

Terrestrial gastropods (Mollusca Gastropoda) from Lepini Mountains (Latium, Italy): a first contribution

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ABSTRACT

Lepini Mountains are a calcareous massif that forms the southern pre-Apennines of Latium (Italy), reaching a maximum altitude of 1536 m. Notwithstanding their central position and the low height reached, the malacofauna of Lepini Mountains has been long neglected and species composition was never reported so far. In this contribution, a preliminary investigation of the terrestrial gastropods (Mollusca Gastropoda) occurring in the Lepini Mountains is reported. At least 43 species are recorded. Several species already reported from Central Apennines occur. The most remarkable findings include a hitherto unrecorded population of *Medora* sp. (Clausiliidae) and the occurrence of two distinct forms ascribable to *Jaminia quadridens* s.l.

KEY WORDS

Terrestrial gastropods; biodiversity; Lepini Mountains; Italy.

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INTRODUCTION

Lepini Mountains, together with Aurunci and Ausoni Mountains, form the southern pre-Apennines of Latium (Italy). They are positioned about 50 km SE of Rome and extend in NE-SW direction (Fig. 1). They are separated from Central Apennines by the Sacco Valley and face the Pontine alluvial plain in the south. Lepini Mountains are comprised of two parallel chains directed in NE-SW direction, separated by the deep Montelanico-Carpineto-Maenza tectonic line. The western chain is comprised by Mount Lupone (1378 m) and Mount Semprevisa group (1536 m, the highest peak), whereas the eastern chain quickly slopes down to the Sacco Valley and is comprised of Mount Gemma, Mount Malaina, Mount S. Marino and Mount Alto, all of which reach heights around 1400 m.

Lepini Mountains are mainly comprised of limestone of Cretaceous age (Sani et al., 2004). The whole massif shows to intense karst phenomena. As a consequence, in the Lepini Mountains no permanent water body occurs, whereas several springs appear at the base of the massif, the best known of which gives rise to the Oasis of Ninfa (Amori et al., 2002).

The vegetation is mainly comprised of holm oak, chestnut and mixed woods at medium-low altitudes and beech forests at medium-high altitudes. Large portions of territory are occupied by grassland mainly used as pasture.

The invertebrate fauna of Lepini Mountains have been studied in some detail with regard to arthropods (Corsetti et al., 2015). Several studies focused on hypogean fauna (Sbordoni, 1971; Latella, 1995; Nardi et al., 2002). Moreover, some endemisms have been reported (Sbordoni, 1971;



Figure 1. Studied area: Lepini Mountains (southern Latium, Italy).
Numbers indicate the sampled stations listed in Table 1.

Stn.	Locality	Coordinates	Alt. (m)	Environment
1	Pass to Campo di Segni	41.672649° N, 12.987930° E	1015	Pasture with stones
2	After pass to Campo di Segni	41.670720° N, 12.993717° E	960	Rocks with low vegetation
3	Close to Campo di Segni	41.667926° N, 12.990029° E	880	Pasture and bushes with stones
4	Mount Erdigheta	41.56410° N, 13.119629° E	1046	Beech forest with rocks
5	Mount Erdigheta	41.562092° N, 13.120613° E	1115	Pasture with stones
6	Mount Semprevisa	41.572228° N, 13.092678° E	1250–1400	Beech forest with rocks
7	Mount Semprevisa, top	41.571147° N, 13.091063° E	1490	Stones on the top
8	Carpineto, Pian della Faggeta	41.575702° N, 13.103665° E	930	Rocks with low vegetation and residuary beeches
9	Bassiano, road to Semprevisa, near the spring	41.552975° N, 13.047529° E	590	Holm oak wood with rocks
10	Bassiano, road to Semprevisa	41.558473° N, 13.059121° E	864	Clearing in holm oak wood
11	Campo Rosello	41.563711° N, 13.077542° E	1174	Pasture with stones
12	Campo Rosello	41.571987° N, 13.072649° E – 41.574551° N, 13.074571° E	1250–1410	Pasture with stones

Table 1. List of the stations: Lepini Mountains (southern Latium, Italy).

Pace, 1975; Magrini, 2005). However, the molluscan fauna of Lepini Mountains was never studied so far. Only four species occurring in hypogean environments were reported (*Discus rotundatus*, *Campylaea planospira*, *Daudebardia brevipes* and *Oxychilus draparnaudi*), none of which strictly hypogean (Latella, 1995).

In this contribution, we report the results of a first survey aimed at assessing the biodiversity of terrestrial gastropods of Lepini Mountains.

MATERIAL AND METHODS

A total of 12 stations along the western chain have been sampled between April and June 2015 (see Table 1). Sampling was carried out only in natural environments. As a consequence, species recorded only from urban areas, such as *Cornu aspersum* (O.F. Müller, 1774) found in the town of Bassiano, were ruled out. Additionally, freshwater or hypogean environments were not considered. For the nomenclature, we mainly referred to the checklist of the species of the Italian fauna (Bodon et al., 1995; Manganelli et al., 1995, 1998, 2000). For the suprageneric nomenclature, we referred to Bouchet & Rocroi (2005). All specimens here illustrated were collected from the Lepini Mountains. Shell length and width were measured parallel and perpendicular to the axis of the shell, respectively, with calipers to the nearest 0.1 mm.

RESULTS AND DISCUSSION

At least 44 species of terrestrial gastropods occur in the Lepini Mountains (see Table 2). The most speciose family is the Clausiliidae, with 7 recorded species. The clausiliid *Leucostigma candidescens* is by far the commonest and widespread species, occurring in almost all calcareous outcrops, either exposed or shaded, often associated with other calciophilous species such as *Cochlostoma* cf. *adamii*, *Marmorana signata*, *Granaria apennina* and *Medora* sp. We agree with Fehér et al. (2010) who indicate the species of the genus *Granaria* Held, 1838 occurring in the Italian peninsula as *G. apennina*. *Medora* sp. was found only in a single station inside the beech forest of Mount Semprevisa. The unexpected finding of this population confirms that

the current knowledge of the genus *Medora* H. et A. Adams, 1855 in Italy is far from being exhaustive (Giusti et al., 1986; Nordsieck, 2012; Colomba et al., 2012). *Cochlodina laminata* and *C. bidens* occur in sympatry in the beech forest. According to Opinion 2355, the Apennine species so far known as *Cochlodina incisa* (Küster, 1876) should be indicated as *C. bidens* (Linnaeus, 1758) (Kadolsky, 2009; ICZN, 2015). They are readily distinguished by the development of palatal plicae. In fact, while in the former palatal plicae are truncated at the level of the clausilium, in the latter both the principal and the lower palatal plicae prolong internally. Moreover, an additional intermediate palatal plica often occurs in the latter. *Cochlodina bidens* in Lepini Mountains shows a stout shell also found in specimens from other localities of Latium, such as the holm oak woods of Mount Circeo and Macchia Grande (Fiunicino) (Hallgass & Vannozi, 2014).

The populations of *Cochlostoma* cf. *adamii* have been studied by Zallot et al. (2015) in the generic revision of the family Cochlostomatidae and assigned to the subgenus *Turritus* Westerlund, 1883. *Cochlostoma adamii* group is comprised of several forms reported with different nominal taxa occurring from Central Apennines to Sicily, whose taxonomy needs to be clarified. The marquis Paulucci (1881) noted the occurrence of forms close to *Pomatias adamii* in the Central Apennines and described “*Pomatias adamii* Var. *Carseolanus*” from Carsoli (Abruzzi). *Cochlostoma* cf. *adamii* from Lepini Mountains is different from *C. cassiniacum* (Saint Simon in Paulucci, 1878) from Cassino and Sterrone (both Latium), though belonging to the same subgenus *Turritus* (Zallot, comm. pers.).

On the whole, the beech forest shows the greatest biodiversity, with 28 recorded species. Among them, there are several species commonly found in beech forests of Central Apennines (Giusti et al., 1985). However, a few of them deserve some comments. *Acicula* sp. was recorded from a worn fragment. The closest finding of this genus is *A. szigethyannae* Subai, 1977 from Val d’Arano (Ovindoli, Abruzzi). Conversely, *Platyla similis* is recorded from several localities of the Italian peninsula. In particular, it has been reported from the neighbouring Aurunci Mountains (Bodon & Cianfanelli, 2008). *Limax* cf. *maximus* appears with different patterns (Figs. 8 and 9). A completely

Family	Species	Stn.	Fig.
COCHLOSTOMATIDAE	<i>Cochlostoma</i> cf. <i>adamii</i> (Paulucci, 1879)	4-9, 11, 12	2
ACICULIDAE	<i>Acicula</i> sp.	6	11
	<i>Platyla similis</i> (Reinhardt, 1880)	6	10
POMATIIDAE	<i>Pomatias elegans</i> (O.F. Müller, 1774)	2, 3, 9	
ORCULIDAE	<i>Sphyradium doliolum</i> (Bruguière, 1792)	6, 8	
VALLONIIDAE	<i>Acanthinula aculeata</i> (O.F. Müller, 1774)	8, 9	13
	<i>Gittenbergia sororcula</i> (Benoit, 1857)	6	15
CHONDRINIDAE	<i>Granaria apennina</i> (Küster, 1850)	4, 8	
	<i>Chondrina avenacea</i> (Bruguière, 1792)	6, 9	
VERTIGINIDAE	<i>Truncatellina callicratis</i> (Scacchi, 1833)	9	14
ENIDAE	<i>Jaminia quadridens</i> (O.F. Müller, 1774) (small morphotype)	7, 8	5, 18
	<i>Jaminia quadridens</i> (O.F. Müller, 1774) (large morphotype)	4, 5, 7, 8, 12	4, 19
	<i>Merdigera obscura</i> (O.F. Müller, 1774)	6, 8	
FERUSSACIIDAE	<i>Cecilioides acicula</i> (O.F. Müller, 1774)	9	
SUBULINIDAE	<i>Rumina decollata</i> (Linnaeus, 1758)	1, 3, 9	
CLAUSILIIDAE	<i>Medora</i> sp.	6	20
	<i>Leucostigma candidescens</i> (Rossmässler, 1835)	1-6, 8, 9, 11, 12	3, 21
	<i>Cochlodina laminata</i> (Montagu, 1803)	6	23
	<i>Cochlodina bidens</i> (Linnaeus, 1758)	6	22
	<i>Siciliaria paestana</i> (Philippi, 1836)	3, 5, 6, 9	
	<i>Macrogastera plicatula</i> (Draparnaud, 1801)	6	
	<i>Clausilia cruciata</i> Studer, 1820	6	
PUNCTIDAE	<i>Punctum pygmaeum</i> (Draparnaud, 1801)	6	12
DISCIDAE	<i>Discus rotundatus</i> (O.F. Müller, 1774)	6, 9	
PRISTILOMATIDAE	<i>Vitrea botterii</i> (Pfeiffer, 1853)	4, 6, 8	17
	<i>Vitrea subrimata</i> (Reinhardt, 1871)	6, 8	16
OXYCHILIDAE	<i>Daudebardia rufa</i> (Draparnaud, 1805)	6	6
	<i>Daudebardia brevipes</i> (Draparnaud, 1805)	6	
	<i>Oxychilus</i> cf. <i>draparnaudi</i> (Beck, 1837)	2, 6, 8, 10	
MILACIDAE	<i>Tandonia sowerbyi</i> (Férussac, 1823)	6, 10	7
VITRINIDAE	<i>Semilimacella bonellii</i> (Targioni Tozzetti, 1873)	6	
LIMACIDAE	<i>Limax</i> cf. <i>maximus</i> Linnaeus, 1758	3, 6, 10	8, 9
	<i>Limax</i> sp. A (black)	3, 6, 8	9
	<i>Limax</i> sp. B (brown)	6	
AGRIOLIMACIDAE	<i>Deroceras</i> cf. <i>lothari</i> Giusti, 1973	8	
HYGROMIIDAE	<i>Monacha</i> cf. <i>cantiana</i> (Montagu, 1803)	9	
	<i>Monacha</i> cf. <i>campanica</i> (Paulucci, 1881)	1, 3, 5, 8, 11, 12	
	<i>Cernuellopsis ghisottii</i> Manganelli et Giusti, 1988	1, 4, 5, 7, 8, 11, 12	
	<i>Cernuella cisalpina</i> (Rossmässler, 1837)	10	
	<i>Hygromia cinctella</i> (Draparnaud, 1801)	1	
HELICIDAE	<i>Campylaea planospira</i> Lamarck, 1822	6	
	<i>Marmorana signata</i> (Férussac, 1821)	6, 9, 11	
	<i>Cantareus apertus</i> (Born, 1778)	9	
	<i>Helix ligata</i> O.F. Müller, 1774	1, 3, 12	24

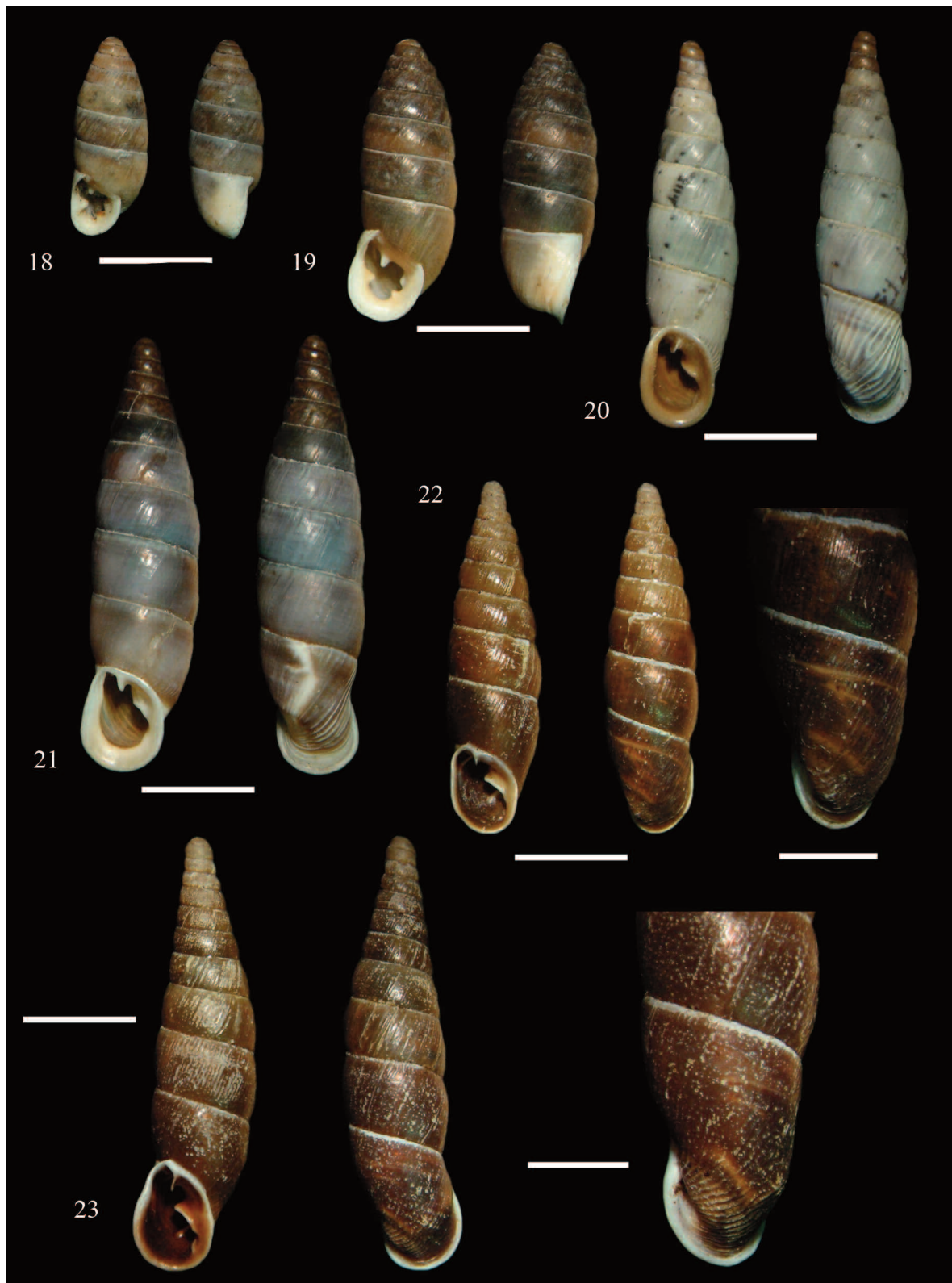
Table 2. List of the species recorded in the sampled stations, Lepini Mountains (southern Latium, Italy).



Figures 2–9. Terrestrial gastropods from Lepini Mountains. Fig. 2: *Cochlostoma* cf. *adamii*. Fig. 3: *Leucostigma candidescens*. Fig. 4: *Jaminia quadridens* (large morphotype). Fig. 5: *Jaminia quadridens* (small morphotype). Fig. 6: *Daudebardia rufa*. Fig. 7: *Tandonia sowerbyi*. Fig. 8: *Limax* cf. *maximus*. Fig. 9: *Limax* sp. A (black) and *L.* cf. *maximus*.



Figures 10–17. Terrestrial gastropods from Lepini Mountains. Fig. 10: *Platyla similis*. Fig. 11: *Acicula* sp. Fig. 12: *Punctum pygmaeum*. Fig. 13: *Acanthinula aculeata*. Fig. 14: *Truncatellina callieratis*. Fig. 15: *Gittenbergia sororcula*. Fig. 16: *Vitrea subrimata*. Fig. 17: *Vitrea botterii*. Scale bar: 1 mm.



Figures 18–23. Terrestrial gastropods from Lepini Mountains. Fig. 18: *Jamina quadridens* (small morphotype). Fig. 19: *Jamina quadridens* (large morphotype). Fig. 20: *Medora* sp. Fig. 21: *Leucostigma candidescens*. Fig. 22: *Cochlodina bidens*. Fig. 23: *Cochlodina laminata*. Scale bar: 5 mm (whole specimens); 2.5 mm (details).

black specimens of *Limax* Linnaeus, 1758 was found in different stations, also in sympatry with *L. cf. maximus* (Fig. 9). A further *Limax* species with uniform brown colour was recorded.

A small black specimen of *Deroceras* Rafinesque, 1820 was collected in Stn. 8, externally resembling *Deroceras lothari*, a species described as endemic to Reatini Mountains (northern Latium) (Giusti, 1973). It is provisionally reported as *Deroceras cf. lothari* pending further study.

Holm oak and mixed woods are poorer in terms of both species and number of specimens. Pastures show a relatively reduced number of species as well, some of which deserve some comments. *Jaminia quadridens* occurs in two distinct forms, here referred to as small and large morphotype, respectively (Figs. 4, 5, 19, 20). At a conchological level, they mainly differ with regard to shell size. Measurements on over 60 specimens show that these two forms can be readily distinguished by the shell width, which shows a clear gap between the two morphotypes (Fig. 25). Moreover, the large morphotype seems to show a proportionally larger width. However, this feature needs confirmation due to the small amount of recorded specimens of

the small morphotype. The large morphotype is widespread and was recorded from several stations. Conversely, the small morphotype is uncommon and was recorded only at higher altitudes. A similar scenario with different morphs of *J. quadridens* occurring syntopically have been recorded also in other localities of Central Apennines, often with the occurrence of an additional, dextral morph.

Monacha campanica, which we regard as a distinct species, is found throughout the Liri Valley up to high altitude. The genitalia of *M. campanica* are characterized by a very short penis provided with a large penial papilla and a slender epiphallus. The flagellum is as long as the epiphallus. The bursa copulatrix shows a thick duct, widened at the base. Specimens from Lepini Mountains share the same anatomy but show a rather different shell. In fact, they are smaller (max. diam. 16 mm) and lighter than those described by the marquis Paulucci (1881) (max. diam. 21 mm). Moreover, they show a less depressed spire and a narrower umbilicus. As a consequence, they are reported in Table 2 as *Monacha cf. campanica*, pending further study.

In Stn. 9 (Bassiano, road to Semprevisa, near the spring) an empty shell clearly different from



Figure 24. *Helix ligata*, height 35 mm, with genitalia (scale bar: 5 mm).

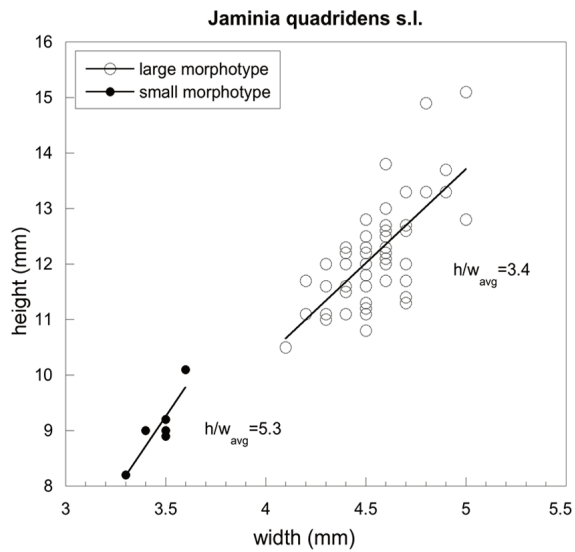


Fig. 25. Height and width measurements of *Jaminia quadridens* s.l. specimens from Lepini Mountains. Best-fit lines for the two morphotypes are shown.

Monaca cf. *campanica* has been collected. It is provisionally reported as *Monacha* cf. *cantiana* waiting for anatomical data.

Cernuellopsis ghisottii is the most abundant species in grasslands and pastures above 1000 m. This species shows a disjunct distribution in the Apennines. Southern populations occur in the Pollino (Calabria-Basilicata) and Sirino (Basilicata) massifs and extend up to Alburni Mountains (Campania), whereas populations from Central Apennines are frequent on the western coastal chains and extend up to Simbruini Mountains (Latium). The species was never recorded from intermediate mountains of central-northern Campania.

Helix ligata is widespread in Lepini Mountains but never abundant. Different populations show a variable appearance. Specimens from Carpinetana Valley were genetically studied by Fiorentino et al. (2016) and are very similar to specimens from Apennine valley floors showing a yellowish background due to the presence of periostracum, whereas specimens from Stn. 1 (pass to Campo di Segni) living in exposed pasture with stones show a whitish background (Fig. 24) likely due to the loss of periostracum that make it resemble *Helix delpretiana* Paulucci, 1878 (Giusti, 1973). However, the anatomy of specimens from Stn. 1 corresponds to

Helix ligata, even though they are genetically distinct from populations from Central Apennines (Fiorentino et al., 2016).

CONCLUSIONS

The preliminary checklist here presented shows that at least 43 species of terrestrial gastropods occur in the Lepini Mountains. The richest environment is represented by beech forests, with 28 recorded species. Along with species already reported from Central Apennines, a new isolated population of *Medora* is recorded. Due to the extremely limited distribution, this population can be considered vulnerable and likely in need of protection. *Jaminia quadridens* occurs in two clearly distinct morphs without intermediate forms, mainly differing in their size. Further research is required in order to ascertain whether they actually belong to different species. Some species remain undetermined, whereas others were determined by comparison, pending further research.

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