





Rediscovery of *Pseudomyrmecion ramalium* Bedel, 1885: a rare endemic saproxylic Longhorn beetle in the Djebel Edough Forest, Algeria (Coleoptera, Cerambycidae)

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Abstract

The rediscovery of *Pseudomyrmecion ramalium* Bedel, 1885, a rare and endemic saproxylic longhorn beetle, in the Djebel Edough forest in Algeria is reported. Hind wings are for the first time showed and described, evidencing the brachyptery of this species. Erroneous nomenclatorial, biological and chorological data referred by previous authors are discussed and corrected. This species, which had not been observed in the region since 1900, is an obligate saproxylic insect exclusively associated with the Algerian oak *Quercus canariensis* Willd. Classified as an endangered species on the IUCN Red List due to its rarity and the threats to its habitat, *P. ramalium* represents a conservation priority. Its rediscovery highlights the need for further research to assess the current state of its population and better understand its ecological requirements. This information will be crucial for developing effective conservation strategies and preserving its fragile habitat.

Key words: Rediscovery, *Pseudomyrmecion ramalium*, saproxylic beetle, endangered species, Djebel Edough forest

Introduction

Pseudomyrmecion ramalium Bedel, 1885 is an obligatory saproxylic longhorn beetle endemic to northern Algeria, which stands out due to its rarity and restricted distribution (Villiers, 1946; Sama & Löbl, 2010). Historically, the species has been recorded exclusively in the Djebel Edough forest (Annaba province) and the Yakouren forest (Tizi Ouzou province), with the last sighting in Djebel Edough dating back to 1900 (Bedel, 1885; Pic, 1896; Villiers, 1946). This prolonged absence of reports has raised concerns about the potential local extinction of the species (Verdugo *et al.*, 2016). The species' obligate association with the Algerian oak *Quercus canariensis* Willd. (Bedel, 1885; Villiers, 1946; Verdugo *et al.*, 2016) suggests its significant role in decomposition processes within Mediterranean forests. *P. ramalium* is currently classified as Endangered by the IUCN, highlighting the urgent need to preserve its habitat to ensure its survival (Verdugo *et al.*, 2016). In this study, we report the rediscovery of *P. ramalium* in the Djebel Edough forest massif in May 2023, after a lack of reports of approximately 124 years, suggesting the possible presence of a residual population. This rediscovery marks a significant milestone, prompting further research to explore the species' spatial distribution and population density, in order to determine the ecological conditions necessary for its survival and to define conservation priorities.

Materials and Methods

Study Area. The study was carried out in the Edough forest massif, situated in the northern part of Annaba Province, northeastern Algeria. Covering an area of 47,350 hectares, this region is bordered by the Mediterranean Sea to the north and encompasses a wide range of altitudinal gradients, with its highest peak, Kef Sabaa, rising to 1,008 meters (Toubal, 1986). Recognized as a biodiversity hotspot within the Palaearctic ecozone, the Edough massif hosts numerous rare and endemic species, underscoring its significant biogeographical value (Véla & Benhouhou, 2007; Boukheroufa *et al.*, 2020; Hadiby *et al.*, 2022; Benhacene *et al.*, 2024). Sampling took place in the Berouaga natural forest, situated northeast of the village of Seraidi at an altitude of 650 m (36°55'27.1"N, 7°42'07.2"E). This site is characterized by a forest corridor composed of cork oak (*Quercus suber* L.), Algerian oak (*Quercus canariensis*), and a mixed forest of maritime pine (*Pinus pinaster* Aiton) and cork oak (Laref *et al.*, 2022). These habitats were selected due to their potential to support saproxylic beetles (Fig.1).

Sampling Strategies. The sampling campaign was conducted in the spring of 2023, during the peak activity period of saproxylic beetles. To maximize species collection, three complementary sampling methods were employed: visual searches, Barber traps and interception traps (Polytraps). These traps were designed to capture beetles either in flight or in moving near the ground. They were systematically positioned at 100-meter intervals throughout the study area and monitored monthly. The specimen of *P. ramalium* (Fig. 2) was collected in one of interception traps located at 650 m altitude in the Edough forest massif on the 23 May 2023 (Fig. 1). The specimen was transferred into vial containing ethyl acetate to maintain joint flexibility and then preserved in 75% ethanol for taxonomic analysis.

Identification. To confirm the rediscovery of *P. ramalium*, an extensive review of the Algerian entomological literature was conducted. This review revealed no records of the species after 1900, highlighting its rarity and emphasizing the significance of this rediscovery. The specimen of *P. ramalium* collected from the Edough massif was sent to the National Museum of Natural History, Luxembourg for dissection. It is currently preserved in the entomological collection at Badji Mokhtar University in Annaba, Algeria. The taxonomic identification was based on the keys provided by Villiers (1946), which include detailed morphological criteria. Additionally, the morphometric characteristics of the dissected specimen were compared with those of a reference specimen from the collection of the National Museum of Natural History, Paris (MNHN). This comparison, conducted by Gérard Tavakilian, further confirmed the identification.

Data Analysis. Sampling locations were georeferenced using GPS, and habitat parameters (*e.g.*, dominant vegetation, altitude) were documented. Geographic data were used to calculate the Extent of Occurrence (EOO) and Area of Occupancy (AOO) for *P. ramalium* using the IUCN GeoCat platform. These metrics were compared with previous records to evaluate distribution trends and assess conservation status. The species' distribution map was generated using ArcGIS software, version 10.3, to ensure precise spatial analysis.

Results

Pseudomyrmecion ramalium Bedel, 1885

Bedel, 1885: CXXXII (description, biology); Pic, 1896: 337 (distribution); Lameere, 1901: 294 (systematics); Bedel, 1901: 358 (mimicry); Pic 1902: 28 (morphology); Aurivillius, 1912: 422 (catalogue); Planet, 1924: 145 (catalogue); Villiers, 1946: 100, fig. 223 (redescription, biology, distribution); Damoiseau & Cools, 1987: 18 (catalogue); Miroshnikov, 2014: 204, 206, 207, figs 22, 34, 41, 51 (morphology); Sama, 2023: 236, figs 450–457, 463 (redescription, biology, distribution, genitalia).

Taxonomical Notes. An important observation concerns a typographical error in the nomenclature of *Pseudomyrmecion ramalium* reported by Verdugo *et al.* (2016), where the species is mistakenly referred to as *Pseudomyrmecion ramalinum*. Such misspellings can lead to confusion in databases and future studies on this rare and endangered species. It is essential to correct this inconsistency to ensure the accuracy and reliability of taxonomic information. We recommend that future works referencing this species address this error to standardize its taxonomy across the scientific community.

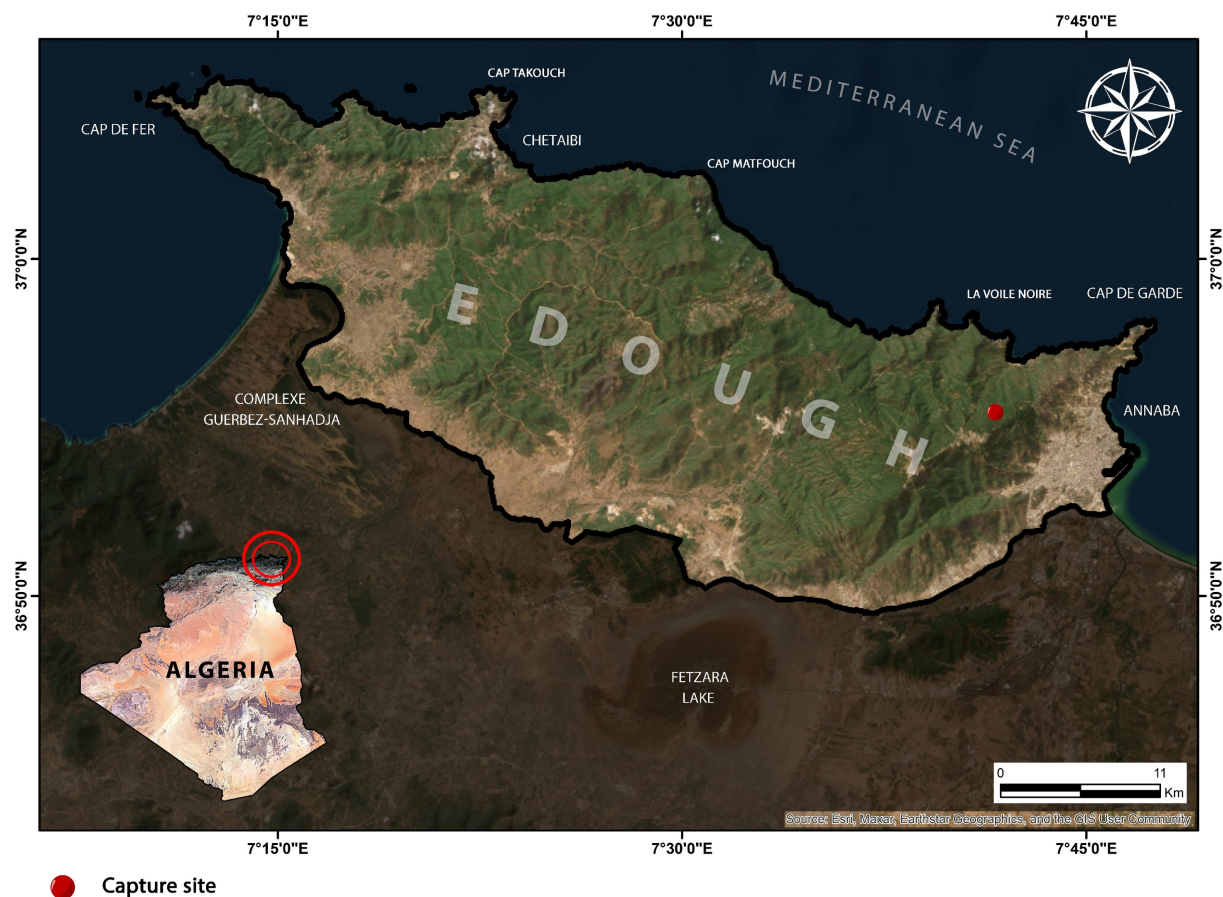


FIGURE 1. Capture site and field photos in the Edough forest massif (North-East Algeria).

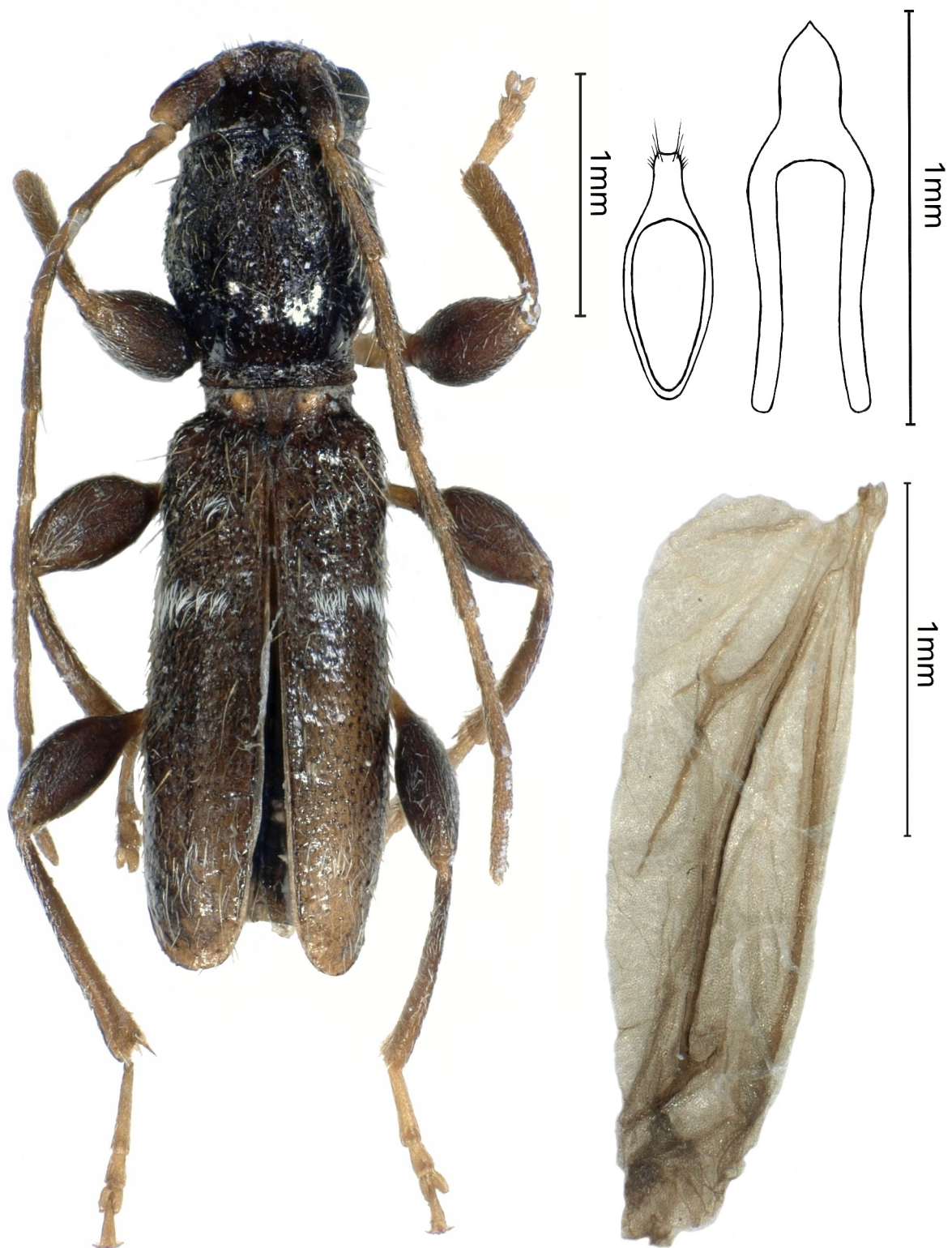


FIGURE 2. *Pseudomyrmecion ramalium* Bedel, 1885, male, from Edough forest (Badji Mokhtar University, Annaba, Algeria). Dorsal view, tegmen, median lobe and hind wings. Scale bar = 1 mm. (Photo and drawings F. Vitali).

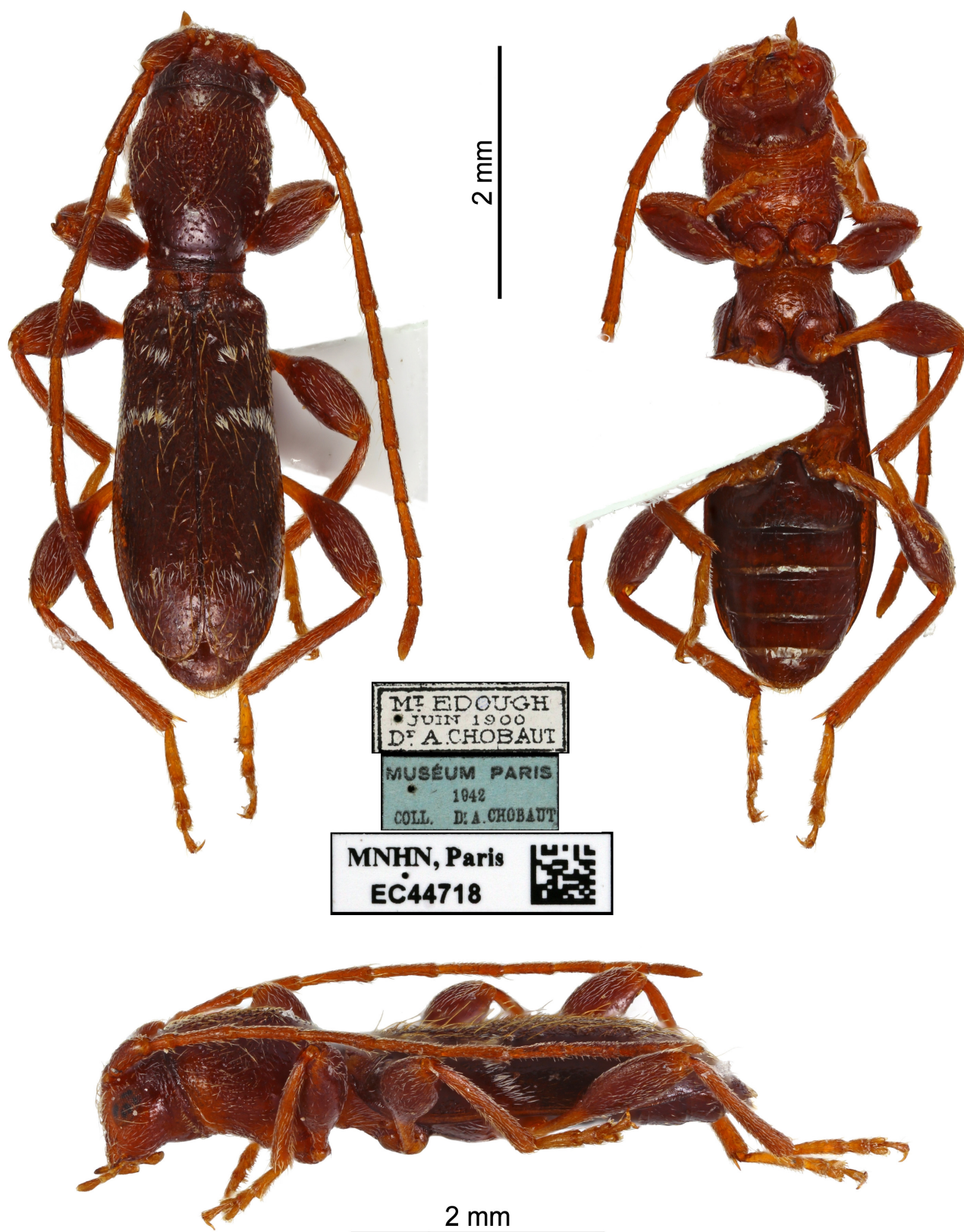


FIGURE 3. *Pseudomyrmecion ramalium* Bedel, 1885 from Edough forest (MNHN). Ventral view, dorsal view, lateral view and labels Scale bar = 2 mm. (Photo C. Rivier, MNHN).

Morphological Notes. Hind wings. Already during the original description, Bedel (1885) remarked that this species “seems not use the [hind] wings, though well developed”. No further author deepened this topic.

Actually, the dissection of the collected specimen has revealed that the hind wings (Fig. 2) are incompletely developed: both anal veins do not reach the wing margin; the anal vein A_{x2} is even rudimentary; both cubital veins $Cu1$ and $Cu2$, the apical cell and the medial vein $M1$ are vestigial; consequently, the apical part remains folded, and the overall wing surface is insufficient to allow flying.

The shape of the humeri, much narrower in comparison with other Tillomorphini (Miroshnikov, 2014) suggests that this species has also lost the possibility to open the elytra naturally. Thus, *P. ramalium* should be defined a brachypterous species.

Male genitalia (Fig. 2). Median lobe (penis) 0.94 mm long, testaceous, slightly curved, parallel-sided, projected at apex, one-third as long as the median struts. Tegmen 0.6 mm long, testaceous; ringed part 3 times as long as root, laterally not geniculated, posteriorly converging; parameres fused together in a rectangular structure, which is dorsally flat, slightly arched, feebly concave at apex and covered with some black setae, increasing of length toward the tip (nomenclature according to Ehara, 1954). This description is consistent with that provided by Sama (2023), except for the shape of the median struts that look unusually convergent backwards is Sama’s drawing, maybe due to an incorrect preparation.

Geographic Notes. Based on Sama & Löbl (2010), Verdugo *et al.* (2016) and later, Sama (2023), provided numerous remarkable inaccuracies concerning the distributional data of this species, which require correction.

They quoted this species as endemic from “forests of Kabylia”: Edough forest, Yakouren forest, Azazga, “Dorsale de Collo (Djebel Edough)”, Akfadou National Park and Blida env.

First, Djebel Edough is not located in the Kabylia region but in the Numidia region, Annaba province (formerly Bône), on the opposite part of the Algerian coast. Second, the “Dorsale de Collo” can in no way associated with Djebel Edough since Collo is a port town located in Skikda province. Was this specimen collected in Collo but coming from wood collected in Djebel Edough? It is only our hypothesis. However, citing two localities over 100 km apart as only one locality makes this datum unreliable. Fourth, Azazga is not another locality but the district where the Yakouren forest is located. Similarly, the “Akkadou National Park” includes the commune of Yakouren. However, this National Park, designated by decree no. 370 of the Governor General of Algeria on 20 January 1925, can no longer be mentioned as such since it has not been reinstated during the reclassification of parks in Algeria starting 1983. Lastly, Sama (2023) cites without comment the surprising datum of “Blida env.”, located 150 km west from the westernmost datum of this species. It might be even correct, but lacking precision, collection date and collector, it is not possible to retain it.

In conclusion, Djebel Edough and the Yakouren forest (Bedel, 1885; Pic, 1896; Villiers, 1946; Damoiseau & Cools, 1987) can be considered as the only sure localities inhabited by *P. ramalium*.

Ethology and Habitat. *Pseudomyrmecion ramalium* is a rare and endemic saproxylic beetle species from northern Algeria, primarily found in the Edough and Yakouren forests. This species is strongly connected to *Quercus canariensis* (Bedel, 1885; Villiers, 1946; Verdugo *et al.*, 2016), which is currently considered as a senior synonym *Q. mirbeckii* Dur. In contrast to all previous authors, Sama (2023) consider this cerambycid as “monophagous on *Quercus faginea*” Lam. This is certainly erroneous since this tree colonize only the Aïn Témouchent province, in the extreme northwest of the country (Bouandas *et al.*, 2024), where *P. ramalium* has never been collected.

The larvae of *P. ramalium* feed under the bark or in the sapwood of dying or recently cut twigs, completing their life cycle within one year. Pupation occurs in the wood during the spring. Adults emerge from late May to early June and are most commonly observed between May and July (Villiers, 1946). They can be collected by beating dead branches of their host tree, where the larvae have developed. The beetles appear to favor isolated trees or those on the edges of forests. Active during the day, they move rapidly along tree trunks and branches. They are frequently found alongside ants, particularly those of the genus *Crematogaster*, and share similar behavioral traits, body structure and coloration, leading to a striking resemblance with these ants (Bedel, 1885; 1901; Villiers, 1946; Verdugo *et al.*, 2016).

Discussion

In the collection of MNHN Paris, there are 94 specimens of *Pseudomyrmecion ramalium*, each cataloged individually in one collection box (Fig. 4). These specimens originate exclusively from two localities in Algeria: four specimens from the Yakouren Forest (Kabylia) (Fig. 5) and 90 specimens from the Edough Forest (Numidia). They were collected between 1885 and 1900 by various entomologists, including Louis Bedel, Alfred Chobaut, and Maurice Pic.

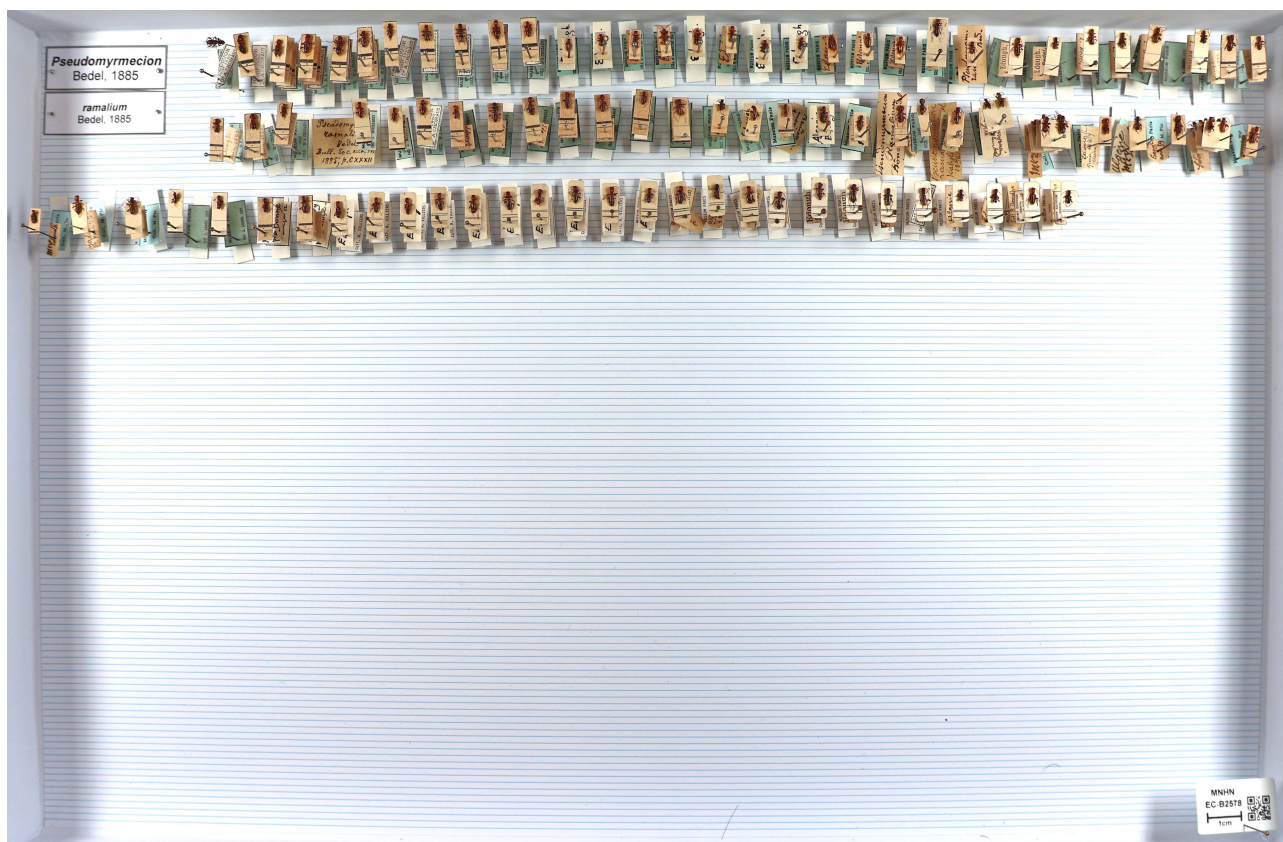


FIGURE 4. All *P. ramalium* samples from the collection boxes of MNHN Paris. (Photo C Rivier, MNHN)

From 1885 to 2024, nine sampling campaigns were conducted in the Edough Forest and two in the Yakouren Forest, resulting in successful observations of *P. ramalium*. Using the IUCN Red List’s GeoCat platform, we calculated the Extent of Occurrence (EOO) and Area of Occupancy (AOO) for the species. Its distribution is extremely limited, with an Extent of Occurrence (EOO) of 276,023 km² and an Area of Occupancy (AOO) of 28,000 km² (Fig. 6). With its occurrence limited to only two locations, *P. ramalium* is considered rare, and its population may be declining due to ongoing habitat loss (Villiers, 1946; Verdugo *et al.*, 2016).

However, the IUCN assessment by Verdugo *et al.* (2016) contains errors in its EOO and AOO calculations due to the inclusion of incorrect locality records. Specifically, Verdugo *et al.* (2016) incorrectly associated the species with locations such as the “Dorsale de Collo” and “Akfadou National Park” which are geographically distinct from the verified sites of Edough and Yakouren forests. These inaccuracies significantly inflated the distribution metrics for the species, leading to a misrepresentation of its conservation status. A reassessment using accurate locality data, as supported by the MNHN collection records, is essential for ensuring the reliability of conservation strategies.

The species is further threatened by habitat destruction, primarily caused by human-induced fires. Additionally, its inability to fly limits its dispersal capacity, further restricting its range. These updated calculations, combined with its limited distribution and biological characteristics, reaffirm its classification as Endangered.



FIGURE 5. *P. ramalium* of Yakouren forest from the collections of MNHN Paris.

Conclusions

Pseudomyrmecion ramalium is a rare and endemic species found only in two regions of northern Algeria. The species is known from the forests of Edough and Yakouren, and its rediscovery in the Djebel Edough forest after 124 years underscores the critical role this area plays in the conservation of rare and endemic saproxylic beetles. This restricted distribution, combined with the low number of known populations, justifies its classification as Endangered according to IUCN Red List criteria.

However, the IUCN assessment from 2016 contains inaccuracies regarding the Area of Occupancy (AOO) and Extent of Occurrence (EOO), as it was based on overestimated locality records. A reassessment is required using the correct number of verified records from the MNHN collection. The updated calculations reinforce the species' highly restricted range and critical conservation status.

The rediscovery of *P. ramalium* after more than a century of no reports emphasizes the critical importance of this region for the conservation of rare and endemic saproxylic beetles. While the rediscovery confirms the species' presence, *P. ramalium* remains highly vulnerable due to ongoing habitat degradation, particularly from human-induced threats such as wildfires. This finding highlights the urgent need for focused conservation actions to protect

its remaining habitats. Future research should prioritize assessing population dynamics, habitat needs, and emerging threats to ensure the species' long-term viability.

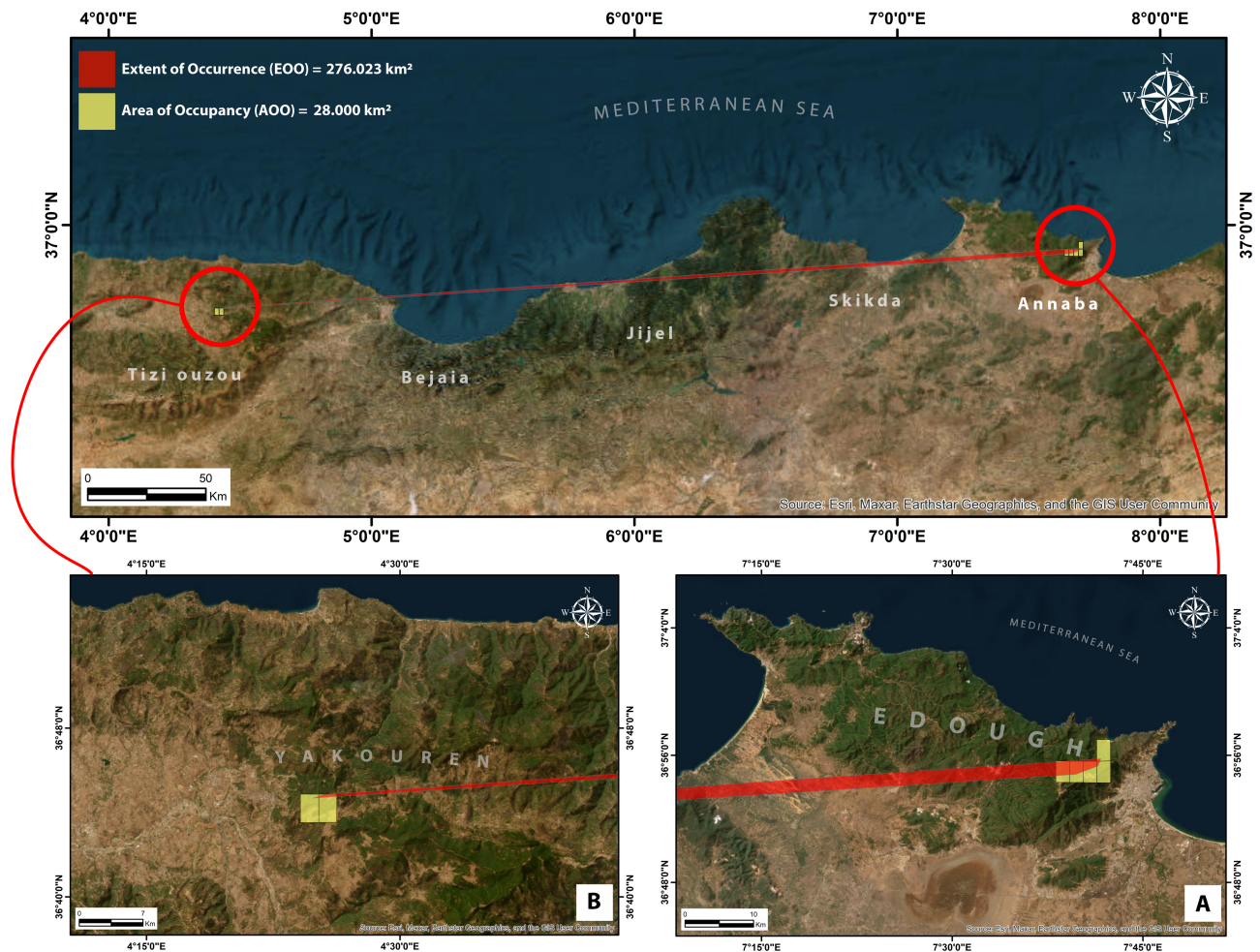


FIGURE 6. Global distribution of *P. ramalium* from two localities (A: Edough forest, B: Yakouren Forest) showing Extent of Occurrence (EOO) and Area of Occupancy (AOO).

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