastropoda Aciculidae) in Sicily (Italy) with the description of two new taxa

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ABSTRACT Two new taxa belonging to the genus *Acicula* Hartmann, 1821, are described: *A. giglioi* n. sp., endemic from the Nebrodi Chain (north Sicily), and *A. giglioi peloritana* n. ssp., endemic from Peloritani Ridge (north-eastern Sicily). Their shells are characterized by the shape of the peristome: flattend, well separated from the last whorl of the spire, arched in lateral view and more or less strongly turned backwards in its upper part, crossed by several superficial striae. The two subspecific taxa differ from each other in the different character of the shell (height and diameter of shell, ratio H/D, number of striae in the penultimate whorl) and their distribution (Nebrodi and Peloritani mountains respectively). In addition, *Acicula szigethyannae* Subai, 1977 (Gastropoda Aciculidae), already known in peninsular Italy (from eastern Liguria to southern Calabria) and in eastern Sicily, is now confirmed as present in all central-eastern Sicily.

KEY WORDS *Acicula*; Sicily; taxonomy; biogeography.

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INTRODUCTION

The aciculids (Gastropoda, Caenogastropoda Aciculidae) are a family of small land molluscs with operculum, provided of cylindrical or cylindro-conical shell, living in the litter, in the soil and in the rotting wood. It includes four different genera: *Acicula* Hartmann, 1821, *Menkia* Boeters, Gittenberger & Subai, 1985, *Platyla* Moquin-Tandon, 1856 and *Renea* G. Nevil, 1880 (Boeters et al., 1989). With the exception of *Menkia*, endemic from the Iberian Peninsula, and *Renea*, restricted to the central-southern Europe, the other two genera are widespread in the western Palearctic area (Subai, 1977; Boeters et al., 1985; Boeters et al., 1989; Gittenberger, 1991; Rolan, 2003; Bertrand, 2003; Gittenberger, 2004; Welter-Schultes, 2012; Bank & Neubert, 2022; Bank & Ramos, 2022; MolluscaBase, 2022).

The taxonomy of this family is based exclusively on the morphological features of the shell: size, superficial macro-sculpture, coloring, presence and features of external peristomal varix and sinulus. Anatomical studies have not provided any significant diagnostic element for a generic and specific separation, due to a remarkable homogeneity of the genital and other internal organs. However, the absence of genetic studies has never established their phylogenetic significance (Manganelli et al., 2014).

About thirty different taxa belong to the genus *Acicula*, the large part of which live in Europe (Subai, 1977; Boeters et al., 1985; Boeters et al., 1989; Gittenberger, 1991; Rolan, 2003; Bertrand, 2003; Gittenberger, 2004; Welter-Schultes, 2012; Bank & Neubert, 2022; Bank & Ramos, 2022; MolluscaBase, 2022). Ten taxa are also reported in the Italian territory, excluding Sardinia (Alzona, 1971; Subai, 1977; Boeters et al., 1989; Bodon, 1994; Bodon et al., 1995; Eikenboom, 1998; Ferreri et al., 2005; Reitano et al., 2009; Welter-Schultes, 2012; Nardi, 2015; Birindelli et al., 2020; Liberto et al., 2020; Bodon et al., 2021; Bank & Neubert, 2022). Moreover, seventeen fossil species are known, ranging from Oligocene to Pliocene, seven of these still live today (Manganelli et al., 2014).

The Italian living species are: *A. beneckei* (Andreae, 1883) endemic to Lombardian Prealps (Bergamo, Brescia and Lecco provinces) but also known for a single record near Molveno (Trento province); *A. benoiti* (Bourguignat, 1864) endemic to Sicily; *A. disjuncta* Boeters, Gittenberger et Subai, 1989, known only for a small area near Catanzaro (Calabria) but also present in the Balkans; *A. hierae* Liberto, Reitano, Viviano et Sparacio, 2020, endemic to Marettimo island (Sicily); *A. lineata sublineata* (Andreae, 1883) living in part of northern Italy (Piedmont, Lombardy and Trentino-Alto Adige); *A. lineolata lineolata* (Pini, 1885) only known for some regions of northern Italy (Valle d'Aosta, Piedmont, Lombardy and Trentino-Alto Adige); *A. lineolata banki* Boeters, Gittenberger et Subai, 1989 known in peninsular Italy, up to Basilicata and northern Calabria; *A. szigethyannae* Subai, 1977, distributed from eastern Liguria (but data from Fiume Magra debris may have originated from Tuscany) to southern Calabria; *A. vezzanii* Bodon, 1994 endemic of Genoa province (Liguria); *Acicula* sp. 1, an undescribed species, endemic to western Liguria (Imperia province), similar to *A. lineolata* but characterized by a larger size (Birindelli et al., 2020; Bodon et al., 2021).

The study of several populations of *Acicula*, found in Sicily in recent years, has made possible to obtain new taxonomic and biogeographical data on the presence of this genus in Sicily. In the present work, two new taxa from north-eastern Sicily are described and the presence of *A. szigethyannae* in central-eastern Sicily is confirmed and supported by new original data.

MATERIAL AND METHODS

The shells examined in the present study were found in litter collected in woods, under stones and in the crevices of the rocky walls; the debris were subsequently dried and sieved. The samples were washed through sieves of decreasing mesh sizes (10, 2 and 1 mm) and the mollusc content was sorted from each residue. The shells were cleaned with an alternate and repeated washing in a solution of sodium hypochlorite and hydrogen dioxide (3.6%), for a few minutes. Subsequently encrusting residues have been removed with a thin brush. In some cases it was necessary to repeat the washing operations for longer times. The specimens have been analyzed by verifying different morphological features of the shell (general silhouette, shape of the peristome, presence and characteristics of external peristomal varix and sinulus, angular lamella, parietal callus and umbilicus) and measuring different morphometric parameters (maximum height and maximum width of the shells, height and width of the aperture, number of whorls, height of the last whorl, number of assial grooves on the last and penultimate whorls). Some specimens were examined and measured under a stereomicroscope and photographed with a Canon EOS 700D camera with a Tamron 60 mm lens, in multifocal shots processed with the CombineZM software. The specimens used for the preparation of the plates were also examined uncoated under a Tescan Vega 2 LMU Scanning Electron Microscope in Low Vacuum modality to investigate shell micromorphology. All images were taken at the Department of Biological, Geological and Environmental Sciences (University of Catania).

The collection localities are listed according to the following scheme: collecting station, altitude,

municipality (in brackets), geographic coordinates, the names of the collectors and the dates of collection (in brackets), the number of shells examined (dry specimens) and the public/private collections where the samples are stored. Toponyms are reported following the official IGM 1:25,000 cartography of Italy. The materials used for this study are stored as follows: Museo Civico di Storia Naturale di Comiso, Comiso (Ragusa), Italy (MSNC); A. Reitano, Tremestieri Etneo (Catania), Italy (ARC); F. Liberto, Cefalù (Palermo), Italy (FLC); R. Viviano, Palermo, Italy (RVC); I. Sparacio, Palermo, Italy (ISC); Gianbattista Nardi, Gussago (Brescia), Italy (GNC); Antonio Braccia, Brescia, Italy (ABC); S. Giglio, Cefalù (Palermo), Italy (SGC). The nomenclature is based on the checklist of the European and Italian land and freshwater molluscs (Bank & Neubert, 2022; Bank & Ramos, 2022; MolluscaBase, 2022; Bodon et al., 2021).
ACRONYMS. H: shell height, Ha: aperture height, LW: last whorl, MD: maximum diameter.

RESULTS

Systematics

Classis GASTROPODA Cuvier, 1795
Subclassis CAENOGASTROPODA Cox, 1960
Ordo ARCHITAENIOGLOSSA Haller, 1892
Familia ACICULIDAE Gray, 1850
Genus *Acicula* Hartmann, 1821
Type species: *Bulimus lineatus* Draparnaud, 1801

Acicula giglioi n. sp. (Figs. 1–6, 11, 30, 60)
https://zoobank.org:act:3501F595-92B6-4546-9510-C8C264ED54E4

Type locality. Contrada Baratta, Alcara Li Fusi (Messina), Nebrodi Chain, NE-Sicily (Italy).

Type material. Holotype: Contrada Baratta, 470 m a.s.l., Alcara Li Fusi (Messina), 38°1'46.48"N, 14°41'40.40"E, A. Reitano leg., 25.V.2020, 1 shell (MSNC n. 4851). Paratypes: same locality of holotype, 25.V.2020, 7 shells (ARC n. 3670); Pizzo Stifani, 670 m a.s.l., Longi (Messina), 38° 1'59.43"N, 14°44'55.51"E, A. Reitano leg. (25.V.2020), 12 shells (ARC n. 3296); Cozzo Bruno, 224 m a.s.l., Alcara Li Fusi (Messina), 38° 1'57.69"N, 14°41'0.90"E, A. Reitano leg., (20.IX.2021) 15 shells (ARC n. 3671); idem, 3 shells (GNC); idem, 3 shells (RVC); idem, 3 shells (ISC 5809–11); Cozzo Bruno, 224 m a.s.l., Alcara li Fusi (Messina), 38° 1'57.69"N, 14°41.0.90"E, F. Liberto leg. (01.XI.2021) 1 specimen (Fig. 74), 4 shells (FLC 19485–19489); idem, 12 shells, S. Giglio legit (SGC).

Description of holotype. Shell dextral, 4.51 mm height, slighty conical in shape with obtuse apex (maximum diameter of the nucleus 6.65µm); trasparent, glossy and light brown in color; about six slightly convex whorls separated by a deep canaliculated suture; last whorl about the 47% of shell height; first whorl of protoconch crossed by very weak growth striae; the beginning of the first whorl of teleoconch is characterized by the presence of regularly spaced assial grooves; teleoconch is crossed by several irregularly spaced assial grooves, but suddenly more dense: 42 on the penultimate whorl, 45 on the last whorl; wide, sub-rectangular aperture; peristome slightly thickened and reflexed on the columellar side, with an external obsolete varix, clearly separated from the last whorl; varix crossed by five thin growth striae; peristome is very arched in lateral view, with maximum convexity just below its half and with the upper part facing far backwards with respect to the lower part; sinulus absent; well developed parietal callus; weak angular lamella; umbilicus closed.

Variability. The specimens collected in the type locality and in two other localities from the limestone massif Rocche del Crasto (Nebrodi Chain) show the same features of holotype: size of the last whorls and morphology of peristome; the variability concerns: shape from conical to cylindro-conical, number of whorls from 6 to 6½, range of their height from 4.51 to 5.51 mm, range of axial grooves from 31 to 60 striae on the penultimate whorl, range of maximum diameter from 1.5 to 2 mm, maximum curvature of the peristoma between 2/3 of its height and the area located just below its half, ratio H/LW within the range from 37 to 51%, ratio H/MD within the range from 2 to 3.6.

Mollusc. Only one young living specimen was examined (Fig. 60). White body with two blackish stripe surrounding the base of the tentacles in front of the eyes and whitish sole; yellowish visceral sac.

Etymology. The specific name is after Dr. Salvo Giglio (Cefalù, Italy), geologist and friend of the authors.

DISTRIBUTION AND BIOLOGY. *Acicula giglioi* n. sp. seems to be endemic and restricted within the area of the limeston massif of "Rocche del Crasto" (Nebrodi Chain, Messina). *Acicula giglioi* n. sp. lives in litter of oak woods (*Quercus ilex* L.) in limestone environment; the associated malacological fauna is represented by *Platyla similis* (Reinhardt, 1880) and *Gomphroa incerta* (Bourguignat, 1858).

STATUS AND CONSERVATION. The restricted distribution area suggests to include *A. giglioi* n. sp. in the NT (Near Threatened) category, among those proposed by the International Union for Conservation of Nature (Neubert et al., 2019). Furthermore, while the type localities are not interested by important human settlements, they are particularly exposed to the risk of seasonal fires.

REMARKS. *Acicula benoiti* (Figs. 13, 32, 49) and *A. hierae* (Figs. 14, 33, 50), both Sicilian endemisms, differ from *A. giglioi* n. sp. for their sculpture, composed of a smaller number of axial striae and for the peculiar shape of their external peristomal varix: in *A. benoiti* flattened, swollen and brownish above, milky below, crossed by a fewer number of striae; in *A. hierae* very thickened, narrowed above and enlarged below, delimited anteriorly and posteriorly by simple lines. *Acicula giglioi* n. sp., for its rather large number of axial grooves (31–60 on the penultimate whorl), could be compared to some specimens of *A. szigethyannae*, but it is easily distinguishable from the last one for its larger size (in *A. szigethyannae* maximum height is less than 4 mm) and for its very arched peristome in lateral view, with the upper part facing far backwards with respect to the lower part. *Acicula szigethyannae* is characterized by having a sub-quadrangular aperture, sometimes with a slightly thickened peristome, for the wide and flattened peristome, usually separated from the last whorl by a step.

Acicula giglioi peloritana n. ssp. (Figs. 7–10, 12, 31, 52) - https://zoobank.org:act:5E1655C8-5C0C-405F-AEA1-D06EBB23496E

TYPE LOCALITY. Monte Pernice, Contrada Olivarella, Melia (Messina), Peloritani Ridge, Northeastern Siciliy (Italy).

TYPE MATERIAL. Holotype: Italy, Sicily, Olivarella, Monte Pernice, 434 m a.l.s., Melia (Messina), 37°53'42"N, 15°16'15"E, F. Liberto leg. (29.IV.2007), ex (FLC 1743 - MSNC n. 4852). Paratypes: same locality of holotype, S. Giglio leg. (29.IV.2007), 1 shell (SGC); 2.X.2021, A. Reitano leg., 1 shell (ARC n. 3672); idem, 1 shell (FLC 1744); idem, 13.III.2022, I. Sparacio and R. Viviano leg., 3 shells juv. (GNC, RVC and ISC 5812).

DESCRIPTION OF HOLOTYPE. Shell dextral, 3.90 mm height, slighty conical in shape with obtuse apex (maximum diameter of the nucleus 5.5 μm); trasparent, glossy and light brown in color; about 5 and half slightly convex whorls separated by a canaliculated suture; last whorl about the 46% of shell height; first whorl of protoconch crossed by very weak growth striae; the beginning of the first whorl of teleoconch is characterized by the presence of a bundle of 11 thin assial grooves very close together; teleoconch is crossed by numerous irregularly spaced assial grooves, but suddenly more dense: 21 on the penultimate whorl, 23 on the last whorl; sub-rectangular aperture peristome slightly thickened and reflexed on the columellar side, with a flat varix, clearly separated from the last whorl; varix crossed by five thin growth striae; peristome is moderately arched, with maximum convexity at 2/3 of its height and with the upper part facing far backwards with respect to the lower part; sinulus absent; well developed parietal callus; very weak angular lamella; umbilicus closed.

VARIABILITY. Shape from conical to cylindro-conical, number of whorls 5.5–6, range of their height from 3.8 to 4.1 mm, range of axial grooves from 21 to 29 on the penultimate whorl, range of maximum diameter from 1.2 to 1.35 mm, ratio H/LW within the range from 40 to 46 %, ratio H/MD within the range of 2.6 to 3.4.

ETYMOLOGY. From the name of type locality: the Peloritani Rigde (Sicily, Italy).

DISTRIBUTION AND BIOLOGY. *Acicula giglioi peloritana* n. ssp. is currently known only from a little area of the eastern slopes of Monte Pernice, along the Peloritani Ridge (North-eastern Sicily). *Acicula giglioi peloritana* n. ssp. was found in litter of degraded soils with *Ampelodesmos mauritanicus* (Poir.) T. Durand & Schinz, 1894), associated to *Gomphroa incerta*, *Cecilioides* cf. *actoniana* (Benoit, 1862) and *Oxychilus* sp.

STATUS AND CONSERVATION. The same considerations proposed for *A. giglioi* n. sp. can also be applied to this subspecific taxon.

Remarks. *A. giglioi peloritana* n. ssp. differs from *A. giglioi giglioi* n. ssp., mainly for: steady smaller dimensions (height and diameter) (Fig. 59), a less broad apex and a smaller number of striae on the penultimate whorl: 21–29 vs. 31–60.

Acicula szigethyannae Subai, 1977 (Figs. 18–21, 34–40, 53–55)

Acicula benoiti. Boeters et al., 1989: 30, 32, 53, Fig. 54a-b. Siracusa, Castello Eurialo [not Bourguignat, 1864]

Acicula cfr. benoiti. Reitano et al., 2009: 184, Fig. 4a-b. Melilli, Grotta Palombara, in an underground environment [not Bourguignat, 1864]

Material examined. Magra river debris near the Camping Mirafiume, Sarzana (La Spezia) (Liguria), A. Braccia and G. Nardi leg. 11.VI.2000, 44°05’49.0574” N, 15°56’39.7838” E, 1 sp. (GNC); La Romana, Southern slope of Monte Sumbra, Apuan Alps, Stazzema, Careggine, Lucca province (Tuscany), G. Nardi, A. Braccia, R. Frassine, C. Bogi, S. Bartolini and M. Sosso leg. 1.IX.2007, 44°03’19.6107” N, 16°16’16.2141” E, 2 sp. (GNC); Prati di Tivo, Gran Sasso, Pietracamela, Teramo province (Abruzzo) A. Braccia and G. Nardi leg. 25.VI.2008, 42°29’53.2268” N, 13°33’32.00030” E, 3 sp. (GNC), 2 sp. (ABC); Celano Gorges, Celano, L’Aquila province (Abruzzi), N. Nardi leg. 15.VII.1999, 42°05’40.6191” N, 13°34’10.8016” E, 1 sp. (GNC), A. Braccia and G. Nardi leg. 23.VI.2008, 2 sp. (GNC), 3 sp. (ABC); Cantoniera d’Umbra, R.N.O. Falascone, Monte S. Angelo, Foggia province (Apulia), A. Braccia and G. Nardi leg., 15.V.1998, 41°48’31.5805” N, 15°58’52.7121” E, 1 sp. (GNC), 1 sp. (ABC); near Caserma Sfilzi, Bosco Sfilzi, Vico del Gargano, Foggia province (Apulia), A. Braccia and G. Nardi leg. 19.III.2001, 41°50’58.6153” N, 16°00’9.0700” E, 2 sp. (GNC); Bosco Quarto, Foresta Umbra, Gargano, Monte S. Angelo, Foggia province (Apulia), A. Braccia and G. Nardi leg. 15.V.1998, 41°45’44.6972” N, 15°50’14.4325” E, 1 es. (ABC); Asinaro river debris, under the bridge of the road SS115, Noto, Siracusa province (Sicily), G. Nardi leg. 11.VII.2019, 36°53’08.3010” N, 15°03’40.0136” E, 1 sp. (GNC); spring on the right bank of Cassibile river, Cava Grande Lakes, Avola, Siracusa province (Sicily), G. Nardi leg. 10.VII.2019, 36°58’11.0028” N, 15°05’54.0216” E, 1 sp. (GNC); Contrada Bicurca, 110 m a.l.s., Torrenova (Messina), 38°04’30” N, 14°40’17” E; F. Liberto leg. (16.XI.2008), 1 shell, (FLC 4086); R.N.I. “Grotta Palombara, 130 m a.l.s., Melilli (Siracusa), 37°06’22” N, 15°11’39”E, F. Liberto leg. (16.V.2009), 7 specimens (FLC 4501–4507); Rocche, 540 m a.l.s., Alì (Messina), 38°03’19” N, 15°22’40” E, F. Liberto leg. (16.VIII.2009), 2 shells (FLC 5087–5088). Pizzo Motta, 172 m a.s.l., Fiumedinisi (Messina), 38°1’15.91”N, 15°23’6.04”E, A. Reitano leg. (26.V.2019), 1 shell (ARC n. 3441); Cava d’Ispica , 344 m a.s.l., Modica (Ragusa), 36°51’13.33”N, 14°50’12.71”E, A. Reitano leg. (2017–2020), 18 shells (ARC n. 2801); Cava del Carosello, 298 m a.s.l., Noto (Siracusa), 36°56’5.30”N, 15° 0’58.70”E, A. Reitano leg. (2015–2019), 19 shells (ARC n. 1114); Cava del Prainito, 156 m a.s.l., Rosolini (Siracusa), 36°52’22.59”N, 14°55’47.44”E, A. Reitano leg. (2017–2019), 5 shells (ARC n. 2074); Vado di Sole, 1645 m a.s.l., Castel del Monte (L’Aquila, Abruzzi), 42°23’43.31”N, 13°47’13.29”E, A. Reitano leg. (13.VIII.2018), 3 shells (ARC n. 2479); Montelanico, 309 m a.s.l., (Rome, Latium), 41°38’4.11”N, 13° 2’39.57”E, A. Reitano leg. (15.VIII.2018), 1 shell (ARC n. 2464).

Remarks. *Acicula szigethyannae* is native to Italy and Montenegro (Subai, 1977). In Montenegro it is reported for the following localities: Crna Gora, Herceg-Novi (Boeters et al., 1989). Until now, the species is also know in the following Italian areas and regions: eastern Liguria (but the specimens collected in the Magra river debris may have originated from Tuscany), Tuscany (Apuan Alps), Marche, Lazio, Abruzzo (Teramo and L’Aquila provinces), Campania (Castellamare di Stabia), Apulia (Gargano, Foggia province), Basilicata, Calabria (Gerace, Reggio Calabria province) and eastern Sicily (Subai, 1977; Boeters et al., 1989; Eikenbbom, 1998; Bodon et al., 2021).

In the new Sicilian localities fresh empty shells and alive specimens were found. They have been sampled in rocky limestone habitat with mediterranean maquin, under big stone, in leaf litter and plant debris. The specimens collected by Subai at Castello di Eurialo (Syracuse, south-eastern Sicily) and determined as *A. benoiti* in Boeters et al. (1989: 30, 32, 53, Fig. 54) must be referred to *A. szigethyannae*; *A.* cfr.

benoiti reported by Reitano et al. (2009) for the Palombara Cave, near Siracusa (southeastern Sicily) must also be referred to *A. szigethyannae.*

The Sicilian specimens, although show a very variable shell morphology (ratio diameter/height, a number of outer variable striae), like all other populations of peninsular Italy, present the typical squared aperture and straight or slightly arched peristome in lateral view of *A. szigethyannae.*

This species is currently not protected in the countries where it occurs and listed in the Least Concern category (LC) by IUCN (Feher, 2013).

DISCUSSION

Due to its morphological features *A. giglioi giglioi* n. ssp. and *A. giglioi peloritana* n. ssp. are both well distinguishable from the other Sicilian taxa, but also from all the other Italian and European ones (Subai, 1977; Boeters et al., 1985; Boeters et al., 1989; Gittenberger, 1991; Rolan, 2003; Bertrand, 2003; Gittenberger, 2004; Welter-Schultes, 2012; Bank & Neubert, 2022; Bank & Ramos, 2022). In particular, no other *Acicula* species present the peculiar shape of the peristome of *A. giglioi* n. sspp., arched in lateral view and usually strongly turned backwards in its upper part; this last element, not known in the shells belonging to the genus *Acicula*, is sometimes present in some *Renea* species (Boeters et al., 1989: 175, Fig. 174).

Acicula beneckei (Andreae, 1883) (Figs. 28, 57), endemic of a limited area between central-eastern Lombardy and western Trentino (Bodon et al., 2021), show a peculiar and wide sinulus in the upper part of the lip. *Acicula disjuncta* Boeters, Gittenberger et Subai, 1989 (Figs. 22, 46), known in Italy for a small area near Catanzaro (Calabria), but also known for the Balkans (Boeters et al., 1989; Welter-Schultes, 2012) is morphologically characterized for its bigger size, being the largest species within the *Acicula* genus (height of 5.4-6.2 mm in the Italian specimens).

Acicula lineata sublineata (Andreae, 1883) (Figs. 35, 54), present only in some regions of northern Italy (Boeters et al., 1989; Bodon et al., 1995; Welter-Schultes, 2012; Bodon et al., 2021) shows a small shell (height that rarely exceeds 3 mm) with varix and sinulus not present. *Acicula lineolata lineolata* (Pini, 1885) (Figs. 36, 37, 57, 58), known only for some region of northern sector Italy (Boeters et al., 1989; Bodon et al., 1995; Welter-Schultes, 2012; Bodon et al., 2021), shows a typical pyriform aperture, the varix which is not arched and never turned backwards in its upper part. *Acicula lineolata banki* Boeters, Gittenberger et Subai, 1989 (Figs. 26, 27, 46, 58), recorded in all peninsular Italy, up to Basilicata and northern Calabria (Ferreri et al., 2005; Bodon et al., 2021), shows a peculiar sinulus, just hinted, in the upper part of the lip.

Acicula szigethyannae Subai, 1977, distributed from eastern Liguria to southern Calabria (Bodon et al., 2021), presents a typical squared aperture. *Acicula vezzanii* Bodon, 1994 (Figs. 29, 48, 56), endemic of the Genoa province, has a particularly thickened lip and a very peculiar sculpture, composed of 18/23 axial striae/mm in the penultimate whorl (Bodon, 1994), not present in the other Italian *Acicula*. The Sicilian species *A. benoiti* (Bourguignat, 1864), endemic of Sicily, and *A. hierae* Liberto, Reitano, Viviano et Sparacio, 2020, endemic to Marettimo Island (Egadi Archipelago), both show a oval aperture and a swollen peristomal varix, not present in the new taxa here described. Finally, *Acicula* sp. 1 (Birindelli et al., 2020; Bodon et al., 2021), an undescribed species endemic to western Liguria, is very similar to *A. lineolata* but with a larger size.

During the acquisition of the SEM photographs, a microsculpture on the protoconch of *Acicula* shells were observed; unfortunately, some specimens apparently in a good state of conservation, turn out to be corroded under SEM view. This did not allow to decide whether this factor can support the taxonomic criteria used so far but, in the future, we hope to be able to study new specimens in a perfect state of conservation, which allow to continue the research along this way.

Anyway, all the Italian species of *Acicula* show a shell surface with microsculpture. In general it consists of superficial punctae and pores that probably run through the entire thickness of the shell. However, the pores are much deeper and generally wider than the punctae. In the present paper, the study of the microsculpture carried out on all the species of sicilian species of *Acicula* has allowed us to suppose that each species has its own peculiar pattern. We selected an area equal to

50µm, within which we described the quantity of punctae and pores.

The sample of *A. benoiti* (Fig. 49) examined by us shows traces of corrosion which do not allow us to evaluate the number of punctae and/or pores present. However, an overall number of punctae/pores of about 20 would seem to be present; *A. hierae* (Fig. 50) clearly has an higher number of punctae than *A. benoiti*, i.e., about 80, and 5 distinct pores; *A. giglioi giglioi* n. ssp. (Fig. 51) has about 160 punctae and 8 distinct pores, while *A. giglioi peloritana* n. ssp. (Fig. 52) presents an higher number of punctae, over 200, and the absence of pores.

Acicula szygethiannae (Figs. 53–55), would seem to be the only Italian species to have a smooth shell, i.e., without punctae, with a variable number of pores depending on the population. The specimen from Cava d'Ispica (Sicily) (Fig. 55), even if corroded, seems to have a greater number of pores (and a few punctae?) than specimens from other Italian populations.

Acicula vezzani (Fig. 56), *A. beneckei* (Fig. 57) and *A. lineolata banki* (Fig. 58), of which we offer detailed photos (only because we have photos of specimens in excellent condition), present very peculiar microsculptures, different in terms of the number and size of the punctae, as well as the number and size of pores. The conclusions we have reached, even if preliminary, allow us to affirm the micromorphological features support to the recent description of *A. hierae* and mainly to the description of the two subspecies proposed here.

In conclusion, a identification key to distinguish the species of the genus *Acicula* living in Italy is proposed below, referring only to adult specimens (shell features as in Boeters et al., 1989: 18, Figs. 11–13):

1a. Shell with sinulus.....2
1b. Shell without sinulus.....3

2a. Sinulus long, running back the suture between the last and the penultimate whorl; endemic to Bergamo, Brescia, Lecco and Trento province.... ..... *A. beneckei*
2b. Sinulus very short, reduced to the upper part of the outer lip; peninsular Italy from Liguria to Basilicata and northern Calabria (Cosenza province).....*A. lineolata banki*

3a. Outer lip with peristomal varix.....4
3b. Peristomal varix not present, umbilicus closed; Piedmont, Lombardy and Trentino-Alto Adige.....*A. lineata sublineata*

4a. Surface very striated (18/23 striae/mm on the last whorl); endemic to Genoa province (Liguria).....*A. vezzanii*
4b. Surface with much less striae.....5

5a. Very large shell, more than 5 mm in height; Catanzaro province (Calabria).....*A. disjuncta*
5b. Shell less than 5 mm in height.....6

6a. Peristomal edge strongly curved in lateral view; upper part moved back than the inferior one....7
6b. Peristomal edge not curved or just little curved in lateral view.....8

7a. Shell higher than 4.51 mm, 31–60 striae on penultimate whorl; Nebrodi Chain (NE Sicily).....*A. giglioi giglioi* n. ssp.
7b. Shell less than 4.10 mm in height; 21 to 29 striae on penultimate whorl; Peloritani Ridge (NE Sicily).....*A. giglioi peloritana* n. ssp.

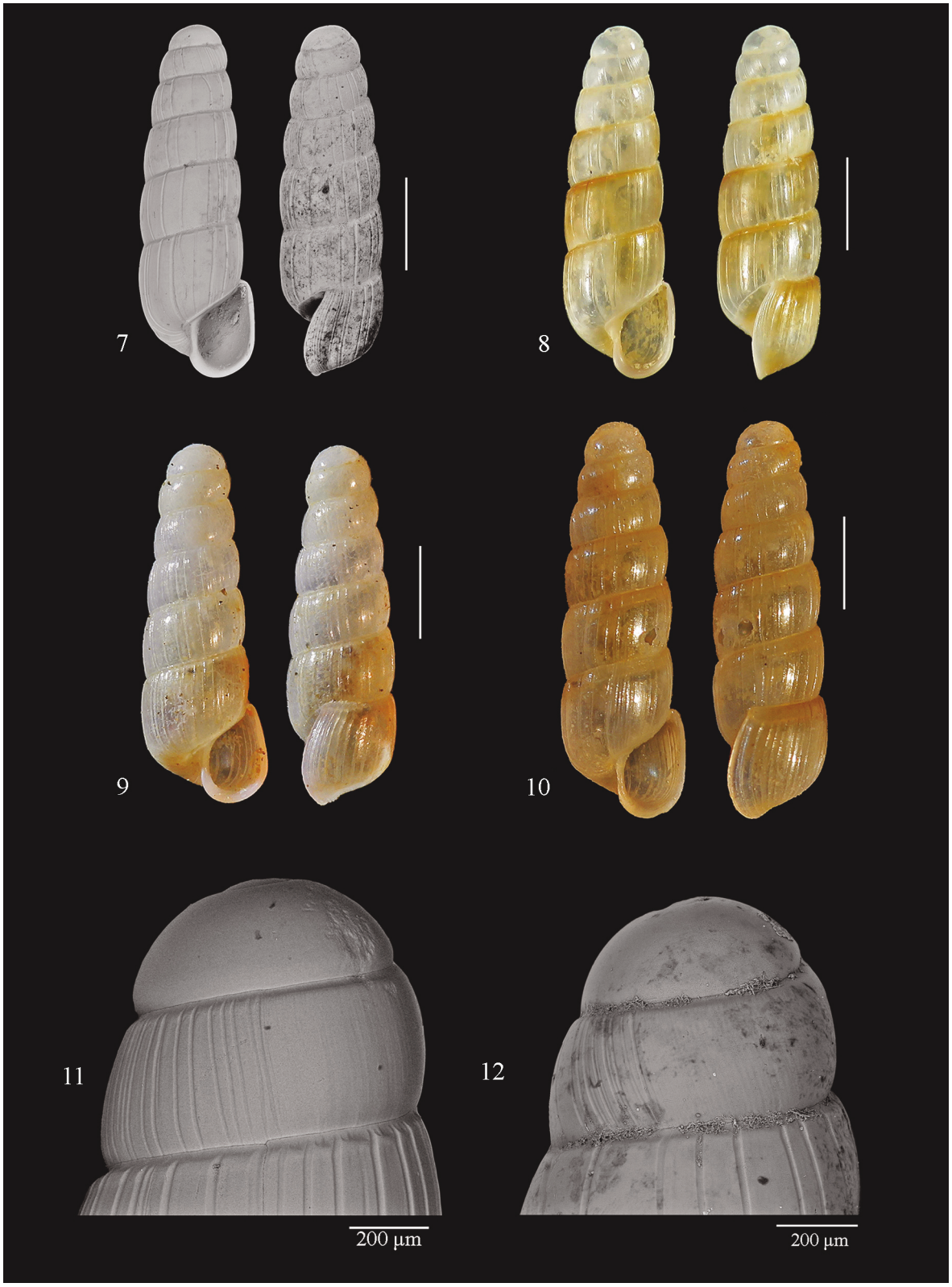
8a. External peristomal varix swollen.....9
8b. External peristomal varix flat or not very distinct.....10

9a. External peristomal varix with same width throughout its length, flat superiorly, swelling below (NW Sicily).....*A. benoiti*
9b. External peristomal varix narrowed at the top and widened in its lower part; Marettimo Island (NW Sicily).....*A. hierae*

10a. Aperture subsquared, in frontal view; mainland Italy from eastern Liguria to southern Calabria and central-eastern Sicily.....*A. szigethyannae*
10b. Aperture piriform, in frontal view.....11

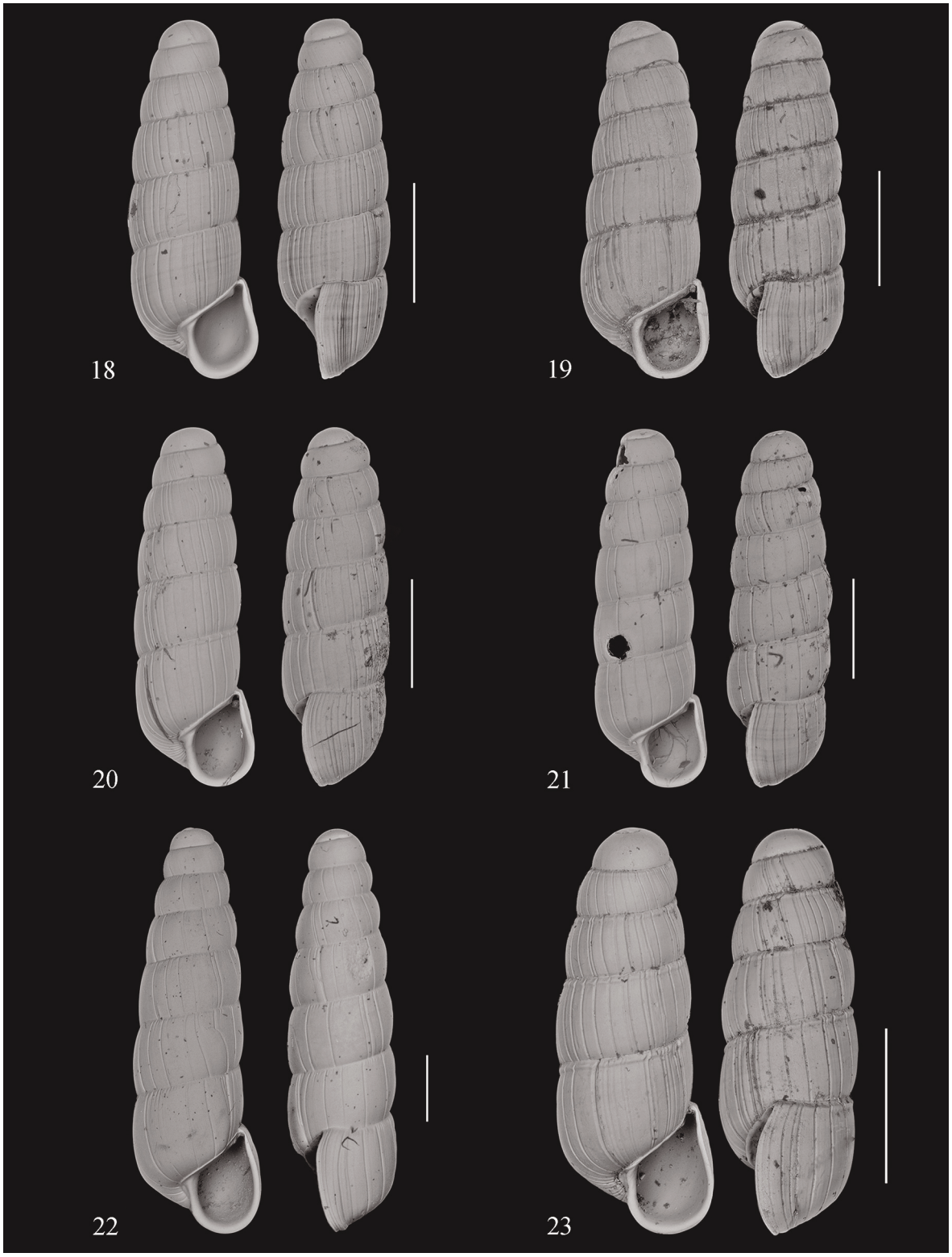
11a. Shell height about from 3.4 to 4.2 mm; Valle d'Aosta, Piedmont, Lombardy and Trentino-Alto Adige.....*A. lineolata lineolata*
11b. Shell larger than *A. lineolata lineolata*; only Imperia province (W Liguria)..... .....*A.* sp. 1 (sensu Birindelli et al., 2020)

Figures 1–6. *Acicula giglioi giglioi* n. ssp. Fig.1 Holotype: Italy, Sicily, Messina, Alcara Li Fusi, Contrada Baratta; Figs. 2–6 Paratypes: Italy, Sicily, Messina, Alcara Li Fusi, Contrada Baratta. Scale bar 1 mm.

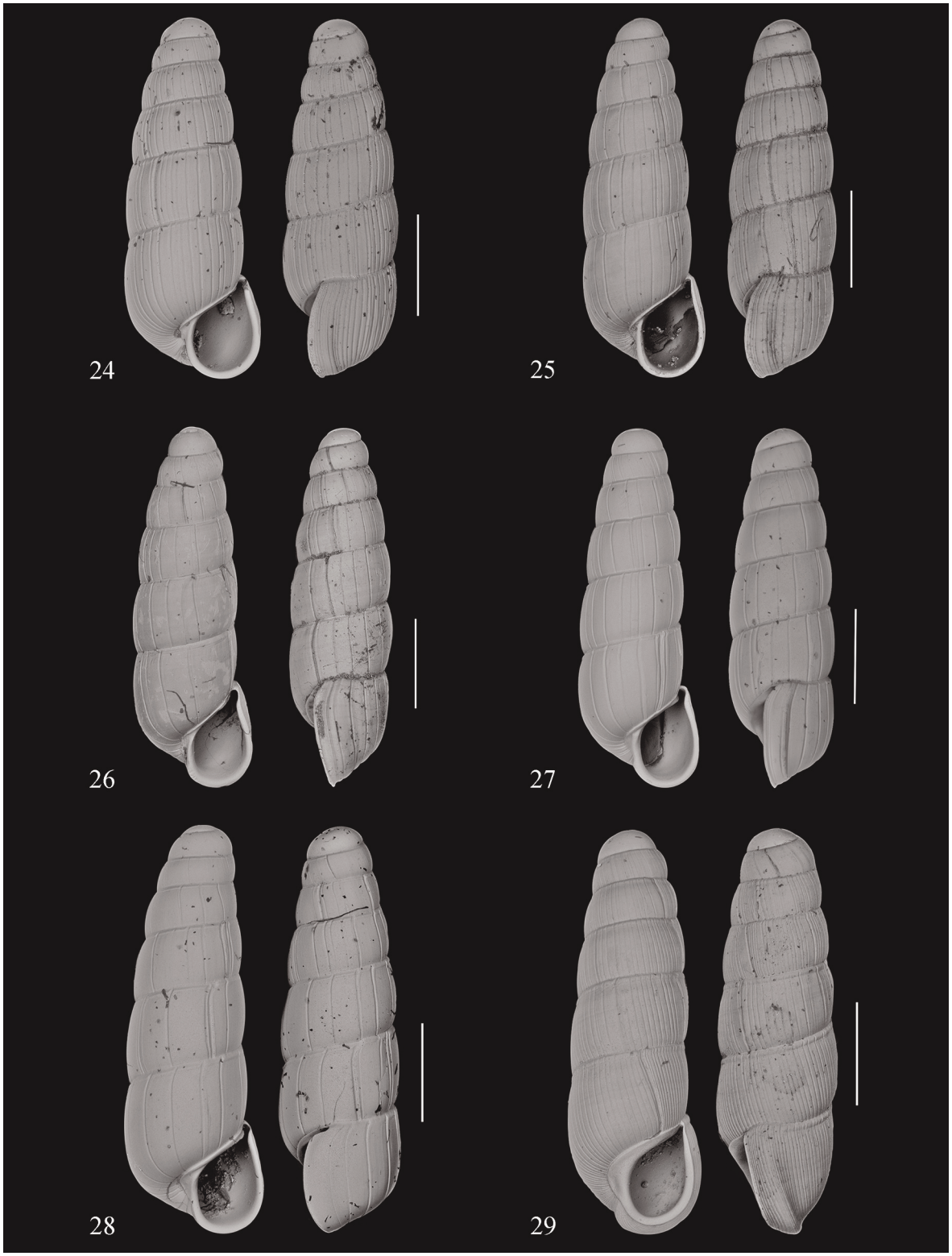


Figures 7–12. *Acicula giglioi peloritana* n. ssp. Figs. 7, 8: holotype: Italy, Sicily, Messina, Melia, Contrada Olivarella. Scale bar 1 mm. Figs. 9, 10: paratypes, Italy, Sicily, Messina, Melia, Contrada Olivarella. Scale bars 1 mm. Figure 11. *Acicula giglioi giglioi* n. ssp., holotype, apex. Figure 12. *Acicula giglioi peloritana* n.ssp., holotype, apex.

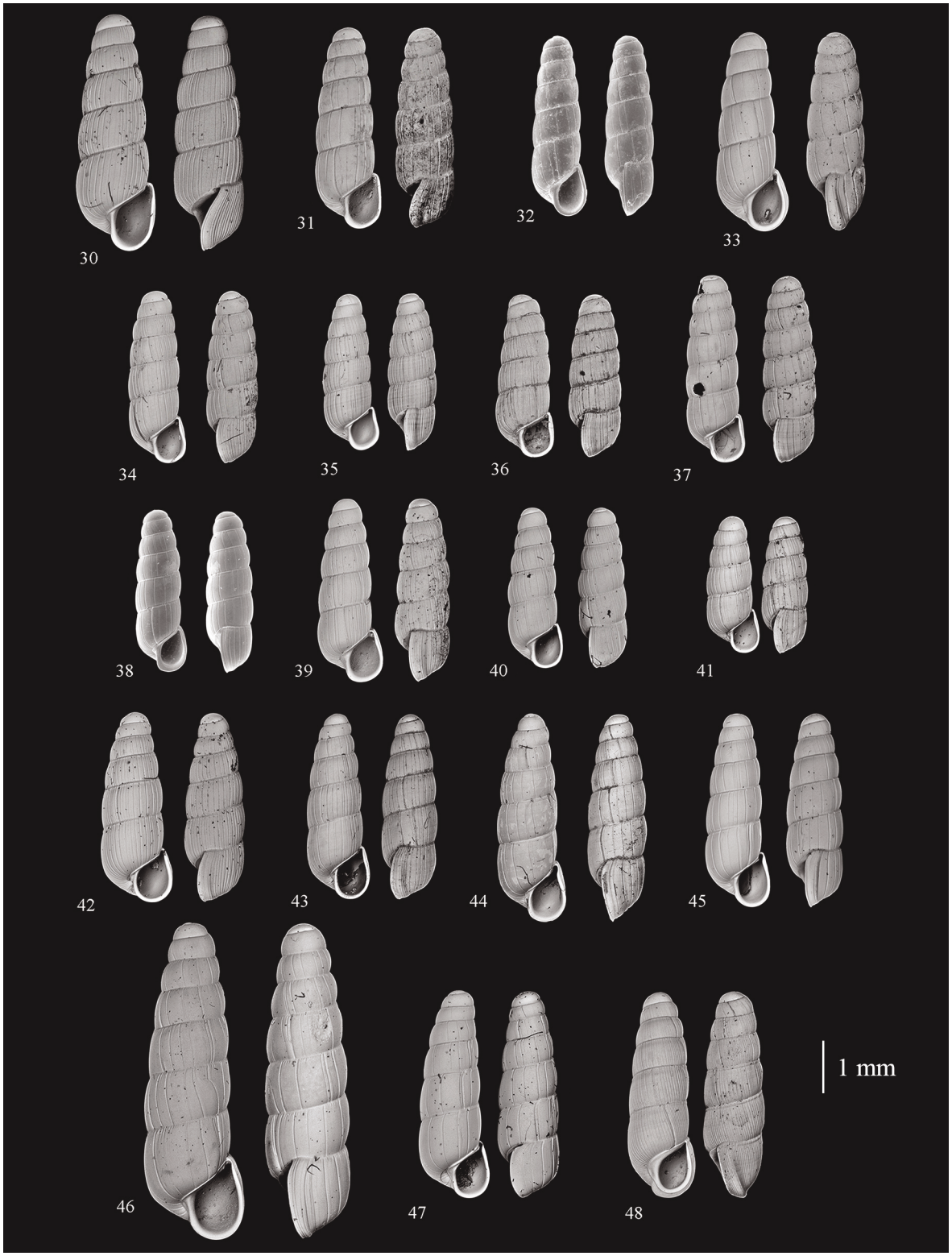
Figure 13. *Acicula benoiti*, Italy, Sicily, Palermo, Grotta Molara. Figure 14. *A. hierae*, Italy, Sicily, Trapani, Marettimo Island. Figures 15–17. *Acicula szigethyannae*. Fig. 15: Italy, Sicily, Siracusa, Cava d'Ispica. Fig. 16: Italy, Sicily, Siracusa, Noto, Noto Antica. Fig. 17. Italy, Sicily, Messina, Torrenova. Scale bars 1 mm.



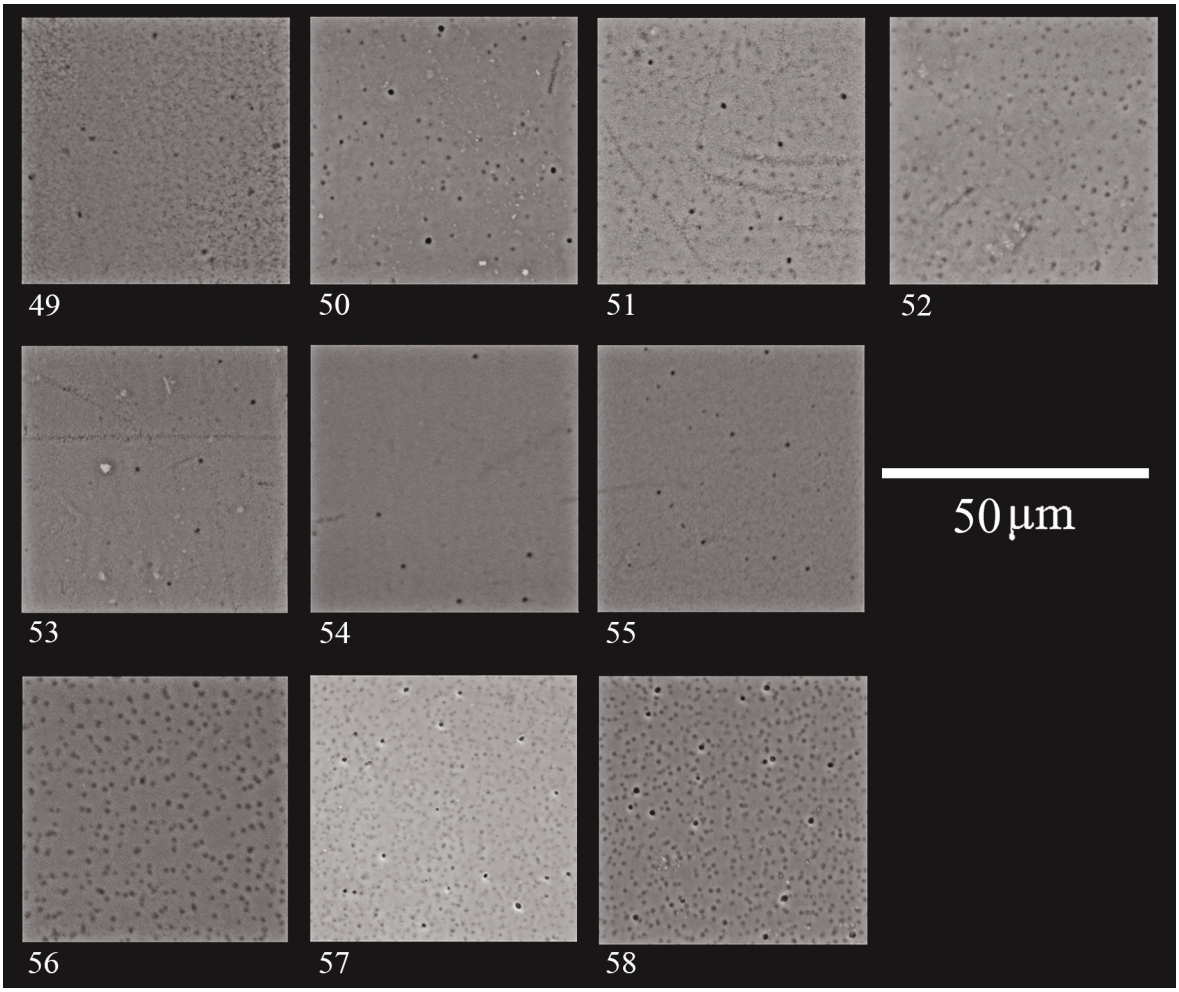
Figures 18–21. *Acicula szigethyannae*, Italy, Puglia, Foggia, Vico Garganico. Fig. 19: Italy, Abruzzo, L'Aquila, Celano, Gole di Celano. Fig. 20: Italy, Abruzzo, L'Aquila, Castel del Monte, Vado di Sole. Fig. 21: Lazio, Roma, Montelanico. Figure 22. *A. disjuncta*, Italy, Calabria, Catanzaro, Tiriolo. Figure 23. *A. lineata sublineata*, Italy, Trentino Alto-Adige, Trento, Storo, Valle d'Ampola. Scale bars 1 mm.



Figures 24, 25. *Acicula lineolata lineolata*. Fig. 24: Italy, Lombardy, Bergamo, Ambria. Fig. 25: Italy, Lombardy, Bergamo, Bracca, Orrido di Bracca. Figures 26, 27. *A lineolata banki*. Fig. 26: Italy, Basilicata, Potenza, Lagonegro; Fig. 27: Italy, Veneto, Verona, Sant'Anna d'Alfaedo, Ponte di Veja. Figure 28. *A. beneckei*, Italy, Lombardy, Bergamo, Ambria. Figure 29. *A. vezzanii*, Italy, Liguria, Genova, Santa Margherita Ligure. Scale bars 1 mm.



Figures 30–48. Dimensional comparison among the Italian taxa belonging to the genus *Acicula*. Figure 30. *Acicula giglioi giglioi* n.ssp. Figure 31. *A. giglioi peloritana* n.ssp. Figure 32. *A. benoiti*. Figure 33. *A. hierae*. Figures 34–40. *A. szigethyannae*. Figure 41. *A. lineata sublineata*. Figures 42, 43. *A. lineolata lineolata*. Figures 44, 45. *A. lineolata banki*. Figure 46. *A. disjuncta*. Figure 47. *A. beneckei*. Figure 48. *A. vezzanii*. Scale bar 1 mm.



Figures 49–58. Microsculpture of apex in *Acicula* shells under the SEM photographs. Fig. 49: *Acicula benoiti*. Fig. 50: *Acicula hierae*. Fig. 51: *Acicula giglioi giglioi* n. ssp. Fig. 52: *Acicula giglioi peloritana* n. ssp. Figs. 53–55: *Acicula szigethyannae.* Fig. 56. *Acicula vezzani*. Fig. 57. *Acicula beneckei.* Fig. 58: *Acicula lineolata banki*.

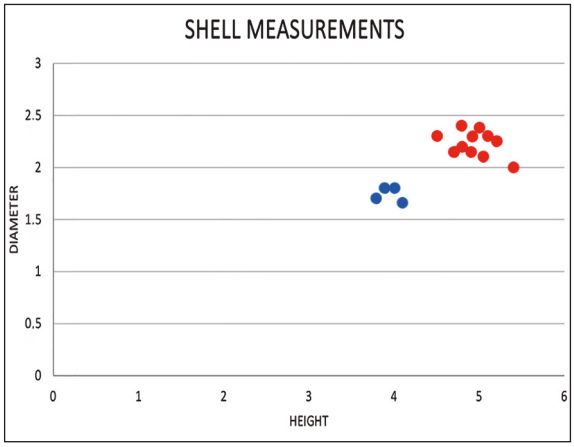


Figure 59. Ratio of shells measurements in *Acicula giglioi* n. sp (red) and *A. giglioi peloritana* n. ssp. (blue).

Figure 60. Young specimen of *Acicula giglioi* n. sp. (Italy, Sicily, Messina, Alcara li Fusi, Cozzo Bruno, 224 m).

CONCLUSIONS

The discovery of two new taxa, belonging to the genus *Acicula*, within two distinct areas - Nebrodi Chain and the Peloritani Ridge (north-eastern Sicily) - confirms the high biodiversity of this mountainous and wooded area, inserted in the broadest context of the great naturalistic value of the island of Sicily. The description of *A. giglioi giglioi* n. ssp. and *A. giglioi peloritana* n. ssp., the recent establishment of *A. hierae* and the confirmation of *A. szigethyannae* in central-eastern Sicily, make this island the richest European region in *Acicula* with 5 taxa which, except *A. szigethyannae*, are endemic.

Based on current knowledge, the total count of Italian species and subspecies also grows further, with 12 different taxa, more than half of which are exclusive: *A. beneckei*, *A. benoiti*, *A. hierae*, *A. giglioi giglio*i n. ssp., *A. giglioi peloritana* n. ssp., *A. vezzanii* and *Acicula* sp. 1 from Liguria.

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