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The endogean beetle fauna of the Marganai-Oridda-Valle del Leni area (SW Sardinia), with description of seven new species of Staphylinidae Leptotyphlinae (Coleoptera)*

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Abstract

Twenty-six species of endogean beetles are recorded from the Marganai-Oridda-Valle del Leni area, belonging to six different families: Carabidae (*Typhloreicheia holdhausi* Magrini, Fancello & Casale, 2006, *T. leoi pilosa* Magrini & Fancello, 2007, *T. tanit* Leo, Magrini & Fancello, 2005), Leiodidae [*Bathysciola damryi* (Abeille de Perrin, 1881)], Staphylinidae [*Eudesis aglena* Reitter, 1882, *E. minima* Binaghi, 1948, *Mayetia* sp., *Trimium amplipenne* Reitter, 1908, *Tychobythinus dentimanus* (Reitter, 1884), *Tychus* sp., *Pselaphostomus* sp., *Phloeocharis ichnusae* Dodero, 1900, *Octavius raymondi* Saulcy, 1878, *O. sardous* Coiffait, 1965, four new species of *Entomoculia*, three new species of *Leptotyphlus*], Zopheridae (*Langelandia reitteri* Belon, 1882, *Lyreus septemstriatus* Fancello & Leo, 1991), Curculionidae (*Torneuma* sp.) and Raymondionymidae [*Alaocyba carinulata* Perris, 1869, *Raymondiellus sardous sardous* (Perris, 1869)]. One species (*Langelandia reitteri*) is W-Mediterranan, one is a Sardo-Corsican endemic (*Tychobythinus dentimanus*), the remaining 24 species are all Sardinian endemics and 16 of these are strictly localized within the study area or restricted to SW Sardinia. The following species of Staphylinidae Leptotyphlinae are described: *Entomoculia villascemae* **sp. nov.**, *E. carbonaria* **sp. nov.**, *E. shardana* **sp. nov.**, *E. melonii* **sp. nov.**, *Leptotyphlus nardii* **sp. nov.**, *L. minator* **sp. nov.** and *L. villacidrinus* **sp. nov.**; all are easily distinguishable from their congeners by the structure of the male copulatory organ and female genital armature. The morphology of the copulatory organ in the newly described *Leptotyphlus* species indicates that the classical subgeneric categories used in *Leptotyphlus* are probably based on characters not reflecting a natural subdivision of the genus.

Key words: Coleoptera, endogean beetles, Carabidae, Leiodidae, Staphylinidae, Zopheridae, Curculionidae, Raymondionymidae, new species, *Entomoculia*, *Leptotyphlus*, SW Sardinia

Introduction

From a zoogeographical and taxonomic point of view, beetles are one of the main components of the endogean arthropod fauna, i.e. the interstitial fauna inhabiting the portion of the soil comprised between the lower humus layer and the maximum depth of plant roots. The endogean beetle fauna of Sardinia is rich in species, mostly endemic, from the families Carabidae, Staphylinidae, Leiodidae, Zopheridae, Curculionidae, and Raymondionymidae; all are small to minute, depigmented, flightless, anophthalmic or microphthalmic, non-vagile and with a usually very reduced distribution range. The current knowledge of Sardinian endogean beetles is quite satisfactory compared to other Mediterranean regions, but still insufficient considering the

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variety of the island's fauna, which reflects its palaeogeographic history and orographic complexity. The first studies on the endogean beetles of Sardinia date back to the second half of the nineteenth century and were carried out by entomologists of the rank of Raymond, Damry, Putzeys and Reitter, and continued during the last century by Dodero, Solari, Holdhaus, Jeannel, Binaghi and others; nonetheless, new and interesting discoveries have been made in recent years by, amongst others, Casale, Fancello, Leo, Magrini, Pace, Poggi, Osella and Vigna Taglianti (*cf.* Osella 1977; Poggi 1992; Leo *et al*. 2005).

The aim of this paper is to illustrate the endogean beetle fauna of a vast part of the Iglesiente area south of the Mount Linas massif, comprising the Marganai region (commune of Iglesias, Carbonia-Iglesias province), Valle d'Oridda (commune of Domusnovas, Carbonia-Iglesias province) and the State-owned forest of Montimannu-Valle del Leni (commune of Villacidro, Medio Campidano province). *Ad hoc* investigations carried out for about two decades by two of the authors (L.F. and P.L.) have brought to light a remarkable species richness. Part of the results have already been published in recent works (Fancello & Leo 1991; Magrini 2003; Leo *et al*. 2005; Magrini *et al*. 2006; Magrini & Fancello 2007), whereas here we present a complete list of the identified taxa and describe seven new species of Leptotyphlinae (Staphylinidae).

Material and methods

The material was collected principally with the soil-washing technique. Soil was extracted up to maximum depths of about 50 cm, and the superficial humus layer was removed when present. The detritus obtained after the washing process was placed in Berlese-type sorters, modified according to Pace (1996), for the collection of Staphylinidae Leptotyphlinae. Samples were collected all year round except during the excessively arid summer months, both in woodland (Fig. 1) and Mediterranean maquis and garigue habitats; some samples were taken also in the historical city centre of Villacidro in a semi-abandoned orchard garden (Fig. 2). In some cases bones were buried as bait at average depth. Finally, some specimens were collected directly by hand under buried stones after particularly abundant rainfalls.

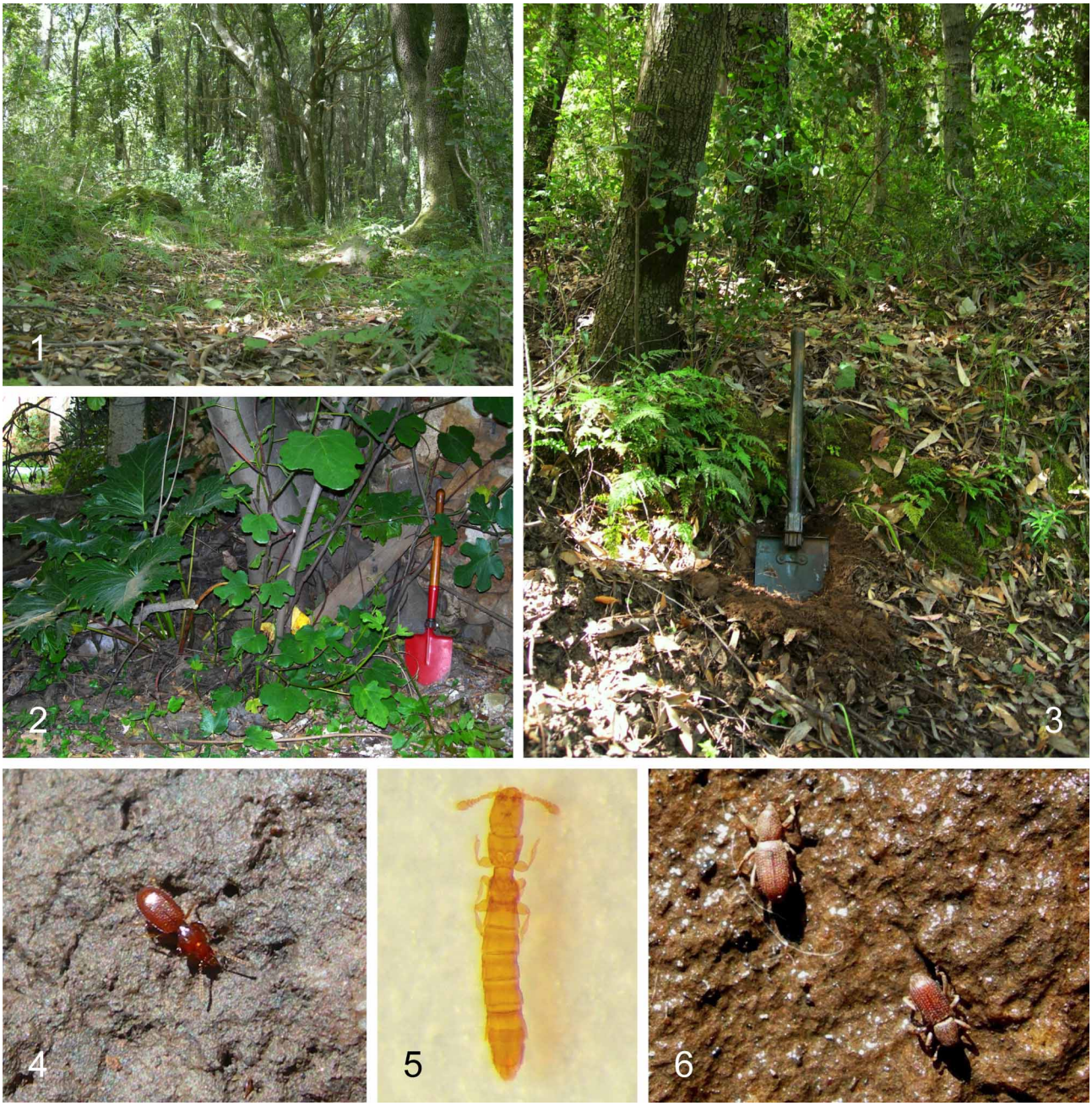
We refer the reader to Mason *et al*. (2006) and Cherchi *et al*. (1982) for further details on the study area.

The faunistic list was prepared according to the nomenclature and systematics proposed in Fauna Europaea (Alonso-Zarazaga 2004; Löbl 2004; Osella & Zuppa 2004; Sánchez-Terròn 2004; Ślipiński 2004; Smetana 2004a; Stüben 2004; Vigna Taglianti 2004), except for the genus *Eudesis* Reitter, 1882 which, like all other taxa previously included in the Scydmaenidae, is now assigned to the Staphylinidae (Grebennikov & Newton 2009).

All specimens were identified by the authors using the works listed at the beginning of the treatment of each species. Localities cited in the text are listed in alphabetical order according to the commune they belong to. It should be noted that until 2005 Sardinia was subdivided into four provinces (Cagliari, Nuoro, Oristano e Sassari) and that the study area dealt with in this paper was entirely located in the province of Cagliari; four new provinces have been instituted since 2005 (Carbonia-Iglesias, Medio Campidano, Ogliastra, Olbia-Tempio), which have reduced the extension of the previous ones. For practical reasons sampling localities were assigned to the new provinces also for specimens collected before 2005.

In our descriptions of the new Leptotyphlinae species, we follow the criteria used by Pace (1996): a brief description of the external morphology limited to the taxonomically relevant characters, together with illustrations of the male and female terminalia which, in this subfamily, contain the main diagnostic features. The aedeagi and female genitalia were studied in glycerol microscopic preparations. Measurements of specimens belonging to the type-series were done using a micrometer mounted on a Wild M3C stereomicroscope, and anatomical drawings were carried out from photographs taken with a Nikon Coolpix 995 digital camera. The holotypes of the new species are included in Dimethyl Hydantoin Formaldehyde Resin (DMHF); permanent preparations of the genitalia, equally in DMHF soluble resin, are pinned together with the corresponding specimens. Paratypes are prepared and preserved in various ways: dry-prepared, included in DMHF resin on a transparent label, included in Canada balsam on a white card or in a slide.

Label data of the holotypes are reported in inverted commas exactly as found on the labels. Holotypes are deposited at Museo Civico di Storia Naturale “G. Doria”, Genoa.



FIGURES 1–6. 1. *Quercus ilex*-dominated woodland at Gutturu di Monte Nieddu (Domusnovas). **2.** Orchard garden in the historical city centre of Villacidro. **3.** Natural habitat of *Alaocyba carinulata* Perris and *Raymondiellus sardous sardous* (Perris) (Raymondionymidae) at Montimannu (Villacidro). **4.** Specimen on *Typhloreicheia tanit* walking on the underside of a buried stone (Villacidro, San Sisinnio). **5.** Habitus of *Entomoculia melonii* sp. nov. (♀, paratype). **6.** Specimens of *Torneuma* sp. on the underside of a buried stone (Domusnovas, Gutturu di Monte Nieddu). Photos by P. Leo.

Acronyms of depositories

CCH	C. Hernando collection, Barcelona (Spain)
CLF-PL	L. Fancello and P. Leo collection, Cagliari (Italy)
MSNG	Museo civico di Storia naturale “G. Doria”, Genoa (Italy).

CNBFVR Centro Nazionale per lo Studio e la Conservazione della Biodiversità Forestale "Bosco Fontana", Verona (Italy).

Other abbreviations used in the text
ex = specimen/s
leg. = legit
prov. = province
rs = rest of specimen

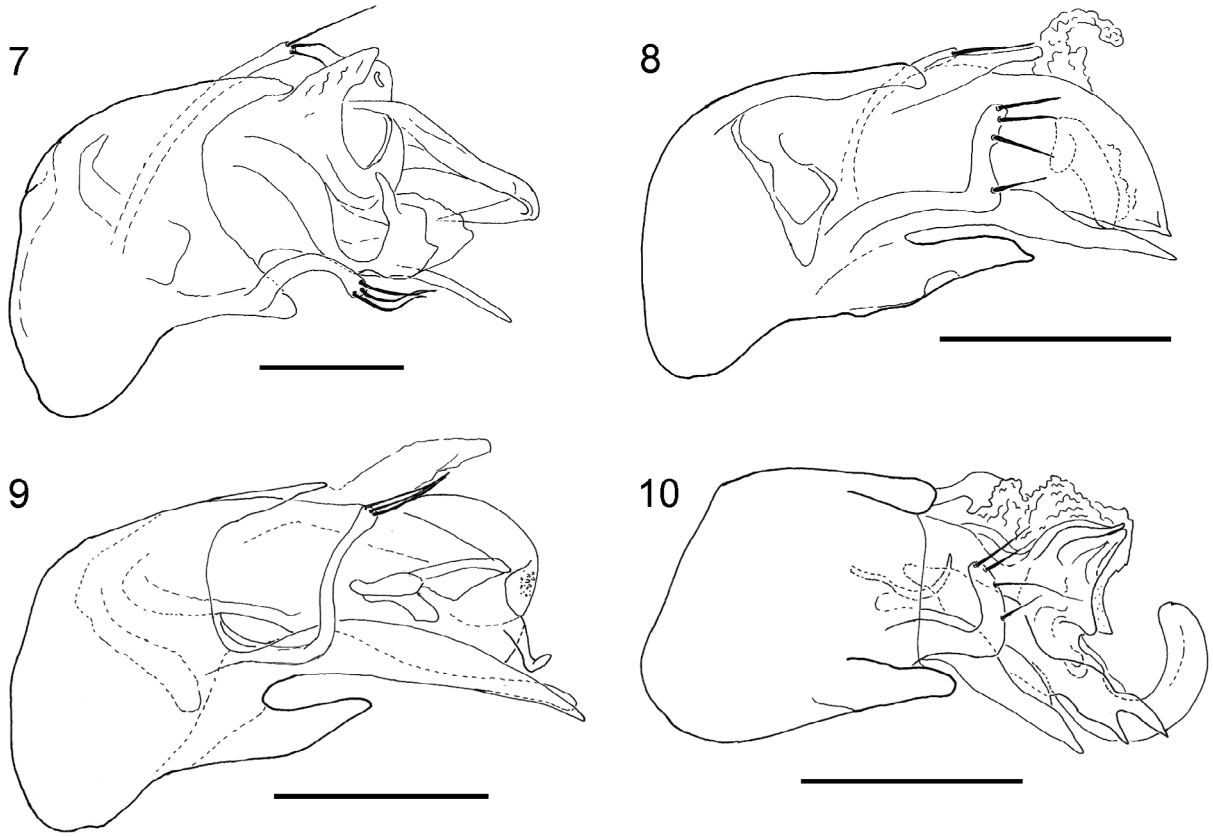
Description of the new species of Leptotyphlinae

***Entomoculia* (*Entomoculia*) *villascemae* sp. nov.**
(Figs 7, 12)

Diagnosis. An *Entomoculia* Croissandeau, 1891 ascribable to the nominal subgenus for its robust build, the presence of chitinized thickenings on the male genital segment and for the characters of the male and female genitalia; well-differentiated from its congeners by the shape of the aedeagus and female copulatory plates.

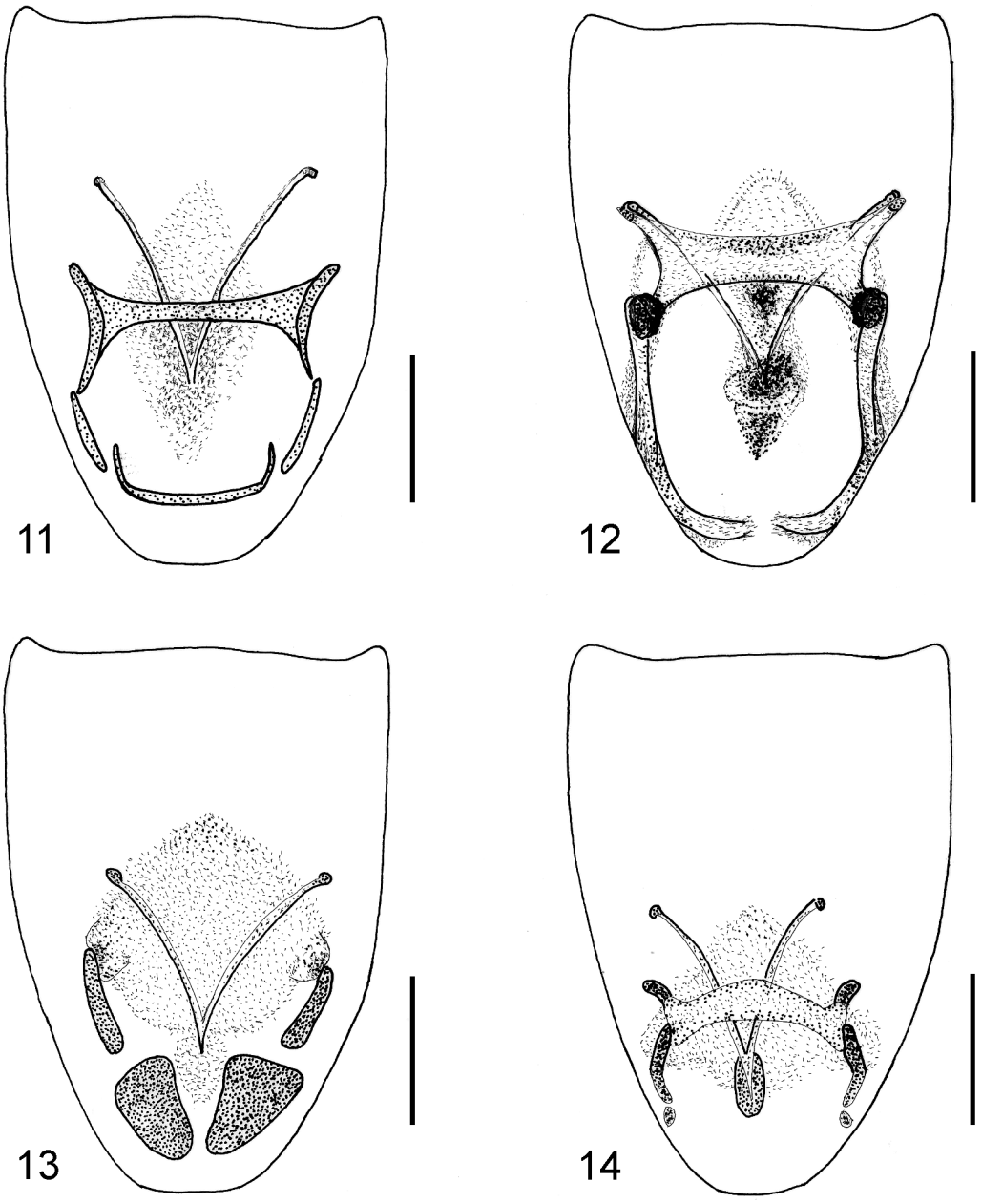
Type locality. SW Sardinia, Medio Campidano prov., Villacidro, Rio Bidda Scema.

Type series. Holotype ♂: "SW Sardinia, Villacidro (Medio Campidano), Rio Bidda Scema, 330 m, 20.IX.1986, leg. P. Leo" (MSNG) . Paratypes: Villacidro (Medio Campidano prov.) Rio Bidda Scema, 330 m, 20.IX.1986, leg. P. Leo, 1 ♀ (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, leg. P. Leo, 2 ♀♀ (CLF-PL); 8.VI.1986, leg. P. Leo, 2 ♀♀ (CLF-PL, CNBFVR); 8.XI.1986, leg. P. Leo, 1 ♀ (CLF-PL); 13.X.1991, leg. P. Leo, 1 ♂ (CLF-PL).



FIGURES 7–10. Male copulatory organ of *Entomoculia* spp. in lateral view, scale bars: 0.05 mm. **7.** *Entomoculia villascemae* sp. nov. (holotype). **8.** *Entomoculia shardana* sp. nov. (paratype). **9.** *Entomoculia carbonaria* sp. nov. (paratype, Gutturu di Monte Nieddu). **10.** *Entomoculia melonii* sp. nov., paratype.

Description. Total length 1.10–1.15 mm. Head subparallel-sided, with short but prominent frontal carinas; microreticulation distinct but superficial; punctuation weak and sparse. Pronotum about as long as wide, shiny, with indistinct microreticulation; punctuation as on head; median longitudinal dimples lacking. Elytra shiny with slight microsculpture and sparse punctuation. Aedeagus as in Fig. 7 with, in lateral view, a short, thin and slightly downcurved sternal lamina; left paramere small, curved. Female genital armature complex, structured as in Fig. 12.



FIGURES 11–14. Female genital armatures of *Entomoculia* spp. in ventral view, scale bars: 0.05 mm. **11.** *Entomoculia melonii* sp. nov. (paratype). **12.** *Entomoculia villascemae* sp. nov. (paratype, Foresta Demaniale di Montimannu). **13.** *Entomoculia carbonaria* sp. nov. (paratype, Gutturu di Monte Nieddu). **14**. *Entomoculia shardana* sp. nov. (paratype).

Observations. Four species of subgenus *Entomoculia* were known so far for Sardinia, three from the central-northern part and one from the south (*cf.* Coiffait 1972; Pace 1996): *E. sassariensis* Pace, 1978 (type locality: surroundings of Sassari (Sassari prov.); both sexes known), *E. sardoa* Coiffait, 1959 (type locality: Ozieri (Sassari prov.); known only from females), *E. gardinii* Pace, 1994 (type locality: surroundings of

Cuglieri (Oristano prov.); known only from males), *E. iknusa* Coiffait, 1959 (type locality: San Sperate (Cagliari prov.); known only from females). The new species is easily distinguishable from the above by the conformation of the male and female genitalia, and shows no obvious affinities with any other species of the genus.

Ecological notes. The specimens were collected by washing soil from mixed woods dominated by *Quercus ilex*. The sampling localities are situated on granitic (Rio Bidda Scema) and argilloschist (Montimannu) Palaeozoic soils. The following endogean beetles were collected in association with the new species: *Bathysciola damryi* (Abeille de Perrin, 1881) (Leiodidae), *Octavius sardous* Coiffait, 1965 (Staphylinidae), *Langelandia reitteri* Belon, 1882 (Zopheridae), *Torneuma* sp. (Curculionidae), *Alaocyba carinulata* Perris, 1869, *Raymondiellus sardous sardous* (Perris, 1869) (Raymondionymidae).

Etymology. Named after the type locality.

***Entomoculia* (*Entomoculia*) *carbonaria* sp. nov.**
(Figs 9, 13)

Diagnosis. An *Entomoculia* ascribable to the nominal subgenus for its robust build, the presence of chitinized thickenings on the male genital segment and for the characters of the male and female genitalia; well-differentiated from its congeners by the shape of the aedeagus and female copulatory plates.

Type locality. SW Sardinia, Carbonia-Iglesias prov., Domusnovas, Gutturu di Monte Nieddu.

Type series. Holotype ♂: "SW Sardinia, Domusnovas (Carbonia-Iglesias), Gutturu di Monte Nieddu, 290 m, 25.X.1985, leg. L. Fancello & P. Leo" (MSNG). Paratypes: Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 22.V.1985, leg. L. Fancello & P. Leo, 4 ♂♂ and 3 ♀♀ (CLF-PL); 18.IX.1985, leg. L. Fancello & P. Leo, 4 ♂♂ and 1 ♀ (CLF-PL); 1.X.1985, leg. L. Fancello & P. Leo, 2 ♂♂ and 1 ♀ (CLF-PL); 25.X.1985, leg. L. Fancello & P. Leo, 6 ♂♂ and 5 ♀♀ (1 ♂ and 1 ♀ CCH, 4 ♂♂ and 2 ♀♀ CLF-PL, 1 ♂ and 1 ♀ CNBFVR, 1 ♀ MSNG); 10.I.1986, leg. L. Fancello & P. Leo, 1 ♀ (CLF-PL); 18.XII.1989, leg. L. Fancello & P. Leo, 3 ♂♂ and 3 ♀♀ (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Grotta [= cave] San Giovanni, ingresso nord [= northern entrance], 200 m, 28.III.1987, leg. P. Leo, 1 ♀ (CLF-PL).

Description. Total length 1.00–1.10 mm. Head subparallel-sided, with prominant frontal carinas slightly diverging posteriorly; microreticulation obvious and punctuation strong and sparse. Pronotum about as long as wide, shiny, with faint microreticulation and superficial and sparse punctuation, much more sparse than on the head; median longitudinal dimples lacking. Elytra shiny with imperceptible microsculpture and scattered punctuation. Aedeagus as in Fig. 9, with sternal lamina, in lateral view, long and robust, tapering at apex; left paramere long, thin and flexuous. Female genital armature complex, structured as in Fig. 13.

Observations. The new species is well-differentiated from the already-known ones and from those described in the present paper; some similarity in the structure of the female genital plates can be found in *E. sassariensis* from northern Sardinia, but they are easily separable by the shape of the aedeagus (*cf.* Pace 1996, fig. 87).

Ecological notes. This species was collected in woodland in soil samples taken at the base of an old *Quercus ilex* and under stone, near a natural cave. Sampling localities are situated on Palaeozoic limestone soil. The following endogean beetles were collected in association with the new species: *Mayetia* sp., *Leptotyphlus minator* sp. nov., *Octavius raymondi* Saulcy, 1878 (Staphylinidae), *Torneuma* sp. (Curculionidae), *Alaocyba carinulata*, *Raymondiellus sardous sardous* (Raymondionymidae).

Etymology. Named after the vegetal coal production that took place in the type locality until the last century.

***Entomoculia* (*Entomoculia*) *shardana* sp. nov.**
(Figs 8, 14)

Diagnosis. An *Entomoculia* ascribable to the nominal subgenus for its robust build, the presence of chitinized thickenings on the male genital segment and for the characters of the male and female genitalia; well-differentiated from its congeners by the conformation of the aedeagus and female copulatory plates.

Type locality. SW Sardinia, Medio Campidano prov., Villacidro, historical city centre.

Type series. Holotype ♂: "SW Sardinia, Villacidro (Medio Campidano), paese [= in town], 260 m, 9.XII.1989, leg. P. Leo" (MSNG). Paratypes: Villacidro (Medio Campidano prov.), paese, 260 m, 10.XI.1985, leg. P. Leo, 2 ♂♂ and 1 ♀ (CLF-PL); 1.I.1986, leg. P. Leo, 4 ♂♂ and 5 ♀♀ (1 ♀ CCH, 3 ♂♂ and 3 ♀♀ CLF-PL, 1 ♂ CNBFVR, 1 ♀, MSNG); 27.IV.1986, leg. P. Leo, 1 ♀ (CLF-PL); 15.III.1987, leg. P. Leo, 1 ♀ (CLF-PL).

Description. Total length 1.10–1.15 mm. Head subparallel-sided, with prominent frontal carinas slightly diverging posteriorly; microreticulation obvious and punctuation strong and sparse. Pronotum about as long as wide, with obvious microreticulation a bit weaker than on head; punctuation strong and sparse, except for a narrow median line on disc which appears as shiny, free of punctuation and microreticulation; median longitudinal dimples present. Elytra shiny with imperceptible microsculpture and scattered punctuation. Aedeagus as in Fig. 8 with sternal lamina, in lateral view, short, robust and tapering; left paramere robust, bent at a right angle. Female genital armature complex, structured as in Fig. 14.

Observations. *Entomoculia shardana* sp. nov. is clearly separable from all congeners by the genital characters of both sexes.

Ecological notes. This species was collected in an abandoned orchard garden of the historical centre of the small town of Villacidro, in soil samples taken at the base of a *Ficus carica*. The sampling locality is situated on Palaeozoic granitic soil. The following endogean beetles were collected in association with the new species: *Bathysciola damryi* (Leiodidae), *Eudesis aglena* Reitter, 1882 , *Leptotyphlus villacidrinus* sp. nov., *L. minator* sp. nov. (Staphylinidae).

Etymology. This new species is named after the mythical Shardana warriors from Nuragic times.

***Entomoculia* (*Entomoculia*) *melonii* sp. nov.**
(Figs 5, 10–11)

Diagnosis. An *Entomoculia* ascribable to the nominal subgenus for its robust build, the presence of chitinized thickenings on the male genital segment and for the characters of the male and female genitalia; well-differentiated from its congeners by the conformation of the aedeagus and female copulatory plates.

Type locality. SW Sardinia, Medio Campidano prov., Villacidro, San Sisinnio.

Type series. Holotype ♂: "SW Sardinia, Villacidro (Medio Campidano), San Sisinnio, 250 m, 2.I.1987, leg. P. Leo" (MSNG). Paratypes: Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 8.V.1986, leg. P. Leo, 3 ♂♂ and 1 ♀ (2 ♂♂ and 1 ♀ CLF-PL, 1 ♂ CNBFVR); 2.I.1987, leg. P. Leo, 2 ♀♀ (CLF-PL); 15.III.1987, leg. P. Leo, 1 ♀ (CLF-PL); 9.XII.1989, leg. P. Leo, 1 ♂ and 1 ♀ (CLF-PL); 24.IV.1990, leg. P. Leo, 1 ♂ (CLF-PL).

Description. Total length 1.00–1.10 mm. Head shiny, with diverging edges, distinctly widening posteriorly, and with inconspicuous frontal carinas; microreticulation faint, punctuation strong and sparse. Pronotum about as long as wide, shiny, with imperceptible microreticulation; punctuation slightly thinner than on head and slightly sparser; median longitudinal dimples lacking. Elytra shiny with imperceptible microsculpture and scattered punctuation. Aedeagus as in Fig. 10, with sternal lamina strongly bending downward, short, robust and tapering at apex. Female genital armature complex, structured as in Fig. 11.

Observations. *Entomoculia melonii* sp. nov. is clearly separable from all congeners by the genital characters of both sexes.

Ecological notes. The type specimens were found in samples taken at the base of old olive trees. The sampling locality is situated on argilloschist Palaeozoic soil. No other endogean beetles were collected together with the new species.

Etymology. We dedicate this species to our friend Carlo Meloni from Cagliari, an expert of the Sardinian insect fauna with whom we have shared countless excursions.

***Leptotyphlus nardii* sp. nov.**
(Figs 16, 18–20)

Diagnosis. A *Leptotyphlus* Fauvel, 1874 of medium size, with rather poor punctuation and superficial microreticulation. Differs from its congeners by the characters of the copulatory organ, but is undoubtedly akin to *Leptotyphlus* s. str. species of the *L. sardous* Coiffait, 1955a-group (*sensu* Pace 1996) and to some peninsular taxa of the *L. lessinicus* Pace, 1973-group, belonging to subgenus *Stigmotyphlus* Coiffait, 1955b.

Type locality. SW Sardinia, Carbonia-Iglesias prov., Iglesias, Nebida.

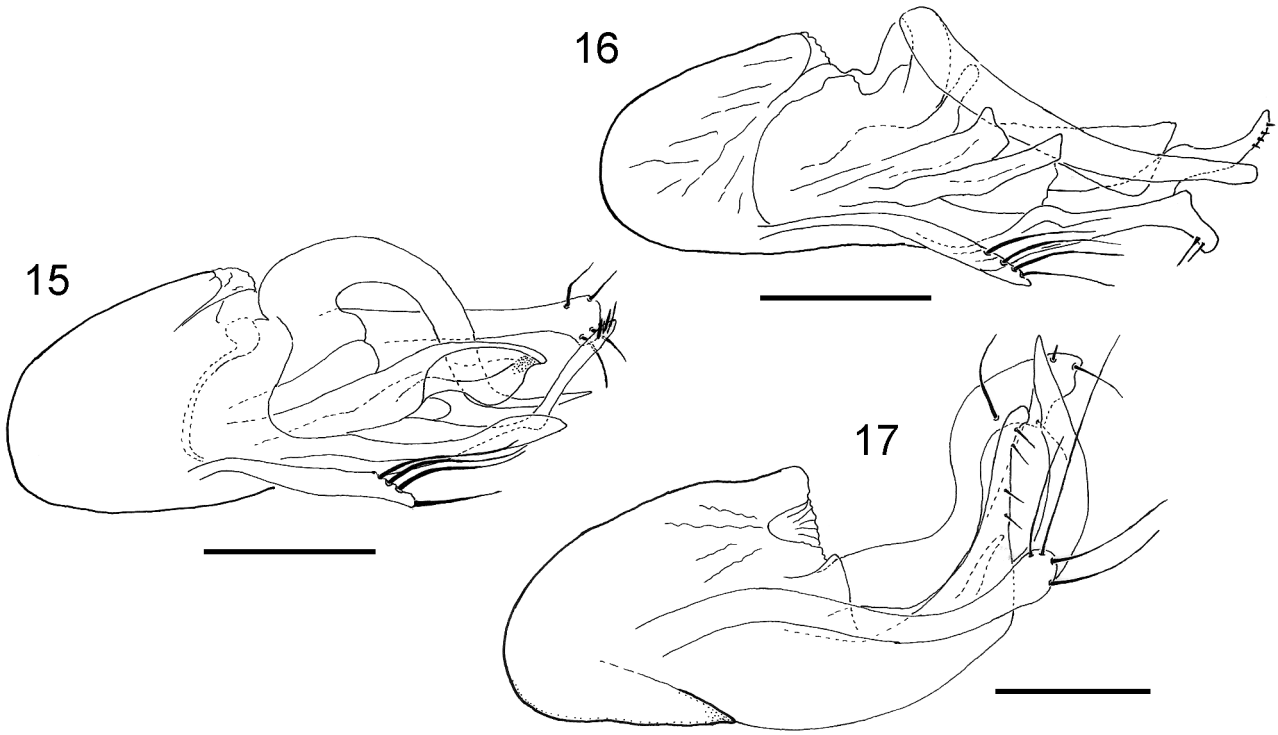
Type series. Holotype ♂: "SW Sardinia, Iglesias (Carbonia-Iglesias), Nebida, 120 m, 25.I.1987, leg. L. Fancello & P. Leo" (MSNG). Paratypes: Carbonia (Carbonia-Iglesias prov.), Barbusi, 130 m, 11.XI.1986, leg. L. Fancello & P. Leo, 2 ♂♂ and 2 ♀♀ (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 12.I.1990, leg. L. Fancello & P. Leo, 1 ♂ and 1 ♀ (CLF-PL); 13.IV.1990, leg. L. Fancello & P. Leo, 2 ♂♂ and 11 ♀♀ (1 ♀ CCH, 2 ♂♂ and 9 ♀♀ CLF-PL, 1 ♀ CNBFVR). Iglesias (Carbonia-Iglesias prov.), Nebida, 120 m, 25.I.1987, leg. L. Fancello & P. Leo, 2 ♂♂ and 3 ♀♀ (2 ♂♂ and 2 ♀♀ CLF-PL, 1 ♀ MSNG).

Description. Total length 1.10–1.20 mm. Body of pale testaceous colour, clearly shiny, with superficial microsculpture on all integuments. Head slightly wider than pronotum, with moderately rounded sides and only slightly outlined frontal carinas; punctuation poor; labrum (Fig. 18) with three weakly developed median teeth; mandibles (Fig. 19) bifid with robust retinaculum and premolar tooth; antennae relatively short, just longer than head. Pronotum slightly longer than wide, with two longitudinal superficial grooves, slightly converging anteriorly; punctuation minute and sparser than on head. Elytral punctuation imperceptible. Convexity of abdominal tergites normal. Aedeagus as in Fig. 16, lying on the left side of the abdomen, with a robust and arched dorsal copulatory piece; sternal lamina distally divided into two branches; tip of ventral branch in lateral view with a distinct downturned lobiform appendix. Female genital armature asymmetrical, structured as in Fig. 20.

Observations. As hinted in the diagnosis, the phyletic relationships of the new species seem complex. This forced us to describe the new species and the following two without subgeneric assignment. Besides, the subdivision of *Leptotyphlus* is still debated: Herman (2001) considers all described subgenera simply as synonyms of *Leptotyphlus*, whereas Smetana (2004a, 2004b) continues to follow the classic arrangement of the genus proposed by Coiffait (1972) and Pace (1996). In our opinion the characters proposed by Coiffait (1972) and Pace (1996) sometimes cause the placement of clearly allied species within separate subgenera, like in the emblematic case of the new species described above. *Leptotyphlus nardii* sp. nov. should indeed be ascribed to subgenus *Stigmotyphlus* for the asymmetrical female genital armature and for the aedeagus with a large coil-shaped dorsal copulatory piece; however, from further examination it appears that *L. nardii* sp. nov. is clearly related to some peninsular species of *Stigmotyphlus* of the *L. lessinicus*-group (*L. molisensis* Pace, 1977 and *L. campanus* Pace, 1977, extremely similar with regard to all structures of the copulatory organ: *cf.* Pace 1977, figs 190–191), and to Sardo-Corsican species of *Leptotyphlus* s. str. of the *L. sardous*-group, also with a coil-shaped dorsal copulatory piece (*cf.* Pace 1996, figs 163–165).

Ecological notes. The species was collected by washing soil in both Mediterranean maquis with *Pistacia lentiscus* dominance and *Quercus ilex* woodland. Collecting sites are situated on Palaeozoic limestone soils. The following endogean beetles were collected together with the new species: *Batysciola damryi* (Leiodidae), *Langelandia reitteri* (Zopheridae), *Torneuma* sp. (Curculionidae), *Alaocyba carinulata*, *Raymondiellus sardous sardous* (Raymondionymidae).

Etymology. It is our pleasure to dedicate this species to our friend Gianluca Nardi (CNBFVR).



FIGURES 15–17. Male copulatory organ of *Leptotyphlus* spp. in lateral view, scale bars: 0.05 mm. **15**. *Leptotyphlus villacidrinus* sp. nov. (paratype, Villacidro). **16**. *Leptotyphlus nardii* sp. nov. (paratype, Nebida). **17.** *Leptotyphlus minator* sp. nov. (paratype, Nebida).

***Leptotyphlus villacidrinus* sp. nov.**
(Figs 15, 21–23)

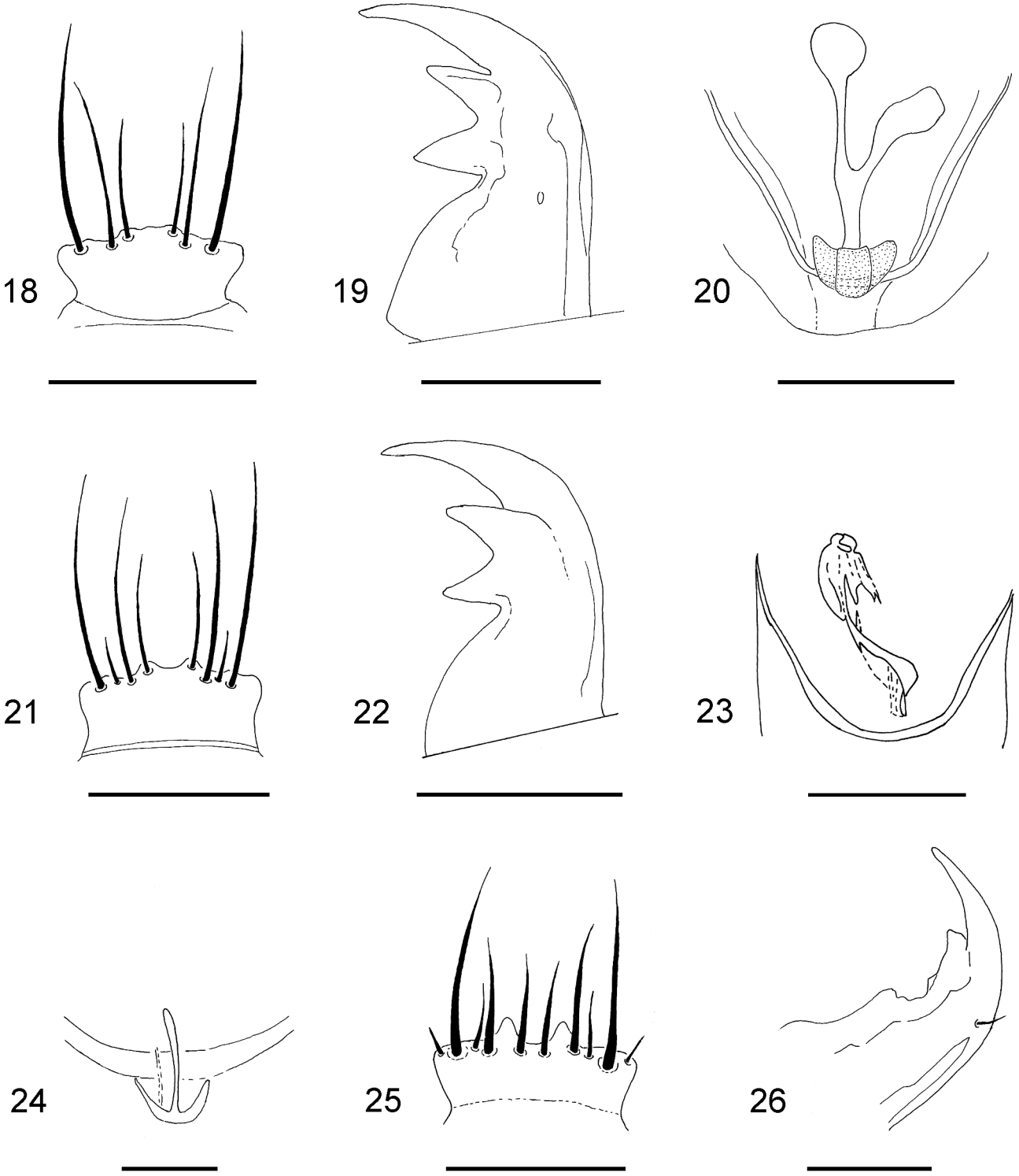
Diagnosis. A *Leptotyphlus* of medium size, with weakly punctuated integuments and superficial microreticulation. Clearly differentiated from all Italian species known so far but undoubtedly related to the North-African species *L. tuniseus* Normand, 1910, from which it differs essentially in the genital structures.

Type locality. SW Sardinia, Medio Campidano prov., Villacidro, historical city centre.

Type series. Holotype ♂: "SW Sardinia, Villacidro (Medio Campidano), paese [= in town], 260 m, 10.XI.1985, leg. P. Leo" (MSNG). Paratypes: Villacidro (Medio Campidano prov.), paese, 260 m, 10.XI.1985, leg. P. Leo, 2 ♂♂ and 5 ♀♀ (CLF-PL); 1.I.1986, leg. P. Leo, 5 ♂♂ and 12 ♀♀ (1 ♀ CCH, 5 ♂♂ and 9 ♀♀ CLF-PL, 1 ♀ CNBFVR, 1 ♀ MSNG); 16.III.1986, leg. P. Leo, 2 ♂♂ and 7 ♀♀ (CLF-PL); 27.IV.1986, leg. P. Leo, 3 ♀♀ (CLF-PL). Villacidro (Medio Campidano prov.), Sa Spendula, 220 m, 9.XII.1989, leg. P. Leo, 1 ♀ (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 8.V.1986, 2.I.1987, leg. P. Leo, 3 ♀♀ (CLF-PL).

Description. Total length 1.10–1.20 mm. Body of pale testaceous colour, rather shiny, with sparse microsculpture on all of its surface. Head just wider than pronotum, not markedly rounded at sides, with only slight frontal carinas; punctuation not strong; labrum (Fig. 21) with two symmetrical median teeth; mandibles (Fig. 22) bifid with robust retinaculum and premolar tooth; antennae relatively short, just longer than head. Pronotum about as long as wide, with two superficial longitudinal grooves, slightly converging anteriorly; punctuation even more minute and sparse than on head. Elytral punctuation almost imperceptible. Abdomen with regularly convex tergites. Aedeagus as in Fig. 15, lying to the left side of the abdomen, with a robust and arched dorsal copulatory piece; sternal lamina distally divided into two branches: ventral branch, in lateral

view, simple, short and not markedly sinuous; upper branch long, very thin and upturned. Female genital armature asymmetrical, structured as in Fig. 23.



FIGURES 18–26. *Leptotyphlus* spp., scale bars 0.05 mm. **18–20.** *Leptotyphlus nardii* sp. nov. (paratype, Nebida). **18.** Labrum in dorsal view. **19.** Right mandible in dorsal view. **20.** Female genital armature in ventral view. **21–23.** *Leptotyphlus villacidrinus* sp. nov. (paratype, Villacidro). **21.** Labrum in dorsal view. **22.** Right mandible in dorsal view. **23.** Female genital armature of *Leptotyphlus villacidrinus* sp. nov. (paratype, Villacidro) in ventral view. **24–26.** *Leptotyphlus minator* sp. nov. (paratype, Gutturu di Monte Nieddu). **24.** Female genital armature in ventral view. **25.** Labrum in dorsal view. **26.** Right mandible in dorsal view.

Observations. As already mentioned in the diagnosis, the only species close to *Leptotyphlus villacidrinus* sp. nov. is *L. tuniseus* from northern Tunisia, which was ascribed by Coiffait (1972) to subgenus *Stigmotyphlus*. In particular, similarities can be found in the large and strongly arched dorsal copulatory piece, and in the shape and chaetotaxy of the left paramere. Differences between these two species lie in the shape and chaetotaxy of the right paramere and the structure of the other copulatory pieces (*cf.* Coiffait 1972, fig. 197).

Ecological notes. Most specimens of the type series were collected in an abandoned orchard garden of the historical city centre of Villacidro, in soil samples taken at the base of a *Ficus carica* tree; other specimens were found in woody areas dominated by *Quercus ilex*. The collecting localities are situated on granitic (Villacidro city centre and Sa Spendula) and argilloschist (San Sisinnio) Palaeozoic soils. The following endogean beetles were found in association with the new species: *Bathysciola damryi* (Leiodidae), *Eudesis aglena*, *Trimium amplipenne* Reitter, 1908, *Entomoculia shardana* sp. nov., *Leptotyphlus minator* sp. nov. (Staphylinidae), *Torneuma* sp. (Curculionidae), *Alaocyba carinulata*, *Raymondiellus sardous sardous* (Raymondionymidae).

Etymology. This new species is named after the type locality.

***Leptotyphlus minator* sp. nov.**
(Figs 17, 24–26)

Diagnosis. A *Leptotyphlus* of large size, with robust punctuation and microreticulation, close to *L. solarii* Coiffait, 1957, but strongly differing from the latter in the shape of the male and female genitalia.

Type locality. SW Sardinia, Carbonia-Iglesias prov., Iglesias, Nebida.

Type series. Holotype ♂: "SW Sardinia, Iglesias (Carbonia-Iglesias), Nebida, 25.I.1987, 120 m, leg. L. Fancello & P. Leo" (MSNG). Paratypes: Carbonia (Carbonia-Iglesias prov.), Monte Sirai, 120 m, 22.XII.1990, leg. L. Fancello & P. Leo, 1 ♂ (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 1.X.1985, leg. L. Fancello & P. Leo, 2 ♂♂ and 2 ♀♀ (1 ♂ and 2 ♀♀ CLF-PL, 1 ♂ CNBFVR). Fluminimaggiore (Carbonia-Iglesias prov.), near grotta Su Mannau, 200 m, 19.III.1989, leg. P. Leo, 1 ♂ (CLF-PL). Narcao (Carbonia-Iglesias prov.), 310 m, 5.I.1990, leg. L. Fancello & P. Leo, 1 ♀ (CLF-PL). Iglesias (Carbonia-Iglesias), Nebida, 25.I.1987, 120 m, leg. L. Fancello & P. Leo 1 ♂ (CLF-PL). Villacidro (Medio Campidano prov.), paese [= in town], 260 m, 27.IV.1986, leg. P. Leo, 1 ♀ (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 15.III.1987, leg. P. Leo, 1 ♀ (CLF-PL).

Description. Total length 1.35–1.50 mm. Body robust, of reddish colour, slightly shiny, with obvious microreticulation throughout. Head large, wider than pronotum distally, slightly rounded at sides, with frontal carinas slightly diverging posteriorly; punctuation strong and deep; labrum bifid (Fig. 25); mandibles (Fig. 26) with a few indistinct small teeth between retinaculum and premolar tooth; antennae somewhat elongated, much longer than head. Pronotum about as wide as long, with two longitudinal grooves from base of pronotum to anterior ¼; punctuation large, as on head. Elytra with sparse, robust punctuation, less strong than on head and pronotum. First five abdominal segments slightly flattened on disc. Aedeagus as in Fig. 17, lying to the left of abdomen and with a strongly developed basal bulb carrying an obvious chitinized nodule on upper surface; sternal lamina in lateral view strongly arched upwards. Female genital armature weakly chitinized, structured as in Fig. 24.

Observations. *Leptotyphlus solarii* (described from Aritzo, central Sardinia) is the only species that show some affinity with *Leptotyphlus minator* sp. nov.: this species, ascribed by Coiffait (1972) and Pace (1996) to subgenus *Subhesperotyphlus* Coiffait, 1972, can be easily distinguished by its smaller size and the shape of the male copulatory organ and female genital armature (*cf.* Coiffait 1972: fig. 172; Pace 1996, fig. 176).

Ecological notes. The new species, relatively widespread but always rare in the study area, was found in soil samples taken from a wide range of habitats: Mediterranean maquis with *Pistacia lentiscus* dominance, *Quercus ilex* woodland, degraded areas at the base of *Ficus carica* and *Olea europaea* trees. The sampling

localities are situated on a range of soil types: Palaeozoic granites, limestones and argilloschists, and Cenozoic basaltic trachytes. The following endogean beetles were collected in association with the new species: *Bathysciola damryi* (Leiodidae), *Eudesis aglena*, *Mayetia* sp., *Entomoculia carbonaria* sp. nov., *E. shardana* sp. nov., *Leptotyphlus villacidrinus* sp. nov. (Staphylinidae), *Torneuma* sp. (Curculionidae), *Alaocyba carinulata*, *Raymondiellus sardous sardous* (Raymondionymidae).

Etymology. Named after the mining activities which took place across the centuries in the area of occurrence of the new species.

Faunistic list

Carabidae

Typhloreicheia holdhausi Magrini, Fancello & Casale, 2006

Magrini *et al*. 2006: 41

Literature data. Iglesias (Carbonia-Iglesias prov.), Mamenga, 1.III.2006, leg. L. Fancello, 1 ex, 1 rs (Magrini *et al*. 2006). Iglesias (Carbonia-Iglesias prov.), Parco Monte Marganai, loc. Mamenga (Magrini & Fancello 2007).

Distribution. Species endemic of the Iglesiente region, known only from the type locality (Iglesias, Passo Genna Bogai) and the above-cited site.

Notes. Collected with the Berlese method in a *Quercus ilex* woodland.

Typhloreicheia leoi pilosa Magrini & Fancello, 2007

Magrini & Fancello 2007: 170

Literature data. Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 28.XI.2006, 20.I.2007, 2.III.2007, leg. L. Fancello, 11 ex (Magrini & Fancello 2007).

Distribution. Species endemic of the Iglesiente region; the nominal subspecies and ssp. *leoi* are only known from the respective type localities: Fluminimaggiore (Carbonia-Iglesias prov.), Sant'Angelo (Magrini 2003) and the above-cited site.

Notes. Collected with the Berlese method in a *Quercus ilex* woodland.

Typhloreicheia tanit Leo, Magrini & Fancello, 2005
(Fig. 4)

Leo *et al*. 2005: 181

Literature data. Villacidro (Medio Campidano prov.), San Sisinnio, 250 m (type locality), 27.IV.1986, 15.III.1987, 24.IV.1990, 2 ex, 2 rs (Leo *et al*. 2005).

Unpublished data. Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 4.IV.2007, leg. L. Fancello & P. Leo, 1 ex (CLF-PL).

Distribution. Sardinian endemic, known only from the above localities.

Notes. Due to a typing error in the species description, it was not clearly stressed that the holotype is of male sex. Collected by hand and with the Berlese method in a *Quercus ilex*-dominated woodland.

Leiodidae

***Bathysciola* (*Bathysciola*) *damryi* (Abeille de Perrin, 1881)**

Giachino 1990: 302

Literature data. Domusnovas (Carbonia-Iglesias prov.), 27.X.1985, leg. L. Fancello & P. Leo, 4 ex. Villacidro (Medio Campidano prov.), 10.XI.1985, 1.I.1986, 16.III.1986, 27.IV.1986, 20.IX.1986, leg. P. Leo, 22 ex. Villacidro (Medio Campidano prov.), Foresta di Montimannu, 8.XI.1986, leg. L. Fancello & P. Leo, 14 ex (Giachino 1990; Zoia & Latella 2006). Iglesias (Carbonia-Iglesias prov.), Mamenga (Magrini *et al*. 2006; Fancello & Magrini 2007; Casale *et al.* 2009).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 10.I.1986, leg. L. Fancello & P. Leo, 5 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 1.III.2006, leg. L. Fancello, 6 ex (CLF-PL). Villacidro (Medio Campidano prov.), paese [= in town], 260 m, 15.III.1987, 9.XII.1989, leg. P. Leo, 6 ex (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, 8.VI.1986, leg. P. Leo, 11 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 27.IV.1986, 8.V.1986, leg. P. Leo, 8 ex (CLF-PL).

Distribution. Sardinian endemic, widespread throughout the island (Giachino 1990, Zoia & Latella 2006).

Notes. Collected in an abandoned orchard garden of the small town of Villacidro and in wooded areas and Mediterranean maquis with the Berlese method, direct collecting and buried bait.

Staphylinidae

***Eudesis aglena* Reitter, 1882**

Binaghi 1948: 37

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Sa Duchessa, 350 m, 10.I.1986, leg. L. Fancello & P. Leo, 1 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 7.IV.2000, leg. L. Fancello, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), paese, 260 m, 1.I.1986, leg. P. Leo, 3 ex (CLF-PL).

Distribution. Sardinian endemic, known so far only from few localities in western Sardinia: Gonnesa, Fluminimaggiore, Asuni and Campeda (Binaghi 1948). Its occurence in Corsica, still mentioned in some recent works (Sánchez-Terròn 2004, with doubt; Vít 2004) should be refused (*cf*. Binaghi 1948).

Notes. Collected with the Berlese method in various habitats: *Quercus ilex* woodland, Mediterranean maquis and in an orchard garden at the base of a *Ficus carica*.

***Eudesis minima* Binaghi, 1948**

Binaghi 1948: 37

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 22.V.1985, 13.IV.1990, leg. L. Fancello & P. Leo, 5 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 7.IV.2000, leg. L. Fancello, 1 ex (CLF-PL).

Distribution. Species seemingly endemic of SW Sardinia, previously known only from the type locality: Fluminimaggiore (Carbonia-Iglesias prov.) (Binaghi 1948).

Notes. Collected with the Berlese method in a *Quercus ilex* wood.

***Mayetia* sp.**

Literature data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m (Fancello & Leo 1991).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 1.X.1985, leg. L. Fancello & P. Leo, 3 ex (MSNG).

Distribution. Sardinian endemic.

Notes. Collected with the Berlese method in a *Quercus ilex* woodland. An undescribed species currently under study.

***Trimium amplipenne* Reitter, 1908**

Orousset 1988: 368

Literature data. Villacidro (Medio Campidano prov.) (Poggi 1992; Poggi & Sabella 2006).

Unpublished data. Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 8.V.1986, 24.IV.1990, 7.V.1991, leg. P. Leo, 10 ex (CLF-PL).

Distribution. Sardinian endemic, widespread throughout Sardinia (Poggi 1992, Poggi & Sabella 2006).

Notes. Collected with the Berlese method in a *Quercus ilex* woodland.

***Tychobythinus dentimanus* (Reitter, 1884)**

Orousset & Dubault 1985: 61

Literature data. Domusnovas (Carbonia-Iglesias prov.) (Poggi 1992). Villacidro (Medio Campidano prov.) (Poggi 1992).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 10.I.1986, leg. L. Fancello & P. Leo, 1 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, leg. L. Fancello & P. Leo, 1 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 1.III.2006, leg. L. Fancello, 1 ex (CLF-PL).

Distribution. Sardo-Corsican endemic, widespread in Sardinia (Poggi 1992; Löbl & Besuchet 2004; Poggi & Sabella 2006).

Notes. Collected with the Berlese method and by hand in wooded and Mediterranean maquis areas.

***Tychus* sp.**

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 25.X.1985, 10.I.1986, leg. L. Fancello & P. Leo, 2 ex (MSNG). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.XI.1986, leg. P. Leo, 1 ex (MSNG). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 24.IV.1990, leg. P. Leo, 1 ex (MSNG).

Distribution. Sardinian endemic.

Notes. Collected with the Berlese method in both *Quercus ilex* woods and Mediterranean maquis. The specimens are still under study and could belong either to a new species or to *Tychus anophthalmus* Reitter, 1882, a species described from “Sardinien” from a single specimen and since then never collected (*cf*. Poggi & Sabella 2006).

***Pselaphostomus* sp.**

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 10.I.1986, leg. L. Fancello & P. Leo, 1 ex (MSNG).

Distribution. Sardinian endemic.

Notes. Collected with the Berlese method in a *Quercus ilex* woodland. The specimen is under study and probably belongs to an undescribed species.

***Phloeocharis* (*Scotodytes*) *ichnusae* Dodero, 1900**

Orousset 1980: 159

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290–320 m, 25.X.1985, 10.I.1986, leg. L. Fancello & P. Leo, 5 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, leg. L. Fancello & P. Leo, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, leg. P. Leo, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 9.XII.1989, leg. P. Leo, 1 ex (CLF-PL).

Distribution. Sardinian endemic (Löbl & Besuchet 2004) recorded only from three localities of central-southern Sardinia: Oristano (Oristano prov.), Aritzo (Nuoro prov.) and Fluminimaggiore (Carbonia-Iglesias prov.) (Orousset 1980).

Notes. Collected with the Berlese method in wooded areas with *Quercus ilex* dominance.

***Entomoculia* (*Entomoculia*) *carbonaria* sp. nov.**
(Figs 9, 13)

Species known only from the study area and described above.

***Entomoculia* (*Entomoculia*) *melonii* sp. nov.**
(Figs 5, 10–11)

Species known only from the study area and described above.

***Entomoculia* (*Entomoculia*) *shardana* sp. nov.**
(Figs 8, 14)

Species known only from the study area and described above.

***Entomoculia* (*Entomoculia*) *villascemae* sp. nov.**
(Figs 7, 12)

Species known only from the study area and described above.

***Leptotyphlus minator* sp. nov.**
(Figs 17, 24–26)

Species known only from the study area and adjacent localities, and described above.

***Leptotyphlus nardii* sp. nov.**
(Figs 16, 18–20)

Species known only from the study area and adjacent localities, and described above.

***Leptotyphlus villacidrinus* sp. nov.**
(Figs 15, 21–23)

Species known only from the study area and described above.

***Octavius raymondi* Saulcy, 1878**

Coiffait 1984: 401

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 310 m, 10.I.1986, 280 m, leg. L. Fancello & P. Leo, 2 ex (CLF-PL).

Distribution. Corsica?, Sardinia, Algeria and Tunisia (Smetana 2004a, 2004c); in Sardinia was previously known only from the type locality in the north of the Island: Bonnari (Sassari prov.) (Coiffait 1984).

Notes. Collected with the Berlese method in a wood, at the base of a *Quercus ilex*.

***Octavius sardous* Coiffait, 1965**

Coiffait 1984: 402

Unpublished data. Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, 8.XI.1986, leg. P. Leo, 9 ex (CLF-PL).

Distribution. Sardinian endemic (Smetana 2004a, 2004c), previously known only from the type locality in central Sardinia: Aritzo (Nuoro prov.) (Coiffait 1984).

Notes. Collected with the Berlese method in a *Quercus ilex*-dominated woodland.

Zopheridae

***Langelandia reitteri* Belon, 1882**

Dajoz 1977: 165

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290–320 m, 22.V.1985, 12.I.1990, 13.IV.1990, leg. L. Fancello & P. Leo, 5 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, 20.III.1992, leg. L. Fancello & P. Leo, 4 ex (CLF-PL). Iglesias (Carbonia-

Iglesias prov.), Mamenga, 430 m, 14.I.2001, leg. L. Fancello, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), Rio Bidda Scema, 330 m, 20.IX.1986, leg. P. Leo, 6 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 7.V.1991, leg. P. Leo, 1 ex (CLF-PL).

Distribution. A West-Mediterranean species (Ślipiński & Schuh 2008) overlooked in the Italian checklist (Angelini *et al*. 1995) but already quoted from Sardinia by Dajoz (1977, as *Langelandia reitteri reitteri*).

Notes. Collected by hand and with the Berlese method, in open habitats and in woodland and Mediterranean maquis.

***Lyreus septemstriatus* Fancello & Leo, 1991**

Fancello & Leo 1991: 129

Literature data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m (type locality), 18.IX.1985, 1.X.1985, leg. L. Fancello & P. Leo, 3 ex (Fancello & Leo 1991).

Unpublished data. Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 20.XI.2005, leg. L. Fancello, 1 ex (CLF-PL).

Distribution. Endemic to SW Sardinia, previously known only from the type locality and Villamassargia (Carbonia-Iglesias prov.), Monte Santu Miai (Magrini *et al*. 2003); known to us also from a neighbouring locality: Iglesias (Carbonia-Iglesias prov.), Masua, 150 m, 13.IV.2004, leg. L. Fancello, 2 ex (CLF-PL).

Notes. Collected with the Berlese method in a *Quercus ilex* woodland.

Curculionidae

***Torneuma* (*Torneuma*) sp.**
(Fig. 6)

Literature data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m (Fancello & Leo 1991). Iglesias (Carbonia-Iglesias prov.), Mamenga (Magrini *et al*. 2006; Magrini & Fancello 2007).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290-330 m, 18.IX.1985, 1.X.1985, 25.X.1985, 10.I.1986, 13.IV.1990, 12.III.2007, leg. L. Fancello & P. Leo, 20 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, leg. L. Fancello & P. Leo, 3 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 1.III.2006, leg. L. Fancello, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, leg. P. Leo, 1 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 27.IV.1986, 8.V.1986, 15.III.1987, 9.XII.1989, 7.V.1991, 4.IV.2007, leg. P. Leo, 14 ex (CLF-PL).

Distribution. Probably a Sardinian endemic.

Notes. Collected by hand and with the Berlese method, in open habitats and in woodland and Mediterranean maquis. Pending a full revision of the genus (*cf.* Colonnelli & Osella 2009) it was impossible to identify these specimens to species.

Raymondionymidae

***Alaocyba carinulata* Perris, 1869**

Osella 1977: 14

Literature data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m (Fancello & Leo 1991). Iglesias (Carbonia-Iglesias prov.), Mamenga (Magrini *et al.* 2006; Magrini & Fancello 2007).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290-330 m, 18.IX.1985, 1.X.1985, 25.X.1985, 10.I.1986, 28.III.1986, 12.I.1990, 13.IV.1990, leg. L. Fancello & P. Leo, 42 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, 20.III.1992, leg. L. Fancello & P. Leo, 4 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Case Marganai, 725 m, 10.IV.2003, leg. L. Fancello, 3 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 20.XI.2005, leg. L. Fancello, 8 ex (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, 8.VI.1986, 8.XI.1986, 13.X.1991, leg. P. Leo, 10 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 8.V.1986, 15.III.1987, 24.IV.1990, 7.V.1991, leg. P. Leo, 11 ex (CLF-PL).

Distribution. Sardinian endemic (Osella 1977).

Notes. Collected by hand and with the Berlese method in wooded areas (Fig. 3) and Mediterranean maquis.

***Raymondiellus sardous sardous* (Perris, 1869)**

Osella 1977: 104

Literature data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, (Fancello & Leo 1991). Iglesias (Carbonia-Iglesias prov.), Mamenga (Magrini *et al.* 2006; Magrini & Fancello 2007).

Unpublished data. Domusnovas (Carbonia-Iglesias prov.), Gutturu di Monte Nieddu, 290 m, 18.IX.1985, 1.X.1985, 25.X.1985, 10.I.1986, 12.I.1990, 13.IV.1990, leg. L. Fancello & P. Leo, 28 ex (CLF-PL). Domusnovas (Carbonia-Iglesias prov.), Valle di Oridda, 570 m, 12.II.1992, 20.III.1992, leg. L. Fancello & P. Leo, 3 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Case Marganai, 725 m, 10.IV.2003, leg. L. Fancello, 2 ex (CLF-PL). Iglesias (Carbonia-Iglesias prov.), Mamenga, 430 m, 20.XI.2005, leg. L. Fancello, 2 ex (CLF-PL). Villacidro (Medio Campidano prov.), Foresta Demaniale di Montimannu, 280 m, 8.V.1986, 8.VI.1986, 8.XI.1986, leg. P. Leo, 4 ex (CLF-PL). Villacidro (Medio Campidano prov.), San Sisinnio, 250 m, 27.IV.1986, 8.V.1986, 15.III.1987, 7.V.1991, leg. P. Leo, 6 ex (CLF-PL).

Distribution. Endemic to SW Sardinia, with a subspecies on Isola di San Pietro (Carbonia-Iglesias prov.) (Osella 1977).

Notes. Collected by hand and with the Berlese method in wooded areas (Fig. 3) and Mediterranean maquis.

Discussion

The present study, though it regards only the endogean beetle fauna, shows that the study area is highly diverse, and further investigations are likely to increase the species list. Despite the relatively small size of the area, as many as 26 species from six different families were counted (Carabidae, Leiodidae, Staphylinidae, Zopheridae, Curculionidae, Raymondionymidae). Apart from *Langelandia reitteri* and *Octavius raymondi*, widespread throughout the West Mediterranean, and the Sardo-Corsican endemic *Tychobythinus dentimanus*, all recorded species are Sardinian endemics and 16 of these are restricted to the study area or to the Iglesiente region (*Typhloreicheia holdhausi*, *T. leoi*, *T. tanit*, *Eudesis minima*, *Mayetia* sp., *Tychus* sp., *Pselaphostomus* sp., *Entomoculia villascemae* sp. nov., *E. carbonaria* sp. nov., *E. shardana* sp. nov., *E. melonii* sp. nov., and *L. villacidrinus* sp. nov.), sometimes extending to the Sulcis (*Leptotyphlus nardii* sp. nov., *L. minator* sp. nov., *Lyreus septemstriatus*, *Raymondiellus sardous*); five species are more widespread and are known also from central-northern Sardinia (*Bathysciola damryi*, *Eudesis aglena*, *Trimium amplipenne*, *Phloeocharis ichnusae*, *Octavius sardous*, *Alaocyba carinulata*). The distribution range of *Torneuma* sp. is hard to define, in the

absecne of a precise identification to species of the collected material.

The lack of in-depth studies extended to the whole island makes comparisons between the investigated assemblage and those of other areas of Sardinia premature. Nonetheless, some peculiarities of the endogean beetle fauna of the area are worthy of mention, such as the presence of a small group of species with Catalan affinities, consisting of *Lyreus septemstriatus* and the two species of genus *Eudesis* Reitter, 1882. The genus *Lyreus* Aubé, 1861, besides the type species *L. subterraneus* Aubé, 1861 (occurring in southern France), also includes *L. caneparii* Magrini, Fancello & Hernando, 2003 from Spanish Catalonia, a close ally of the SW Sardinian species witnessing the faunal exchanges that took place between the two territories during the palaeogeographic history of the Mediterranean. The same can be said of the genus *Eudesis*, which contains the two above-mentioned Sardinian endemics and a third species, *E. adela* Saulcy, 1890, from French Catalonia (Pyrénées-Orientales) (*cf.* Vít 2004). Noteworthy is also the small size of the endogean Sardo-Corsican assemblage with just the one species *Tychobythinus dentimanus*, contrary to other areas of Sardinia – particularly the central-northern part – where species with this pattern of distribution are more abundant. Finally, the absence of a few genera otherwise widespread in Sardinia (*Paramaurops* Jeannel, 1948, *Scotonomus* Fauvel, 1873 [Staphylinidae], *Derosasius* Ganglbauer, 1906 [Raymondionymidae]) is difficult to explain.

Given the strict association of the endogean microfauna with the deep-soil habitat, no immediate risks of rarefaction or extinction can be foreseen, not even for the more localized species, except in the event of a severe environmental catastrophe gravely compromising the tree cover and hydrogeology of the area. A demonstration of this is the rich endogean fauna found in an abandoned orchard garden in the historical city centre of Villacidro.

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