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Two new records of the elusive *Millieria dolosalis* (Heydenreich, 1851) (Lepidoptera: Millieriidae) in Portugal

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Abstract: *Millieria dolosalis* (Heydenreich, 1851) (Lepidoptera: Millieriidae) is here reported for the first time for the Portuguese districts of Guarda and Lisboa, bringing the total known records in the country to seven, and revealing its widespread but generally unnoticed presence. We seize the opportunity to update on the presence of this species in its westernmost limit of distribution, whilst highlighting aspects of its biology relevant for the surface of further records of this elusive species.
Key words: Lepidoptera, Millieriidae, *Millieria dolosalis*, pollinator, *Aristolochia*, leaf-miner, Portugal.

Resumen: Dos nuevas observaciones de *Millieria dolosalis* (Heydenreich, 1851) (Lepidoptera: Millieriidae) en Portugal. Se aportan las primeras citas de *Millieria dolosalis* (Heydenreich, 1851) (Lepidoptera: Millieriidae) para los distritos portugueses de Guarda y Lisboa, elevando a siete el total de registros conocidos en el país y revelando su amplia pero generalmente desapercibida presencia. Aprovechamos la oportunidad para actualizar sobre la presencia de esta especie en su límite de distribución más occidental, al tiempo que destacamos aspectos de su biología relevantes para la aparición de registros adicionales de esta esquiva especie.
Palabras clave: Lepidoptera, Millieriidae, *Millieria dolosalis*, polinizador, *Aristolochia*, minadora de hojas, Portugal.

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Introduction

The Millieriidae is a poorly known, small family of moths with a highly fragmented distribution and a still incompletely comprehended biogeography. *Millieria dolosalis* (Heydenreich, 1851) (TL: Hungary), is its type-species and sole Old World representative, whereas the other genera are restricted to the Western hemisphere: *Nyx* Heppner, 1982, with two species in Chile, and *Phormoestes* Heppner, 1982, with one species in Florida (USA) (Rota & Kristensen, 2011). Actually, in spite of a number of morphological characters in common between these widely disjunct taxa (Heppner, 1982; Rota & Kristensen, 2011), the cohesion of this family is challenged by some morphological, ecological and molecular differences, especially between the American genera and *Millieria* (Rota, 2011) and it will possibly have to be further split. Not even the position of the Millieridae among the Lepidoptera has been consistent, for it has yet to be settled whether they belong in the Apodytrisia or not, or how phylogenetically informative are the morphological similarities with the Choreutidae or Roeslerstammiidae (Heikkilä *et al.*, 2015). Meanwhile, as genetic studies have not yet reached a solution

to this, relating the Millieridae to the Douglasiidae (Mutanen *et al.*, 2010), the Limacodidae (Rota, 2011), the Immidae or the Schrekensteiniidae (Regier *et al.*, 2013) or even to genus *Cadmogenes* Meyrick, 1923 (Plutellidae?) (Heikkilä *et al.*, 2015) has been attempted, but always with poor support. Irrespective of placement or how small the family is, it shows that *Millieria dolosalis* is a singular taxon with an elevated interest from both a phylogenetic point of view, in a cornerstone position for the understanding of the evolution of the Lepidoptera, and from a conservation one, for being the only known species in its family in the Old World. Therefore, the more data is brought-up on its occurrence and biology, the better we understand and comprehend how it came to be where it is.

Millieria dolosalis (Heydenreich, 1851) (Lepidoptera: Millieriidae) is a small moth of diurnal habits, whose life-cycle is ecologically dependent on warm-temperate environments. Its early-stages and ecology have been studied in detail by Millière (1856), where the main points are the detailed description of every stage and that the larvae are leaf-miners (mesophyll feeders) of birthworts (genus *Aristolochia*), among which have been cited on *Aristolochia clematitis* and *A. pistolochia* (Heppner, 1982).

Currently, *M. dolosalis* is known from Europe, North-Africa and the Middle East, from Portugal (Mendes d'Azevedo, 1904) and Morocco (Heppner, 1982), eastwards throughout both Europe and the Maghreb into Cyprus (Barton, 2018), southern Russia and Palestine (Heppner, 1982). Records from the southern-part of its distribution are in general old and scattered whilst it seems to be currently more often recorded from middle latitudes of Europe (GBIF, 2023). However, it is neither well known from France (Heppner, 1982; Vandromme *et al.*, 2024), nor from the Iberian Peninsula (GBIF, 2023), given the paucity of records.

In Portugal, *M. dolosalis* has been recorded only four times since the first documented observation in Portas de Ródão (Vila Velha de Ródão, Castelo Branco) in May at the turn of the 20th century (Mendes d'Azevedo, 1904). Two specimens assignable to this record are still found in what remains of the collection of Cândido Mendes d'Azevedo at the Science Museum of Coimbra University (MCUC) (C. Rufino, pers. comm.). The remaining records of the species are much more recent (1995-2019), but considerably expand the potential distribution of the species to encompass the whole of the country: first in the Algarve (Passos de Carvalho & Corley, 1995), then in Alentejo (database record in Corley & Afonso, 2021) and more recently in the Bragança district (Corley *et al.*, 2018; Laštůvka & Laštůvka, 2020).

In more recent years, the species has been further observed in the country, and the novelty of these locations enticed this update on its status. With these new records, we hope to stimulate the production of further research on the species, into the finding of more areas of occurrence, of a better knowledge on its trophic relationships and ultimately on the better understanding of its evolution.

Studied material

Specimens of *M. dolosalis* were recorded during daytime in two different localities of the center-south of Portugal by the junior author, between 2021 and 2024. Both are new county records (Guarda and Lisboa), bringing the total known records of the species in the country to seven (Table 1).

Quinta de Leandres (Manteigas, Guarda) lies in a north-east-facing side of the valley of river Zêzere circa 700 m a.s.l., under a Supra-Mediterranean climatic regime where dominant vegetation include *Pinus pinaster* and *Castanaea sativa* woodlands. *M. dolosalis* was observed here on the 21st May 2021 (Fig. 1a).

East of Cabra Figa (Rio de Mouro, Lisboa), under a Thermo-Mediterranean climatic regime, *M. dolosalis* was observed in late March 2024 (Fig. 1b) in a degraded maquis where *Quercus coccifera* is the dominant arboreal species, but rich dry-meadows harbor a diverse calciphilous flora.

Table 1.- Portuguese records of *Millieria dolosalis*.

Record	Locality data	Date	Reference
1	Portas do Ródão, Vila Velha Ródão, Castelo Branco	May (cf. 1904)	Mendes d'Azevedo (1904)
2	Barranco do Velho, Loulé, Faro	17.April.1993	Passos de Carvalho & Corley (1995)
3	Marvão, Portalegre	10.May.1999	Corley & Afonso (2021) - dataset
4	Santuário Santo Ambrósio, Macedo de Cavaleiros, Bragança	23.April.2016	Corley *et al.* (2018)
5	São Martinho, Miranda do Douro, Bragança	15.June.2019	Laštůvka & Laštůvka (2020)
6	Quinta de Leandres, Manteigas, Guarda (MGRS: 29TPE2672)	31.May.2021	This study
7	Cabra Figa, Sintra, Lisboa (MGRS: 29SMC7188)	23.March.2024	This study

Fig. 1.- New photographic records of *Millieria dolosalis* in Portugal. **1a.-** Quinta de Leandres, Manteigas (Guarda), 31.05.2021. **1b.-** Cabra Figa, Rio de Mouro (Lisboa), 23.03.2024. Photos: Fernando Pires.

Discussion

With the two new locations for *M. dolosalis* in Portugal brought up here, the known distribution gaps of the species are shortened in the country, so that the species is expected to be found not only in between, along a north-south axis but also closer to the Atlantic, western coasts as long as the host-plants are present. However, this ecological component is worth being commented upon: *M. dolosalis* is only known to use two species of birthworts, *Aristolochia clematitis*, absent from the greatest part of Iberia, including Portugal, except Catalonia and the Pyreneean area, and *A. pistolochia*, widespread in Iberia, but local and uncommon in Portugal (Porto *et al.*, 2024b), and given that neither is known from where the moth has been found, another *Aristolochia* could be involved. Two other species are known from Portugal, *A. baetica*, predominant in the extreme-south, but not recorded from any of the moth localities, and *A. paucinervis*, the most widespread species, from north to south and nearly in the whole of the country (Porto *et al.*, 2024a). Even though *M. dolosalis* may explore any of these species locally, where not yet recorded, the most likely host is indeed *A. paucinervis* as the superimposed moth-plant map implies (Fig. 2). Nonetheless, actual field-proof is still needed and no early-stages of the species have yet been found in Portugal.

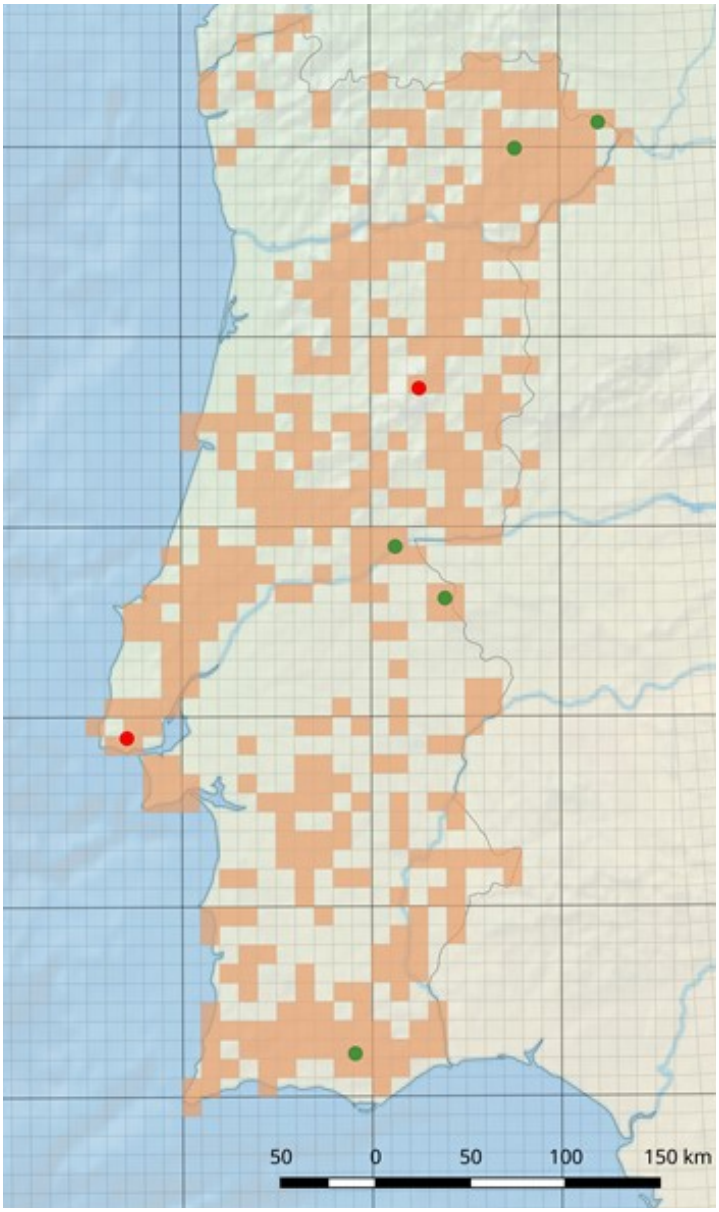

Fig. 2.- The superimposed distributions of *Aristolochia paucinervis* and *Millieria dolosalis*. Orange squares: presence of *A. paucinervis* according to Porto *et al.* (2024a). Circles: confirmed Portuguese records of *M.dolosalis*.
- published records.
- new records.

From the locations mentioned above, *Millieria dolosalis* flies at altitudes ranging from 100 to 700 m, on the wing at least between March and June. The species small size and diurnal habits may partly explain the small number of observations, since it is unlikely to be attracted to the light traps usually used for moth sampling.

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References

Barton, I. 2018. A second contribution to the Lepidopteran fauna of Cyprus, presenting records for 48 taxa from 17 families. *Entomologist's Record and Journal of Variation,* **130**: 29–39.

Corley, M.F.V., Rosete, J., Gonçalves, A.R.M., Mata, V.A., Nunes, J. & Pires, P. 2018. New and interesting Portuguese Lepidoptera records from 2016 (Insecta: Lepidoptera). *SHILAP Revista de Lepidopterología*, **46**: 33–56.

Corley, M.F.V. & Afonso, B. 2021. *Portuguese Lepidoptera records compiled by Martin Corley's database. Version 1.5*. CIBIO (Research Center in Biodiversity and Genetic Resources) Portugal. Occurrence dataset https://doi.org/10.15468/ca4xt8 accessed via GBIF.org on the 25th of June, 2024. https://www.gbif.org/occurrence/3391186054

GBIF. 2023. *Millieria dolosalis* (Heydenreich, 1851) in GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on the 2nd of July, 2024.

Heikkilä, M., Mutanen, M., Wahlberg, N., Sihvonen, P., Kaila, L. 2015. Elusive ditrysian phylogeny: an account of combining systematized morphology with molecular data (Lepidoptera). *BMC Evolutionary Biology,* **15**, 260.

Heppner, J.B. 1982. Millieriinae, A New Subfamily of Choreutidae, with New Taxa from Chile and the United States (Lepidoptera: Sesioidea). *Smithsonian Contributions to Zoology*, **370**: 27 pp.

Laštůvka, A. & Laštůvka, Z. 2020. New faunistic records of moths from the Iberian Peninsula (Insecta: Lepidoptera). *SHILAP Revista de Lepidopterología*, **48**: 47–58.

Millière, P. 1856. Histoire de la *Choreutis dolosana*, Herr.-Sch., *dolosalis* F.-V.-R. *Annales de la Société entomologique de France*, (3)**4**: 39-49.

Mendes d'Azevedo, C. 1904. Lepidopteros de Portugal. II. Microlepidopteros da região de S. Fiel (Beira Baixa) (continuado). *Brotéria: Revista de Sciencias Naturaes do Collegio de S. Fiel*, **3**: 223-254.

Mutanen, M., Wahlberg, N. & Kaila, L. 2010. Comprehensive gene and taxon coverage elucidates radiation patterns in moths and butterflies. *Proceedings of the Royal Society B: Biological Sciences*, **277**: 2839–2848.

Passos de Carvalho, J. & Corley, M.F.V. 1995. Additions to the Lepidoptera of Algarve. *SHILAP Revista de Lepidopterología*, **23**: 191-230.

Porto, M., Araújo, P.V., Clamote, F., Almeida, J.D., Carapeto, A., Pereira, A.J., Portela-Pereira, E., Correia, M.J. *et al*. 2024a. *Aristolochia paucinervis* Pomel - distribution map. Flora-On: Flora de Portugal Interactiva, Sociedade Portuguesa de Botânica. Available from: http://www.flora-on.pt/#wAristolochia+paucinervis. [accessed on the 2nd of July, 2024].

Porto, M., Carapeto, A., Clamote, F., Araújo, P.V., Gomes, C.T., Almeida, J.D., Covelo, F., Alves, H.D. *et al*. 2024b. *Aristolochia pistolochia* L. - distribution map. Flora-On: Flora de Portugal Interactiva, Sociedade Portuguesa de Botânica. Available from: www.flora-on.pt/#wAristolochia+pistolochia. [accessed on the 2nd of July, 2024].

Regier, J.C., Mitter, C.W., Zwick, A., Bazinet, A.L., Cummings, M.P., Kawahara, A.Y., Sohn, J.-C., Zwickl, D.J., Cho, S., Davis, D.R., Baixeras, J., Brown, J.W., Parr, C., Weller, S.J., Lees, D.C., Mitter, K.T. 2013. A large-scale, higher-level, molecular phylogenetic study of the insect Order Lepidoptera (moths and butterflies). *PLoS ONE*, **8**(3): e58568. [23 pp.]

Rota, J. 2011. Data partitioning in Bayesian analysis: molecular phylogenetics of metalmark moths (Lepidoptera: Choreutidae). *Systematic Entomology*, **36**: 317–329.

Rota, J. & Kristensen, N.P. 2011. Note on taxonomic history, thoraco-abdominal articulation, and current placement of Millieriidae (Insecta: Lepidoptera). *Zootaxa*, **3032**: 65–68.

Vandromme, D., Demerges, D. & Dupont, P. 2024. *Lépidoptères de France. Base de données: Liste systématique et taxinomique des Lépidoptères de France (Corse comprise)*. Oreina, Artemisiae. Available from: https://oreina.org/artemisiae/observatoire/index.php. [accessed on the 2nd of July, 2024].