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Notas / *Notes*

New data and threat status of two rare North African species of the subgenus *Bolognaia* (Coleoptera: Meloidae: Meloini: *Eurymeloe*)

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ABSTRACT

This study updates the distribution and conservation status of two poorly documented blister beetle species in Morocco: *Eurymeloe* (*Bolognaia*) *pallidicolor* (Martínez de la Escalera, 1909) and *E.* (*B.*) *saharensis* (Chobaut, 1898). A new locality for *E. pallidicolor* is added, which represents the southernmost known occurrence for the species, along with a total of seven new localities for *E. saharensis* in both the southwest and southeast of Morocco, significantly expanding its known area of occupancy in the country. A preliminary assessment of the threat status for these species is conducted based on IUCN criteria. Additionally, the habitat characteristics of both species in Morocco are described. While *E. saharensis* faces no immediate threats, *E. pallidicolor* appears to be a stenotopic species confined to low-altitude coastal and subcoastal areas. Its extent of occurrence and area of occupancy are very limited, which would place *E. pallidicolor* in an unfavorable conservation status. However, due to the limited available information, it would qualify as "Data Deficient" species according to the IUCN criteria. These findings emphasize the crucial role of natural protected areas, such as Souss-Massa National Park, in supporting populations of species affected by habitat destruction in the region. Lastly, a brief comment on the internal taxonomy of the genus *Eurymeloe* is provided, and a new combination is established: *Eurymeloe* (*Bolognaia*) *digiuliorum* (Bologna, Riccieri & Spagoni, 2024) **comb. nov**.

Keywords. Souss Valley; Oriental region; North Africa; geographic range; habitat; conservation; Meloini.

RESUMEN

Nuevos datos y grado de amenaza de dos especies norteafricanas raras del subgénero *Bolognaia* (Coleoptera: Meloidae: Meloini: *Eurymeloe*)

Este estudio actualiza la distribución y el estado de conservación de dos especies de coleópteros vesicantes poco documentadas en Marruecos: *Eurymeloe* (*Bolognaia*) *pallidicolor* (Martínez de la Escalera, 1909) y *E.* (*B.*) *saharensis* (Chobaut, 1898). Se añade una nueva localidad de *E. pallidicolor*, que constituye la más meridional conocida para la especie, y un total de siete nuevas localidades para *E. saharensis* tanto en el suroeste como en el sureste de Marruecos, que amplían considerablemente su área de ocupacion en el país. Se efectúa una evaluación preliminar del estado de amenaza de ambas especies en base a los criterios UICN. Asímismo, se efectúa una caracterización del habitat de sendas especies en Marruecos. Mientras que *E. saharensis* no enfrenta amenazas inmediatas, *E. pallidicolor* parece ser una especie estenoica confinada a áreas costeras y subcosteras de baja altitud. Su extensión de presencia y área de ocupación son muy limitadas, lo que situaría a *E. pallidicolor* en un estado de conservación desfavorable. Sin embargo, debido a la escasa información disponible, esta especie calificaría como "Datos Insuficientes" según los criterios de la UICN. Estos hallazgos enfatizan el papel crucial de las áreas naturales protegidas, como el Parque Nacional de Souss-Massa, en el mantenimiento de las poblaciones de especies afectadas por la destrucción del hábitat en la región. Por último, se efectúa un breve comentario sobre la taxonomía interna del género *Eurymeloe*, y se establece una nueva combinación: *Eurymeloe* (*Bolognaia*) *digiuliorum* (Bologna, Riccieri & Spagoni, 2024) **comb. nov.**

Palabras clave. Valle del Souss; región Oriental; Norte de África; distribución geográfica; hábitat; conservación; Meloini.

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Several species of western Palaearctic blister beetles of the tribe Meloini Gyllenhal, 1810 are known from scarce records, often relying on a single or a few specimens (e.g., Bologna, 1991; Ruiz & García-París, 2009, 2015; García-París & Ruiz, 2011; Sánchez-Vialas *et al.*, 2022, 2024). Consequently, knowledge about their geographical distributions is, in general, very deficient. This shortfall is particularly evident in the case of the North African species of *Eurymeloe* Reitter, 1911. The limited availability of specimens in scientific collections (Bologna, 1988; Ruiz & García-París, 2015), coupled with apparently low population densities and secretive behaviours, including some nocturnal species (Martínez de la Escalera, 1909; Bologna, 1988, 1991; Ruiz & García-París, 2008, 2009), makes the study of this group a complex task. The lack of basic geographical information, often referred to as the Wallacean shortfall (Lomolino 2004; Whittaker *et al.*, 2005; Bini *et al.*, 2006), represents one of the main problems regarding species conservation (Cardoso *et al.*, 2011a). It is particularly concerning in *Eurymeloe*, hindering or even preventing the correct evaluation of the threat status of species and the subsequent implementation of effective conservation actions (Samways & Böhm, 2012; Numa *et al.*, 2020).

Like most Meloini (excepting *Physomeloe* Reitter, 1911), *Eurymeloe* presents a phoretic first instar larva (triungulin), which holds on solitary bees (Apoidea) to reach their nest (Bologna, 1988, 1991; Bologna *et al.,* 1989; Di Giulio *et al.,* 2013; Sánchez-Vialas *et al.*, 2021a, 2022). Once in a bee nest, the triungulin start to feed on the bee larvae and even on their food resources; thus, the presence of viable populations of *Eurymeloe* species depends on previously established populations of their host solitary bees species (e.g., Bologna, 1991; Whitehead, 1991; Ruiz & García-París, 2008; Saul-Gershenz *et al.*, 2018). Unfortunately, the host bee species parasitized by most specific taxa of *Eurymeloe* (*Bolognaia*) are unknown (Bologna, 1988; Bologna *et al.,* 1989; Di Giulio *et al.,* 2013), making it difficult to evaluate their respective threat status.

The knowledge about the geographic distribution of many species of *Eurymeloe* in North Africa, particularly of the subgenus *Bolognaia* Ruiz, García-París, Sánchez-Vialas & Recuero, 2022 [previously referred as "*rugosus* group" *sensu* Bologna (1988); see Sánchez-Vialas *et al.* (2022)], is often limited to a handful of localities, in some cases no more than five. Currently, ten species of *Bolognaia* have been recorded in Morocco (Bologna, 2008, 2020; Ruiz & García-París, 2015): *Eurymeloe* (*B.*) *affinis* (Lucas, 1847), *E.* (*B.*) *apivorus* (Reitter, 1895), *E.* (*B.*) *baamarani* (Ruiz & García-París, 2015), *E.* (*B.*) *baudueri* (Grenier, 1863), *E.* (*B.*) *gomari* (Ruiz & García-París, 2009), *E.* (*B.*) *mediterraneus* (Müller, 1925), *E.* (*B.*) *murinus* (Brandt & Erichson, 1832), *E.* (*B.*) *nanus* (Lucas, 1847), *E.* (*B.*) *pallidicolor* (Martínez de la Escalera, 1909), and *E.* (*B.*) *saharensis* (Chobaut, 1898). As Sánchez-Vialas *et al.* (2022) pointed out, *E. saharensis* is morphologically isolated within the genus, and the species ascription to subgenus *Bolognaia* is tentative, awaiting further molecular studies.

In this work, we report additional records of two of the least-known species of *Eurymeloe* in Morocco, *E.* (*B.*) *pallidicolor* and *E.* (*B.*) *saharensis*, which have not been recorded alive since the last century. Likewise, new data on the habitat and considerations about their conservation status are provided.

Eurymeloe (Bolognaia) pallidicolor (Martínez de la Escalera, 1909)

Eurymeloe (*Bolognaia*) *pallidicolor* is a narrowly distributed species endemic to the middle Atlantic coast of Morocco (Martínez de la Escalera, 1909, 1914; Cros, 1939; Kocher, 1956; Bologna, 1988; Ruiz & García-París, 2009). It was described from "Mogador" (*loc. typ.*, current Essaouira, 31°30′ N, 9°45′ W, 0–15 m a.s.l.; Martínez de la Escalera, 1909) based on an indeterminate number of specimens [ten syntypes are currently housed at the Museo Nacional de Ciencias Naturales-CSIC, Madrid, Spain (García-París & Ruiz, 2011), and two others are deposited at the Muséum national d'Histoire naturelle, Paris, France (Bologna, 1988)]. Since its description, only three more locations have been reported: Azemmour (33°17′ N, 8°21′ W, 0–20 m a.s.l.), Casablanca (33°34′ N, 7°41′ W, 0–50 m a.s.l.), without further information (Kocher, 1964), and Sidi Said Maachou (33°08′ N, 8°07′ W, 35–70 m a.s.l., southeast of Azemmour), where an exemplar was collected on 20/III/1974 (Bologna, 1988). This last location is the only one separated from the coastline, around 28 km, penetrating inland through the basin of the Oued Oum er Rbia river. No more living specimens or localities have been later recorded since then; therefore, the last reference to a population of *E.* (*B.*) *pallidicolor* is from 50 years ago.

The species cryptic coloration in the sandy soils where it inhabits (Martínez de la Escalera, 1909; Bologna, 1988; Ruiz & García-París, 2009; García-París & Ruiz, 2011; this work), its apparently low population density, nocturnal activity (Martínez de la Escalera, 1909), and the adult phenology (mostly active during humid periods of the winter), makes this species a difficult target to find.

Here, we provide a new record of *E.* (*B.*) *pallidicolor* from Sidi R'bat (Souss-Massa-Draâ region, Chtouka Ait Baha province; 30°04′50.78″ N, 9°39′58.45″ W, 38 m a.s.l.) based on a specimen found on 10/II/2018 (Fig. 1A; photographed, non-collected) by one of the authors (A. Roujas obs. pers). The photographed exemplar is morphologically consistent with all the traits characterizing *E. pallidicolor* (Martínez de la Escalera, 1909; Bologna, 1988; Ruiz & García-París,

2009; García-París & Ruiz, 2011; Fig. 2A), which can be readily differentiated from the congeneric species by (1) its singular coloration pattern, with the head, antennae, palps, legs, prothorax and elytra between straw-yellowish and yellowish-brown, and reddish-brown abdomen, although in some individuals, the coloration darkens somewhat on the head, prothorax, and elytra, (2) the presence of a tegument covered by a dense yellowish vestiture, (3) a transverse pronotum with rounded angles with a deep midline longitudinal depression (Figs. 1A, 2A).

The specimen was detected under a stone during daytime in the coastal fixed dunes at the southwestern limit of the Souss-Massa National Park (mouth of the Massa River) (Fig. 1B), a biodiversity hotspot (Elbahi *et al.*, 2022). The newly discovered population represents the southernmost locality of the species, which is located 160 km south to the nearest recorded, Essaouira. The precise location in Sidi R'bat is very close to the coastline (around 450 m in straight line), within the inframediterranean bioclimatic level (Benabid, 1985). The bioclimate of the area is classified as upper arid-temperate [annual average rainfall (anr) around 250 mm], with marked Atlantic influence (Le Houérou, 1989; Benadid & Fennane, 1984; Mokhtari *et al.*, 2014). The habitat here is a coastal steppe on Quaternary sandy substrates, with relatively low vegetation coverage, related to the phytosociological associations *Frankenio corymbosae-Ononidetum ramosissimae* and *Polycarpeo niveae-Bubonietum imbricati*. These associations, very similar and with introgressions between them, are dominated by psammophilous and relatively nitrophilous species (due to the proximity to both an human inhabited nucleus and crops), mainly *Frankenia corymbosa* Desf., *Ononis natrix* L. ssp. *ramosissima* (Desf.) Batt., *Limonium mucronatum* L. (Fil.) Chaz, *Lotus creticus* L., *Polycarpaea nivea* (Aiton) Webb, *Asteriscus imbricatus* (Cov.) DC., *Centaurea aspera* L. ssp. *gentilii* (Braun-Blanq. & Maire) Dobignard, *Sclerosciadium nodiflorum* (Schousb.) Ball and also scattered bushes of *Retama monosperma* (L.) Boiss., *Licium intrincatum* Boiss. and *Launaea arborescens* (Batt.) Murb. (see Peltier, 1986; Géhu & Biondi, 1996; Taleb & Fennane, 2019; pers. obs.).

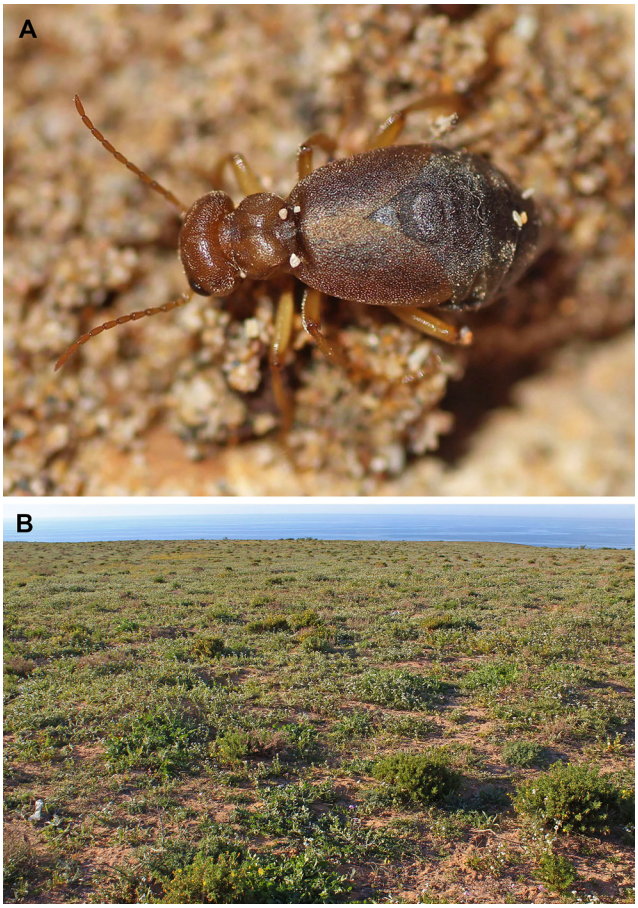

Fig. 1. (A) Adult of *Eurymeloe (Bolognaia) pallidicolor* from Sidi R'bat. (B) Habitat where *E. (B.) pallidicolor* and *E. (B.) saharensis* occurs at the surroundings of Sidi R'bat. [Photographs AR (A), AS-V (B)].

Fig. 1. (A) Adulto de *Eurymeloe (Bolognaia) pallidicolor* de Sidi R'bat. (B) Hábitat donde *E. (B.) pallidicolor* y *E. (B.) saharensis* se encuentran en los alrededores de Sidi R'bat. [Fotografías AR (A), AS-V (B)].

Fig. 2. (A) From left to right: dorsal, frontal, and lateral views of one of the syntypes of *Eurymeloe (Bolognaia) pallidicolor* (MNCN 107882). (B) *E. (B.) saharensis* from Missour, preserved in the ECWP collection: left—dorsal view; upper right—lateral view; bottom right—frontal view. [Photographs AS-V].

Fig. 2. (A) De izquierda a derecha: vistas dorsal, frontal y lateral de uno de los sintipos de *Eurymeloe (Bolognaia) pallidicolor* (MNCN 107882). (B) *E. (B.) saharensis* de Missour, conservado en la colección ECWP: izquierda—vista dorsal; arriba a la derecha—vista lateral; abajo a la derecha—vista frontal. [Fotografías AS-V].

According to the few known records (Fig. 3A), *E.* (*B.*) *pallidicolor* appears to be a stenoic species, occupying open coastal and subcoastal areas of low altitude (range: 0–70 m a.s.l.) with sandy or alluvial substrates, at infra- and thermomediterranean bioclimatic levels and ombrotypes ranging from dry (Casablanca, anr: 430 mm) to upper arid (Sidi R'bat). The main habitats occupied by the species include coastline dunes with psammophilous vegetation [e.g., *Ammophila arenaria* (L.) Link, *Juniperus phoenicea* L., *Polygonum maritimun* L., *Retama monosperma*, *Traganum moquinii* Webb ex Moq., *Euphorbia paralias* L., etc.], and fixed sands and subcoastal plains with grasslands (similar to that described for Sidi R'bat), and possibly scrub steppes [e.g., *Ziziphus lotus* (L.) Lam., *Pistacia lentiscus* L., *Chamaerops humilis* L., *Licium intrincatum, Olea europaea* L. var. *sylvestris* (Mill.) Lehr] (Benabid & Fennane, 1994; Taleb & Fennane, 2019).

The extent of occurrence (EOO: 20.070 km^2) and the area of occupancy (AOO: 125 km^2, 5 × 5 km cells) of the species are very reduced [*sensu* IUCN (2012); calculated with GeoCAT, Geospatial Conservation Assessment Tool, available at http://geocat.kew.org; see Bachman *et al.* (2011)]. Its known populations are in appearance clearly separated from each other, at least between three of them [Sidi R'bat, Esssaouira, and Azemmour-Sidi Said Maachou; the Casablanca population could be currently extinct, as it has not been recorded for 60 years]. Suitable habitats are declining in a significant part of its geographic range (middle Moroccan Atlantic coast) due to strong anthropogenic pressures (Mouna *et al.,* 2011; Berrane, 2019; Numa *et al.,* 2020).

In accordance with this framework, *E.* (*B.*) *pallidicolor* a priori could meet the IUCN (2012) criteria (B2) to qualify for "Vulnerable" or even "Endangered" threat categories. This potential qualification could make it a candidate for inclusion in the IUCN Red List, a fate shared by other Moroccan beetles occupying similar habitats and geographical ranges [e.g., *Thorectes variolipennis* Marseul, 1876, *Renaudtrupes distinctus* (Marseul, 1878); see Numa *et al.* (2020)]. However, considering its rarity and the difficulty in locating it, it is likely that an undetermined number of subpopulations or locations have been overlooked. Consequently, its AOO would be underestimated, hindering a reliable application of the IUCN (2012) criteria, as occurs in most invertebrate species (Cardoso *et al.,* 2011b; Goodsell *et al.,* 2024). For this reason, we estimate that *E. pallidicolor* must be currently considered a "Data Deficient" species (*sensu* IUCN, 2012, 2022).

Despite the aforementioned factors, the species suffers from a certain degree of threat (still to be adequately evaluated). This threat stems from the loss and degradation of its preferential habitats, due to the increasing urban expansion and tourism development

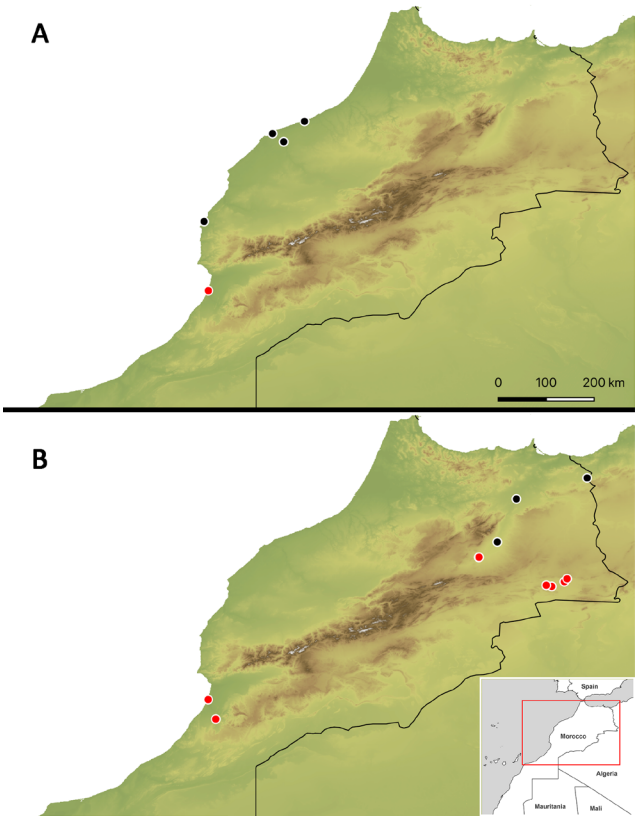

Fig. 3. Geographic distribution in Morocco of: (A) *Eurymeloe (Bolognaia) pallidicolor* and (B) *E. (B.) saharensis*. Black dots represent previous records, while red dots indicate new records.

Fig. 3. Distribución geográfica en Marruecos de: (A) *Eurymeloe (Bolognaia) pallidicolor* y (B) *E. (B.) saharensis*. Los puntos negros representan registros previos, mientras que los puntos rojos indican nuevos registros.

along the coastal areas of central Morocco (from Casablanca to Agadir) and, especially, to the excessive intensification and expansion of the agriculture, predominantly in the form of greenhouses (Ayache *et al.,* 2009; Mouna *et al.,* 2011; Maanan *et al.,* 2014; Numa *et al.,* 2020). Similar threats are observed in other regions of the Mediterranean basin, where habitat loss due to greenhouse expansion affects vulnerable insect species [e.g. *Berberomeloe insignis* (Charpentier, 1818); Sánchez-Vialas *et al*. (2023)].

Nevertheless, further studies are needed to elucidate its AOO in more detail, understand its ecological preferences and, especially, identify its host solitary bee species. These steps are essential to obtain a more accurate knowledge about its threat status and propose conservation measures in alignment with such situation. The host bee species are unknown, but maintaining them in a favorable conservation status is crucial for the persistence of viable populations of *E.* (*B.*) *pallidicolor*. However, the intensification of agricultural practices in the Middle Atlantic Coast region, accompanied by the indiscriminate use of pesticides and fertilizers (to which pollinators, such as

bees, are particularly sensitive), does not bode well for the short to medium-term future.

Eurymeloe (Bolognaia) saharensis (Chobaut, 1898)

Eurymeloe (*Bolognaia*) *saharensis* was described from Ghardaia (*loc. typ.*; 32°29′ N, 3°38′ E), a desertic Algerian locality, based on a single female specimen (Chobaut, 1898) housed at the Muséum national d'Histoire naturelle, Paris (Ruiz *et al.*, 2010). A morphological characterization, a taxonomic and nomenclatural revision and a synthesis of its geographical range was performed by Ruiz *et al.* (2010). This species can be easily identified using the key and characters provided by Bologna (1988) and, additionally, by Ruiz *et al.* (2010). It exhibits a broad distribution, ranging from the Canary Islands in the West to Saudi Arabia in the East, including most North African countries. Isolated occurrences have been documented in the southeastern Iberian Peninsula (Spain), Lampedusa Island (Italy), and the Middle East (Israel) (Bologna, 1988, 2020; Ruiz *et al.*, 2010). Despite its extensive range, few precise records are known (only thirteen spread across eight countries) (Ruiz *et al.*, 2010; Bologna, 2020).

In Morocco, *E. saharensis* is known from the following three eastern localities, relatively close to each other: Oujda (34°41′ N, 1°55′ W; Kocher, 1954, 1956; Chavanon, 2020), Outat-el-Haj (33°19′ N, 3°43′ W; Kocher, 1954, 1956), and Guercif (34°12′ N, 3°21′ W; *loc. typ.* of *Meloe otini* Peyerimhoff, 1949, a junior synonym of *E. saharensis*; Peyerimhoff, 1949; Ruiz *et al.*, 2010) (Fig. 3B). The westernmost recorded population of *E. saharensis* is located in Tenerife, Canary Islands (Spain), and no records between this island and eastern Morocco are known (Ruiz *et al.*, 2010).

Here, we provide new records of *Eurymeloe saharensis* across Morocco, that partially fill the gap between the Canary Island and the eastern Moroccan populations, also expanding its area of occupancy to the southeast of the country (Fig. 3B). Most of the material examined is housed at the entomological collection of the Emirates Center for Wildlife Propagation, Missour, Morocco (ECWP). The studied material (collected or observed and photographed) is as follows:

Sous Massa-Draa region: Chtouka Ait Baha province: Sidi R'bat, 30°4′50.97″ N 9°39′53.41″ W, 52 m a.s.l., 31/I/2014, Alain Roujas obs.: 1 specimen detected under a stone during day time, non-collected (photographed; Fig. 4A). Tiznit province: Mighermane, R 104 road, 29°40′47.98″ N, 9°30′19.56″ W, 229 m a.s.l., 31/I/2014, Alain Roujas obs.: 2 specimens detected, actively wandering during the afternoon, non-collected (photographed). **Fés-Boulemane region**: Boulemane province: Missour-ECWP, 33°00′25.90″ N, 4°05′51.36″ W, 954 m a.s.l., 23/II/2012, H. Hdidou leg.: 2 specimens (ECWP); *idem*, 16/III/2012: 1 specimen (ECWP); *idem*, 11/IV/2012, C. Cornec leg.: 1 specimen (ECWP); Missour-ECWP, 33°00′28.52″ N, 4°05′56.67″ W, 950 m a.s.l., 27/XII/2012, H. Hdidou leg.: 1 specimen (ECWP); *idem*, 17/I/2013: 2 specimens (ECWP); Missour-ECWP, 33°00′35.86″ N, 4°05′27.20″ W, 950 m a.s.l. (Fig. 4B), 23/I/2013, H. Hdidou leg.: 1 specimen (ECWP) (Fig. 2B); *idem*, 14/II/2013: 1 specimen (ECWP). **Oriental region**: Figuig province: Tamlelt 1, 58 km W Bouârfa, 32°24′34.74″ N, 2°35′48.16″ W, 1054 m a.s.l., 2/I/2008, S. Touil leg.: 2 specimens (ECWP); Tamlelt 2, 35 km W Bouârfa, 32°30′24.44″ N, 2°20′13.88″ W, 1039 m a.s.l., 2/I/2008, S. Touil leg.: 1 specimen (ECWP); Tamlelt 3, 30 km W Bouârfa, 32°33′57.96″ N, 2°16′47.82″ W, 1080 m a.s.l., 20/II/2008, S. Touil leg.: 1 specimen (ECWP); Tamlelt 4, 68 km W Bouârfa, 32°25′57.90″ N, 2°42′30.42″ W, 1076 m a.s.l., 5/III/2008, S. Touil leg.: 1 specimen (ECWP). The specimens from Tamlelt were collected by pitfall traps.

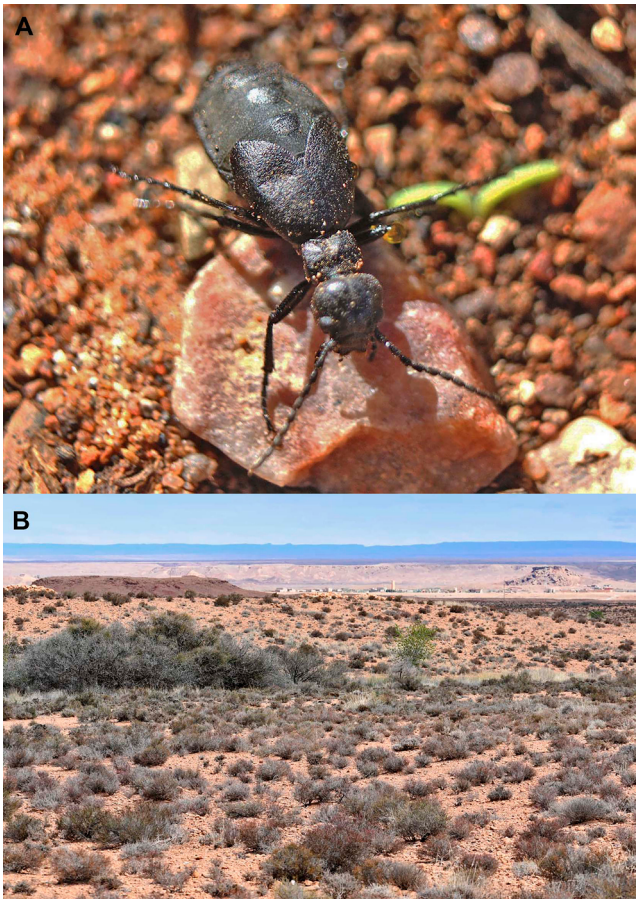

Fig. 4. (A) Adult of *Eurymeloe (Bolognaia) saharensis* from Sidi R'bat. (B) Habitat where *E. (B.) saharensis* was found in Missour. [Photographs AR (A), AF (B)].

Fig. 4. (A) Adulto de *Eurymeloe (Bolognaia) saharensis* de Sidi R'bat. (B) Hábitat donde se ha encontrado *E. (B.) saharensis* en Missour. [Fotografías AR (A), AF (B)].

The location of the Sidi R'bat specimen (Fig. 1B) is exactly the same (90 m to the E) as for *E.* (*B.*) *pallidicolor* (see above). The second western Moroccan record here reported, Mighermane (18 km E of Tiznit), is located in the domain of the infra-mediterranean bioclimatic level, in the so-called "Moroccan macaronesian region" (Benabid, 1985; Géhu & Biondi, 1998). The bioclimate of this area is classified as arid-medium warm (anr: 190 mm in Tiznit; Le Houérou, 1989). The landscape is semi-steppic, featuring open argan formations, *Argania spinosa* (L.) Skeels, related to the phytosociological association *Arganio spinosae-Euphorbietum echini*. In addition to argan, this phytosociological association includes *Acacia gummifera* Willd., *Rhus pentaphylla* (Jacq.) Desf., *Rhus tripartita* (Ucria) Grande, *Periploca angustifolia* Labill., *Euphorbia officinarum* L. ssp. *echinus* (Hook. F. & Coss.) Vindt, and *Waronia saharae* Benthem ex Benth. & Coss. as characteristic species (Peltier, 1983; Benabid & Fennane, 1994; Taleb & Fennane, 2019). Additionally, the area hosts dryland crops of wheat and olive trees.

The location of Missour is in the interior area of Emirates Center for Wildlife Propagation (ECWP; 3 km²), at medium altitude (Fig. 4B). It falls within the mesomediterranean bioclimatic level (Benabid, 1985) and exhibits a lower arid ombrotype (anr: 123 mm) with marked continentality and cold winters (Le Houerou, 1989; Defaut & François, 2019). The predominant habitat consist of a rocky steppe (reg) on quaternary alluvial calcareous substrates, with little vegetal cover (< 30%). Within the interior area of the ECWP, the landscape primarily consists of open formations known as "*Hammada* steppes". Typical species found in these arid environments include *Hammada scoparia* (Pomel) Iljin, *Launaea arborescens* (Batt.) Murb., *Atriplex halimus* L., *Acanthorrhinum ramosissimum* (Coss. & Durieu) Rothm., *Echinops spinosissimus* Turra, and *Salsola* L., and along drainage lines *Pistacia atlantica* Desf., *Retama sphaerocarpa* (L.) Boiss., *Ziziphus lotus* (L.) Lam., *Nerium oleander* L. and *Tamarix* L. (Quézel *et al.*, 1994; Ruiz *et al.*, 2019). Given the predominantly winter activity of this Meloini species, it takes advantage of high diurnal temperatures, while daily minimum mean can fall to 0 to -1°C during the night (Le Houérou, 1995). In Missour-ECWP, *E.* (*B.*) *saharensis* shares habitat with another recently described singular species of Meloidae, *Croscherichia armass* Ruiz, François & García-París, 2019, also described from this precise location (Ruiz *et al.*, 2019).

Finally, Tamlelt settles in a large alluvial rocky steppe between 30–68 km West of Bouârfa (southeastern Morocco). This area falls within the northern part of the Saharan region in Morocco. The bioclimate is characterized as lower arid-cool (anr: between 135 mm at Bouârfa and 99 mm at Bouânane; see Le Houérou, 1989, 1995). In this area, vegetation presents minimal coverage, belonging to the distinctive Saharan association named *Fredolietum aretioidis*, which is characterized by *Fredolia aretioides* Coss. & Dur. ex Bunge, abundant in this place, and accompanied by other typical species of arid lands, as *Hammada scoparia*, *Farsetia occidentalis* B.L., *Gymnocarpos decandrus* Forssk., *Thymelaea microphylla* Coss. & Durieu ex Meisn. and *Deverra* sp. (see Quezel, 1965; Taleb & Fennane, 2019). The plain of Tamlelt also hosts vast sandy places and "dayas" (silty temporary ponds).

According to available distribution data, the apparently deep fragmentation of the *E. saharensis* populations is likely a result of sampling deficits across the vast semiarid and desertic areas of southwestern Palaearctic (Sahara, Arabian Peninsula, Middle East), rather than the current absence of the species in these regions. This interpretation aligns with the morphological homogeneity observed throughout the wide geographic range of the species (Ruiz *et al.*, 2010; pers. obs.), as observed in another phoretic species of Meloini, *Mesomeloe coelatus* (Reiche & Saulcy, 1857), which shares a comparable geographical range (Sánchez-Vialas *et al.*, 2021b).

Despite the limited number of locations (AOO: 500 km², 5 × 5 km cells), *E. saharensis* has a broad extent of occurrence (EOO: 2.483.280 km²) and a wide extent of suitable habitat. Consequently, the species does not meet the IUCN (2012) criteria for classification into any of the threat categories. Furthermore, the ongoing climate change-induced expansion of the western Palaearctic arid zones (Hickler *et al.*, 2011) is expected to increase the availability of favorable habitats for arid-adapted species. This, in turn, could hypothetically lead to a northward expansion of its area of occupancy (Hickling *et al.*, 2006).

These observations highlight that additional, carefully planned field work should be carried out in the known localities and around ecologically similar regions in order to know the population status and the real distribution range of the rare and probably threatened species of *Eurymeloe* of the subgenus *Bolognaia*. Additionally, it would be of particular significance to identify the host bee species, whose favourable conservation status is essential for the maintenance of viable populations of *Eurymeloe* (Bologna, 1991; Di Giulio *et al.*, 2013; Ruiz & García-París, 2008; Sánchez-Vialas *et al.*, 2021a). This information would also aid in planning future fieldwork aimed at locating these species. Unfortunately, solitary bees are generally experiencing a marked decline (Potts *et al.*, 2010; Nieto *et al.*, 2014). The Wallacean shortfall directly affects these species of *Eurymeloe*, whose distribution range are far from being known. Moreover, as reported for other species of Meloini (García-París *et al.*, 2006; Ruiz & García-París, 2008), some populations of, at least, *E.* (*B.*) *pallidicolor* in Morocco could be declining,

especially for those localities placed outside natural protected areas. Thus, it is crucial to improve the basic knowledge (species distribution) for data deficient species, as several populations could be extinct before they are known (see Costello *et al.*, 2013). The newly reported populations of *E. pallidicolor* and *E. saharensis* benefit from the protection of the Souss-Massa National Park, which is recognized as a crucial conservation area for birds (e.g., *Geronticus eremita* Linnaeus, 1758 and *Marmaronetta angustirostris* Ménétries, 1832; Bowden *et al.*, 2008; Cherkaoui *et al.*, 2016) and mammals [e.g., *Oryx dammah* Cretzschmar, 1826, *Addax nasomaculatus* Blainville, 1816, and *Nanger dama* (Pallas, 1866), with captive-breeding programmes; Stanley Price, 2016]. The finding of *E. pallidicolor* and *E. saharensis* increases the relevance of this protected natural area as an entomological spot for conservation. However, previously recorded populations of both species lack protection. In this sense, conservation efforts over unprotected regions, which could be carried out by relatively simple actions as suggested by Ruiz & García-París (2008) for *Eurymeloe*, should be developed at least for *E. (B.) pallidicolor*, before populations become extinct by imminent threats, especially in coastal habitats.

Finally, we find it necessary to comment briefly on the taxonomy of *Eurymeloe*, considering the recent contribution of Riccieri *et al.* (2024) on the matter. Thus, these authors (Riccieri *et al.*, 2024), within the framework of the description of a new species very related to *E.* (*Bolognaia*) *orobates* Sánchez-Vialas, Ruiz, Recuero, Gutiérrez-Pérez & García-París, 2022, reject both the elevation of *Eurymeloe* to genus status as proposed by Sánchez-Vialas *et al.* (2021a), and its division into three subgenera, including *Bolognaia* (see Sánchez-Vialas *et al.*, 2022), without more data or argumentation than the following: "morphology of larvae and adults (Bologna, 1988; Bologna *et al.*, 1989; Bologna & Pinto, 1992, 2001; Pan & Bologna 2021), as well as in molecular evidence (Salvi *et al.* in prep.)". In contrast, Sánchez-Vialas *et al.* (2020), supported their argument with a robust molecular phylogeny that demonstrated the paraphyly of *Meloe* Linnaeus, 1758 *sensu auctorum*, and identified three well-differentiated lineages within *Eurymeloe*, corresponding to as many subgenera (Sánchez-Vialas *et al.*, 2022): *Eurymeloe*, *Coelomeloe* Reitter, 1911 and *Bolognaia*. Therefore, until the conclusions of Sánchez-Vialas (2020, 2022) are refuted with compelling molecular evidence, *Eurymeloe* continues to be regarded at the genus level, with *Bolognaia* recognized as one of its subgenera, in which the new species described by Riccieri *et al.* (2024) is integrated: *Eurymeloe* (*Bolognaia*) *digiuliorum* (Bologna, Riccieri & Spagoni, 2024) **comb. nov.**

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Declaration of competing interest

The authors of this article declare that they have no financial, professional or personal conflicts of interest that could have inappropriately influenced this work.

Authorship contribution statement

Alberto Sánchez-Vialas: conceptualization, resources, writing-original draft, writing-review & editing. José L. Ruiz: conceptualization, resources, writing-original draft, writing-review & editing. Alain Roujas: resources. Alexandre François: resources, writing-review & editing.

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