

A CAMPYLAEA SPECIES FROM CORSICA (GASTROPODA: PULMONATA: HELICIDAE)

GIUSEPPE MANGANELLI¹, ANDREA BENOCCI² & FOLCO GIUSTI¹

¹Dipartimento di Scienze Fisiche, della Terra e dell’Ambiente, Università di Siena, Via Mattioli 4, 53100 Siena, Italy

²Museo di Storia Naturale dell’Accademia dei Fisiocritici, Piazzetta S. Gigli 2, 53100 Siena, Italy

Abstract A species of the ariantine helicid genus *Campylaea* is first reported from Corsica. Shell and anatomical features of the Corsican specimens, particularly the structure of the penial papilla, match those of *C. planospira* (Lamarck, 1822) and the shell size and thick hairy periostracum are in line with those of specimens from the southern coasts of Tuscany (Monte Argentario and Cosa promontory) and the southern Tuscan Archipelago (Giglio and Giannutri islands) assigned to *C. planospira occultata* (Paulucci, 1886). Although autonomous arrival in Corsica cannot be excluded a priori it is probable that the species, only recorded from a single site, was introduced into Corsica, presumably in Roman times.

Key words Land snails, taxonomy, biogeography

INTRODUCTION

During a malacological trip to the island of Corsica in late autumn 1983, we collected some live specimens of an ariantine helicid near Aleria. Despite its faunal interest – species of this group have never been reported from this Tyrrhenian island (cf. Holyoak, 1983; Falkner *et al.*, 2002) – the record was never published.

The ariantine helicids are a large group of mainly medium sized, *Chilostoma*-like shelled species from central and south-eastern Europe (Groenenberg *et al.*, 2016). In the Tyrrhenian area only one genus, *Campylaea* Beck, 1837, is reported (Manganelli *et al.*, 1995; Welter-Schultes, 2012). The speciology of *Campylaea* is inadequately narrative: some taxa have been investigated with molecular tools (Groenenberg *et al.*, 2016), but few populations per clade/taxon were considered and no rigorous anatomical or shell research using statistical analysis was conducted on populations studied by molecular methods.

Alzona (1971), who assembled the first modern checklist of Italian malacofauna, only recognized one species from the peninsular regions and Sicily: *Campylaea planospira* (Lamarck, 1822), divided into many subspecies, tentatively reduced to five by Manganelli *et al.* (1995): *C. p. benedictum* (Kobelt, 1872), *C. p. macrostoma* (Rossmässler, 1836), *C. p. occultata* (Paulucci, 1886), *C. p. planospira* and *C. p. setulosa* (Briganti, 1825).

Subsequent new data on Sicilian taxa was published by Lo Brano & Sparacio (2006), Liberto *et al.*

(2010) and Reitano *et al.* (2012). Lo Brano & Sparacio (2006) stated that *C. p. macrostoma* is anatomically distinct by virtue of a very long diverticulum of the bursa copulatrix duct, while *C. p. benedictum* is very similar to *C. p. setulosa*. Liberto *et al.* (2010) and Reitano *et al.* (2012) subsequently listed *C. benedicta* and *C. macrostoma* as distinct species, based on the unpublished results of a molecular study (Colomba *et al.*, 2008), which however only considered populations from southern Italy and Sicily.

According to Groenenberg *et al.* (2016), the genus *Campylaea* is split into two subgenera: the western Mediterranean *Campylaea* (s.str.) and the mainly central European *Oricampylaea* Groenenberg, Subai & Gittenberger, 2016. Again based on molecular data, *Campylaea* (s.str.) proved to include *C. planospira* while *Oricampylaea* included *C. illyrica* (Stabile, 1864), *C. lefeburiana* (Férussac, 1821), and possibly also *C. ljubetenensis* (Wagner, 1914).

Although Groenenberg *et al.* (2016: 44) clearly stated that morphology (shell and genitalia) usually does not offer diagnostic characters and that more molecular research is needed to obtain a reliable setting at genus level, Bank & Neubert (2017) assigned some of the other *Campylaea* species and subspecies to *Campylaea* (s.str.): *C. p. benedicta*, *C. p. setulosa* and *C. p. occultata* and others to *Campylaea* (*Oricampylaea*): *C. hirta* (Menke, 1830), *C. macrostoma*, *C. padana* (Stabile, 1864) and *C. sadleriana* (Rossmässler, 1838).

The aims of this note are: 1) to describe the Corsican specimens; 2) to attempt a taxonomic

identification; 3) to discuss the biogeographical setting.

THE CORSICAN *CAMPYLAEA*

The shell (Figs 1–2) is medium-sized, subdiscoidal, tectiform above, semitransparent, opaque

above, glossy below, pale yellowish-brown in colour, with a variably evident peripheral brown band bordered on both the sides by a variably evident pale yellowish band; the protoconch whorls have a finely pustulate surface; the teleoconch whorls have a rather thick periostracal layer and



Figures 1–2 Shells of *Campylaea planospira* (Lamarck, 1822) from Aleria (Corsica), F. Giusti & G. Manganelli leg. 30.11.1983 (F. Giusti collection no. 32419).

the surface is covered by collabral growth lines and thick rows of small hairs (longer on upper surface of last whorl) disposed in quincunx (ca 8 per square millimeter on the last whorl), which, being deciduous, are often represented by scars; the whorls, 4.5 in number, grow regularly, the last descending slightly; the umbilicus is wide (ca 1/5–1/6 of max shell diameter) and deep; the aperture is large, oblique, oval to trapezoidal, with a whitish interrupted, slightly thickened and reflexed peristome.

The body and foot are brownish in colour; the pulmonary wall has black spots partially fused to form a net, one larger spot lying close to the pneumostomal opening; the right tentacle retractor passes between penis and vagina; the penial nerve runs from the right cerebral ganglion; the left lateral lobe of the mantle border is small and distant from the left dorsal lobe. For shell dimensions, see Table 1.

The genitalia (Figs 3–4) have the typical scheme of ariantine helicids (see Groenenberg *et al.*, 2016). The male distal genitalia include flagellum, epiphallus and penis. The flagellum is very long (more than double penis length); the epiphallus is slender and slightly shorter than the penis, with the penial retractor inserted distally at ca. 1/3 of its length; the penis is club-like and has a conical, pointed penial papilla with transverse ridges and a longitudinal, slit-like pore, about half its length.

The female distal genitalia comprise free oviduct, bursa copulatrix, bursa copulatrix duct and diverticulum, vagina, digitiform glands and dart sac. The diverticulum of the bursa copulatrix duct is variably long (in one case about as long as the duct, in another about double); the two digitiform glands (mucous glands or accessory glands according to other authors) start close to the base of the dart sac and branch apically into two arms at about 2/3–2/5 of their length (in one specimen, one was unbranched). For dimensions

of some selected tracts of distal genitalia of specimens, see Table 2; for details on material examined, see Appendix 1.

DISCUSSION

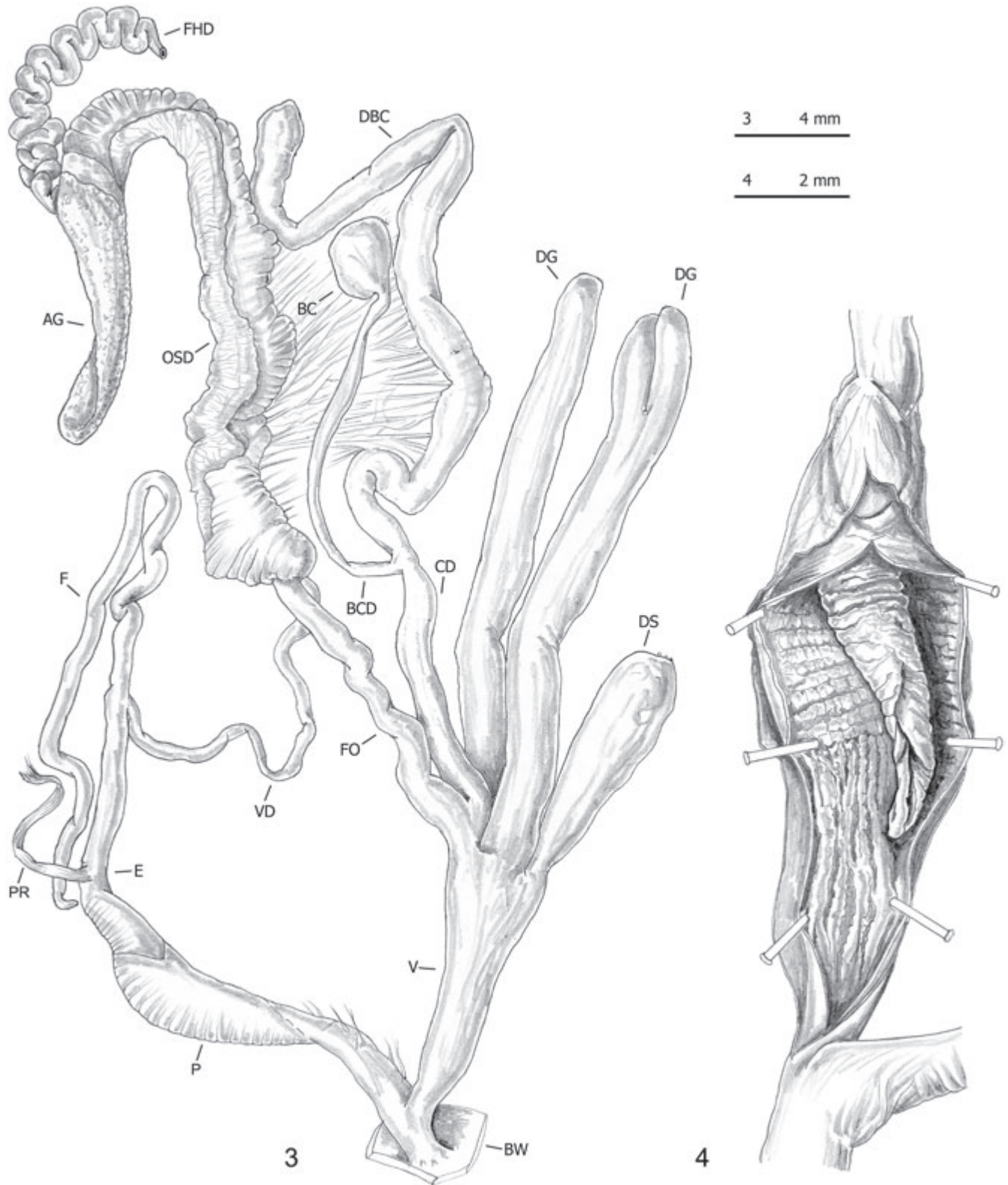
Shell and anatomical features of the Corsican specimens, particularly the structure of the penial papilla, are consistent with those of *C. planospira* s.l., but in the absence of a modern revision of this group, no firm determination is possible. It is also made difficult by uncertainty about the type locality of Lamarck's species. According to Paulucci (1880), who analysed the issue at length and studied the syntypes in Lamarck's collection, F.J.-B. Ménard de la Groye may have collected the shells on which Lamarck based his description in Tuscany (shells from the neighbourhood of Florence and the upper Valdarno matched the syntypes very well). Paulucci agreed with an earlier statement by A. Mousson. Her opinion was later adopted by subsequent authors (e.g. Hesse, 1931; Forcart, 1965) and followed here.

The shell size and thick hairy periostracum of the Corsican specimens are in line with those of *Campylaea* from the southern coasts of Tuscany (Monte Argentario and Cosa promontory) and the southern Tuscan Archipelago (Giglio and Giannutri islands). The Corsican specimens have a variably long diverticulum of the bursa copulatrix duct (13.1 to 21.0mm). Such a variability is also reported by Hesse (1932: 35.0 to 65.0mm) for specimens from Florence, although his figures are very different from those usual for specimens from Monte Argentario and the Tuscan Archipelago (Table 2). The Corsican specimens only have apically branched digitiform glands (at about 2/3–2/5 of their total length). In specimens from Florence the branching apparently starts at about half their length (Hesse, 1931: Pl. 9, fig. 70), in those from Tarquinia branching is absent (Hesse, 1932: Pl. 14, fig. 2) and in those from the Tuscan Archipelago it starts at about 2/3 of their length (Giusti, 1968: Fig. 19, 1976: Figs 42A–B).

It is therefore possible to postulate that the Corsican specimens may belong to *C. planospira occultata*, reported as endemic to the southern Tuscan coasts (Monte Argentario and promontory of Cosa) and the southern Tuscan Archipelago (Giglio and Giannutri islands). However, the true

Table 1 Shell dimensions (in mm) of specimens of *Campylaea planospira* (Lamarck, 1822) from Aleria (Corsica), F. Giusti & G. Manganelli leg. 30.11.1983 (F. Giusti collection no. 32419). Acronyms: SH shell height, SD shell diameter, UD umbilicus diameter.

Site	exx	SH	mim SD	max SD	UD
Aleria	2	11.7–11.8	17.2–19.0	20.6–22.2	3.9–4.0



Figures 3–4 Genitalia (Fig. 3) and internal structure of penis (Fig. 4) of a specimen of *Campylaea planospira* (Lamarck, 1822) from Aleria (Corsica), F. Giusti & G. Manganelli leg. 30.11.1983 (F. Giusti collection no. 32419). Acronyms: AG albumen gland, BC bursa copulatrix, BCD duct of bursa copulatrix, BW body wall, CD common duct, DBC diverticulum of duct of bursa copulatrix, DG digitiform glands, DS dart sac, E epiphallus, F flagellum, FHD first hermaphrodite duct, FO free oviduct, OSD ovispermiduct, P penis, PR penial retractor, V vagina, VD vas deferens.

Table 2 Dimensions (in mm) of selected tracts of distal genitalia of specimens of *Campylaea planospira* (Lamarck, 1822) from Aleria (Corsica), F. Giusti & G. Manganelli leg. 30.11.1983 (F. Giusti collection no. 32419) and other sites from the literature. Anatomical tracts were measured using a calliper under a Wild light microscope (0.01mm). Acronyms: BCD duct of bursa copulatrix, CD common duct, DBC diverticulum of duct of bursa copulatrix, DE distal epiphallus, DG digitiform gland (longest arm), DS dart sac, F flagellum, P penis, PE proximal epiphallus, V vagina.

Site	no.	P+DE	PE	F	V	CD	BCD	DBC	DS	DG	References
Aleria	2	10.5-11.2	4.2-5.0	19.8-20.6	6.7-7.8	7.2-7.9	9.4-14.9	13.1-21.0	6.4-7.0	14.3-16.9	this paper
Giannutri	2	8.3-10.9	3.7-4.7	17.3-22.9	4.1-4.3	6.2-6.3	18.9-19.1	19.1-25.5	5.3	9.9-12.7	Giusti (1976)
Giglio	?			23.0-25.0							Hesse (1932)
Giglio	?	11.0-12.0	4.0-4.5	25.0-26.0	5.0-5.5				5.5-6.0	5.0-5.5	Giusti (1968)
Firenze	?			21.0-35.0	5.5-7.0	7.0-10.0	16.0-25.0	35.0-65.0	9.0	7.0-8.5	Hesse (1931, 1932)
Tarquimia	?			30.0-39.0	7.0-11.0	3.5-5.0	15.0-17.0	26.0-30.0		15.0	Hesse (1932)

taxonomic value of this entity (a species distinct from *C. planospira*? a valid subspecies of *C. planospira*? a junior synonym of *C. planospira*?) remains to be clarified in the context of a comprehensive revision of *Campylaea*.

The present finding is the first report of a species of an ariantine genus in the Sardinian-Corsican Complex, however its biogeographical meaning is uncertain. Although autonomous arrival in Corsica cannot be excluded *a priori*, it seems rather improbable. Indeed an array of diverse organisms occurs in Sardinia and Corsica, the Tuscan Archipelago and/or the coastal areas of Tuscany. Their distribution can be explained in light of the paleogeographic history of the northern Tyrrhenian area. Corsica and Sardinia became definitively isolated at the beginning of the Pliocene (about 5.3 Myr) but repeated, relatively short-lived connections between the mainland Tuscany, via the Tuscan Archipelago, took place during the Quaternary up to 20,000 years ago at least during the major glacial peaks as a consequence of the worldwide lowering of the sea level. These connections enabled biotic exchanges which brought continental species into Sardinia and Corsica and sometimes Sardo-Corsican entities to the Tuscan islands and mainland (for references, see Ketmaier *et al.*, 2010).

However if the taxonomic setting is right, we are faced with a taxon of narrow range in the southernmost sector of the Tuscan coast and Archipelago. This sector seems to have had few contacts with the other islands of the archipelago or with Sardinia and Corsica (Manganelli *et al.*, 2015, 2017). Moreover, the southern Tuscan coasts (Monte Argentario and promontory of Cosa) and islands of Giglio and Giannutri experienced extensive human colonization in Roman times. This colonization probably brought alien species to the area; for example *Trochoidea elegans* (Gmelin, 1791) which can be found on the promontory of Cosa and Giannutri. Aleria is a Roman site and here we can find *T. elegans*. The occurrence of *C. planospira* in Corsica may therefore have a similar origin.

ACKNOWLEDGEMENTS

Many thanks to Giovanni Cappelli (Siena, Italy) who took the photos and to Helen Ampt (Siena, Italy) who revised the English.

REFERENCES

- ALZONA C 1971 Malacofauna italiana. Catalogo e bibliografia dei Molluschi viventi, terrestri e d'acqua dolce. *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano* **111**: 1–433.
- BANK R & NEUBERT E 2017 MolluscaBase. Checklist of land and freshwater Gastropoda of Europe. Last update: 16th July 2017. Accessed at <http://www.molluscabase.org>.
- BECK H 1837 *Index molluscorum praesentis aevi musei principis augustissimi Christiani Frederici*. Hafniae, pp. 1–124.
- BRIGANTI V 1825 Descrizioni di due nuove specie di elici. *Atti della Reale Accademia delle Scienze. Sezione della Società Reale Borbonica* **2**: 165–176, pls: 1–2.
- COLOMBA MS, GREGORINI A, LIBERTO F, REITANO A, RENDA W, POCATERRA G, GIGLIO S & SPARACIO I 2008 Dati molecolari su *Chilostoma (Campylaea) planospira* (Lamarck, 1822) dell'Italia meridionale e Sicilia (Gastropoda Pulmonata Helicidae). Unpublished poster, XXXVII Congresso della Società Italiana di Biogeografia, Catania, 7–10 ottobre 2008.
- FALKNER G, RIPKEN TEJ & FALKNER M 2002 Mollusques continentaux de France: liste de référence annotée et bibliographie. *Patrimoines Naturels* **52**: 1–350.
- FORCART L 1965 Rezenten land- und Süßwasser-mollusken der süditalienischen Landschaften Apulien, Basilicata und Calabrien. *Verhandlungen der Naturforschenden Gesellschaft in Basel* **76**: 59–184.
- GIUSTI F 1968 Notulae Malacologicae – V. Le isole di Gorgona, Capraia e Giglio. *Atti della Società Toscana di Scienze Naturali Residente in Pisa Memorie Serie B* **75**: 265–324.
- GIUSTI F 1976 Notulae Malacologicae XXIII. I Molluschi terrestri, salmastri e di acqua dolce dell'Elba, Giannutri e scogli minori dell'Arcipelago Toscano. Conclusioni generali sul popolamento malacologico dell'Arcipelago Toscano e descrizione di una nuova specie. (Studi sulla Riserva naturale dell'Isola di Montecristo, IV). *Lavori della Società Italiana di Biogeografia Nuova Serie* **5**: 99–355, 19 Pls.
- GMELIN JF [1791] *Caroli a Linné systema naturae*. Tom. I. Pars VI. Beer, Lipsiae, pp. 3021–3910.
- GROENENBERG DSJ, SUBAI P & GITTENBERGER E 2016 Systematics of Ariantinae (Gastropoda, Pulmonata, Helicidae), a new approach to an old problem. *Contributions to Zoology* **85** (1): 37–65.
- HESSE P 1931 Zur Anatomie und Systematik palaearktischer Stylommatophoren. *Zoologica (Stuttgart)* **81**: 1–118, Pls. 1–16.
- HESSE P 1932 Zur genaueren Kenntnis einiger italienischer Heliciden. *Archiv für Molluskenkunde* **64** (6): 189–197, Pl. 14.
- HOLYOAK DT 1983 Distribution of land and freshwater Mollusca in Corsica. *Journal of Conchology* **31** (4): 235–251.
- KETMAIER V, MANGANELLI G, TIEDEMANN R & GIUSTI F 2010 Peri-Tyrrhenian phylogeography in the land snail *Solatopupa guidoni* (Pulmonata). *Malacologia* **52**: 81–96.

- KOBELT W 1872 Neue oder wenig bekannte Campyläen. *Malakozoologische Blätter* **19**: 125–133, pl. 4.
- LAMARCK JPBA DE MONET DE 1822 *Histoire naturelle des animaux sans vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent; précédée d'une introduction offrant la détermination des caractères essentiels de l'animal, sa distinction du végétal et des autres corps naturels, enfin, l'exposition des principes fondamentaux de la zoologie*. Tome sixième. 2me. partie. Chez l'Auteur, Paris, pp. 1–3, 1–232.
- LIBERTO F, GIGLIO S, REITANO A, COLOMBA MS & SPARACIO I 2010 Molluschi terrestri e dulciacquicoli di Sicilia della collezione F. Minà Palumbo di Castelbuono. *Monografie Naturalistiche* **2**: 1–134. Palermo.
- LO BRANO VD & SPARACIO I 2006 Molluschi terrestri dulciacquicoli del S.I.C. Rupi di Catalfano e Capo Zafferano (Sicilia) (Gastropoda Neotaenioglossa Pomatiasidae, Basommatophora, Stylommatophora). *Il Naturalista Siciliano* **30** (3/4): 555–589.
- MANGANELLI G, BARBATO D & BENOCCI A 2017 I molluschi terrestri e d'acqua dolce del Monte Argentario. *Atti della Società Toscana di Scienze Naturali Residente in Pisa Memorie Serie B* **123**: 103–128.
- MANGANELLI G, BENOCCI A & GIUSTI F 2015 Chioccioline e lumache dell'Arcipelago Toscano. Una guida ai molluschi non marini del Parco Nazionale dell'Arcipelago Toscano. *I Quaderni del Parco* **6**: 1–155.
- MANGANELLI G, BODON M, FAVILLI L & GIUSTI F 1995 Gastropoda Pulmonata. In: Minelli A, Ruffo S, La Posta S (eds), *Checklist delle specie della fauna d'Italia* **16**: 1–60. Bologna.
- MENKE CT 1830 *Synopsis methodica molluscorum generum omnium et specierum earum, quae in museo Menkeano adservantur; cum synonymia critica et novarum specierum diagnosis. Editio altera, auctior et emendatior*. Uslar, Pymonti, pp. I–XVI, 1–168, [1].
- PAULUCCI M 1880 *Escursione scientifica nella Calabria 1877–78. Fauna malacologica. Specie terrestri e fluviatili enumerate e descritte da M. Paulucci con tavole illustrative*. Arte della Stampa, Firenze, pp. i–xix, 1–223, [1–2], pls. [1–2], 1–9.
- PAULUCCI M 1886 Conchiglie terrestri e d'acqua dolce del Monte Argentaro e delle isole circostanti. *Bullettino della Società Malacologica Italiana* **12**: 6–62, pls. 1–2.
- REITANO O A, LIBERTO F, GIGLIO S, GRASSO R & SPENA MT 2012 Terrestrial molluscs from the R.N.I. "Grotta Conza" (Palermo, Sicily) (Gastropoda Architaenioglossa Pulmonata). *Biodiversity Journal* **3** (4): 555–570.
- ROSSMÄSSLER EA 1836 *Iconographie der Land- und Süßwassermollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten*. Heft 4, pp. [1–3], 1–27, pls 16–20. Arnold Dresden, Leipzig.
- ROSSMÄSSLER EA 1838 *Iconographie der Land- und Süßwassermollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten*. Heft 7/8, pp. I–IV, 1–43, [1], pls 31–40. Arnold Dresden, Leipzig.
- STABILE G 1864 Mollusques terrestres vivants du Piémont. *Atti della Società Italiana di Scienze Naturali* **7** (1): 3–141, pls 1–2.
- WELTER-SCHULTES F 2012 *European non-marine molluscs, a guide for species identification*. Planet Poster Edition, Göttingen, 1–679 pp, Q1–Q78 quick identification plates.

APPENDIX 1 MATERIAL EXAMINED

All material is kept in F. Giusti collection (FGC), at Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, Via Mattioli 4, 53100 Siena, Italy.

Corsican material:

? *Campylaea planospira* cf. *occultata* (Paulucci, 1886)
Aleria (Haute-Corse), UTM: 32TNM4261, F. Giusti & G. Manganelli leg. 30.11.1983 (1 shell, 3 specimens – FGC 32419).

Other material examined for comparison:

Campylaea planospira cf. *occultata* (Paulucci, 1886)
Promontorio di Ansedonia, Cosa ruins (Grosseto), UTM: 32TPM8898, S. Cianfanelli & G. Manganelli leg. 7.10.2001 (3 specimens – FGC 17616).

Tuscan Archipelago, Giannutri Island, Cala Maestra (Grosseto), UTM: 32TPM7380, F. Giusti leg. 25.9.1968 (32 shells, 5 specimens – FGC 12054; ref.: Giusti, 1976, erroneously as collected at Poggio del Cannone).

Tuscan Archipelago, Giglio Island: Il Campese (Grosseto), UTM: 32TPM5492, F. Giusti leg. 18.11.1967 (103 shells, 7 specimens – FGC 8956; Ref.: Giusti, 1968).

Tuscan Archipelago, Giglio Island: Il Franco, between Campese and Punta Faraglione (Grosseto), UTM: 32TPM5492, A. Benocci, F. Giusti & G. Manganelli leg. 27.2.2013 (3 specimens – FGC 40790).

Campylaea planospira cf. *planospira* (Lamarck, 1822)
Castellino delle Formiche, Grotta della Fassuraccia (Modena), UTM ?, P. Laghi leg. 9.10.2000 (1 specimen – FGC 17557).

Nusenna (Siena), UTM: 32TQP059143, L. Favilli & G. Manganelli leg. 10.3.1990 (3 specimens – FGC 5013).

Ancaiano (Siena), UTM: 32TPN7896, C. Periccioli leg. 27.10.1981 (5 specimens – FGC 26975).

Montalcino (Siena), UTM: 32TQN0270, A. Daviddi leg. 4.1986 (13 specimens – FGC 26983).

Monte Cetona, Fonte Vetriana (Siena), UTM: 32TQN3257, G. Manganelli & V. Spadini leg. 10.10.1982 (5 shells, 2 specimens – FGC 26934).

State Road 209, cross to Saccoveschio (Perugia), UTM: 33TUH4052, G. Manganelli & L. Manganelli leg. 23.6.1997 (1 shell, 1 specimen – FGC 7633).

La Palazzina (Pesaro-Urbino), UTM: 33TUIJ2942, L. Poggiani leg. 24–28.12.2006 (3 shells, 2 specimens – FGC 36843).

Monti Reatini: Vallonina (Rieti), UTM: 33TUH30, F. Giusti leg. 3.8.1966 (2 shells, 1 specimen – FGC 26964).

Gran Sasso d'Italia: Bosco Aschiero (Teramo), UTM: 33TUH8206, G. Manganelli & L. Manganelli leg. 3.7.1992 (1 shell, 2 specimens – FGC 6877).

Campylaea planospira cf. *setulosa* (Briganti, 1825)

Isole Eolie, Filicudi Island: Siccagni (Messina), UTM: 33SVC6070, F. Giusti leg. 29.10.1969 (5 shells, 2 specimens – FGC, 11749; 3 shells – FGC 26969).

Isole Eolie, Filicudi Island: Siccagni (Messina), UTM: 33SVC6070, F. Giusti leg. 22.3.1972 (3 shells, 1 specimen – FGC 26967)