

Isidus moreli Mulsant et Rey, 1874 in Sicily (Elateridae Pomachiliini): regional distribution and threat factors

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ABSTRACT

The distribution of *Isidus moreli* Mulsant et Rey, 1874 (Elateridae Pomachiliini) in Sicily is updated, a saproxylophagous species linked to dune environments and considered “Vulnerable” in the national red lists and “Near Threatened” in the European ones. For this species, the ecological peculiarities are also highlighted and the main threat factors are discussed, underlining the importance of protected areas for its conservation.

KEY WORDS

Elateridae; distribution; Sicily; endangered species.

Received xx.xx.2023; accepted xx.xx.2023; published online 30.03.2024

Proceedings of 6th International Congress on Biodiversity “Biodiversity and the new scenarios on alien species, climate, environment and energy” - Trapani (Italy, Sicily) 2–3 September 2022

INTRODUCTION

Isidus Mulsant & Rey, 1874 is a genus of Elateridae belonging to the tribus Pomachiliini. This tribe lists four Palearctic species, three of which are also present in the Mediterranean area: *I. appendiculatus* (Pic, 1912), *I. letourneuxi* (Pic, 1902) and *I. moreli* (Mulsant et Rey, 1874) (Cate, 2007; Alonso-Zarazaga & Cate, 2010). *Isidus moreli*, a species with Turanian-Mediterranean chorotype, is widespread in France, Italy, Malta, Spain, Ukraine, Morocco, Tunisia, Algeria, Egypt, Cyprus and Turkey (Leseigneur, 1972; Platia, 1994; Cate, 2007; Delnatte, 2010; Alonso-Zarazaga & Cate, 2023).

Only about twenty locations are known for Italy (Platia, 1994, 2005); of these, the only ones indicated for Sicily are Casabianca, a coastal area

located about 10 km north of Messina (Baviera & Platia, 2018) and the mouth of the Simeto River near Catania (Altadonna, 2015). However, Pulvirenti & Platia (2022) indicate its presence in the provinces of Trapani, Agrigento, Ragusa and Messina but without providing its precise location.

Knowledge on the ecology of this species have been provided by Leseigneur (1972), Giordani Soika (1992) and Platia (1994) while the species has been studied in detail by Delnatte (2010). The pre-imaginal stages are saproxylophagous and develop mainly in large strains of *Platanus* and *Populus* in advanced state of decomposition which are found on beaches near the river mouths. Here, the larvae colonize the part of the wood directly in contact with the sandy substrate and can move between the roots of the dune plants through different microhabitat.

Isidus moreli show a marked opportunistic and predatory behaviour by preferably attacking larvae of other saproxylophagous beetles, with a specific preference towards Curculionidae Cossoninae and can integrate their diet by also feeding on wooden compounds, fungi or organic debris. Similarly to other predatory Elateridae (Kozlov et al., 2020) cannibalism is observed in the larvae of this species. Larval development is between 3 and 4 years, adults emerge between June and August and are active from late in the evening and throughout the night after which they take refuge in the sand. The adults are photophilous (Contarini, 1992; Delnatte, 2010). *Isidus moreli* is extremely important for conservationist reasons because it is associated with intact coastal habitats and is an excellent bioindicator of the conservation status of the biocenoses of the sandy coasts of the Mediterranean area (Audisio et al., 2003; Jaulin & Soldati, 2003, 2005; Fattorini, 2008). Due to the fragmentation of its range and the degradation of its habitat, it is considered Vulnerable (VU) in the IUCN Red List of Italian saproxylic beetles (Audisio et al., 2014) and Near Threatened (NT) in the European Red List of Saproxylic Beetles (Calix et al., 2018). During some sampling carried out in the sandy coastal areas of Sicily in order to survey the faunal

component, various populations of *I. moreli* were identified. The new data presented here therefore allow us to significantly extend its regional range.

MATERIAL AND METHODS

Study area

The sampling was carried out in 13 Sicilian coastal locations between 2019 and 2023 (Table 1, Fig. 1), focusing on sites of potential presence of the species, i.e. intact dune environments and near the river mouths.

Sampling

Adults of *I. moreli* were attracted with light traps consisting of a white sheet placed on the ground and illuminated with a 20 Watt black light lamp (Wood light) and a 10 Watt cold white light lamp (color temperature 6500 degrees Kelvin) powered by 20,000 mha lithium batteries. This system was joined by another consisting of a white umbrella illuminated by a 10 watt UV LED with an emission frequency between 390 and 405 nm. Information on the presence of the species was also



Figure 1. *Isidus moreli* in Sicily. The localities where its presence has been confirmed are marked in red, those cited only in the literature are marked in yellow and the localities already reported where the species has not been found are marked in green.

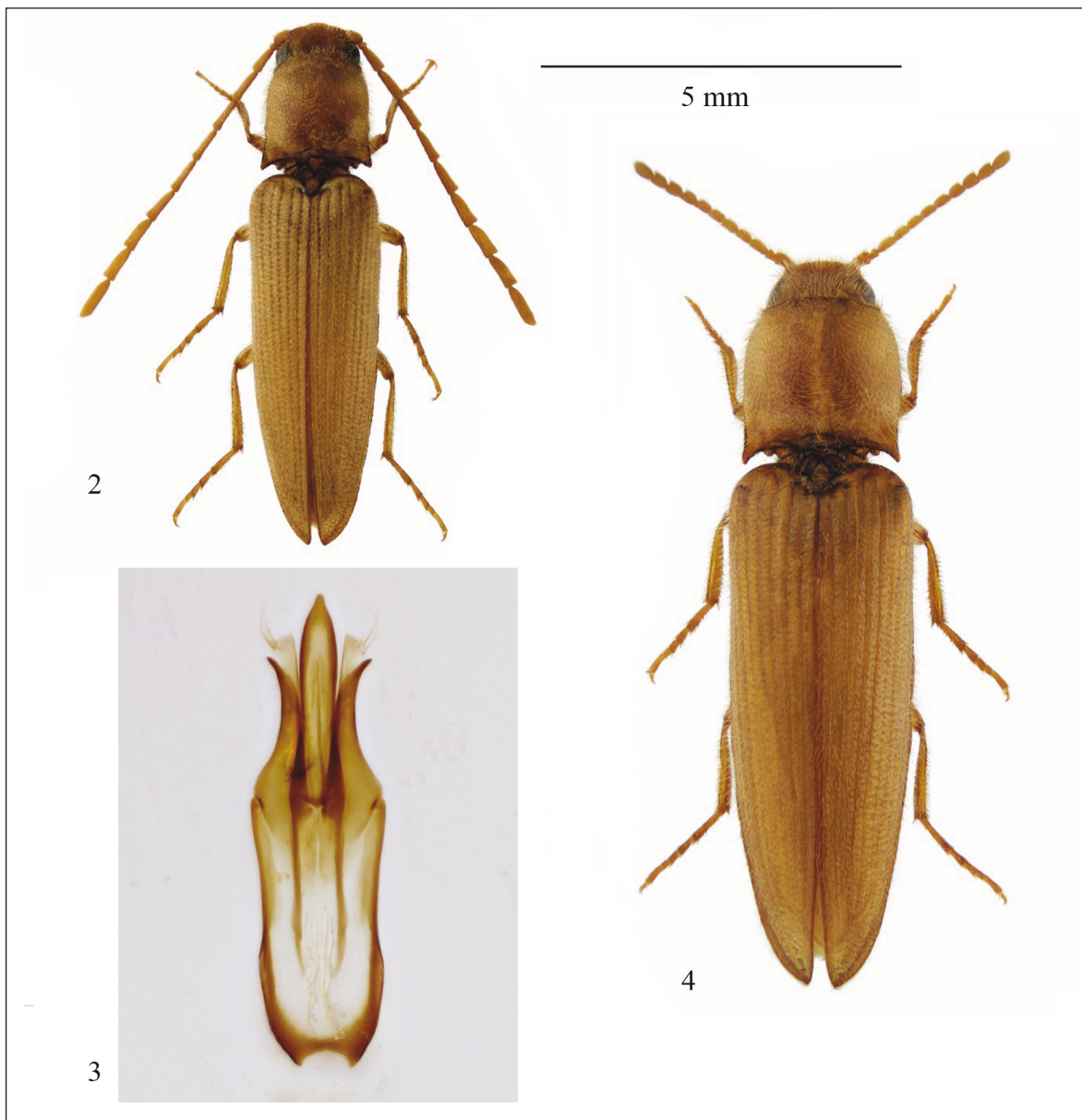
obtained by inspecting decaying trunks or by collecting elytra or fragments of specimens found in the field. The specimens were identified following Pesarini (1986) and Platia (1994) and, unless otherwise indicated, preserved in the authors' collections.

ABBREVIATIONS. C. Muscarella collection, Palermo, Italy: CM; D. Sechi collection Cagliari, Italy: CS; G. Altadonna collection, Tramestieri (ME), Italy: CA.

RESULTS

Isidus moreli Mulsant et Rey, 1874

REPORTS. ITALY • 1 specimen, Trapani: Castelvetrano, foce del Modione, 37.583253°, 12.819380°, 17 Jun. 2021 (CM); 4 specimens, ibidem, 16 Jun. 2022 (CS); 1 specimen, ibidem, 18 Jun. 2022, legit F.P. Faraone (CM); 1 specimen, ibidem, 7 Jul. 2022 (CM); 2 specimens, Castelvetrano: foce del Belice,



Figures 2-4. *Isidus moreli* from mouth of Modione River (Castelvetrano, Sicily, Italy), 16.VI.2022. Fig. 2. Male. Fig. 3. Aedeagus. Fig. 4. Female.

37.582581°, 12.866473°, 14 Jun. 2020 (CM); 1 specimen, ibidem, 4 Jun. 2022 (CM); 2 specimens, ibidem, 15 Jun. 2022 (CS). 2 specimens, Agrigento: Ribera, foce del Platani, 37.396757°, 13.271031°, 5 Aug. 2020 (CM); 2 specimens, Siculiana Marina, Torre Salsa, 37.360426°, 13.344660°, 23 Jun. 2019, legit Costa S., Mascarello G. and Muscarella C. (CM); 2 specimens, ibidem, 14 Jul. 2022 (CM). 2 specimens, Caltanissetta: Marina di Butera, 37.104509°, 14.110676°, 15 Jul. 2021, legit Giacalone G. and Muscarella C. (CM); 2 specimens, ibidem, 16 Jul. 2022, legit Giacalone G. and Muscarella C. (CM). 1 specimen, Ragusa: Marina di Ragusa, foce Irmínio, 36.773034°, 14.595208°, 5 Jun. 2023 (CM); 2 specimens, Sampieri, foce Petrarò, 36.719579°, 14.751147°, 6 Jun. 2023 (CM); 2 specimens, Ispica, Santa Maria del Focallo, 36.717670°, 14.923889°, 26 Jun. 2022 (CM); 2 specimens, Siracusa: Noto, foce Tellaro, 36.837814°, 15.105748° (CM); 1 specimen, Catania: foce Fiume Simeto, 37.398820°, 15.088872°, 7 Jun. 2015 (CA); 3 specimens, ibidem 5 Jun. 2020, legit Costa S., Mascarello G. and Muscarella C. (CM).

REMARKS. Overall, 10 populations of *I. moreli* were identified on 13 sampled sites (Table 1; Fig. 1). All the new stations fall in southern and south-eastern Sicily, including the provinces of Caltanissetta, Syracuse and Catania where it had not been reported until now.

These are the localities on the island where the coastal dune system, although fragmented and constantly threatened, still has large strips of relatively intact beaches (Lapiana & Sparacio, 2010). This is made possible thanks to the system of Natural Reserves falling within the network of SACs (Special Protection Areas) or the ecological network for the conservation of European biodiversity established pursuant to Directive 92/43/EEC “Habitats” to guarantee the maintenance long-term view of natural habitats and species of flora and fauna that are threatened or rare at Community level.

8 out of 11 sites in which the presence of *I. moreli* is confirmed fall within this network, while the investigations carried out in 3 sites potentially suitable for the presence of the species in north-western Sicily have provided negative results.

DISCUSSION

Isidus moreli is a predominantly saproxylic stenoeccious species linked to well preserved coastal dunes and an extremely specialized microhabitat, decaying wood. The space-time presence of this resource, in an over-exploited ecosystem such as the coastal fringe, is severely limited, therefore posing the serious problem of its medium-long term

Province	Location	Latitude	Longitude	Presence
Palermo	Termini Imerese, foce del Torto	37°58'21.76"N	13°46'16.48"E	—
Palermo	Balestrate, foce del Calatubo	38° 2'26.56"N	12°58'46.76"E	—
Trapani	Castellamare, foce San Bartolomeo	38° 1'29.64"N	12°54'29.00"E	—
Trapani	Castelvetrano, foce Modione	37°34'59.72"N	12°49'9.79"E	Yes
Trapani	Castelvetrano, foce Belice	37°34'57.31"N	12°51'59.34"E	Yes
Agrigento	Ribera, foce del Platani	37°23'48.33"N	13°16'15.71"E	Yes
Agrigento	Siculiana Marina, Torre Salsa	37°21'37.56"N	13°20'40.79"E	Yes
Caltanissetta	Marina di Butera, foce Rizzuto	37° 6'16.26"N	14° 6'38.47"E	Yes
Ragusa	Marina di Ragusa, foce Irmínio	36°46'22.72"N	14°35'43.03"E	Yes
Ragusa	Sampieri, foce Petrarò	36°43'10.50"N	14°45'4.13"E	Yes
Ragusa	Santa Maria del Focallo	36°43'3.61"N	14°55'26.01"E	Yes
Siragusa	Noto, foce Tellaro	36°50'16.14"N	15° 6'20.72"E	Yes
Catania	Catania, foce Simeto	37°23'55.78"N	15° 5'19.96"E	Yes

Table 1. Stations sampled in Sicily whose presence is confirmed. Sites falling within Special Protection Areas (SAC) are in bold.

conservation. The main threat factor is, in general, the compromise of its elective habitat, i.e. the coastal habitats already included in Annex I of Directive 92/43/EEC “Habitats” (macrocategory 22: Maritime dunes of the Mediterranean coasts). From the national reports on the state of conservation of priority habitats carried out by ISPRA, it emerges that in Italy coastal habitats are currently among the most threatened, with 40% in an inadequate state of conservation and 46.7% in a state of bad conservation (Biondi & Zivkovic, 2014; Acosta & Ercole, 2015). The situation, if possible, is even more serious in Sicily, particularly on the north-western coastal side (Lapiana & Sparacio, 2010) where the anthropic impact has led to the rarefaction and sometimes to the local extinction of various insect taxa (Lapiana & Sparacio, 2008; Muscarella et al., 2002a, 2022b; Sparacio et al., 2023). The main pressures in these environments are related to anthropic exploitation, in particular to activities connected directly or indirectly with seaside tourism (coastal roads, development of tourist facilities and residential areas, cleaning of the beaches with mechanical means and beach leveling, trampling, landfills, transit of vehicles on

dunes), but also to other modifications of natural balances (drainages, artificial coastal defense works, extraction of materials, etc.) (Acosta & Ercole, 2015; Angelini et al., 2021). In Sicily the main threat factor of *Isidus moreli* seems to be the cleaning of the beaches carried out with mechanical means. These interventions, in fact, have a significant impact on the embryonic dunes belt both by removing the pioneer plants and by leveling their natural morphology, therefore negatively impacting the flora and fauna. Added to this the systematic removal of decaying wood improves the use of the seaside resort. These are interventions which, although strongly discouraged by national guidelines (Buffa et al., 2022), are still heavily carried out by numerous public administrations.

It is an umbrella species, and as the only saproxylophagous elaterid present in the Italian dunes plays a fundamental ecological role. Its conservation must be perceived as a priority by the competent authorities and the application of current guidelines (Buffa et al., 2022). In conclusion, for the correct management of the beaches the guidelines can no longer be systematically avoided.



Figure 5. Santa Maria del Focallo beach, July 2022, as it appears after cleaning carried out with mechanical means.



Figure 6. Torre Salsa beach, habitat of choice for *Isidus moreli*.

ACKNOWLEDGEMENTS

We are very grateful to Ignazio Sparacio (Palermo, Italy) for support in the field and during the preparation of this paper and Martina Morana, Elia Coppola and Claudio Labita (Palermo, Italy) for the English revision of the manuscript.

REFERENCES

- Acosta A.T.R. & Ercole S. (Eds.), 2015. Gli habitat delle coste sabbiose italiane: ecologia e problematiche di conservazione. ISPRA, Serie Rapporti, 215/2015
- Alonso-Zarazaga M. & Cate P.C., 2023. *Isidus moreli* Mulsant & Rey, 1874. Fauna Europea (<https://fauna-eu.org/>) [accessed 12 X 2023]
- Altadonna G., 2015. *Isidus moreli* - Foce del Fimeto (CT) 7.VI.2015. <http://www.entomologiitaliani.net/public/forum/phpBB3/viewtopic.php?f=251&t=99762> [accessed 6 XII 2023]
- Angelini P., Casella L. & Carli E., 2021. IV Report Direttiva Habitat: Habitat. In: Ercole S., Angelini P., Carnevali L., Casella L., Giacanelli V., Grignetti A., La Mesa G., Nardelli R., Serra L., Stoch F., Tunesi L. & Genovesi P. (Eds.), 2021. Rapporti Direttive Natura (2013–2018). Sintesi dello stato di conservazione delle specie e degli habitat di interesse comunitario e delle azioni di contrasto alle specie esotiche di rilevanza unionale in Italia. ISPRA, Serie Rapporti 349/2021.
- Audisio P., Muscio G., Pignatti S. & Solari M., 2003. Sand dunes and beaches. Environments between land and sea. Museo Friulano di Storia Naturale, Udine, 155 pp.
- Audisio P., Baviera C., Carpaneto G.M., Biscaccianti A.B., Battistoni A., Teofili C. & Rondinini C., 2014. Lista Rossa IUCN dei Coleotteri saproxilici Italiani. Comitato Italiano IUCN e Ministero dell’Ambiente e della Tutela del Territorio e del Mare, Roma.
- Baviera C. & Platia G., 2018. The Elateridae (Coleoptera: Elateroidea) excl. Cebrionini and Drilini of Sicily: recent records and updated checklist. Atti della Accademia Peloritana dei Pericolanti Classe di Scienze Fisiche, Matematiche e Naturali, 96: 1–33 <https://doi.org/10.1478/AAPP.962A1>
- Buffa G., Baldin M., Borgia F., Cavalli I., Fantinato E., Felli S., Fiorentin R., Mazzucco S., Pernigotto Cego F., Piccolo F., Richard J., Scarton F. & Vianello F., 2022. La fruizione turistica sostenibile e la corretta gestione per la conservazione a lungo termine degli ecosistemi dunali. Linee Guida. Progetto LIFE RE-DUNE (LIFE16 NAT/IT/000589).

- Calix M., Keith A., Nieto A., Dodelin B., Soldati F., Telnov D., Vazquez-Albalade X., Aleksandrowicz, O., Audisio P., Istrate P., Jansson N., Legakis A., Liberto A., Makris C., Merkl O., Pettersson R., Schlaghamersky J., Bologna M., Brustel H. & Purchart L., 2018. European Red List of Saproxyllic Beetles. Available at: <https://portals.iucn.org/library/node/47296> [accessed 6.XII.2023]
- Cate P.C., 2007. Elateridae. In: Löbl, I. & Smetana, A. (Eds.), Catalogue of Palaearctic Coleoptera. Vol. 4. Elateroidea, Derodontoidea, Bostrichoidea, Lymexyloidea, Cleroidea, Cucujoidea. Apollo Books, Stenstrup, pp. 89–209.
- Contarini E., 1992. Eco-profilo d'ambiente della coleottero-fauna di Romagna: 4 - Arenile, duna e retroduna della costa adriatica. Bollettino del Museo civico di Storia naturale di Venezia, 41: 131–182.
- Delnatte J., 2010. A' propos d'*Isidus moreli* Mulsant & Rey, 1874, en France (Coleoptera, Elateridae, Elaterinae, Pomachiliini). Bulletin de la Société entomologique de France, 115: 325–338.
- Fattorini S., 2008. Ecology and conservation of tenebrionid beetles in Mediterranean coastal areas. In: Fattorini S. (Ed.), Insect Ecology and Conservation, 165–297. Research Signpost, Trivandrum, India.
- Fattorini S., 2009. Lineamenti faunistici delle dune italiane. in AA.VV., 2009. Il ripristino degli ecosistemi marino-costieri e la difesa delle coste sabbiose nelle Aree protette. ISPRA, Rapporti 100/09, pp. 183–204.
- Giordani Soika A., 1992. Crostacei, Insetti ed altri invertebrati. In: “La laguna, Tomo I, Ambiente Fauna e Flora”, Corbo e Fiore (Eds), pp. 367–393.
- Kozlov M.V., Prosvirov A.S. & Zvereva E.L., 2020. Can Larvae of Forest Click Beetles (Coleoptera: Elateridae) Feed on Live Plant Roots? Insects, 11: 850. <https://doi.org/10.3390/insects11120850>
- Jaulian S. & Soldati F., 2003. Les Coléoptères Carabidae, Scarabaeoidea et Tenebrionidae des complexes dunaires du littoral de la Région Languedoc-Roussillon. Compléments d'inventaire, menaces pesant sur le littoral, conseils et orientations de gestion. OPIE-LR/ DIREN-LR, Millas, 50 pp.
- Jaulian S. & Soldati F., 2005. Les dunes littorales du Languedoc-Roussillon. Guide méthodologique sur l'évaluation de leur état de conservation à travers l'étude des cortèges spécialisés de Coléoptères. OPIE-LR/ DIREN-LR, Millas, 58 pp.
- Lapiana F. & Sparacio I., 2008. Lo studio degli Insetti nella valutazione della naturalità degli ambienti dunali costieri in Sicilia: Coleoptera e Orthoptera. Il Naturalista siciliano, 32: 411–434.
- La Piana F. & Sparacio I., 2010. Le dune e gli ambienti umidi costieri della Sicilia tra passato, presente e futuro. Le guide del Brigantino, 2. Il Brigantino, Palermo, 279 pp.
- Leseigneur L., 1972. Coléoptères Elateridae de la faune de France. Société Linnéenne de Lyon, Supplément au Bulletin mensuel de février 1972, 382 pp.
- Muscarella C., Luiselli L., Di Vittorio M., Sparacio I., Amori G. & Dendi D., 2022a. Factors associated with occurrence, potential distribution and conservation of *Polyphylla ragusae*, an endemic Scarabaeidae (Melolonthinae) from Sicily. Journal of Insect Conservation. <https://doi.org/10.1007/s10841-022-00403-5>.
- Muscarella C., Luiselli L., Di Vittorio M., Sparacio I., Amori G. & Dendi D., 2022b. Factors Associated with the Occurrence, Potential Distribution and Conservation of *Anoxia orientalis* (Coleoptera, Scarabaeidae) at Different Spatial Scales. Diversity. <https://doi.org/10.3390/d14050397>.
- Pesarini C. 1986. Insetti della fauna italiana. Coleotteri Elateridi. Natura, 77: 2–44.
- Platia G., 2005. “Insecta Coleoptera Elateridae”. In: Checklist e distribuzione della fauna italiana. Ed. by S. Ruffo and F. Stoch. Vol. 16. Memorie del Museo Civico di Storia Naturale di Verona, 2. serie, Sezione Scienze della Vita. Verona. URL: http://faunaitalia.it/documents/CKmap_ITA.pdf
- Pulvirenti E. & Platia G. 2022. The new Checklist of the Italian Fauna: Elateridae, not including Cebriioninae, Drilinae and Lissominae. Biogeographia - The Journal of Integrative Biogeography, 37: 1–7. <https://doi.org/10.21426/B637256219>
- Sparacio I., Muscarella C., Falci A. & Surdo S., 2023. Tiger beetles of Sicily (Coleoptera Cicindelidae). Biodiversity Journal, 14: 791–849. <https://doi.org/10.31396/Biodiv.Jour.2023.14.4.791.849>
- Zapata de la Vega J.L. & Sánchez-Ruiz A., 2019. Nuevas aportaciones al catálogo de la familia Elateridae. (Coleoptera) en la Península Ibérica e Islas Baleares, VII. Archivos Entomológicos, 21: 43–82.

