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A new species of *Acicula* Hartmann, 1821 (Gastropoda Architaenioglossa Aciculidae) from western Sicily (Italy)

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ABSTRACT

Malacological surveys in the limestone massifs west of Palermo (Carini, North-western Sicily, Italy), revealed the presence of a new species of Aciculidae: *Acicula occidentalis* n. sp. (Gastropoda Architaenioglossa Aciculidae). Diagnostic traits are: the high number of axial irregularly distributed grooves, the sub-rectangular to pyriform aperture and the larger size compared to other *Acicula* taxa known for Sicily. *Acicula occidentalis* n. sp. seems to be restricted to the mountains west of Palermo, until now known only to the eastern slopes of Montagna Longa (Carini).

KEY WORDS

Taxonomy; biogeography, biodiversity hot spot.

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INTRODUCTION

The Aciculidae is a family of small land operculate snails, with a cylindrical or cylindro-conical shell, living among litter, soil and rotting wood, at the base of limestone cliffs, usually in calcareous substrate. It includes four genera: *Acicula* Hartmann, 1821, *Menkia* Boeters, Gittenberger et Subai, 1985, *Platyla* Moquin-Tandon, 1856 and *Renea* G. Nevil, 1880 (Boeters et al., 1989). Excluding *Menkia* (endemic to the Iberian Peninsula) and *Renea*, (restricted to the central-southern Europe), the other two genera are widespread distributed within the western Palearctic (Subai, 1977; Boeters et al., 1985; Boeters et al., 1989; Gittenberger, 1991; Rolan, 2003; Bertrand, 2003; Gittenberger, 2004; Welter-Schultes, 2012; Bank &

Neubert, 2022; MolluscaBase, 2024). The taxonomy and the systematics of this family are exclusively based upon the traits of the shell: size, macro-sculpturing, colour, presence/absence of an external peristomal varix (and its variability) and shape of the sinulus. Anatomical studies have not provided any significant diagnostic character for a generic and specific delimitation (Boeters et al., 1985). However, the absence of genetic studies has never established their phylogenetic significance (Manganelli et al., 2014).

In Italy, 12 taxa belonging to *Acicula* are currently known (Reitano et al, 2022; MolluscaBase 2024): *A. beneckeai* (Andreae, 1883), *A. benoiti* (Bourguignat, 1864), *A. disjuncta* Boeters, Gittenberger et Subai, 1989, *A. giglioi giglioi*, Reitano, Nardi, Liberto, Sanfilippo, Di Franco, Viviano et

Sparacio, 2022, *A. giglioi peloritana*, Reitano, Nardi, Liberto, Sanfilippo, Di Franco, Viviano et Sparacio, 2022, *A. hierae* Liberto, Reitano, Viviano et Sparacio, 2020, *A. lineata sublineata* (Andreae, 1883), *A. lineolata lineolata* (Pini, 1885), *A. lineolata banki* Boeters, Gittenberger et Subai, 1989, *A. szigethyannae* Subai, 1977, *A. vezzani* Bodon, 1994, *A. sp. 1* (Birindelli et al., 2020; Bodon et al., 2021).

The cryptic habitat of these species does not allow them to be easily found. Much still needs to be done to consider the knowledge of this group satisfactory, especially with regard to possible site protection actions. Field surveys in the western environs of the province of Palermo led to the description of a new species; *Acicula occidentalis* n.sp., from the eastern slopes of Montagna Longa (Municipality of Carini) (Figs. 1, 2).

MATERIAL AND METHODS

The shells were found in litter, under rotten woods, under stones and in the crevices of limestone cliffs, usually in shady, humid north-exposed spots.

The measured shell traits are shown in Fig. 25 and listed in the Acronyms paragraph. The multivariate analyses were conducted using Past v. 4.02 (Hammer et al., 2001), with z-standardized data matrix, both for the principal component analysis PCA (using all principal component axes) and for the NJ tree (performed by means of Euclidean distance).

Specimens were measured under a stereomicroscope and photographed with a Canon EOS 700D camera with a Tamron 60 mm lens, in multifocal shots processed with the CombineZP software. To investigate shell micromorphology the specimens were examined uncoated under a Tescan Vega 2 LMU Scanning Electron Microscope in Low Vacuum modality (Department of Biological, Geological and Environmental Sciences, University of Catania).

The samples are stored as follows: Museo Civico di Storia Naturale di Comiso, Comiso (Ragusa), Italy (MSNC); A. Reitano, Tremestieri Etneo (Catania), Italy (ARC); R. Viviano, Palermo, Italy (RVC); I. Sparacio, Palermo, Italy (ISC); W. De Mattia, Noto (Siracusa), Italy

(WDC); Gianbattista Nardi, Gussago, Brescia, Italy (GNC).

The taxonomic nomenclature follows Bodon et al. (2021), Bank & Neubert (2022) and MolluscaBase (2024), where not otherwise specified. Specimen data are listed using the standardised format suggested by Chester et al. (2019).

ACRONYMS. AH: aperture height, AW: aperture width, BAG: body (last) whorl axial grooves; BSA: body (last) whorl suture angle; BSL: body (last) whorl suture length; BWH: body (last) whorl height; FSA: fourth whorl suture angle; FSL: fourth whorl suture length; FWH: fourth whorl height; PAG: penultimate whorl axial grooves; SH: shell height; SMW: shell maximum width; SSA: second whorl suture angle; SSL: second whorl suture length; SWH: second whorl height; TSA: third whorl suture angle; TSL: third suture length; TWH: third whorl height; W: number of whorls.

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 occidentalis n. sp.

<https://www.zoobank.org/4550DA9A-9D27-4078-9F94-51B8729D20DF>

TYPE MATERIAL. Holotype. ITALY • 1 shell; Contrada Serra Fossi (Carini, Palermo); 483 m a.s.l.; 38° 7'15.44"N-13°9'22.54"E; 18 March 2024; legit A. Reitano, R. Viviano and W. De Mattia; MSCN. Paratypes. • 11 ex; same locality of holotype; ARC. • 11 shells; same locality of holotype; WDC. • 2 shells; same locality of holotype; GNC. • 10 shells; same locality of holotype; RVC. • 25 shells; same locality of holotype; 20 Apr. 2024; RVC. • 11 shells; same locality of holotype; 26 Dec.2024; ISC. • 3 shells; Montagna Longa, trail on the east side, 38°07'48"N 13°08'58.7"E, 800 m, 10 Apr. 2022; RVC.

DESCRIPTION OF HOLOTYPE. Shell dextral, 4.7 mm in height, maximum diameter 1.5 mm, slightly conical in shape with obtuse apex (maximum diameter of the nucleus 6.60 μm) (Figs. 3, 4; 25); translucent, glossy and light brown in colour; with about six slightly convex whorls separated by a deep canaliculated suture; last whorl 2.2 mm, 28.7% of shell height; first whorl of protoconch with very weak radial growth striae; the beginning of the first whorl of teleoconch shows regularly spaced axial grooves; teleoconch presents many

irregularly spaced axial grooves: 46 along the penultimate whorl, 34 along the last whorl; the axial ribs are irregularly spaced and locally denser, abruptly interrupting, giving way to short portions of the whorls, in which the spacing between the ribs becomes wider; this feature is repeated several times along the teleoconch, giving a peculiar appearance to the shell, characterized then by the presence of discontinuous bands with few or without axial grooves; aperture wide, sub-rectangular to pyriform; peristome slightly thickened



Figura 1. Location of the sampling area of Contrada Serra Fossi (Western Sicily, Italy).

Figure 2. Eastern slopes of Montagna Longa (Carini, Palermo, Western Sicily, Italy).



Figures 3, 4. *Acicula occidentalis* n. sp., holotype: Italy, Sicily, Palermo, Carini, Contrada Serra Fossi.
Fig. 3: SEM photo. Fig. 4: Photos of the shell. Scale bar 1 mm.

and reflexed on the columellar side, without external varix; peristome is sharp and slightly arched in side view (Fig. 14); parietal callus well developed; very weak angular lamella; umbilicus closed by a weak callus that forms a slight depression along the columella towards the parietal callus (Fig. 12).

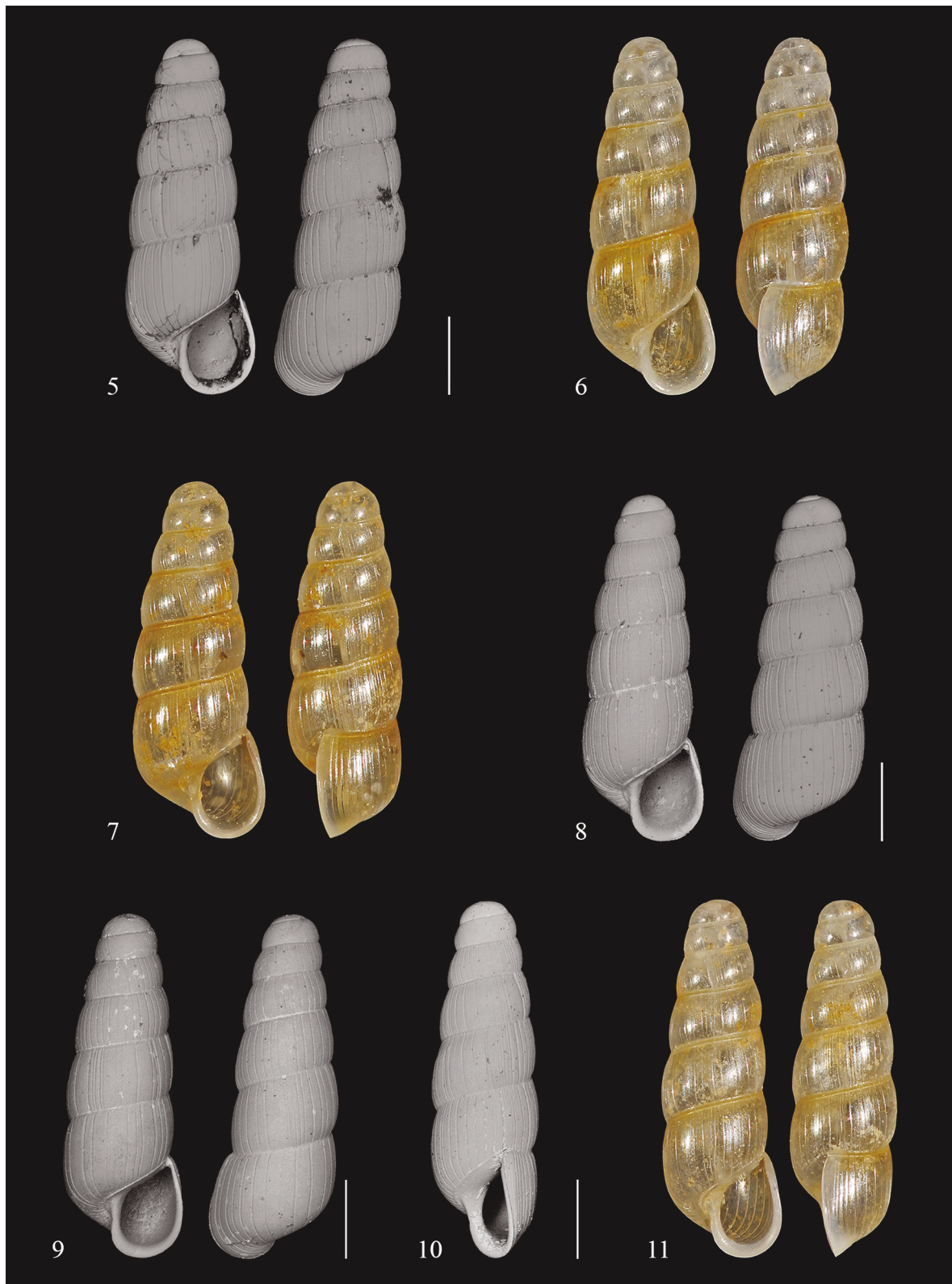
VARIABILITY. The paratypes have no substantial morphological differences with the holotype. Measurements: shell height 4.4 ± 0.2 , min. 4.1 max, 4.6; aperture height 1.3 ± 0.05 , min. 1.2, max 1.4; last whorl height 2.2 ± 0.1 , min. 1.9, max. 2.3; maximum diameter 1.6 ± 0.1 , min. 1.4, max. 1.7. Range of axial grooves from 38 to 49 striae on the penultimate whorl, range of axial grooves from 33 to 49 striae on the last whorl. Ratio H/LW from 3.22 % to 3.48 %, ratio H/MD from 2.69% to 3.03 %. Measurements in mm, n=15 (Figs. 5-11).

ETYMOLOGY. The specific name is “*occidentalis*” since this species was found in the western part of mainland Sicily.

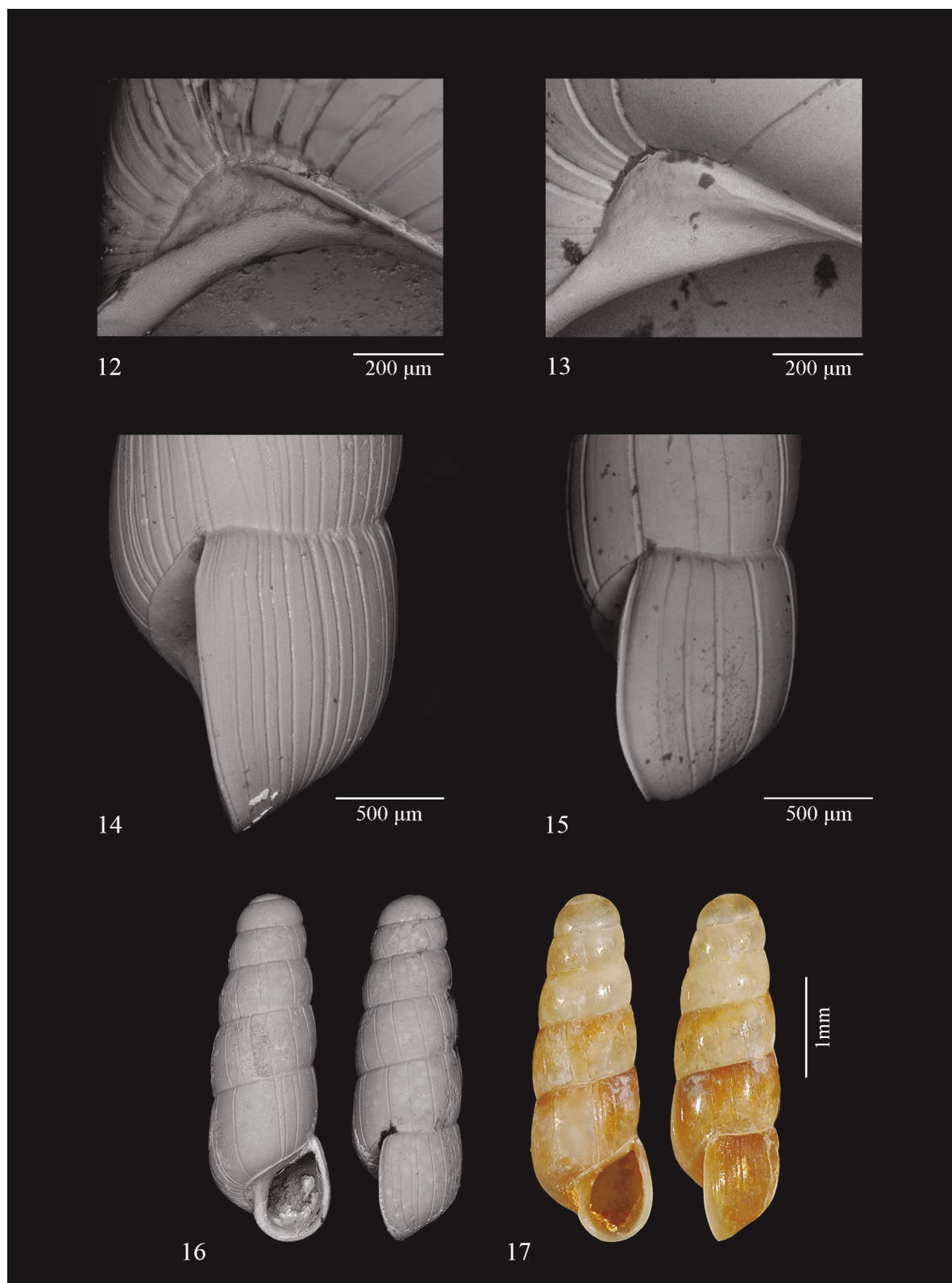
DISTRIBUTION. Until now *A. occidentalis* n. sp. is known only from the type locality Contrada Serra Fossi, Montagna Longa (Carini, Palermo, Sicily, Italy). It lives in sympatry with the congeneric *A. benoiti* (Bourguignat, 1864) (Figs. 13, 15, 16, 17, 19, 20).

STATUS AND CONSERVATION. The area of occupancy of 4 km² suggests to include *A. occidentalis* n. sp. in the NT (Near Threatened) category, among those proposed by the International Union for Conservation of Nature (Neubert et al., 2019). The type locality is not subject to human activities despite it is threatened by seasonal fires.

REMARKS. Among the *Acicula* species found in Sicily, *A. occidentalis* n. sp. is mainly distinguishable due to the absence of the peristomal varix and the pyriform shape of the aperture. Nevertheless, *A. occidentalis* n. sp. could be mistaken with *A. benoiti* and *Acicula* sp. aff. *szigethyannae* (Fig. 24), previously ascribed to *A. szigethyannae* (Bodon et al., 2021; Reitano et al., 2022).



Figures 5-11. *Acicula occidentalis* n.sp., paratypes from Italy, Sicily, Palermo, Carini, Contrada Serra Fossi. Scale bar 1 mm.



Figures 12, 14. *Acicula occidentalis* n.sp. Fig. 12: detail of the parietal callus. Fig. 14: detail of the peristome in side view. Figures 13-17. *A. benoiti* from Palermo, Fossa della Garofala (Italy, Sicily). Fig. 13: detail of the parietal callus. Fig. 15: detail of the peristome in side view. Fig. 16: SEM photo shell. Fig. 17: shell.



Figures 18-24. SEM photos of *Acicula* species from Sicily; scale bar 1 mm; Fig. 18: *A. occidentalis* n. sp., holotype, Contrada Serra Fossi (Palermo, Carini). Fig. 19, 20: *A. benoiti*, Palermo, Fossa della Garofala. Fig. 21: *A. giglioi giglioi*, holotype, Messina, Alcara Li Fusi, Contrada Baratta. Fig. 22: *A. giglioi peloritana*, holotype, Messina, Melia, Contrada Olivarella. Fig. 23: *A. hierae*, Trapani, Marettimo. Fig. 24: *A. sp. aff. szigethyannae*, Ragusa, Cava d'Ispica.

The morphological taxa delimitation has been tested by the order and clustering of the shell quantitative parameters. For each taxon (*A. benoiti*, *A. hierae*, *A. giglioi giglioi*, *A. giglioi peloritana*, *A. szigethyannae* and *A. occidentalis* n. sp.) 19 shell parameters (Fig. 25) are available from 4 specimens: W, SH, BWH, SWH, TWH, FWH, SMW, AW, AH, BSL, SSL, TSL, FSL, BSA, SSA, TSA,

Taxon	Locality
<i>A. benoiti</i>	Fossa della Garofala, Palermo (2 spms)
<i>A. benoiti</i>	Monte Pecoraro, Cinisi, Palermo (2 spms)
<i>A. giglioi giglioi</i>	Contrada Baratta, Alcara Li Fusi, Messina (4 spms)
<i>A. giglioi peloritana</i>	Monte Pernice, Contrada Olivarella, Melia, Messina (4 spms)
<i>A. occidentalis</i> n. sp.	Contrada Serra Fossi, Carini, Palermo (4 spms)
<i>A. szigethyannae</i>	Foresta Umbra, Vico Garganico, Foggia (4 spms)

Table 1. Collecting data of the measured *Acicula* specimens.

FSA, BAG, PAG. Collecting data of the measured *Acicula* specimens are listed in Table 1.

The results of the principal component analysis PCA are visualized in Fig. 26. Each colour represents a taxon (n = 25, see figure's caption for taxa colour code). In the PCA plot the morphological taxa delimitation can be easily seen. A clustering analysis (NJ clustering) of the Euclidean distances from the PCA of shell traits is presented in Fig. 27. Despite the tree illustrates a certain degree of homoplasy of the shell traits, the morphological taxa delimitation can nevertheless be seen by the homogeneous and independent clustering of each taxon.

To make identification easier, a shell morphological dichotomous key is herewith provided.

- 1a. Shell with peristomal varix.....2
1b. Shell without peristomal varix.....3

- 2a. External peristomal varix with same width throughout its length, flat superiorly, swelling below (NW Sicily).....*A. benoiti* (Figs. 19, 20)
2b. External peristomal varix narrowed at the top and widened in its lower part; Marettimo Island (NW Sicily).....*A. hierae* (Fig. 23)

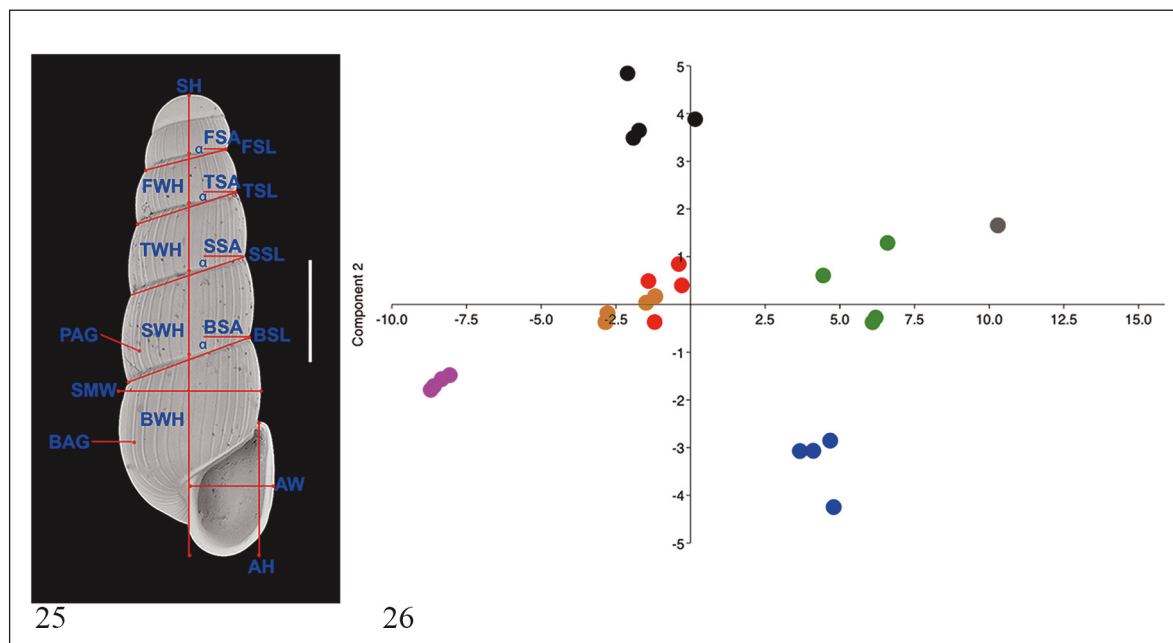


Figure 25, 26. Order and clustering of the shell quantitative parameters of the examined taxa of *Acicula* and results of the principal component analysis PCA (Fig. 26). Each colour represents a taxon. For explanation see text.

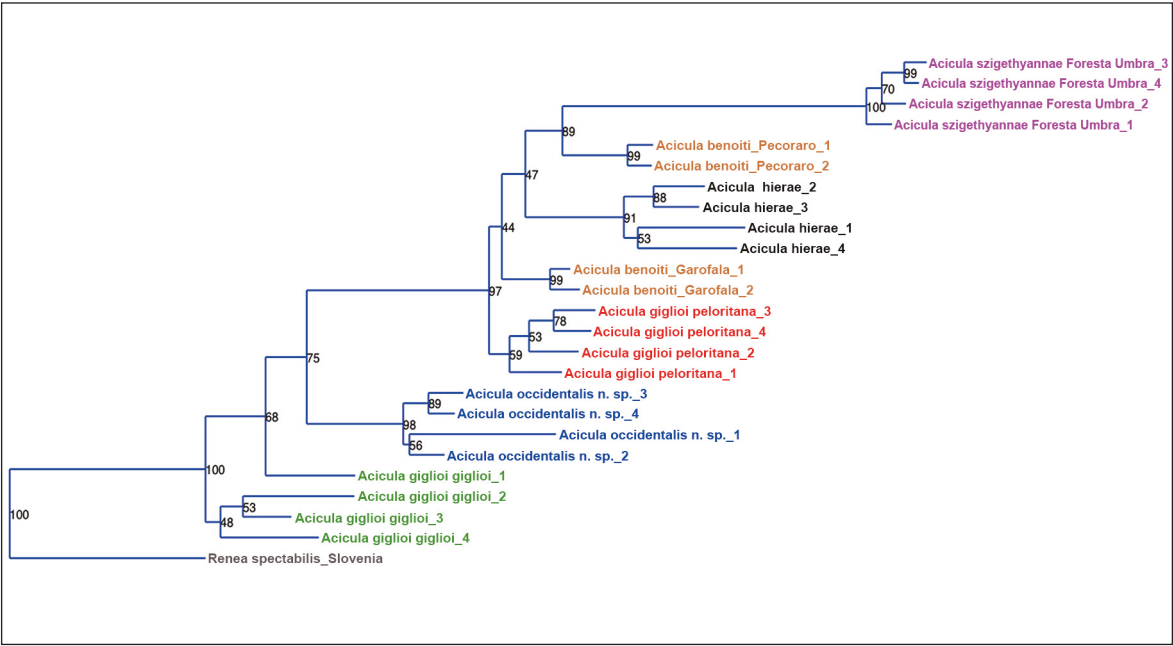


Figure 27. A clustering analysis (NJ clustering) of the Euclidean distances from the PCA of shell traits of the examined taxa of *Acicula* (Nboot = 1000).

- 3a. Peristomal edge strongly curved in lateral view; upper part moved back than the inferior one..... 4
3b. Peristomal edge slightly curved in lateral view.....5
- 4a. Shell higher than 4.51 mm, 31–60 striae on penultimate whorl; Nebrodi Chain (NE Sicily).....
.....*A. giglioi giglioi* (Fig. 21)
4b. Shell less than 4.10 mm in height; 21 to 29 striae on penultimate whorl; Peloritani Ridge (NE Sicily).....*A. giglioi peloritana* (Fig. 22)
- 5a. Shell height more than 4 mm, aperture pyriform in frontal view.....*A. occidentalis* n. sp. (Fig. 18)
5b. Shell height less than 4mm, aperture subquadran- gular in frontal view; side view with a “step” along the lower peristomal margin.....
.....*A. sp. aff. szigethyannae* (Fig. 24)

CONCLUSIONS

The discovery of another new species of terrestrial mollusc supports, as has already emerged in other studies (see Beckmann, 2004; Reitano et al., 2007, 2012; Viviano et al., 2019; De Mattia et al., 2020; Sparacio et al., 2021; Sparacio et al., 2023; Colomba

et al., 2025), the importance of Palermo’s limestone massifs as a hot spot for biodiversity in Sicily. The presence of *A. benoiti*, the recent descriptions of *A. hierae*, *A. giglioi giglioi* and *A. giglioi peloritana*, and the discovery of *A. occidentalis* n. sp., makes Sicily the richest European region in endemic taxa of *Acicula* with 5 species (Bodon et al., 2021; Reitano et al., 2022). The total count of Italian *Acicula* taxa also grows further to 13, more than half of which are endemic, like *A. occidentalis* n. sp., *A. ben-neckei*, *A. benoiti*, *A. hierae*, *A. giglioi giglioi*, *A. gi-glioi peloritana*, *A. vezzanii* and *Acicula* sp. 1 from Liguria (Bodon et al., 2021; Reitano et al., 2022).

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