Confirmed occurrence of *Leistus sardous* in mainland France and new reports of *Philorhizus paulo* in the French Pyrenees (Coleoptera, Carabidae)

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Abstract. – The occurrence of *Leistus sardous* Baudi di Selve, 1883, a rarely collected species, is confirmed in mainland France, in the Corbières region. It was only known in France from a few Corsican localities and a doubtful report from Haute-Garonne. *Philorhizus paulo* Wrase, 1995, which was only recorded in France during the years 1978 and 2023, in two localities in the Pyrenees, is reported by the authors from five new localities in the Aude, Pyrénées-Atlantiques and Pyrénées-Orientales departments. Photographs of both species, as well as anatomical parts, are presented. *Leistus sardous* appears to be a nummulitic tyrrhenian relict, with a few widely scattered populations in the western Mediterranean Basin. *Philorhizus paulo*, although very localized, is probably widely distributed in the Pyrenees and the Cantabrian mountains.

Résumé. – **Présence confirmée en France continentale de *Leistus sardous* et nouvelles localités de *Philorhizus paulo* dans les Pyrénées françaises (Coleoptera, Carabidae)**. La présence de *Leistus sardous* Baudi di Selve, 1883, espèce rarement observée, est confirmée en France continentale, dans les Corbières. Elle n'était connue dans ce pays que de quelques localités corses et d'une localité fort douteuse de Haute-Garonne. *Philorhizus paulo* Wrase, 1995, qui n'avait été signalé en France qu'en 1978 et 2023, dans deux localités des Pyrénées, est rapporté par les auteurs de cinq nouvelles localités de l'Aude, des Pyrénées-Atlantiques et des Pyrénées-Orientales. Les photos des deux espèces, ainsi que de parties anatomiques, sont présentées. *Leistus sardous* paraît être une relique de la Tyrrhénide nummulitique, avec quelques populations très dispersées dans le bassin occidental de la Méditerranée. *Philorhizus paulo,* bien que très localisé, est probablement largement distribué dans les Pyrénées et les monts Cantabriques.

Keywords. – Adephaga, Ground Beetles, Lebiini, Nebriini, faunistic, new records.

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Ground beetles (Carabidae) is a well-studied family in France, in spite of being very diverse, with about 1,150 known species in the country. Several main works have been dedicated to them, including two editions of the Fauna of France (Jeannel, 1941, 1942, 1949; Coulon *et al.*, 2011a, b), a national catalogue (Bonadona, 1971) and a recent illustrated catalogue dedicated to Corsica (Jiroux *et al.*, 2019). The updated list of species and their distribution can be found in Coulon *et al.* (2024).

There are also several comprehensive and recent regional catalogues, *i.e.* Coulon *et al.* (2000) for the Rhône-Alpes region, Callot & Schott (1993) for Alsace and Reisdorf *et al.* (2021) for Île-de-France. In addition, web tools such as the Inventaire national du Patrimoine naturel (INPN) are used to monitor the distribution of all species in France.

Nevertheless, some species of Carabidae are still poorly known or even enigmatic in France. This is the case of *Leistus sardous* Baudi di Selve, 1883, and *Philorhizus paulo* Wrase, 1995, which appeared to be restricted to very small geographical areas, with only one and three observations in mainland France. Here, we report them from several previously unknown localities in the Pyrenees and Corbières regions.

Material and methods

Preparation of specimens and photos. – For making photos of habitus and morphological details, specimens were placed for 24 hours in a solution of 5 % detergent and 95 % water and then cleaned with a set of different supple paintbrushes. Male genitalia (aedeagi) were extracted from the abdomen, cleaned, glued and mounted together with male specimens on transparent cards. As the *Philorhizus* aedeagi are very small and not very sclerotized, they were mounted in a drop of Eukitt®. Photographs of habitus and morphological details were taken either on the image acquisition technical platform of the National Forest Entomology Laboratory of the ONF (Quillan, France), with the Entovision multifocus® system, or with a Sony DSC-W7 compact digital camera mounted on a Wild M5 stereomicroscope. The construction of sharp images from multifocal stacks (focus stacking) was carried out with Cartograph software from Microvision Instruments (Evry, France) or Combine ZM software. The infographic work and plates were created using Adobe Photoshop CC 2018 software.

Material depositories and acronyms used. – The material studied is deposited in the following institutional or private collections:

– Office National des Forêts, Laboratoire national d'entomologie forestière, Quillan, France (LNEF-ONF);

– collection David Lessieur, Pouzac, France (DL);

– collection Thibault Le Pen, Aix-en-Provence, France (LP);

– collection Fabien Soldati, Limoux, France (FS);

– collection Cyrille Van Meer, Saint-Pée-sur-Nivelle, France (CVM).

Results

Family **Carabidae** Latreille, 1802

Subfamily **Nebriinae** Laporte de Castelnau, 1834

Tribe **Nebriini** Laporte de Castelnau, 1834

Genus ***Leistus*** Fröhlich, 1799

Subgenus ***Sardoleistus*** Perrault, 1980

Leistus (Sardoleistus) sardous Baudi di Selve, 1883 (fig. 1–2)

The genus *Leistus* Fröhlich, 1799, is Holarctic and includes more than 170 species in the Palaearctic region, more than half of which occur in Asia (Farkak & Janata, 2003). Eleven species have been recorded in France, distributed in three subgenera (Coulon *et al.*, 2024).

The morphological characters used to separate the *Leistus* species relate to mandibles, length of antennomeres, the eyes size, the lateral grooves of the pronotum and the elytral striation. The mouthparts, and particularly the shape of the cruciform tongue beneath the labrum, was first proposed by Bruneau de Miré & Menier (1978) as a new character for a coherent classification of the genus. In response to the need for a comprehensive study, Perrault (1980, 1990) undertook a worldwide revision and a biogeographical analysis to illustrate the presumed phylogenetic evolution of the genus *Leistus*. The different subgenera, including *Sardoleistus*, can be distinguished based on the shape of this tongue, by the insertion of setae on its ventral surface, but also by the conformation of the median lobe of the aedeagus (Perrault, 1980).

Leistus sardous belongs to the subgenus *Sardoleistus*, which comprises only one species and is easily recognized by the very small, subapical cross-brace on the cruciform tongue below the labrum (fig. 5) and the median lobe of the aedeagus (fig. 3-4), which is unmodified and simply acuminate towards the apex (Perrault, 1990). It should also be noted that, among the French species, this is nearly the one with the most oblique temples, which makes the convexity of the eyes stand out more (fig. 1-2). *Leistus numidicus* Fiori, 1913, described from Algeria (Fiori, 1913) and *L. sardous* var. *romanus* K. Daniel, 1903, described from central Italy (Daniel, 1903) are junior synonyms of *L. sardous* (Perrault, 1990; Farkak & Janata, 2003).

Although it belongs to another subgenus, *L. sardous* is morphologically related to *L. fulvibarbis* Dejean, 1826, from which it can be distinguished by the temples, which are longer and oblique backwards, the shape of the cruciform tongue under the labrum and its aedeagus.

Between the years 2022 and 2024, sampling of saproxylic beetles was carried out on a small islet-like stand of old wood by the National Forest Entomology Laboratory of the Office National des Forêts (LNEF-ONF) as part of the accompanying measures following the extension of a wind farm (Vincent *et al.*, 2024). This small islet-like stand, essentially composed of beech (*Fagus sylvatica* L.), is located in Ladern-sur-Lauquet, in the Castillou national forest, western Corbières (Aude). On June 5th, 2024, one of the authors (AV) collected a singular *Leistus* from a downy oak (*Quercus pubescens* L.) on the edge of the studied wood. Examination of this specimen revealed, not without surprise, that it was *L. sardous* (fig. 2). As the collected specimen was a male, the shape of the median lobe of the aedeagus supported this identification (fig. 4). Moreover, it was identical to those from Corsica (FS) and Sardinia (LP) with which we compared it. Following such a surprising finding, new field research was carried out in this forest, particularly along a talweg at night using a headlamp, but without new findings.

The species was wrongly considered to be endemic to Corsica and Sardinia by Jiroux *et al.* (2019) and Coulon *et al.* (2014, 2024). In fact, it appears to occupy part of the western Mediterranean Basin, by isolated populations in restricted mountainous areas. It is known from Corsica, Italy (Sardinia, Sicily and central Italy) and North Africa, north of Tunisia and Algeria (Perrault, 1990; Farkac & Janata, 2003).

Leistus sardous was also reported from the Haute-Garonne French department, near Toulouse, according to Boscaini *et al.* (2000), that was the only mainland France report (INPN, 2024). This citation is very doubtful and most probably due to a misidentification for the following several reasons. The number of specimens collected (57 ex.) is most unlikely for such a rarely observed species, the most common species of the genus in riparian ecotones, *L. fulvibarbis*, is not even reported. On the other hand, other obvious misidentifications appear in the list of species collected from the same sites, for example *Phonias maritimus* (Jeannel, 1942) or *Harpalus punctipennis* Mulsant, 1852. The former was described by Jeannel (1942) from Alpes-Maritimes and Var counties and is currently synonymous with *Pterostichus (Phonias) strenuus*

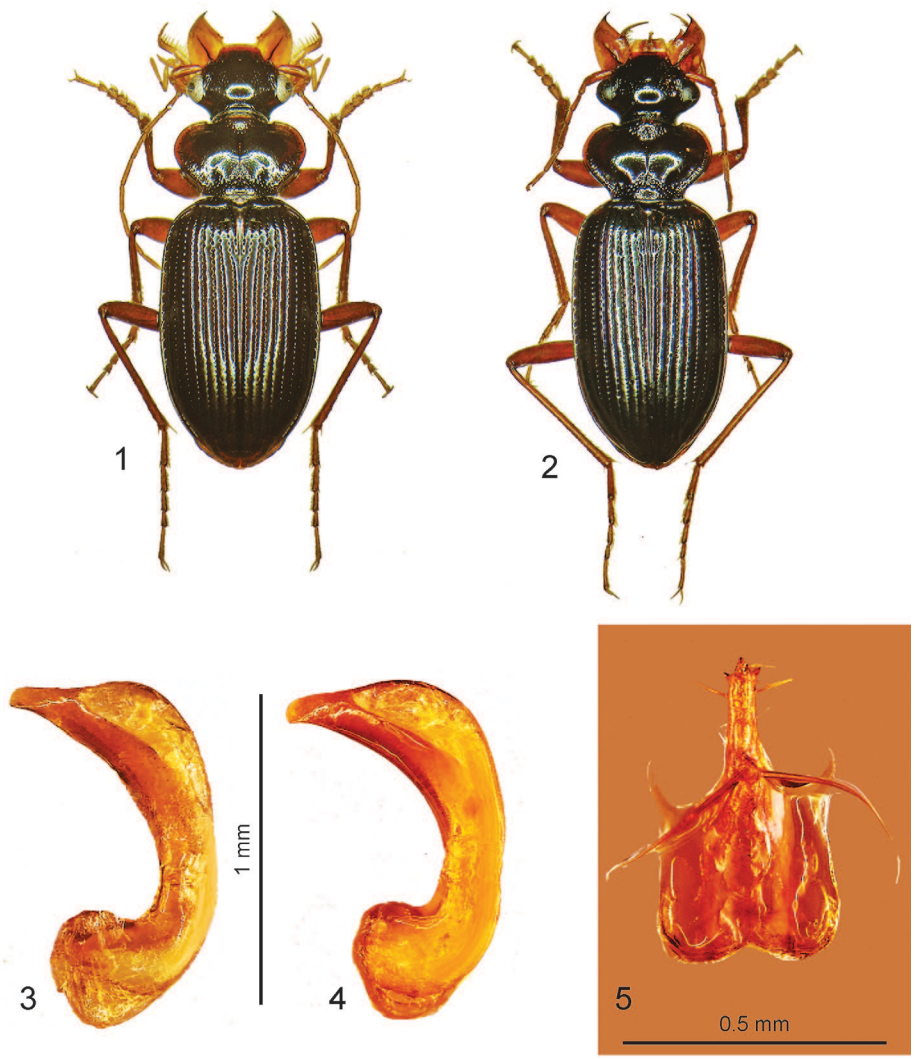

Fig. 1-5. – *Leistus sardous* Baudi di Selve, ♂. – **1**, Habitus, specimen from Monte Gennargentu, Sardinia (length from clypeus to apex of elytra: 6.8 mm). – **2**, Habitus, specimen from Corbières, France (length from clypeus to apex of elytra: 7.1 mm). – **3-4**, Aedeagus (median lobe): **3**, specimen from Monte Gennargentu, Sardinia; **4**, specimen from Corbières, France. – **5**, Cruciform tongue below the labrum.

(Panzer, 1796). The second is an orophilous species only found at high altitude in the southern French and Italian Alps (Coulon *et al.*, 2024). Finally, these remarkable observations are not commented on, as if they deal with common species.

Our observation in the Corbières is therefore the first genuine and verified occurrence in mainland France.

Subfamily **Harpalinae** Bonelli, 1810

Tribe **Lebiini** Bonelli, 1810

Genus ***Philorhizus*** Hope, 1838

Philorhizus paulo Wrase, 1995 (fig. 6)

In Europe, the genus *Philorhizus* Hope, 1838, comprises 19 species, most of which have restricted distributions (Sciacky, 1991; Kabak, 2003; Anichtchenko, 2005; Wrase, 2005; Wrase & Assmann, 2008; Allegro *et al.*, 2015; Lompe, 2025). In France, eight species have been recorded (Coulon *et al.*, 2024), *P. paulo* being only reported by a single specimen found in 1978 at Prats-de-Mollo, Ares pass (Coulon *et al.*, 2011b, 2024). This is an Iberian species at the edge of its range, described from Cantabria

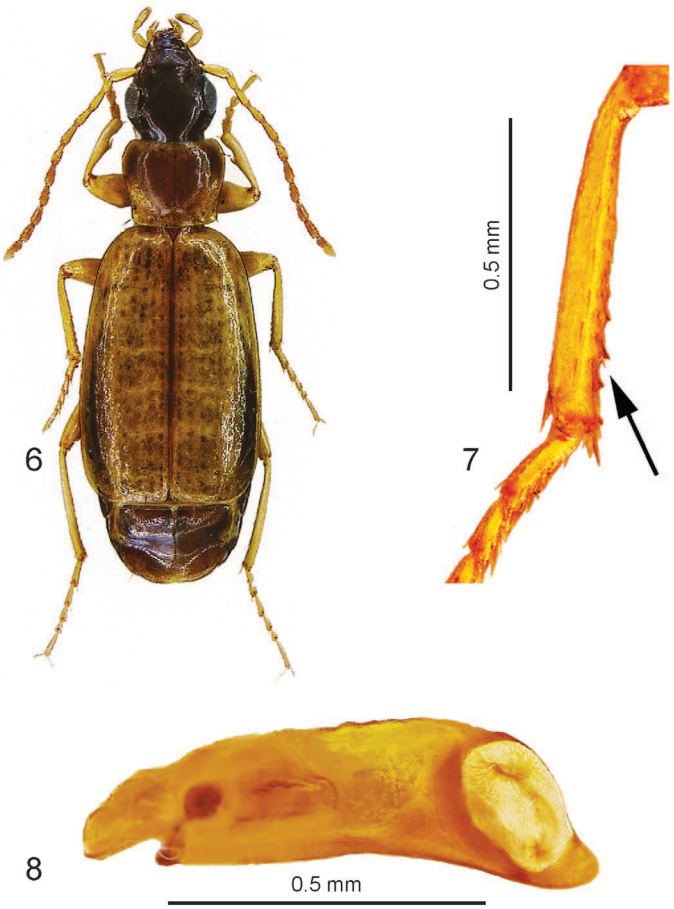

Fig. 6-8. – *Philorhizus paulo* Wrase, ♂. – **6**, Habitus, from Iraty forest, French Pyrenees (length from clypeus to apex of elytra: 3.9 mm). – **7**, Mesotibia. – **8**, Aedeagus.

(Wrase, 1995), still only reported from this region by Serrano (2003), then cited from Lugo, Navarre (Wrase, 2005) and Guipúzcoa (Anichtchenko, 2005).

Very recently, five new specimens were reported from the western Pyrenees, in Accous and Urdos (Pyrénées-Atlantiques), 45 years after the only known record in France (De Bleeckere, 2023). In the meantime, some of the authors (CVM, DL, FS) found the species between the years 2000 and 2024, in three Pyrenean departments. These unpublished observations show that this *Philorhizus*, although rarely collected, is probably widespread in the Pyrenees. They are reported below, all located at an altitude above 1300 m and spread from the Pyrénées-Orientales to the Pyrénées-Atlantiques departments.

Pyrénées-Orientales. – 1 ♀, Dorres, Balloc, around 1700 m asl, 22.VII.2018, F. Soldati (FS). 1 ♂ and 2 ♀, Fontrabiouse, Val de Galbe, around 1900 m asl, 24.VI.2015, F. Soldati (FS). 1 ♂, Prats-de-Mollo, around 1850 m asl, 31.VII.2000, F. Soldati (FS). At the edge of the subalpine forest, by beating the recently dead pines (*Pinus sylvestris* L., *P. uncinata* Ramond).

Aude. – 2 ♂, La Fajolle, between pic de Serembarre and Sarrat de la Devèse, 1836 m, on sight, on the ground on a flat lawn, 26.VI.2024, David Lessieur (DL).

Pyrénées-Atlantiques. – 8 ♂ and 4 ♀, Larrau, Iraty forest, around 1300 m asl, 8.X.2013, 20.XI.2015, 25.VII.2016 and 2.IV.2018, C. Van Meer (CVM, LNEF-ONF); beating up broken branches or fallen Scots pine trees (*Pinus sylvestris* L.).

As with most species belonging to the same genus, *Philorhizus paulo* therefore seems to live in the litter and under the bark of recently dead trees, particularly pines. Closely related to *Philorhizus melanocephalus* (Dejean, 1825), it differs at least by the following characters: totally apterous; body more elongated, especially elytra and head; elytra more narrowed at humeri; male mesotibiae denticulate at inner edge (fig. 7); differently shaped aedeagus (fig. 8).

Discussion

The discovery of *L. sardous* in the Corbières was totally unexpected, being moreover the first verified occurrence in mainland France. However, this region is under-sampled and often reveals surprises, such as the recent discovery of *Paussus favieri* Fairmaire, 1851 (Coleoptera, Carabidae) (Cabon *et al.*, 2024), another emblematic species, in the southern Corbières. Or, more recently, the discovery of a cave-dwelling species new to science in the same French department (Faille *et al.*, 2025). In addition, two specimens of *Leistus* were found by one of the authors (FS) in April 2020 while beating a pubescent oak tree (*Quercus pubescens*) in the hills above Limoux (Aude) but were not conserved because too quickly attributed at first sight to the common *L. fulvibarbis*. The conditions in which they were found and their geographical proximity to Ladern-sur-Lauquet suggest that they could in fact also be *L. sardous*. Field research is therefore ongoing in the Corbières region.

Its distribution pattern, with very sporadic and scattered populations in several mountainous regions of the western Mediterranean Basin, is reminiscent of that of *Cardiomera genei* Bassi, 1834 (Coleoptera, Carabidae), a very rare species not recorded in France for a very long time, with a few isolated populations in northern Algeria, Morocco (Middle and High Atlas), Spain, Sicily, French eastern Pyrenees and Corsica, whose known stations are found along the remains of the Nummulitic Tyrrhenid (Jeannel, 1942).

As for *P. paulo*, its late discovery in France may seem surprising, especially in a region so prospected for Carabidae as the Pyrenees, and this species could be wide-

spread across the mountain range. It should be noted, however, that this species was described fairly recently (Wrase, 1995) and was previously confused with the common *P. melanocephalus*. Finding a species described from the Cantabrian mountains in the Pyrenees is not very surprising, and it occupies widespread biotopes such as high-altitude lawns, heaths with ericaceous vegetation, and pine forests with *Pinus sylvestris* or *Pinus uncinata*. It is also likely that *P. paulo* has a continuous distribution across the Pyrenees and Cantabria.

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