



Updates to the bee fauna of Portugal with the description of three new Iberian *Andrena* species (Hymenoptera: Apoidea: Anthophila)

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Abstract

Portugal is home to a rich but understudied bee fauna that was recently comprehensively documented for the first time. As part of ongoing work to improve the knowledge of Portuguese bees, efforts have been made to survey poorly recorded parts of the country and to continue to review existing material in museum collections. These efforts have resulted in 28 species newly discovered in Portugal, as well as eight species added from the literature and two taxa recently raised to full species status. Three additional species, *Andrena* (*Lepidandrena*) *baetica* **spec. nov.**, *Andrena* (*Micrandrena*) *omnilaevis* **spec. nov.**, and *Andrena* (*Notandrena*) *foeniculae* **spec. nov.** are described from material collected in southern Iberia, north-western Iberia, and southern Iberia, respectively. *Andrena omnilaevis* **spec. nov.** is the new name for north-western Iberian material previously identified as *Andrena* (*Micrandrena*) *semilaevis* Pérez. The male of *Stelis hispanica* Dusmet, previously only known from the holotype female, was also found and is described here. The taxon *Andrena* (*Melandrena*) *limata mixtura* Warncke has been variously treated as a subspecies of *A. limata* Smith or *A. nitida* Müller. Examination of the holotype from Portugal shows that it actually belongs in its original combination *Andrena limata* **comb. nov.**, and that true *A. nitida* is not present in Portugal. Seven additional species have been removed from the total due to misidentification or uncertainty. We also present discussion on the status of species complexes present in Portugal, and review species doubtfully recorded from the country. Altogether, this work increases the number of bee species recorded from mainland Portugal from 680 to 712, and to 722 for the country as a whole when including the faunas of the Madeira and Azores archipelagos.

Key words: endemic, identification key, oligolecty, solitary bees, taxonomy

1. Introduction

The Iberian Peninsula is one of the most biodiverse parts of Europe, with mountains, woodlands, meadows, and scrublands, and with Atlantic and Mediterranean coastlines and influences that combine to produce a wide variety of habitats. This rich diversity of habitats supports a high diversity of bee species, with over 1,000 species known from peninsular Spain (Ortiz-Sánchez 2011). Compared to Spain, the bee fauna of Portugal has been understudied until recently, with 680 species listed from mainland Portugal in a recent comprehensive revision (Baldock *et al.* 2018).

Despite being part of the comparatively well-studied European bee fauna, new endemic bee species continue to be described from Iberia with numerous recent publications (e.g. Müller 2012; Radchenko 2017; Wood & Cross 2017; Kuhlmann & Smit 2018; Smit 2018). During the process of cataloguing the Portuguese fauna, material of a possible new *Andrena* species was discovered, but was not published in Baldock *et al.* (2018) due to uncertainty over its status. Additional material conforming to this new species was discovered in the Klaus Warncke Collection when visiting the Oberösterreich Landesmuseum (OÖLM) in Linz, Austria. This specimen was separated by Warncke as ‘*Lepidandrena* spec.’, but as it was only collected in 1985 it is likely that he did not have time to describe it before his death in 1993. Additional material from a third locality in southern Spain was also found in undetermined material in the OÖLM general *Andrena* collection.

Another species with uncertainty over its status in Portugal was *Andrena semilaevis* Pérez, 1903. Widespread in continental Europe, the species appears to have its western limit in the Pyrenees (Gusenleitner & Schwarz 2002). However, the species was reported from the Serra da Estrela in Portugal by Dardon *et al.* (2014), an area approximately 600 km to the west that is not connected to the Pyrenees by a mountain chain. Examination of newly collected material from northern Portugal and material from the Maximilian Schwarz collection (Ansfelden, Austria) from north-western Spain reveals that this taxon is actually distinct, explaining this disjunct distribution.

Finally, a new *Andrena* in the *nitidiuscula* species group was unexpectedly found in western Portugal. The *nitidiuscula* species group contains primarily Apiaceae oligoleges, and has been the subject of taxonomic discussion, with subtly different species only being accepted relatively recently (Westrich 1989; Schmid-Egger & Doczkal 1995; Schwenninger 2013; Benon & Praz 2016). In contrast, the taxon described here is markedly distinct, and as with the other new taxa has probably been overlooked as it is found on the periphery of the European continent.

The current publication describes these new species, takes the opportunity to present data on bee species newly recorded from Portugal, and critically examines the status of some species reported from the Western Mediterranean.

2. Methods

We follow the subgeneric classification system of Warncke (1968), with morphological terminology and measurement criteria following Michener (2007). Specimens were measured from the vertical plane of the front of the head to the tip of the metasoma, and relative measurements such as head width relative to head length were calculated from measurements taken from photographs. Photographs were taken using an Olympus E-M1 Mark II with a 60mm macro lens and were stacked using Zerene Stacker 1.04 (Zerene Systems, USA) and plates were prepared in GNU Image Manipulation Program (GIMP) 2.10.

3. Results

3.1 Description of new Iberian *Andrena* species

Andrena (Lepidandrena) baetica Wood spec. nov.

Holotype: PORTUGAL: Alto Alentejo, Portalegre, Vaiamonte, 1–30.iv.2012, pan trap, 1♀, leg. A. van Harten. Deposited in the OÖLM.

Paratypes: SPAIN: Cadiz, Hozgarganta-Tal, E Puerto d. Galiz, 500 m, 12.iv.1985, 1♀, leg. W. Schacht, OÖLM; Sierra Pozo, Mnt. Palomas, 1450 m, 11.vi.2003, 1♀, leg. M. Kafka, OÖLM; Sierra Pozo, 1800 m, Puento Liano, 12.vi.2003, 5♀, leg. M. Kafka, OÖLM; PORTUGAL: Alto Alentejo, Portalegre, Vaiamonte, 1–30.iv.2012, pan trap, 1♀, leg. A. van Harten; Alto Alentejo, Ribeira de Abrilongo, 2.v.2019, 2♀, leg. A. Gonçalves, F. Barros, R. Félix, R. Costa, white pan trap; Baixo Alentejo, Ebio Noudar, 11.iv.2019, 1♀, leg. A. Soares, F. Barros, A. Gonçalves, R. Félix.

Paratypes are deposited in the OÖLM, the TAGIS collection, Avis (Portalegre District, Portugal), with two retained in the personal collection of T.J. Wood.

Diagnosis: This species belongs to the subgenus *Lepidandrena* Hedicke that is characterised in the female by the combination a row of thorn-like projections on the inner side of the hind femur, the femur also being carinate and bearing a fringe of dense, short bristles, as well as plumose scopal hairs on the tibia, and densely punctate terga. Nine species of *Lepidandrena* are currently known from Western Europe and the Western Mediterranean (*A. curvungula* Thompson, 1870; *A. dorsalis* Brullé, 1832; *A. florivaga* Eversmann, 1852; *A. mocsaryi* Schmiedeknecht, 1883; *A. pandellei* Pérez, 1895; *A. paucisquama* Noskiewicz, 1924; *A. rufizona* Imhoff, 1834; *A. sardoa* Lepeletier, 1841; and *A. tuberculifera* Pérez, 1895).

Andrena baetica has uniformly dark tergal integument (Figure 6, at least partly red in *A. rufizona*, *A. sardoa*, and *A. tuberculifera*; excluded from the following comparisons), dense, tomentose, squamous hairs on the scutum, scutellum, and metanotum (Figures 4–5, simple hairs in *A. florivaga* and *A. mocsaryi*), a shagreened galea (smooth

in *A. curvungula*, *A. pandellei*, and *A. paucisquama*), a dull and shagreened clypeus with an impunctate central line (Figure 3, smooth and shiny in *A. curvungula*, *A. florivaga*, *A. pandellei*, and *A. paucisquama*, shagreened but without an impunctate central line in *A. dorsalis*), and tarsi 2 and 3 and tibia 3 are orange (dark in *A. curvungula*, *A. dorsalis*, *A. pandellei*, and *A. paucisquama*).

For these characters, *A. baetica* is therefore closest to *A. mocsaryi* that is known from eastern and south-eastern Europe. However, *A. mocsaryi* has squamous hairs limited to the very edges of the metanotum and the scutellum, and the hairs of the scutum are simple, allowing the dense and clear punctation below to be seen clearly. Therefore, in profile the vast majority of the hairs of the scutum are not squamous (Figure 1). The structure of the labrum also differs: in *A. mocsaryi* the labral process is apically emarginate, forming two points, whereas in *A. baetica* it is truncate with a straight fore margin. Altogether, these characters therefore combine to make *A. baetica* unique.

Description: Female: Body length 10 mm (Figure 4). **Head:** Head 1.2 times wider than long (Figure 3). Clypeus weakly domed, broadly flattened in the central part, shagreened, punctures shallow but clear, separated by a distance of 1–1.5 puncture diameters over majority of the clypeus except at margins where punctures density increases to the point of almost touching, absent from centre where a clear longitudinal impunctate line is formed. Clypeal surface completely shagreened and dull, not shining. Process of labrum trapezoidal, twice as broad basally as long, apical margin weakly emarginate. Pubescence brown to light brown with the exception of the frons and the paracocular area which include a mixture of black hairs that are most visible in profile. Fovea not noticeably widened or narrowed, occupying half of paracocular area. Distance between inner margin of fovea and compound eye equivalent to distance between lateral ocellus and inner margin of the fovea. **Mesosoma:** Punctures of scutum and scutellum dense, separated by much less than the diameter of a puncture (Figure 5). Scutum, scutellum, and metanotum with short, squamous, light brown hairs, these hairs almost uniformly short, with only 20–30 individual longer hairs projecting in centre of the scutum when viewed in profile. Mesepisternum shagreened without apparent punctures, with long yellow-brown simple hairs. Lateral faces of propodeum with long simple hairs forming part of propodeal pollen basket. Legs generally with orangey pubescence, floccus whitish, tibial scopa light orange. Integument of legs dark except orange tarsi 2+3 and tibia 3 (Figure 4). **Metasoma:** Terga uniformly dark with only apexes of margins lightened and slightly translucent (Figure 6). Terga deeply and uniformly punctured over entire surface, punctures separated by 1 puncture diameter at most, often less. T2–4 with dense white hairbands, that on T2 widely broken, those on T3+4 complete. Terminal fringe of T5 orange. Pygidial plate with slightly raised margin, and slightly raised centre caused by strong cluster of punctures with raised edges, therefore appearing domed.

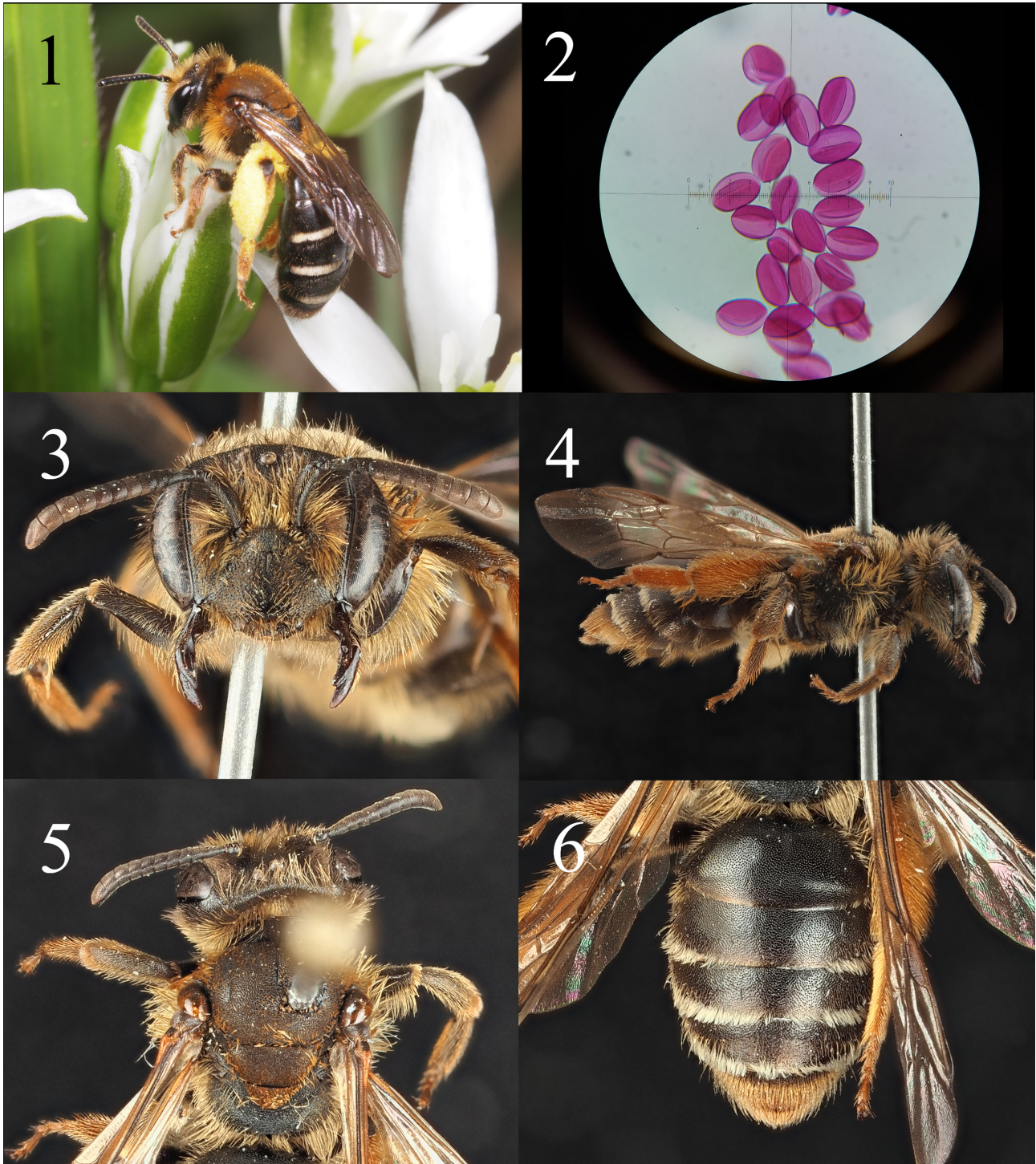
Male: Unknown.

Distribution: South-eastern Portugal and two mountainous areas of Andalucía in southern Spain.

Floral preferences: The specimen collected from Puerto de Galiz had the scopa full of large, semi-cylindrical pollen grains. Pollen analysis showed that this consisted of 60 µm long grains of *Ornithogalum*-type (Asparagaceae, Figure 2). If this floral preference is consistent, it stands in contrast to the other dark coloured western *Lepidandrena* species with short scutal hairs, *A. curvungula*, *A. pandellei*, and *A. paucisquama* which are all narrow oligoleges of *Campanula* (Campanulaceae, Westrich 1989). In line with the morphological evidence, the use of Asparagaceae pollen also places *A. baetica* close to *A. mocsaryi* which is a narrow oligolege of *Ornithogalum* (Westrich 2010). The identity of the pollen collected by *A. baetica* must be confirmed through field observations, but it is possible that it is also narrowly oligolectic on *Ornithogalum* like its sister species. Interestingly, the specimens collected from the Sierra Pozo (11.vi.2013 and 12.vi.2003) were collected with *Andrena saxonica* Stoeckhert (see records in Dardon *et al.* 2014), an oligolege of *Ornithogalum* (Westrich 2010).

Discussion: *Andrena mocsaryi* is distributed from Turkey in the east to the Czech Republic in the north and to Croatia and southern Italy in the west (Gusenleitner & Schwarz 2002). The nearest records of *A. mocsaryi* from southern Italy are approximately 1,700 kilometres away from the records of *A. baetica* in southern Spain. This remarkable disjunct distribution mirrors the situation in the *Colletes albomaculatus*-group. The recently described *C. jansmiti* Kuhlmann was found in southern Spain approximately 2,000 km from the western range edge of *C. punctatus* Mocsary, its nearest relative, which is found in eastern Austria and the Balkan Peninsula (Kuhlmann & Smit 2018). The Puerto de Galiz site for *A. baetica* is less than 50 km from the *locus typicus* of *C. jansmiti*. The presence of two species with distributional ranges seemingly restricted to southern Iberia that are morphologically close to more widespread species in eastern Europe and the eastern Mediterranean with presumably a very similar ecological niche (Kuhlmann & Smit 2018) suggests that the taxa may have been separated only recently, perhaps as species were forced into the Iberian, Italian, and Balkan glacial refugia during the last Glacial Maximum (Hewitt 1999).

Etymology: After conquering Iberia, the Romans divided it into three provinces with Hispania Baetica corresponding roughly to present day Andalucía. As the current species is so far only known from southern Iberia, the name *baetica* was chosen to emphasise this distribution. Hopefully this name will prove less transient than previous incarnations, with *Osmia baetica* Spinola, 1843 now considered a junior synonym of *Osmia rutila* Erichson, 1835 and *Megachile baetica* Gerstäcker, 1869 which may just be a form of *Megachile parietina* Geoffroy, 1785 (C. Praz *in litt*).



FIGURES 1–6. 1. *Andrena mocsaryi* Schmiedeknecht at flowers of *Ornithogalum* (photo credit Bernhard Jacobi). 2. Pollen grains (Asparagaceae) removed from the scopa of *Andrena baetica* **spec. nov.** Each of the smallest subdivisions represent 2.5 μm (total scale length = 250 μm). *Andrena baetica*, 3. female head, 4. female scutum, 5. female habitus, 6. female metasoma.

Updated key to female *A. (Lepidandrena)* species of Central and Western Europe and the Western Mediterranean

This key is based on the one for Central Europe presented by Schmid-Egger & Scheuchl (1997) with the addition of Western Mediterranean *Lepidandrena* species.

1. At least one tergite extensively red marked. Scutal hairs dark brown to black 2
- All terga dark, without traces of red colouration. Scutal hairs brown, grey brown, or light brown, never black 4
2. Scutum, scutellum, metanotum, and tegulae with short, squamous hairs, these being only 2–3 times as long as their basal width. Hind tibiae dark 3
- Scutal hairs simple, without any sign of squamous hairs. Hind tibiae orange *A. tuberculifera* Pérez
3. Only tergum 2, sometimes also tergum 3, red, remaining terga black. Scopa light orange *A. rufizona* Imhoff
- Reddish colouration of terga more extensive, usually with T1–4 completely red. Scopa black *A. sardoa* Lepeletier
4. Scutum, scutellum, metanotum, and tegulae with short, squamous hairs, these being only 2–3 times as long as their basal width 5
- Scutum, scutellum, metanotum, and tegulae with simple hairs. If squamous hairs are present, these are restricted to the very margins of the scutellum and metanotum 9
5. Galea shagreened, dull. Clypeus also completely shagreened and dull 6
- Galea smooth, shiny between the punctures. Clypeus also at least partially shiny 7
6. Tarsi and hind tibia orange. Squamous scutal hairs sparse, so that the punctuation of the underlying integument is clearly visible. Clypeus with an impunctate central line *A. baetica* spec. nov.
- All legs completely dark. Squamous scutal hairs thick, so that the underlying punctuation is obscured. Clypeus without an impunctate central line *A. dorsalis* Brullé
7. Tarsal segment 5 of the hind leg elongated and strongly bent. Squamous hairs light brown *A. curvungula* Thompson
- Tarsal segment 5 of the hind leg shorter and only weakly bent. Squamous hairs darker grey brown 8
8. Squamous hairs very thick, in fresh individuals the underlying scutal punctures are obscured. Midline of the scutum is only slightly impressed. Process of labrum markedly elongate with a clear apical emargination in the fore margin. Larger, 10–12 mm *A. pandellei* Pérez
- Squamous hairs moderately thick, the underlying scutal punctures clearly visible. Midline of the scutum clearly impressed. Process of labrum regularly trapezoidal, not elongate, fore margin almost straight. Smaller, 8–10 mm *A. paucisquama* Noskiewicz
9. Process of labrum wide and three sided, wider than the length of antennal segment 5. Hairs on the scutellum and metanotum simple. Clypeus strongly domed, laterally strongly shining between the punctures *A. florivaga* Eversmann
- Process of labrum very small, only as wide as the length of antennal segment 5. Squamous hairs present on the scutellum and metanotum. Clypeus more weakly domed, shagreened, not shiny *A. mocsaryi* Schmiedeknecht

Andrena (Micrandrena) omnilaevis Wood spec. nov.

Holotype: PORTUGAL: Confurco, Várzea Cova, 14.v.2019, 1♀, leg. Wood. Deposited in the OÖLM.

Paratypes: PORTUGAL: Confurco, Várzea Cova, 14.v.2019, 2♂; Castro Laboreiro, 3 km south, 1♂, leg. Wood; Lindoso, 1.5 km E, 41.8720, -8.1792, 13.v.2019, 1♀, leg. Wood; Guarda, Vale do Rossim, 24.vi.1987, 1♀, leg. F. Torres (reported as *Andrena semilaevis* by Dardon *et al.* 2014), University of Salamanca; SPAIN: Leon, Villablino, Puerto Leitariegos, 1400 m, 12.vii.1987, 1♂, 5♀, leg. M. Schwarz; Leon, La Magdalena, 1100 m, 11.vii.1987, 1♀, leg. M. Schwarz. Paratypes are deposited at the OÖLM, and the personal collections of T.J. Wood and M. Schwarz (Ansfelden, Austria) and in the Collection of Zoology, University of Salamanca.

Other material examined (*Andrena omnilaevis*): PORTUGAL: Trás-os-montes, Viade [de Baixo], 30.vi.1977, 1♀, leg. Ph. Pronk, Naturalis; SPAIN: Ávila, Sierra de Gredos, La Plataforma, 1800 m, 19.v.1995, 4♂, leg. H. & J.E. Wiering, Naturalis; Ávila, 6 km S of Santa Cruz del Valle, 800 m, 26.v.1995, 1♂, leg. H. & J.E. Wiering, Naturalis. (*Andrena semilaevis*): SPAIN: Gerona, Vilallonga de Ter, 1100 m, 16.vii.1970, 1♀, leg. V.S. v. d. Goot & J.A.W. Lucas, Naturalis, Leiden.

Diagnosis: This species belongs to the subgenus *Micrandrena* Ashmead that contains small black bees with ungrooved clypei and (usually) with a strongly and entirely reticulate propodeal triangle. *Andrena omnilaevis* can be recognised in the female sex by the unique combination of shiny, unshagreened terga, fovea that are not narrowed below, and tergal margins that are uniformly and regularly depressed, shiny, and unpunctured (Figure 9). Only two other Iberian species have shiny terga (though this is common in central and eastern European species e.g. *Andrena enslinella* Stoeckert, 1924 Schmid-Egger & Scheuchl 1997), *Andrena nana* (Kirby, 1802), which has fovea that narrow to half their maximum width at the level of the antennal insertions, and *Andrena floricola* Eversmann, 1852,

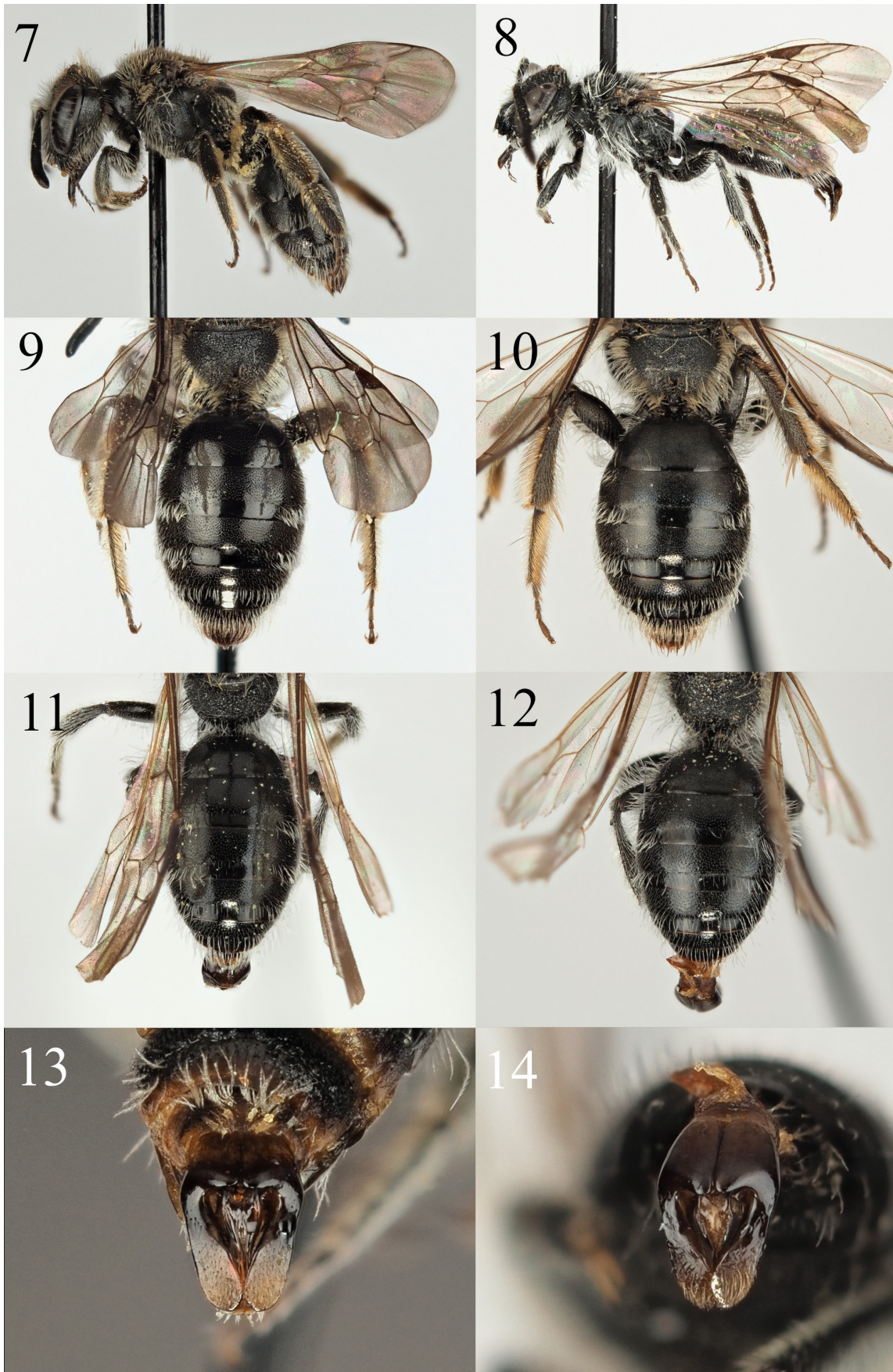
which does not have shiny depressed margins on T2–4 (in common with *A. nana*). *Andrena omnilaevis* is structurally closest to *Andrena semilaevis* which has the same regularly depressed, shiny, and unpunctured margins on T2–4. However, these strongly contrast with the surface of the tergal discs which are shagreened and dull (Figure 10), the feature behind its scientific name *semilaevis* (partially shiny). The male can be recognised with *A. semilaevis* by the combination of shiny depressed tergal margins (Figure 11) and an antennal segment 4 that is as long as wide, and then separated from it by the shiny, not dull, tergal discs (Figures 11–12). The genitalia are very similar, but the gonocoxal teeth are slightly less pronounced in *A. omnilaevis* in direct comparison (Figures 13–14).

Description: Female: Body length 6 mm (Figure 7). *Head:* Head 1.3 times wider than long. Clypeus densely but somewhat shallowly punctate, space between punctures less than 1 puncture diameter, underlying clypeal surface shagreened, weakly shining. Impunctate central midline generally but weakly present. Process of labrum trapezoidal, slightly wider than long, glossy. Fovea normal, at their zenith occupying half the space between compound eye and lateral ocellus, slightly narrowed below becoming 80% of maximal width at level of antennal insertions. Pubescence of face white, particularly around clypeus and antennal insertions to whitish brown on vertex. Antennae uniformly dark. *Mesosoma:* Scutum moderately punctured, punctures separated by 1–2 puncture diameters. Underlying surface slightly shagreened therefore moderately shining, particularly on scutellum. Scutum, scutellum, and immediately adjacent areas with short, light brownish hairs, episternum and sides of the propodeum with longer white hairs. Entire dorsal surface of propodeum reticulate in typical *Micrandrena* fashion, with propodeal triangle outlined by inconspicuous carina. Propodeal corbicula with stout, simple hairs. Legs dark, with white to light brownish pubescence. Scopal hairs white. *Metasoma:* Terga uniformly dark, without lightened margins, lacking shagreenation or reticulation, shiny (Figure 9). Tergal discs uniformly punctate, those on T2–4 separated by 1 puncture diameter, those on T1 by 2 puncture diameters. Apical margins of T1–4 impunctate and glossy, those on T2–4 strongly and uniformly depressed, most pronouncedly on T4. T2–4 with loose hair fringes of white hairs, those on T2–3 widely separated, that on T4 complete, though sparse. General pubescence of terga and sterna white, except for central apical fringe of T5–6 around pygidial plate which is dark brown. Pygidial plate small, pointed, with central longitudinal raised area.

Male: Body length 5.5–6 mm (Figure 8). *Head:* Head 1.3 times wider than long, compound eyes slightly convergent below. Clypeus densely punctate, spaces between punctures 1 puncture diameter, underlying clypeal surface weakly shagreened, shining more strongly than in female. Impunctate central line absent. Process of labrum cuboidal, as long as wide, weakly emarginate. Pubescence of head entirely white. Antennae uniformly dark, antennal segment 4 as long as broad, as long as segment 3. *Mesosoma:* Scutum moderately punctured, punctures separated by 2 puncture diameters. Underlying surface weakly shagreened therefore moderately shining, scutellum with shagreenation much weaker to absent and therefore clearly shiny. Pubescence entirely white. Dorsal surface of propodeum entirely reticulate as in female, propodeal triangle also marked with shallow carina. Legs dark, pubescence white. *Metasoma:* Terga uniformly dark, without lightened margins, shiny, particularly T1, with very weak shagreenation on discs of T2–5 (Figure 11). Tergal discs moderately punctate, punctures separated by 1–2 puncture diameters. Tergal margins impunctate and glossy, those on T2–4 strongly and uniformly depressed, most pronouncedly on T4. T2–4 with very loose white hair fringes, those on T2 widely separated, those on T3–4 complete but sparse. General pubescence of terga and sterna white, with only apical fringe of T6 darker brown. Genitalia simple (Figure 13), apical half of gonostyli with golden hairs, penis valve slightly flared out before base but not markedly widened.

Distribution: From the Sistema Central in western Spain (Sierra de Gredos) to central Portugal (Serra da Estrela), and north to northern Portugal (Serra do Gerês) and north-western Spain (Muniellos mountains).

Floral preferences: Six pollen loads are available, all of which contained pure *Sedum* pollen (Crassulaceae). Pollen loads were collected on the 13th and 14th of May (north Portugal), 24th of June (central Portugal, Serra da Estrela), 30th June (north Portugal), and the 12th of July (northern Spain, Galicia), so they span the known flight period of the species. This contrasts strongly with the foraging ecology of *A. semilaevis*, where analysis of 97 pollen loads from southern England showed that this species is polylectic with a strong preference for Apiaceae, collecting 73.5% of its pollen from this family and with Apiaceae pollen in 97.9% of analysed loads (Wood *et al.* 2016). The habitats where *A. omnilaevis* has been found are rocky, generally acidic uplands with little flowering Apiaceae, at least during May (TJW, *pers. obs.*). Instead, there is a great profusion of blossoming *Sedum* at this time. In all three Portuguese locations where the bee was captured in 2019, *A. omnilaevis* was flying with *Flavipanurgus kastiliensis* (Warncke, 1985), one of the only two currently known European bees that are specialists of *Sedum* species (Wood and Cross 2018) along with the recently described *Hoplitis galichiae* Müller, 2016 (Müller 2016). It is too early



FIGURES 7–14. *Andrena omnilaevis* **spec. nov.** 7. female profile, 8. male profile, 9. female terga, 11. male terga, 13. male genitalia; *Andrena semilaevis* Pérez, 1903, 10. female terga, 12. male terga, 14. male genitalia.

to say if *A. omnilaevis* is a specialist of *Sedum*, and indeed this may not be the case since the majority of *Micrandrena* species are polylectic even if some show preferences for certain botanical families at certain time of the year (Westrich 1989; Schwenninger 2009; Wood *et al.* 2016, but see Westrich 2010 for an example of oligolecty). What is clear is that based on the habitats in which it was found and the pollen analysis results so far, *A. omnilaevis* does not appear to share the foraging niche of its sister species.

Discussion: *Andrena omnilaevis* appears to be a univoltine bee with males and females emerging in May and flying into the beginning of July. It is known from upland areas of north-western Iberia, often in open acidic areas supporting flowering *Sedum* species, so far the only confirmed pollen host. We are confident that there is no previous type material referring to this taxon as north-western Iberia is historically under-recorded, and the only published synonym of *A. semilaevis* has its type locality in England (*Andrena saundersella* Perkins, 1914; Gusenleitner & Schwarz 2002), and that this species was therefore previously undescribed. Interestingly, in a survey of the Serra da Estrella, Kuhlmann (1996) reports an *Andrena* (*Micrandrena*) nov. spec. recognised by Warncke, but after taking possession of this material he died and it cannot be found in his collection (M. Kuhlmann *in litt.*). Given the location (Penhas da Saude, approximately 15 km from the Vale do Rossim) and the flight period (3–7.vi.1989) it is highly likely that this was the same taxon as *A. omnilaevis*.

It is beyond the scope of this paper to reproduce a modified key to Iberian *Micrandrena*, but following the key of Dardon *et al.* (2014) female material would key to couplet 3 where it can be easily separated on the basis of the depressed and shiny tergal margins. Male *A. omnilaevis* material would key to couplet 19 at which point its characters conflict as the base of the penis valve is not widened, but the tergal margins are impunctate. *Andrena omnilaevis* males can be separated at couplet 19 by the fourth antennal segment which is as long as broad, whereas for the other two taxa here it is shorter than broad.

Etymology: *Andrena semilaevis* means the one who is partially shiny, a reference to the shiny depressed rear margins of the otherwise shagreened terga. Because of the entirely shiny terga of this new taxon, the name *omni* (all) + *laevis* (shiny) was chosen both to reflect its different appearance and to refer back to its sister species.

Andrena (*Notandrena*) *foeniculae* Wood spec. nov.

Holotype: PORTUGAL: Ribatejo, Tomar, Aqueduto do Convento de Cristo, 39.6077, -8.4380, 18.ix.2019, 1♀, leg. Cross. Deposited in the OÖLM.

Paratypes: PORTUGAL: Algarve, Lagos, Salema, 9.ix.2018, 1♀, leg. Cross; Parque Natural da Arrábida, Santana, Estr. Fonte de Carvalho, 3.viii.2019, 1♀, leg. Wood; SPAIN: Malaga, Almogía, 2 km z. van dorp, 29.ix.1992, leg. W. Klein. Paratypes are retained in the collections of T.J. Wood, I. Cross, and in the Naturalis Biodiversity Center, Leiden.

Diagnosis: Seven species of *Notandrena* are known from Iberia—*A. chrysoseles* (Kirby, 1802), *A. erythrocnemis* Morawitz, 1870 (reported as *A. griseobalteata* Dours, 1872 by Ortiz-Sánchez 2011), *A. fulvicornis* Schenck, 1853, *A. langadensis* Warncke, 1965, *A. nitidiuscula* Schenck, 1853, *A. pallitarsis* Pérez, 1903, and *A. urdula* Warncke, 1965. *Andrena foeniculae* can instantly be separated from all these taxa by its small body size (8 mm, smaller than *A. erythrocnemis*, *A. langadensis*, and *A. urdula* which average 11–12 mm in length) in combination with the structure of the vertex, where the hind ocelli are separated from the hind margin of the vertex by greater than an ocellar diameter (Figure 17). This space is slightly depressed, shiny, and sparsely punctured. Within the smaller species it additionally has black legs (orange in *A. chrysoseles*) and lacks the distinctive shortened dorsal scopal hairs of *A. pallitarsis*. It is therefore closest to *A. fulvicornis* and *A. nitidiuscula* which both have short vertexes which are clearly less than the diameter of a lateral ocelli (Figures 19 and 21). Additionally, the mid line in the front half of the scutum is only weakly impressed (Figure 18), like *A. fulvicornis* (Figure 20), in contrast to *A. nitidiuscula* where it is clearly depressed (Figure 22).

Description: Female: Body length 8 mm (Figure 15). **Head:** Head 1.5 times wider than long. Clypeus domed, particularly below antennal insertions where it joins the protruding supraclypeal area. Clypeus moderately punctured, punctures separated by a distance of 1 puncture diameter except for the very centre where a faint impunctate line is present. Process of labrum wide and short, three times wider than long, fore margin widely but weakly emarginate. Pubescence of head uniformly white, sparse except on paraocular areas where it is moderately thick. Fovea not noticeably widened or narrowed, occupying half the paraocular area. Vertex noticeably elongated, distance from a lateral ocellus to hind margin of vertex 1.5 ocellar diameters, clearly longer than one ocellar diameter (Figure 17).

Vertex slightly depressed sparsely punctate with large punctures, punctures separated by 2–3 puncture diameters, thus contrasting strongly with the punctures at the apex of the fovea which are dense and separated by less than a puncture diameter (Figure 17). Gena moderately wide, slightly wider than the width of the compound eye. Top of gena joining vertex clearly shiny and thickened, the hind margin of vertex therefore forming a U-shaped curve (Figure 17). *Mesosoma*: Scutum moderately but irregularly punctured, punctures separated by 1–2 puncture diameters, punctures around edges denser, separated by less than a puncture diameter. Underlying surface shagreened, weakly shining. Central line in anterior half of scutum only weakly impressed. Scutellum very sparsely punctured in centre, punctures largely confined to edges and very slightly impressed central line. Scutum, scutellum, episternum, and propodeum with sparse whitish hairs. Propodeal corbiculae with a few long, simple hairs. Dorsal surface of propodeum reticulate. Propodeal triangle marked with weak carina, basal two thirds of propodeal triangle with stronger and more pronounced reticulation to slightly rugose. Legs black, pubescence whitish except for apex of tarsi 2 and inner faces of basitarti which are brownish orange. Scopal hairs white. *Metasoma*: Terga dark with apical quarter to third of marginal area translucent brown (Figure 16). T2–4 deeply punctate with punctures separated by 1 puncture diameter. T1 similarly densely punctate on the marginal zone, punctures on disc more sparse, separated by 2–3 diameters, declivity impunctate. Underlying surface of T1–4 smooth and shiny, T5 with weaker punctures, underlying surface strongly shagreened. Terga with apical bands of short white pubescence around half the length of the marginal areas. T1 with only flecks at corners, band on T2 widely interrupted, those on T3–4 complete. General pubescence of terga and sterna white with the exception of dark brown central hairs of T5 and T6 flanking pygidial plate. Pygidial plate flat and broad with slightly raised margins, densely punctate in a semi-circular pattern, punctures almost touching.

Male: Unknown.

Distribution: Central and southern Portugal and southern Spain.

Floral preferences: The species has exclusively been collected from *Foeniculum vulgare*. Pollen analysis of two loads were composed of pure *Foeniculum* pollen. The species is highly likely to be broadly oligolectic on Apiaceae like other summer-only active *Notandrena* such as *A. erythrocnemis*, *A. nitidiuscula*, and *A. pallitarsis* (Dylewska 1987; Westrich 1989; Schmid-Egger & Scheuchl 1997, Table 1). Searching of other flowering Apiaceae during August and September may reveal other pollen hosts, though *Foeniculum* is by far and away the dominant flowering Apiaceae in southern Iberia during this time.

Discussion: In Iberia, *A. chrysoseles*, *A. erythrocnemis*, and *A. pallitarsis* are restricted to the area around the Pyrenees (Gusenleitner & Schwarz 2002). Furthermore, *A. langadensis* and *A. urdula* fly only in the spring, leaving only *A. nitidiuscula* and *A. fulvicornis* active in the heat of the summer (Table 1). Against this context, it makes sense that this new species is closer to these summer-active taxa rather than *A. langadensis* and *A. urdula* which are, in addition to their spring phenology, geographically restricted (in Iberia) to central Spain (Warncke 1976).

TABLE 1. Flight period and lecty status for Iberian *Notandrena* species.

Species	Flight period	Lecty	Reference(s)
<i>Andrena chrysoseles</i> (Kirby, 1802)	April–June	Polylectic	Westrich (1989); Wood <i>et al.</i> (2016)
<i>Andrena erythrocnemis</i> Morawitz, 1870	June–July	Probably oligolectic (Apiaceae)	Dylewska (1987), TJW <i>unpublished data</i>
<i>Andrena foeniculae</i> spec. nov.	August–September	Probably oligolectic (Apiaceae)	Current paper
<i>Andrena fulvicornis</i> Schenck, 1853	March–August in two generations	Oligolectic (Apiaceae)	Schmid–Egger & Doczkal (1995)
<i>Andrena langadensis</i> Warncke, 1965	April–June	Unknown	Warncke (1976)
<i>Andrena nitidiuscula</i> Schenck, 1853	July–August	Oligolectic (Apiaceae)	Westrich (1989); Schmid–Egger & Doczkal (1995)
<i>Andrena pallitarsis</i> Pérez, 1903	July–August	Oligolectic (Apiaceae)	Schmid–Egger & Scheuchl (1997)
<i>Andrena urdula</i> Warncke, 1965	April–June	Unknown	Warncke (1976)



FIGURES 15–22. *Andrena foeniculae* **spec. nov.** 15. female profile, 16. female terga, 17. female vertex, 18. female scutum. *Andrena fulvicornis* Schenck, 1853, 19. female vertex, 20. female scutum. *Andrena nitidiuscula* Schenck, 1853, 21. female vertex 22. female scutum.

Etymology: The specific epithet *foeniculae* comes from its only currently known host plant, *Foeniculum vulgare*. In Portugal, this is one of the most common late summer flowering plants, attracting great numbers of aculeates late into September.

Key to Iberian *Notandrena* females

This key is based on a modification of the key to the *nitidiuscula*-group presented by Schmid-Egger & Scheuchl (1997).

1. Scutum with very dense and even punctation across the entire surface of the disc, punctures separated by much less than the diameter of a puncture, in some cases nearly touching. Underlying integument strongly shagreened and dull *erythrocnemis* Morawitz
- Scutum with moderate and uneven punctation, punctures separated by 1–3 puncture diameters in some cases. If occasional punctures are close to touching, then this is not consistently replicated across the whole scutum, with other punctures being separated by a clear distance. Underlying integument variable, from shagreened to shining 2
2. Hind tibia and all tarsi completely orange *chrysoceles* (Kirby)
- Hind tibia black, tarsi may be black or orange 3
3. Larger species, body length 11–12 mm 4
- Smaller species, body length 7–10 mm 5
4. Pronotum laterally with a clear fold forming a keel comparable in strength to that found in the subgenus *Andrena* sensu stricto. Clypeus densely punctured, underlying surface smooth but not shiny. Hairs surrounding pygidial plate golden orange. *langadensis* Warncke
- Pronotum laterally with a very weak keel, almost absent, therefore appearing predominantly rounded. Clypeus densely punctured, underlying surface weakly shining, shagreened, only the front edge almost smooth. Hairs surrounding pygidial plate dark brown *urdula* Warncke
5. Tibial scopa, when viewed from the hind face, dorsally short and thick, hair length only 1–1.5 ocellar diameters, clearly shorter than the scopal hairs ventrally *pallitarsis* Pérez
- Tibial scopa equally long on the dorsal and ventral sides, at least as long as two ocellar diameters. 6
6. Vertex clearly elongate, the hind ocelli separated from the margin of the vertex by a distance greater than the diameter of a lateral ocellus (Figure 17). Genae enlarged so that the hind margin of the vertex forms a weak U-shape (Figure 17). *foeniculae* spec. nov.
- Vertex not elongate, the hind ocelli separated from the margin of the vertex by a distance clearly less than the diameter of a lateral ocellus (Figures 19 and 21). Hind margin of the vertex in comparison almost straight 7
7. Central line in the front half of the scutum only weakly impressed (Figure 20). Scutellum more densely punctured (Figure 20). Hind basitarsi orange *fulvicornis* Schenck
- Central line in the front half of the scutum strongly impressed (Figure 22). Scutellum less densely punctate, particularly around the central line (Figure 22). Hind basitarsi dark. *nitidiuscula* Schenck

3.2 Species newly recorded for Portugal

ANDRENIDAE

Andrena (Andrena) synadelpha Perkins, 1914

Distribution: Northern and central Europe, with a scattered southern distribution into Spain and Turkey (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Trás-os-Montes, Paradela, 1 km south, M308-4, 12.v.2019, 1♀; Minho, Serra do Gerês, Cascata de Leonte, 13.v.2019, 1♂; Minho, Estorãos, Parque de Merendas do Passadouro, 14.v.2019, 1♀; Minho, Castro Laboreiro, 15.v.2019, 1♀, all det. & leg. Wood.

Notes: Found frequently in wooded areas in northern Portugal, this species has clearly been previously overlooked, perhaps due to its association with broadleaf woodland where it is known to forage extensively from woody plants such as *Acer*, *Rubus*, *Crataegus*, *Quercus*, *Rhamnus*, *Frangula* and *Ilex* (Wood and Roberts 2017). In Portugal, this habitat type is found only in the north of the country.

Andrena (Carandrena) leucophaea Lepeletier, 1841

Distribution: Spain, Italy, and Algeria (Gusenleitner & Schwarz 2002).

New data: Pombal, Pelariga, Vêrigo, 26.i.2019, 1♂; 24.ii.2019, 1♀; 2.iii.2019, 1♀, all det. Wood, leg. H. Gaspar.

Notes: The very early flight period probably explains why this species has been overlooked until now.

***Andrena (Cryptandrena) ventricosa* Dours, 1873**

Distribution: Southern Europe, North Africa and the Near East (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Alto Alentejo, Foros de Vale Figueira, Montemor-o-Novo, 20.iii.2019, 1♀, det. and leg. Wood.

Notes: *Nomada tridentirostris* Dours, 1873, the brood parasite of *A. ventricosa* (Smit 2018), has been recorded in Portugal since 2014 (Baldock 2018), so the presence of the widespread *A. ventricosa* is not unexpected.

***Andrena (Hoplendrena) rosae* Panzer, 1801**

Distribution: Central, northern, and eastern Europe with scattered populations in southern Europe and Turkey (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Minho, Castro Laboreiro, 15.v.2019, 2♂, det. & leg. Wood.

Notes: We follow the interpretation of Reemer *et al.* (2008) who treat *A. stragulata* Illiger, 1806 as the spring generation of *A. rosae*.

***Andrena (Leucandrena) barbilabris* (Kirby, 1802)**

Distribution: Europe to North America, with scattered European populations south to Spain, Italy, and Greece (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Algarve, Carrapateira, 7.iii.2015, 3♂, 3♀, det. Wood, leg. Cross (previously reported in Baldock *et al.* (2018) as *Andrena leptopyga* Pérez); Algarve, Praia da Bordeira, 14.iii.2019, 1♀, det. Wood, leg. A. Soares, P. Garcia Pereira, R. Félix, F. Barros.

Notes: This taxon is known from northern Spain, and so its presence was considered unlikely in southwestern Portugal, and the material from 2015 was confused with *A. leptopyga* which is present elsewhere in Portugal. The true presence of *A. barbilabris* in Portugal solves two mysteries, namely the presence of *Sphecodes pellucidus* Smith, 1845 and *Nomada alboguttata* Herrich-Schäffer, 1839, both of which are brood parasites strongly, if not obligately, associated with *A. barbilabris* (Bogusch & Straka 2012; Smit 2018). The presence of this seemingly isolated population in the Algarve is surprising, but as *N. alboguttata* has been reported from the Setúbal peninsula (Baldock *et al.* 2018), *A. barbilabris* is probably more widespread in Portugal but under-recorded due to its early flight period.

***Andrena (Lepidandrena) paucisquama* Noskiewicz, 1924**

Distribution: Eastern Europe and Turkey with scattered populations in the south of France and Spain (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Alto Alentejo, Reguengos, Cerros, near to Restaurante Herdade do Esporão, 2–3.v.2019, 1♀; 15–16.v.2019, 1♀; both det. Wood, leg. C. Figueiredo.

Notes: Though *A. paucisquama* was recorded in Iberia only from southern Spain by Warneke (Gusenleitner & Schwarz 2002), it is known from the Picos de Europa (D. Baldock collection, det. E. Scheuchl) and so its appearance in Portugal is not unexpected.

***Andrena (Leucandrena) parviceps* Kriechbaumer, 1873**

Distribution: Southern Europe to the Caucasus (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Alto Alentejo, Foros de Vale Figueira, Montemor-o-Novo, 20.iii.2019, 1♂, det. and leg. Wood.

***Andrena (Melanapis) fuscata* Erichson, 1835**

Distribution: Mediterranean basin into Asia (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Minho, Confurco, Várzea Cova, 14.v.2019, 1♀; Trás-os-Montes, Sapiãos, N103, 16.v.2019, 2♂, all det. & leg. Wood.

***Andrena (Micrandrena) saxonica* Stoeckhert, 1935**

Distribution: Spain to central Europe and eastwards to Bulgaria (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Alto Alentejo, Montemor-o-Novo, Foros de Vale de Figueira, 13.v.2016, 1♀, det. B. Tomozii, leg. A. Albernaz-Valente; Alto Alentejo, Castelo Vide, 3.v.2019, 1♂, 2♀, det. Wood, leg. R. Felix, F. Barros, A. Gonçalves, R. Costa.

Notes: A widespread species generally uncommonly collected in Iberia. However, the species is known from Andalucía (Dardon 2014) and it may generally be overlooked and under-recorded. Another species that is narrowly oligolectic on *Ornithogalum* (Westrich 2010) which may contribute to its previous lack of records.

***Andrena (Notandrena) nitidiuscula* Schenck, 1853**

Distribution and notes: The true distribution of *A. nitidiuscula* is unclear. Historically, the two taxa *A. nitidiuscula* and *A. fulvicornis* were considered synonymous and distribution maps often combined both taxa (e.g. Gusenleitner & Schwarz 2002). However, they were separated by Schmid-Egger & Doczkal (1995), a position that is supported by more recent genetic work (Benon & Praz 2016), see also Schwenninger (2013) for designation of Lectotype. *Andrena fulvicornis* is bivoltine, flying in the spring and the summer, whereas *A. nitidiuscula* is univoltine and flies only in the summer. *Andrena nitidiuscula* is the more northerly of the taxa, reaching southern Britain (Else and Edwards 2018), with *A. fulvicornis* the more southerly taxa which is confirmed as far north as southern Germany and Switzerland (Schmid-Egger & Doczkal 1995; Benon & Praz 2016). Until now, all material that we had examined from Portugal conformed to *A. fulvicornis*, but this record confirms that both taxa are present.

New data: PORTUGAL: Beira Litoral, Aguada, Ribiero Agueda, Talhada, 24.vii.2018, 1♀, det. Wood, leg. M. & E. Howe.

Other material examined: Senckenberg, Frankfurt (*Andrena fulvicornis*): no collection details, 1♀, (Neotype, designated by Schwenninger in 2012); (*Andrena nitidiuscula*): no collection details, 1♀, (Lectotype, designated by Schwenninger in 2013).

***Andrena (Trachandrena) haemorrhoea* (Fabricius, 1781)**

Distribution: Europe, North Africa, and Asia (Gusenleitner & Schwarz 2002; Cherair *et al.* 2013).

New data: PORTUGAL: Minho, Estorãos, Parque de Merendas do Passadouro, 14.v.2019, 1♀; Minho, Castro Laboreiro, 15.v.2019, 1♀, 5♂, all det. & leg. Wood.

Notes: The presence of *A. haemorrhoea* in Portugal was expected, as its obligate brood parasite *Nomada ruficornis* (L.) has been recorded from northern Portugal historically (Baldock *et al.* 2018).

***Andrena (Truncandrena) doursana* Dufour, 1853 *citreola* Warncke, 1975**

Distribution: Iberia, North Africa, and the Near East (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Baixo Alentejo, Ebio Noudar, 11.v.2019, 1♂, det. Wood, leg. A. Soares, A. Gonçalves, R. Felix, F. Barros.

Notes: The subspecies called *citreola* was previously known from a few specimens from central and southern Spain. Its presence in Portugal is therefore not unexpected.

***Andrena (Truncandrena) medeninensis* Pérez, 1985 *donata* Warncke, 1967**

Distribution: Iberia, North Africa, Cyprus and Turkey, with subspecies *donata* restricted to Iberia (Gusenleitner & Schwarz 2002).

New data: PORTUGAL: Alto Alentejo, Reguengos, Cerros, near to Restaurante Herdade do Esporão, 21–22.iii.2019, 1♀, det. Wood, leg. C. Figueiredo.

Notes: There are major differences between the subspecies of *A. medeninensis* described by Warncke, though for now they are all united in the female under the distinctive arched but broadly flattened clypeus that is densely punctured with the exception of a clear longitudinal unpunctate midline in combination with an evenly triangular labrum. This potential species complex requires further investigation.

***Panurgus (Panurgus) dentipes* Latreille, 1811**

Distribution: Western Europe, from Iberia north to Belgium and east to Germany and Italy (Patiny 2012b).

Data (presented in map form by Patiny (2012b)): PORTUGAL: Beira Alta, Tábua, 9.vii.1985, 1♀, det. S. Patiny; Estremadura, Caldas da Rainha, 14.v.1958, 1♂, det. K. Schwammberger; Algarve, Loulé, Ludo, 7.vi.1980, 1♀, det. S. Patiny. All specimens at the Naturalis Biodiversity Center, Leiden.

Notes: This species was not originally included in the list of Baldock *et al.* (2018) due to uncertainty over its identity and an inability to confirm the details of exact records.

HALICTIDAE

Lasioglossum (Hemihalictus) corvinum (Morawitz, 1878)

Distribution: Europe to Armenia and Turkey, and Morocco (Pauly 2016a).

New data: PORTUGAL: Algarve, Burgau, Barrancão, 18.v.2018, 1♀, det. & leg. Cross.

Notes: This long-faced species seems to be associated with Dipsacaceae, with the only confirmed pollen that we have seen collected coming from *Scabiosa atropurpurea* and *Cephalaria leucantha*.

Halictus (Seladonia) submediterraneus Pauly, 2015

Distribution: Europe to Turkey and Iran (Pauly *et al.* 2015).

New data: PORTUGAL: Porto, Leca de Palmeira, 3.viii.1962, 1♂, leg. J. Abraham & L. Horacsek (BMNH; Pauly *et al.* 2015); Sesimbra, Santana, Estr. Fonte de Carvalho, 3.viii.2019, 1♂, det. & leg. Wood.

Notes: Pauly *et al.* (2015) separated *H. submediterraneus* from *H. smaragdulus* s.s. (Vachal, 1895) on genetic and morphological differences, most clearly in the male genitalia. *Halictus submediterraneus* was not listed in Baldock *et al.* (2018) due to uncertainty about how to separate the two taxa. Both species occur in Portugal, but their relative frequency and full distributions are currently unknown as females are morphologically inseparable. In Portugal, confirmed males are currently known only from the west coast.

Halictus (Halictus) quadripartitus Blüthgen, 1923

Distribution: Iberian endemic (Ortiz-Sánchez & Pauly 2017).

New data: PORTUGAL: Algarve, Ribeira de Seixe, Zambujeira de Baixo, 26.vii.2015, 2♂; Baixo Alentejo, Cercal, Janeirinha de Cima, 23.vii.2016, 2♂; Baixo Alentejo, Praia de Odeceixe, saltmarsh, 26.vii.2016, 1♂; Baixo Alentejo, Ribiera do Torgal, 21♂, all det. Wood, leg. M. & E. Howe; Alto Alentejo, Reguengos, Cerros, near to Restaurante Herdade do Esporão, 2–3.vi.2019, 1♂, det. Wood, leg. C. Figueiredo.

Notes: The species was not accepted as present in Portugal by Baldock *et al.* (2018) because no male material could be found, and female material cannot be identified with confidence from other members of the *crenicornis*-group. These series of males confirm that the species is indeed present in southern Portugal.

Halictus (Halictus) tridivisus Blüthgen, 1923

Distribution: France, Spain, and Portugal (Ortiz-Sánchez & Pauly 2017).

New data: Ortiz-Sánchez & Pauly (2017): PORTUGAL: Lagoa, near Fafe, 16–26.vii.1994, 11♂, 1♀, det. Pauly, M. Schwarz Colln (OÖLM).

Notes: Another species in the *crenicornis*-group, female material cannot be identified with confidence.

Sphecodes niger von Hagens, 1874

Distribution: Spain to Ukraine and Turkey, absent from North Africa (Bogusch & Straka 2012).

New data: PORTUGAL: Guimarães, 7.v.1990, 1♀, det. M. Schwarz, leg. F. Gusenleitner, OÖLM.

Notes: Reported as new to Portugal by Scheuchl & Willner (2016), but without precise specimen details.

MEGACHILIDAE

Afranthidium (Mesanthidium) carduele (Morawitz, 1876) *malacopygum* (Gribodo, 1894)

Distribution: *Afranthidium carduele* is distributed in Spain and North Africa to Greece, Bulgaria, Turkey, the Caucasus, and the Middle East (Aguib *et al.* 2010). The subspecies *malacopygum* is found in Iberia, Morocco, and Algeria, and *carduele* s.s. is found in the eastern part of the range.

New data: PORTUGAL: Trás-os-Montes, Bragança, França, 25.vii.2018, 1♀, det. G. Le Goff, leg. R. Andrade.

Notes: The status of subspecies *malacopygum* may need to be revised in the future given the non-overlapping West Mediterranean distribution compared to the easterly distribution of the subspecies *carduele* s.s.

Pseudoanthidium (Royanthidium) reticulatum Mocsáry, 1884

Distribution: Northwestern Africa, and southern Europe from Spain to the Caucasus (Kuhlmann *et al.* 2020).

New data: PORTUGAL: Trás-os-Montes, Bragança, Serra de Nogueira, 16.viii.2019, 1♂, det. J. Litman, leg. A. Soares, R. Santos, S. Pina, T. Moreira.

***Stelis (Heterostelis) hispanica* Dusmet y Alonso, 1921**

Distribution: Known only from the holotype female collected from ‘Valadol 14.vi.[18]92’, presumably Valladolid in northwestern Spain (Schwarz and Gusenleitner 2010; Kasperek 2015).

New data: PORTUGAL: Beira Atla, Sabugal, 20.vi.2019, 1♂, det. Wood, leg. A. Soares, R. Santos, R. Felix, R. Ramirez. Deposited in the OÖLM (Figure 23).

Notes: *Stelis hispanica* was resurrected from synonymy with *Stelis annulata* (Lepelletier, 1841) by Schwarz and Gusenleitner (2010) who cited multiple differences. However, as only the holotype was known it was difficult to judge potential variation within this species, and whether it might fall within the variation seen in *S. annulata*. Examination of newly caught male material approximately 250 km from the *locus typicus* shows that *S. hispanica* is clearly distinct from *S. annulata*, supporting the position of Schwarz and Gusenleitner. The male is described here for the first time.

Description: Male: Body length 11 mm (Figure 23). *Head:* Head as broad as long, round in frontal view. Gena and vertex enlarged, gena near occiput 1.2 times wider than maximal width of compound eye. Vertex greatly enlarged, longer than ocellular distance. Paraocular area with thin yellow mark that widens slightly near lateral margin of clypeus; greatest width less than half antennocular distance. Clypeus centrally with a transverse yellow marking that does not reach paraocular markings, the three yellow marks on the face therefore separated. Face, gena, and vertex with fine whitish to brownish pubescence, longest hairs equalling the length of scape. Facial integument clearly and consistently punctured, punctures almost touching, interspaces near lateral ocelli separated by 0.5 puncture diameters. Malar space linear. Mandibles black, bidentate. *Mesosoma:* Mesosoma entirely black (Figure 25). Axillae rounded, slightly protruding, outer margin not smoothly contiguous with the scutellum. Mesosoma with moderately long brownish pubescence, shorter than that of face, individual hairs less than length of scape. Scutum, scutellum, axillae, episternum, and propodeum clearly and densely punctate, punctures almost touching, interspaces shiny, except propodeal declivity with central impunctate section. Femora black with apex orange, tibiae and tarsi orange with yellow highlights at base and apex of tibiae. Tarsal claws dark brown, apically bifid. Wings generally dark, infumate, with black venation. *Metasoma:* Terga black, T1–3 with pairs of yellow markings clearly interrupted medially (Figure 23), T4 with markings touching, T5 with markings contiguous. T6 with a central yellow marking (Figure 24). T7 weakly tripartite with two weak lateral lobes and a central projection with a longitudinal carina. All terga densely punctured, punctures on tergal margins almost touching, those on disc separated by 0.75–1 puncture diameters. Sterna black, S3 and S4 with long fringes of orange setae (Figure 26), S4 medially and apically with black comb made up of short, thick hairs. Comb 3 times wider than long, occupying approximately a quarter of the sternal margin. S5 deeply emarginate, forming a V shape. Terga and sterna with general brownish pubescence, at most equalling length of hairs on the mesosoma.

Notes: Using the key of Kasperek (2015), the male of *S. hispanica* keys to couplet 21 due to its yellow tergal colouration, its lack of a claw-like inner spine on the fore tibia, its large size, and its deeply emarginate S5. Here it can be separated from *S. annulata* as the latter has the axillae and scutellum marked with yellow (Figure 27) and the dark comb of S4 is narrow, longer than wide (Figure 28). It can be separated from *S. gigantea* Friese, 1921 because the axillae are not produced into blunt teeth (Figure 29) and whilst the dark comb of S4 is similarly wide, the hind margin of S2 is strongly emarginate in *S. gigantea* (Figure 30) whereas the hind margin of S2 is only weakly emarginate in *S. hispanica* (Figure 26). Nothing is known about its host, but given its similarity to *S. annulata* and *S. gigantea*, presumably a species of *Trachusa* (Megachilidae) is used.

***Hoplitis (Hoplitis) tkalcuella* Le Goff, 2003**

Distribution: South-eastern Spain (Le Goff 2003).

New data: Algarve, Cacela Velha, 11.iv.2017, 1♂, det. & leg. Cross

Notes: The only other member of the *Annosmia* group in Iberia, the other being *Hoplitis (Hoplitis) annulata* (Latreille, 1811), this species was described from the Alicante region of Spain. Male specimens can easily be separated based on the structure of the antennae and genitalia (Le Goff 2003). It is perhaps slightly surprising to find it on the other side of the Iberian Peninsula but, given its recent description and lack of records, the species is probably widespread but unrecorded across Andalucía.

***Osmia (Osmia) cornuta* (Latreille, 1805)**

Distribution: West Palearctic (Müller 2020).

New data: Beira Alta, Escalhão, 10.iii.2019, 1♂, det. Wood, phot. A. Jorge.

Notes: Found throughout Spain south to Andalucía (A. Müller *in litt*), the presence of *O. cornuta* in Portugal was not unexpected. It may have been overlooked due to its early flight period.

***Coelioxys (Allocoelioxys) polycentris* Förster, 1853**

Distribution: Europe from Spain to Turkey (Warncke 1992).

New data: Baixo Alentejo, Praia de Odeceixe, saltmarsh, 21.vii.2016, 1♂, det. Cross, leg. M. & E. Howe

Notes: Originally listed in Baldock *et al.* (2018) on the basis of Warncke's revision (Warncke, 1992), this manuscript does not actually present any specific records from Portugal or actually include Portugal in its maps. However, the species is indeed present in Portugal, so it is retained on the national list.

***Coelioxys (Coelioxys) aurolimbatus* Förster, 1853**

Distribution: Northwestern Africa and Europe east to Turkey and Russia (Kuhlmann *et al.* 2020).

New data: PORTUGAL: Beira Litoral, Tomar, Nossa Senhora das Lapas, 21.v.2019, 1♀, leg. R. Félix, S. Antunes, S. Mendes, A. Gonçalves.

Notes: The parasite of *Megachile ericetorum* which has been recorded across Portugal (Baldock *et al.* 2018).

APIDAE

***Bombus (Thoracobombus) sylvarum* (Linnaeus, 1761)**

Distribution: Europe north to southern Scandinavia, though absent from southern Iberia and most Mediterranean Islands (Rasmont and Iserbyt 2014).

New data: PORTUGAL: Trás-os-Montes, Vila Real, Contim, 16.vi.2019, 1♀ (queen); Vila Real, Serra do Larouco, 7.ix.2019, 1♀ (worker); Minho, Viana do Castelo, Castro Laboreiro, 8.ix.2019, 1♀ (worker); Viana do Castelo, Gavieira, 8.ix.2019, 1♀ (worker), all det. & leg. L. Castro

Notes: *Bombus sylvarum* is known from central and northern Spain extending to the Portuguese border. Its presence in northern Portugal is therefore not unexpected.

***Bombus (Psithyrus) bohemicus* Seidl, 1837**

Distribution: Throughout Europe, though avoiding warmer areas such as the Mediterranean, through the Palearctic to North America (Rasmont and Iserbyt 2014).

New data: PORTUGAL: Trás-os-Montes, São Martinho de Anta, Vila Real, undated, 3♂, leg. C. & O. Vogt, Naturalis, Leiden, ZMA.INS.638813.

Notes: The specimens are undated, though it is noted that they were accepted into the Amsterdam Museum collection in 1960. Vogt was very active in the early part of the 20th century, so the specimens may well be over 100 years old. Two known hosts, *B. lucorum* (L.) and *B. magnus* (Vogt, 1911) are present in northern Portugal (Baldock *et al.* 2018).

***Bombus (Psithyrus) rupestris* (Fabricius, 1793)**

Distribution: Europe, from northern Spain north to Britain and Finland and west to Turkey and Russia (Rasmont and Iserbyt 2014).

New data: PORTUGAL: Beira Baixa, Serra do Açor, 29.vi.2019, 1♂, det. Wood, leg. R. Félix, A. Soares, R. Santos, R. Ramirez.

Notes: Inquiline of *Bombus lapidarius* and other *Melanobombus* (Rasmont and Iserbyt 2014). *Bombus lapidarius* (Linnaeus, 1758) can be abundant in northern Portugal, and was common at the site of this capture.

***Nomada bluethgeni* Stoeckhert, 1943**

Distribution: Europe (Smit 2018).

New data: PORTUGAL: Santarem, 17.viii.1975, 1♀, leg. J. Smit, leg. N. Mendonça, Museu Bocage, Lisbon; Algarve, Tareja, 28.iv.1991, 1♀, det. J. Smit, leg. C.T. van Joh, Naturalis, Leiden.

Notes: Listed in Smit (2018) but not in Baldock *et al.* (2018). Bivoltine, attacking *Lasioglossum* species probably including *Lasioglossum marginellum* (Schenck, 1853) in Germany (Stoeckhert 1943), though this species has not yet been recorded in Portugal.

***Nomada corcyraea* Schmiedeknecht, 1882**

Distribution: Southern Europe (Smit 2018).

New data: PORTUGAL: Algarve, Alvor, 18.iii.1991, 1♀, det. J. Smit, leg. W. Klein, W. Klein Colln.

Notes: Listed in Smit (2018) but not in Baldock *et al.* (2018). Nothing is known about the host(s).

***Nomada piccioliana* Magretti, 1883**

Distribution: Europe, Turkey, and the Caucasus (Smit 2018).

New data: PORTUGAL: Trás-os-Montes, Cabril, CM1021, 12.v.2019, 1♂, det. Wood/J. Smit, leg. Wood.

Notes: *Nomada piccioliana* is the brood parasite of *Andrena combinata* (Smit 2018) which is widespread but infrequently recorded throughout Portugal (Baldock *et al.* 2018).

***Epeolus cruciger* (Panzer, 1799)**

Distribution: Throughout Europe (Bogusch & Hadrava 2018).

New data: PORTUGAL: Algarve, Aljezur, Medo da Pipa, 30.ix.2018, 1♂, det. & leg. Cross.

Notes: *Epeolus cruciger* is probably a complex of species or races, with at least one race attacking *Colletes succinctus* (L.) and one race attacking *Colletes marginatus* Smith (Bogusch & Hadrava 2018). Frustratingly, both taxa were present at the Portuguese site, making identification of the host challenging, though the presence of a male at this late date might suggest *C. succinctus*.

***Epeolus fasciatus* Friese, 1895**

Distribution: Europe to the Middle East (Bogusch & Hadrava 2018).

New data: Bogusch & Hadrava (2018): PORTUGAL: Algarve, 1973, OÖLM/M. Schwarz Colln.; Estremadura, Covo do Vapor, 1951, OÖLM/M. Schwarz Colln.

***Epeolus productulus* Bischoff, 1930**

Distribution: Southern Europe (Bogusch & Hadrava 2018).

New data: Bogusch & Hadrava (2018): PORTUGAL: Estremadura, Caparica, 1982, leg. K.M. Guichard, Natural History Museum London.

***Eucera (Synhalonia) tricincta* Erichson, 1835**

Distribution: Scattered distribution from Iberia and Morocco through North Africa, the Near East, and Eastern Europe.

New data: PORTUGAL: Baixo Alentejo, São Torpes, Sines, 10.v.1986, 1♂, det. S. Risch, leg. K. Warncke, OÖLM.

Notes: *Eucera tricincta* was not counted in the total of Baldock *et al.* (2018) even though the species was listed by Kuhlmann *et al.* (2020) because of uncertainty about the precise details of the record.

***Anthophora (Pyganthophora) leucophaea* Pérez, 1879**

Distribution: France, Spain, Italy, and Algeria (Rasmont 2014).

New data: PORTUGAL: Algarve, Sagres, Praia do Tonel, 29.iii.2005, 1♂, det. Rasmont, leg. M. & E. Howe.

3.3 Taxa raised to full species status

ANDRENIDAE

***Flavipanurgus kastiliensis* (Warncke, 1985)**

Distribution: Spain and Portugal only (Patiny 2012a; Cross & Wood 2018).

Notes: Originally described from northern Iberia as a subspecies of *Flavipanurgus ibericus* (Warncke, 1972), *F. kastiliensis* was raised to species status by Cross & Wood (2018) due to distinct genetic, dietary, and distributional differences. *Flavipanurgus kastiliensis* is an oligolege of *Sedum* (Crassulaceae), whereas *F. ibericus* is an oligolege of *Jasione* (Campanulaceae). *Flavipanurgus kastiliensis* is known from northern Portugal with 13 confirmed records from Minho and Trás-os-montes provinces between 2014 and 2019, and the species can be easily found in northern hilly areas wherever *Sedum* species grow in abundance.

HALICTIDAE

Sphcodes rubripes Spinola, 1839

Distribution: South-west Europe, North Africa, Cyprus, and the Near East (Astafurova *et al.* 2019).

Notes: Warncke (1992) considered *S. rubripes* to be a subspecies of *Sphcodes albilabris* (Fabricius, 1793). However, it has several morphological and ecological differences (Bogusch & Straka 2012; Cross 2017; Astafurova *et al.* 2019) and should be considered a valid species (Bogusch & Straka 2014). In Portugal, *S. rubripes* is known only from the Algarve where it is a parasite of *Eucera nigrilabris* Lepeletier, 1841 (Cross 2017), whereas *S. albilabris* sensu stricto is found throughout the country.

3.4 Changes to the identity of taxa previously recorded from Portugal

ANDRENIDAE

Andrena (Melandrena) nitida (Müller, 1776)

Distribution: Europe (Gusenleitner & Schwarz 2002), though highly confused and subject to revision.

Discussion: The identity of the large predominantly black and brown *Andrena* in Europe and the Mediterranean basin continues to pose problems. Of these, *Andrena nitida*, *A. thoracica* (Fabricius, 1775), and *Andrena limata* Smith, 1853 have been particularly confused, with numerous subspecies and combinations proposed. *Andrena limata mixtura* Warncke, 1967 (Figures 31–32) was originally described with a locus typicus in central Portugal (Warncke, 1967). However, with no written justification, he later formally moved the subspecies to *A. nitida* (Warncke 1976, though because of publication delays he actually used this combination a year before in a treatment on North Africa, Warncke 1974). This confusion persisted to Gusenleitner & Schwarz (2002), who although they list the name *mixtura* as a synonym of *A. limata*, the distribution map of Warncke that they present is for *A. nitida* with material in central and southern Iberia and north-western Africa separated as *A. n. mixtura*.

Examining the type series directly, the holotype of *A. l. mixtura* has dark hairs on the propodeum (Figure 33), the defining characteristic as proposed by Warncke (1967). However, this is not consistent and two of the paratype females (Playa de Aro, Gerona, Spain; Catalonia, Beceite, Spain) have light brown hairs on the propodeum, with the specimen from Beceite almost entirely brown haired on the propodeum. The hind tibial spine is pale red (Figure 34), in line with both *A. nitida* and *A. limata*. Recent records of *A. limata* from central Portugal close to the locus typicus show variation in the extent of black hairs on the propodeum. These Portuguese individuals also show bivoltine behaviour which is typical for *A. limata* but not for *A. nitida* which flies only in the spring, and the type series contains both spring and summer individuals (e.g. from Catalonia, see below).

On this basis, the form *mixtura* is returned to its original combination with *A. limata* **comb. nov.** We have seen no Portuguese material corresponding to true *A. nitida* and it is therefore removed from the Portuguese list. *Andrena nitida* is present in cooler regions of northern Iberia (e.g. provinces of Burgos and Santander, TJW unpublished data), just like other typical species of central and northern Europe such as *Nomada flava* Panzer, 1798 (Fidalgo *et al.* 2019), but based on its ecology it is extremely likely to be absent away from these temperate areas, and certainly absent from regions with a clear Mediterranean influence.

Material examined: *Andrena limata mixtura* type series: MOROCCO: Ifrane, 18.vii.1931, 1♀, leg. A. Nadig; Koudia, 19.iii.1969, 1♀, leg. J.N. Tasei; PORTUGAL: Carcavelhos, 29.iv.1956, 1♀, leg. N.F. d'Andrade (**holotype**); Coimbra, Ponte da Portela, 30.iii.1968, 1♂, leg. M.A. Diniz; SPAIN: Catalonia, Arenys, 15.iv.1929, 1♀, leg. Zariquiey (**paratype**); Playa de Aro, Gerona, 1♀, leg. H. Pochon (**paratype**); Catalonia, Beceite,

16.vii.1923, 1♀, leg. Zariquiey (**paratype**); Alicante, Orihuela, 30.v.1925, 1♀, leg. Andréu (**paratype**) ; 8.iv.1925, 1♀, leg. Andréu; 16.vi.1949, 1♂, leg. Andréu; (illegible), 8.vi.1912, 1♂, leg. J.M. Dusmet y Alonso; Barcelona, 7.vii.1898, 1♂; TUNISIA: 2 km E Menzel Bourguiba, 28.iii.1976, 1♀, leg. P. Robinson.

Other *Andrena limata* from close to the locus typicus: PORTUGAL: Mafra, 1.iii–30.iv.2012, 4♀; Ninho de Águia, Alcobaca, 18.iii.2019, 1♂, leg. T.J. Wood; Sesimbra, 3.vi.2011, 1♀, leg. A. Livory & R. Coulomb; Torres Vedras, 14.iv.2011, 3♀, leg. J. Franco; 12.iv.2013, 1♀, leg. C. Reis; 29.v.2012, 1♀, leg. C. Reis; Valado Nazaré, 27.iv.2000, 1♀, leg. M. Jenner; Fátima, Ourém, 30.vi.1969, 1♂; 9.vii.1969, 1♂, Mendoça Colln., Lisbon; Golegã, Paul do Boquilobo, 25.iv.1997, 1♀, leg. M. Jenner; Santarem, 20.iv.1986, 1♂, Mendoça Colln., Lisbon.

***Andrena (Micrandrena) abjecta* Pérez, 1895**

Distribution: Morocco, Algeria, and Spain (Gusenleitner & Schwarz 2002).

Discussion: *Andrena abjecta* was reported to occur in Portugal by Baldock *et al.* (2018) on the basis of a single specimen. Examination of material from North Africa shows that the original Portuguese record is *Andrena tenuistriata* Pérez, 1895 as the fovea are too wide and the base of the propodeal triangle is too extensively wrinkled and lacks the necessary granular microsculpture. *Andrena abjecta* could occur in Portugal with records known from the neighbouring Huelva province in Spain (Dardon *et al.* 2014) but for now its presence must remain unconfirmed.

Material examined: *Andrena abjecta*: ALGERIA: Oran, (no date), 1♀, OÖLM (**paratype**); MOROCCO: Tizn-Fedrhate, 60 km NE, Quarzazate, 1370 m, 6°40'N31°06'W, 11.iv.1996, 1♀, leg. M. Schwarz, M. Schwarz Colln.

***Andrena (Proxiandrena) alutacea* Stoeckhert, 1942**

Distribution: Southern Germany eastwards to Turkey (Schmid-Egger 2005).

Notes: *Andrena alutacea* was included in the list of Baldock *et al.* (2018) on the basis of misidentifications of *Andrena ampla* Warncke, 1967. In Europe, *A. alutacea* is a more easterly taxon found from central Europe eastwards whereas *A. ampla* is a more westerly taxon, found from Switzerland to Morocco (Schmid-Egger 2005). *Andrena proxima* (Kirby, 1802) is found throughout Europe, but seems to have a clear allopatric distribution with *A. ampla* (e.g. Falk *et al.* 2019) and is probably absent from Iberia (Schmid-Egger *et al.* 2005, TJW unpublished data). In Switzerland, *A. alutacea* is a relatively late flying bee with most records from June onwards compared to *A. proxima* that peaks in May (C. Praz *in litt*). In comparison, in Portugal all *Proxiandrena* records come from March-early May, with a clear peak in April. Following Schmid-Egger (2005), and in the absence of any molecular data to the contrary (C. Praz *in litt.*), *A. ampla* is the only *Proxiandrena* taxon in Iberia, and *Andrena alutacea* is therefore removed from the Portuguese list.

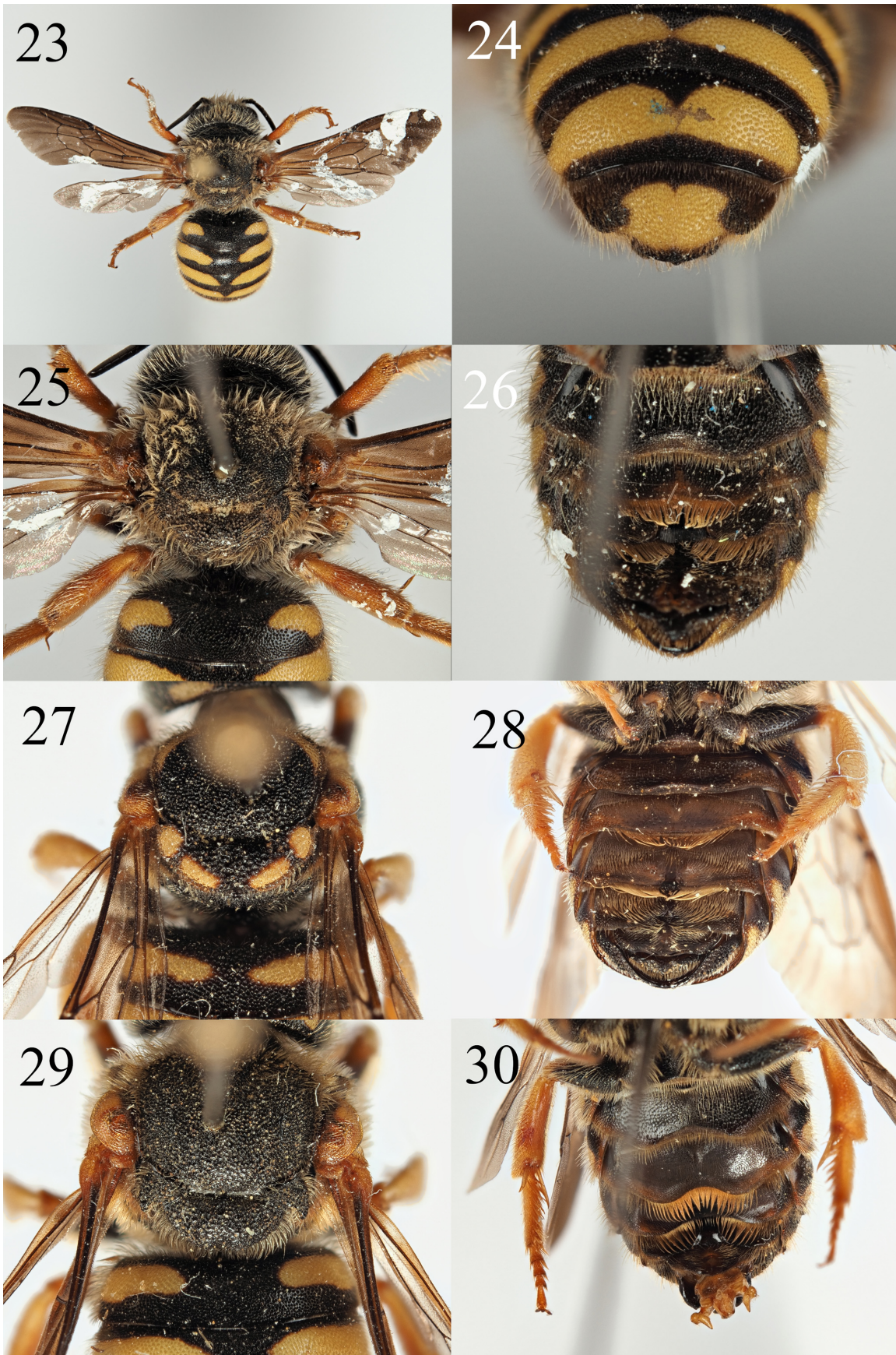
Other material examined: *Andrena ampla*: SPAIN: Alberche, v.1908, 1♀, leg. Arias, OÖLM (**holotype**).

***Andrena (Zonandrena) vachali* Pérez, 1895**

Distribution: North Africa to Israel and Crete (Gusenleitner & Schwarz 2002).

Notes: *Andrena vachali* was reported to occur in Portugal by Baldock *et al.* (2018). This due to confusion regarding the identification of Iberian *Zonandrena*. Inspection of material from the Warncke Collection has revealed that Portuguese material previously identified as *A. vachali* corresponds to *A. discors* Erichson, 1840, and that Portuguese material previously identified as *A. discors* corresponds to *A. vulcana* Dours, 1873. On this basis, *A. vachali* is removed from the Portuguese list and *A. discors* and *A. vulcana* are retained. *Andrena discors* is currently known only from southern Portugal, whilst *A. vulcana* ranges further north to central Portugal in the Coimbra area.

Material examined: *Andrena discors*: MOROCCO: Lixus, 5.iv.1967, 1♀, leg. Schultze, det. K. Warncke, OÖLM; PORTUGAL: Montemor-o-Novo, Foros de Vale de Figueira, 27.iv.2011, 1♀, leg. A. Albernaz-Valente, det. Wood, TJW Colln.; TUNISIA: Fritissa, 11–22.iv.1983, 3♀, det. K. Warncke, UMons Colln; ***Andrena vachali*:** MOROCCO: Marraqesh, iii.1907, 1♀, det. K. Warncke, OÖLM; ***Andrena vulcana*:** PORTUGAL: Coimbra, Pinhal de Marrocos, 30.iii.1962, 1♀, leg. M.A. Diniz, det. K. Warncke, OÖLM; Santo Estêvão, near Tavira, 25.iv.2016, 1♀, det. & leg. Wood; Burgau, Barrancão, 2.iv.2017, 1♀, det. Wood, leg. Cross; Ermegeira, near Torres Vedras, 14.iv.2011, 3♀, det. Wood, leg. J. Franco, TJW Colln.; TUNISIA: Fritissa, 24–29.iv.1983, 2♀, det. K. Warncke, UMons Colln.



FIGURES 23–30. *Stelis hispanica* Dusmet y Alonso, 1921, 23. male dorsal profile, 24. male tergita 4–6, 25. male mesosoma, 26. male sterna; *Stelis annulata* (Lepelletier, 1841), 27. male mesosoma, 28. male sterna; *Stelis gigantea* Friese, 1921, 29. male mesosoma, 30. male sterna.



FIGURES 31–34. 31. *Andrena limata mixtura* Warncke, 1967, **holotype**. 31. female dorsal view, 32. female profile, 33. female propodeum, 34. female hind tibial spur.

HALICTIDAE

Pseudapis (Nomiapis) monstrosa (Costa, 1861)

Distribution: Primarily Eastern Mediterranean into the Near East with a few records from Spain and Portugal (Warncke 1976; Pauly 2015).

Notes: The taxonomic state of *Pseudapis* has been greatly confused (Baker 2002). Whilst the shape and structure of the male legs is often diagnostic for species delimitation, females can be challenging to separate morphologically. *Pseudapis monstrosa* is a species primarily from the Eastern Mediterranean with a few records for Spain (Warncke 1976; Van der Zanden 1997). However, the sex of this material was either unspecified (Warncke 1976) or female (Van der Zanden 1997). In Portugal, all identifications of *P. monstrosa* were based on the female sex, as seemingly none of the highly distinctive males could be found at nesting sites (Baldock *et al.* 2018). Instead, only the clearly different *P. bispinosa* (Brullé, 1832) males were collected in these areas. This suspicious lack of *P. monstrosa* males led to the re-examination of Portuguese *Pseudapis* material.

Two subspecies of *P. bispinosa* have been described. The subspecies combination of *Pseudapis bispinosa albocincta* (Lucas, 1849) was proposed by Warncke (1976, erroneously under *Nomia unidentata* Olivier, 1811, see Baker 2002). Females of *P. b. albocincta* have a scutum that is much more densely punctate than *P. b. bispinosa* (Warncke 1976, Pauly 2015). Males of the two subspecies are very similar, and it is beyond the scope of this paper to resolve this current taxonomic situation.

For the records reported by Baldock *et al.* (2018) that we have been able to double check, records previously reported as *P. bispinosa* refer to *P. b. albocincta*, and records previously reported as *P. monstrosa* refer to *P. b. bispinosa*. *Pseudapis b. albocincta* is therefore widespread throughout Portugal in a wide range of habitats, but *P. b. bispinosa* is seemingly restricted to saline soils on the southern coast of the Algarve at Pêra and Mexilhoeira

Grande. This association was also found in central Spain at Rivas-Vaciamadrid (40.3217, -3.5633, 21.vii.2019, 2♂, 4♀, leg. Wood, TJW Colln.) where *P. b. bispinosa* was nesting in saline soils hosting the similarly halophilous sea-lavender *Limonium*. More work is needed to establish the consistency of this habitat association, and on the taxonomic status of the two subspecies of *P. bispinosa*.

On this basis, *P. monstrosa* is removed from the Portuguese list. The presence of *P. monstrosa* in Spain must be confirmed, since it is not clear if any identifications have been made from male material and may therefore all be incorrect (Warncke 1976; Van der Zanden 1997; examined USDA-ARS material listed on GBIF). Inspection of the Warncke Collection found only one female *P. monstrosa* specimen from Spain labelled ‘Madrid’ (no date). This specimen was determined as *P. monstrosa* but was clearly *P. bispinosa albocincta* and moreover did not agree with other Warncke determinations of *P. monstrosa* from the Eastern Mediterranean. No specimen from Granada (Warncke, 1976) could be found. It remains to be confirmed if any valid male records of true *P. monstrosa* exist in Iberia, and for now its presence in the Western Mediterranean is considered doubtful.

Material examined: *Pseudapis bispinosa bispinosa*: PORTUGAL: Mexilhoeira Grande, 15.vii–19.viii.2015, 1♂, 2♀, det. Wood, leg. J. D’Haeseleer [all Portuguese material previously determined as *Pseudapis monstrosa*]; SPAIN: Rivas-Vaciamadrid, Camino de Uclés, 21.vii.2019, 2♂, 4♀, det. & leg. Wood); ***Pseudapis bispinosa albocincta*:** PORTUGAL: Sesimbra, Santana, R. Vasco Santana, 4.viii.2019, 1♀, det. & leg. Wood; SPAIN: Segovia, Camino Natural Via Verde Valle del Eresma, 18.vii.2019, 1♀, det. & leg. Wood; Madrid, (no date), 1♀, leg. Mercet, OÖLM [previously determined as *Nomia monstrosa* by K. Warncke]; ***Pseudapis monstrosa*:** BULGARIA: Sandanski, 20.vii.1966, 1♀, leg. Kocourek, det. A. Pauly, OÖLM; Sandanski, 24.vi.1978, 1♀, leg. Z. Pédr, det. A. Pauly, OÖLM; MONTENEGRO: Uleinj, 15–20.vii.1967, 1♀, leg. Z. Pédr, det. A. Pauly, OÖLM; ***Pseudapis valga* (Gerstäcker, 1872):** SPAIN: Zaragoza, 30 km E, 16.vi.1974, 1♂, leg. P.F. Torchio & E. Ase, USDA-ARS collection at Utah State University, BBSL740380 [previously determined as *Pseudapis monstrosa*].

***Halictus (Halictus) tetrazonius* Klug in Germar, 1817**

Distribution: Southern Europe (Pauly *et al.* 2016).

Notes: *Halictus tetrazonius* is another *Halictus* species that cannot be confidently identified in the female sex. This species has been misidentified in the past, and is probably absent from France (Pauly *et al.* 2016) and Iberia (Ortiz-Sánchez & Pauly 2017). Because the only records from Portugal were made from female material, the species is removed from the Portuguese list.

***Lasioglossum (Dialictus) mandibulare* (Morawitz, 1866) and *Lasioglossum (Dialictus) aglyphum* (Pérez, 1895)**

Distribution: Mediterranean basin (Pauly 2016b).

Records: PORTUGAL: Algarve, Tavira, Santa Luiza, 30.v.2016, 1♂, det. as *Lasioglossum aglyphum* by A.W. Ebmer, leg. A. Livory & R. Coulomb.

Notes: Currently only *L. mandibulare* is recorded from Portugal (Baldock *et al.* 2018). The taxonomic status of *L. aglyphum* is unclear, and it may be a subspecies of *L. mandibulare* that is found in North Africa, Sicily, Israel, and Iran (Pauly 2016b). For now, material from Portugal is best referred to as *L. mandibulare* until this situation has been clarified.

***Lasioglossum (Dialictus) soror* Saunders, 1901**

Distribution: Mediterranean basin (Pauly 2016b).

Notes: *Lasioglossum soror* was originally described from the Balearics, but there has been a great deal of confusion over its identity and its relationship to closely related species including *L. (D.) collopiense* (Pérez, 1903) and *Lasioglossum (D.) morio* (Fabricius, 1793) (Pauly 2016b), with female material proving particularly challenging.

Lasioglossum soror was reported from Portugal by Baldock *et al.* (2018) on the basis of a female collected from Ilhas Berlengas, 12.vii.1977 by H. Teunissen (Naturalis), an island in the Atlantic just off central Portugal. However, Ortiz-Sánchez & Pauly (2017) reported *L. soror* as having a strictly Mediterranean distribution, and being absent from Portugal. The Teunissen female specimen could not be located at Naturalis, but a long series of males collected from the same site on the same day was present, all identified as *Lasioglossum morio cordiale* (Pérez, 1903) by A.W. Ebmer.

Following the interpretation and the photographs provided by Pauly (2016b), this material conforms to *Lasioglossum collopiense* (= *L. soror* sensu Blüthgen, = *L. cordiale* sensu Ebmer). The difficulties in identifying female material of this group is illustrated by DNA barcoding which shows that the two female records of *L. collopiense* reported from northern Portugal (Ortiz-Sánchez & Pauly 2017; Baldock *et al.* 2018) are actually *L. morio* (A. Pauly, *in litt*). This confusion ultimately resolves into three taxa: the widespread *Lasioglossum morio* which is known from throughout Portugal, the West Mediterranean *L. collopiense* which is known from central and southern Portugal, and the strictly Mediterranean *L. soror* which is removed from the Portuguese list.

Material examined: *Lasioglossum collopiense* (sensu Pauly 2016b): PORTUGAL: Peniche, Ilhadas Berlingas, 12.vii.1977, 14♂, det. A.W. Ebmer, leg. Ph. Pronk, Naturalis, Leiden, RMNH.INS.826292.

***Lasioglossum (Hemihalictus) villosulum* (Kirby, 1802)**

Pauly *et al.* (2019) separated *L. villosulum* from *Lasioglossum medinai* (Vachal, 1895) on the basis of genetic and morphological differences. *Lasioglossum medinai* has a sub-Mediterranean distribution and is found in Spain close to the Portuguese border. Re-examination of Portuguese material available to us did not detect the presence of *L. medinai* in Portugal, with all specimens conforming to *L. villosulum* sensu Patiny *et al.* (2019).

Pollen use in the *L. villosulum* group is unclear as a result of previous taxonomic problems, with *L. villosulum* being previously reported both as polylectic (Westrich 1989; Rust *et al.* 2003) and oligolectic on Asteraceae (Wood *et al.* 2016). The first two of these studies were conducted in southern Germany and France where the ranges of *L. villosulum* and *L. medinai* overlap, whereas the latter study was conducted in Britain from which *L. medinai* appears to be absent (Pauly *et al.* 2019).

All analysed pollen loads of *L. villosulum* from Portugal (n=11) contained pure Asteraceae (Cichorieae) pollen. These would seem to be in line with the preference of this species across the western part of the West Palearctic (n=46 analysed pollen loads; Belgium, France, Portugal, Spain [Canary Islands], United Kingdom; 99.3% Asteraceae (Cichorieae), Wood *et al.* 2016; TJW *unpublished data*). True *Lasioglossum villosulum* therefore appears to be a specialist on Asteraceae (Cichoriaceae), with previous records indicating polylecty probably referring to *L. medinai*. *Lasioglossum medinai* is likely to occur in Portugal, but for now this remains to be confirmed.

APIDAE

***Eucera (Eucera) graeca* Radoszkowski, 1876**

Distribution: Western (Portugal, Spain, France) and eastern Europe into Russia and the Near East (Kuhlmann *et al.* 2020).

Discussion: Following Nieto *et al.* (2014) and Kuhlmann *et al.* (2020), the correct name for this taxon is *Eucera (Eucera) proxima* Morawitz, 1875.

***Thyreus scutellaris* (Fabricius, 1781)**

Distribution: Central Asia to Europe, west to Slovenia (Lieftinck 1968).

Notes: Reported from Portugal by Dusmet (1931) and Diniz (1959), these are probably misidentifications given the disjunct distribution—these are the only records reported from Western Europe. Lieftinck studied material from the museum of the University of Coimbra where Diniz's material was stored, so it is highly likely that he would have come across it during his revision but there is no mention of it (misidentified or otherwise) in his 1968 revision, so we take a conservative approach and remove it from the current Portuguese list until this material can be directly inspected.

3.5 Species not confirmed from Portugal

MEGACHILIDAE

***Stelis ornatula* (Klug, 1807)**

Distribution: Europe, North Africa, and into Asia (Kasperek 2015).

Notes: The distribution map for *Stelis ornatula* presented by Kasperek (2015) in his review of West Palearctic *Stelis*

includes Portugal. However, this record comes from the island of Madeira (Fellendorf *et al.* 1999) and we know of no records from mainland Portugal itself.

Stelis ornatula is the parasite of *Hoplitis claviventris* (Thomson, 1872) and *H. leucomelana* (Kirby, 1802) (Kasperek 2015), both of which occur in Portugal (Baldock *et al.* 2018). *Stelis ornatula* is known from Spain and is therefore highly likely to occur in mainland Portugal, but for now its presence here must be considered unconfirmed.

HALICTIDAE

Sphecodes intermedius Blüthgen, 1923

Distribution: Spain to central Europe, Russia, and Turkey (Bogusch & Straka 2012).

Notes: Though also reported as new to Portugal by Scheuchl & Willner (2016), no precise specimen information was provided and no specimens from Portugal could be found in the Linz Collection. For now, its presence in Portugal is considered unconfirmed.

3. Discussion

Overall, these changes raise the total of bees recorded from mainland Portugal to 712, with 40 species added and eight species removed. The number of species endemic to mainland Portugal reduces to four, as *Flavipanurgus fuzeztus* Patiny, 1999 was recently found in Spain (Cross & Wood 2018). Taking these faunal changes into account, a total of four species (0.6%) are endemic to mainland Portugal, 40 species are endemic to the Iberian Peninsula (5.6%), 150 species are restricted to the West Mediterranean (21.1%), and 49 species have predominantly North African and/or near-Eastern distributions with the only European mainland records coming from Iberia (6.9%). Including the island archipelago faunas of Madeira and the Azores, the number of bee species known from Portugal as a whole is 722 with 12 endemic species (Weissmann *et al.* 2017; Kratochwil *et al.* 2018).

The family Melittidae shows the highest level of regional endemism, with five of the 13 species (38.5%) restricted to the Western Mediterranean (Table 2). The family Megachilidae shows the lowest level of endemism with only 25 out of 166 species (15.1%) restricted to the Western Mediterranean. Of the five larger families, Andrenidae show the highest level of endemism with 42 out of 139 species (30.2%) restricted to the Western Mediterranean, driven in part by Panurgini which show an extraordinary 11 out of 15 species (73.3%) found only in this region. The description of three new species of *Andrena* illustrate that studies of this genus in Iberia are far from complete. This should perhaps not be surprising, as only one paper focusing on Iberian *Andrena* has been published since Warncke's 1975 revision (Dardon 2014). When taxonomic attention has been turned to the furthest edges of Europe, it has often revealed the presence of previously unrecognised species (e.g. Müller 2012; Müller 2016; Smit 2018), and it is highly likely that the Iberian Peninsula contains further undescribed bee species.

There is extensive variation in the level of recording and subsequent species totals for Portuguese regions. Precise province-by-province distributional data is available for 702 Portuguese species, with the highest species richness recorded in the southern province of Algarve, followed by the central province of Estremadura, and then the northern province of Trás-os-montes (Table 3). Unsurprisingly, the three provinces with the largest number of records have the highest species totals. A total of 498 bee species are known from the Algarve, 83.6% of the total number of species recorded from the neighbouring Spanish region of Andalucía (596, Ortiz-Sánchez 2006), despite being only 1/18th the size and lacking true montane and desert-like habitats such as those found in the Sierra Nevada and the province of Almería respectively.

Whilst the Algarve probably does genuinely harbour the highest bee diversity in Portugal, it is also disproportionately well recorded due to its status as a popular holiday destination for northern Europeans, including entomologists. Due to under-recording away from this area, the true species richness in central and eastern provinces of Portugal such as Beira Baixa and Ribatejo is likely to be at least twice as high as their current total. New species for science continue to be discovered in and described from Iberia, with 10 species described from Portugal alone since 1999, and Portugal remains an under-recorded country for large parts of the interior that border Spain. Given that many of the new species for Portugal came from under-recorded northern and eastern parts of the country, the total number of bee species Portugal could potentially be as high as 750. These findings continue to reinforce the impor-

tant point that increasing the level of biological recording in southern European countries is necessary to understand the true diversity and population trajectories of Mediterranean wild bees (Nieto *et al.* 2014).

Acknowledgements

This paper is dedicated to our friend and colleague David Baldock who passed away during the course of its writing. We would like to thank Leopoldo Castro, Romain Le Divelec, Hugo Gaspar, Gérard Le Goff, Patricia Garcia Pereira, Jessica Litman, Andreas Müller, Alain Pauly, Andreia Penado, Christophe Praz, Jan Smit, Albano Soares, and Bogdan Tomozii for sharing data and for important help, discussion, and assistance with identification. We thank John Ascher for access to his global bee database which helped locate several overlooked species. We thank Felix Torres for sending *Andrena omnilaervis* material, Skyler Burrows for sending information on and photographs of material from the USDA-ARS collection, and Bernhard Jacobi for allowing use of his photograph. We also thank Esther Ockermüller, Martin Schwarz, and Fritz Gusenleitner for access to the Warncke Collection and hospitality in Linz, Frederique Bakker for access to the collection at Naturalis, and Pierre Rasmont for *Anthophora* identification, assistance with photography, and access to the University of Mons European wild bee database. We also thank Jason Gibbs and two anonymous reviewers for their comments which substantially improved the manuscript.

TABLE 2. A summary of the species richness for the six families of bees found in mainland Portugal, as well as their levels of endemism to Portugal, Iberia, the West Mediterranean, and species showing a predominantly North African and/or Near Eastern distribution.

Family	No. species	Endemic to Portugal	Endemic to Iberia	West Mediterranean	Africa+ distribution
Andrenidae	139	1 (0.7%)	14 (10.1%)	42 (30.2%)	12 (8.6%)
Apidae	200		6 (3.0%)	39 (19.5%)	13 (6.5%)
Colletidae	66	1 (1.5%)	6 (9.1%)	15 (22.7%)	3 (4.5%)
Halictidae	128		6 (4.7%)	24 (18.8%)	10 (7.8%)
Megachilidae	166	1 (0.6%)	5 (3.1%)	25 (15.1%)	11 (6.7%)
Melittidae	13	1 (7.7%)	2 (15.4%)	5 (38.5%)	
Total	712	4 (0.6%)	40 (5.6%)	150 (21.1%)	49 (6.9%)

TABLE 3. A summary of the total number of records, bee species, and the percentage of the national fauna for each Portuguese province for which precise geographic information is known.

Province	No. records	No. species recorded	Percentage of national total
Algarve	5,724	498	69.9
Estremadura	1,536	364	51.2
Trás-os-montes	848	310	43.6
Baixo Alentejo	605	271	38.1
Beira Litoral	549	242	34.0
Minho	775	233	32.8
Alto Alentejo	521	223	31.4
Douro Litoral	494	200	28.1
Beira Alta	455	193	27.1
Ribatejo	241	135	19.0
Beira Baixa	221	134	18.8
	11,969	702	98.6

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