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ORIGINAL ARTICLE

Morphological and genetic evidence support the species status of *Lasioglossum angustifrons*, distinct from *L. punctatissimum* (Hymenoptera: Halictidae)

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Abstract. Europe hosts a remarkable diversity of wild bees, among which the genus *Lasioglossum* Curtis, 1833 ranks among the most species rich. The definition of the taxonomic status of many species within this genus remains challenging. In this work, we reassessed the subspecific status of *Lasioglossum* (*Hemihalictus*) *punctatissimum angustifrons* (Vachal, 1892) through a comprehensive analysis integrating morphology, molecular and distributional data. Phylogenetic reconstruction using a Maximum Likelihood tree and three independent species delimitation models revealed that *L. angustifrons* forms a distinct and well-supported lineage, separated from *L. punctatissimum* (Schenck, 1853) and related taxa by significant genetic distances. Morphological examination confirmed stable diagnostic features, including reddish metasomal terga, finer punctation on the scutum, and the specific appearance of the male genitalia. *Lasioglossum angustifrons* is mainly distributed along the coastal regions of Western North Africa, extending to the Iberian Peninsula and Sicily, with a few inland records. Based on congruent morphological and molecular evidence, *Lasioglossum* (*Hemihalictus*) *angustifrons* stat. nov. is best treated as a species than a subspecies. This revision resolves a long-standing taxonomic ambiguity in the *Lasioglossum punctatissimum* complex and contributes to a more accurate understanding of species diversity in Mediterranean halictine bees.

INTRODUCTION

Europe shows a remarkable diversity of wild bees, with more than 2,100 species currently reported (Ghisbain et al., 2023). This richness stems from the ecological diversity of bees, which can occur in a wide array of habitats, from alpine meadows to Mediterranean shrublands and even arid landscapes (Michez et al., 2025). Among the many genera found in the region, *Lasioglossum* (Curtis, 1833) is notable for its diversity, ranking as the third most species-rich bee genus in Europe, with 183 species reported so far (Ghisbain et al., 2023).

During the past decade, the systematics of Halictini in general, and *Lasioglossum* in particular, have been reshaped by integrative taxonomy studies. Frequently, these studies considered morphology, DNA-based and ecological evidence (e.g. Gibbs et al., 2013). This multi-evidence framework has repeatedly exposed cryptic or near-cryptic lineages and provided objective criteria for redefining species limits (Pauly et al., 2019; Gardner & Gibbs, 2020; Zhang et al., 2022; Flaminio et al., 2025). Yet, many taxa with broad spatial distribution and distinct phenotypic variation still pose a challenge. Authors have captured phenotypic variation by describing subspecies, but validation of the taxonomic status through examination of the evolutionary history is missing in most cases (Ebmer, 1988; Pauly, 2016). The results of this approach can lead to expert-based, sometimes subjective, conclusions on the species or subspecies taxonomic status.

Here, we challenge the taxonomic hypotheses related to the subspecies associated with *Lasioglossum* (*Hemihalictus*) *punctatissimum* (Schenck, 1853). Particularly, we examine *Lasioglossum* (*Hemihalictus*) *punctatissimum angustifrons* (Vachal, 1892), originally described from Algeria as a valid species and later classified as a subspecies

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of *L. punctatissimum* (Ebmer, 1985). Despite its taxonomic treatment, *L. angustifrons* consistently differs in morphology and occurs across a distinct, though partially overlapping, geographic range in Western North Africa and parts of Southern Europe. These observations raise questions about its current taxonomic placement, as already noted by Ebmer (1988). In this study, we reconsider the status of *L. punctatissimum angustifrons* using a combination of morphological traits, geographical records, and molecular analyses, alongside a critical re-examination of historical material.

MATERIAL AND METHODS

The examination and identification of type and non-type specimens were achieved in the following institutions and private collections; type deposits are also listed (acronyms included): FSEC – Entomological Collection "Filippo Silvestri", Naples, Italy; KJPC – Kobe Jannsen Private Collection, Belgium; MNHN – Muséum National d'Histoire Naturelle, Paris, France; MSC – Marco Selis Private Collection, Viterbo, Italy; MZCP – Universidade de Coimbra, Coimbra, Portugal; MZUR – Università degli Studi di Roma "La Sapienza", Rome, Italy; NHMUK – Natural History Museum, London, UK; NMPC – National Museum, Prague, Czech Republic; NMW – Wien Natural History Museum, Wien, Austria; SFPC – Simone Flaminio Private Collection, Mons, Belgium; SMF – Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt-am-Main, Germany; TJWC – Thomas J. Wood Private Collection, Leiden, Netherlands; UMONS – University of Mons Collection, Mons, Belgium; ZIN – Zoological Institute, St. Petersburg, Russia. Morphological terminology follows Michener (2007). The abbreviations T and S are used for metasomal terga and metasomal sterna, respectively.

Specimen collections

We examined the type material of *Lasioglossum angustifrons*. We did not examine *Lasioglossum punctatissimum* type material, and we followed Ebmer (1988) for the synonymy of types we did not inspect. Regarding non-type material, a total of 94 specimens were examined.

Spatial data

All analysed specimens' label information was recorded. Google EarthTM (http://earth.google.com) was used to georeference their locations when original coordinates were not reported on the label. The map was prepared with QGIS 3.40.2 (QGIS.org, 2024).

Photography

Photographs of habitus were taken using an Olympus E-M1 Mark I with a 60 mm Zuiko macro lens, and details were taken using Keyence VHX-970F. Habitus images were stacked with Helicon 8.2.2 (HeliconSoft, Kharkiv, Ukraine).

Genetic analysis

DNA analyses were conducted using Cytochrome Oxydase I (COI) sequences available on the Barcode of Life Data System (BOLD), a cloud-based data storage and analysis platform developed by the Canadian Centre for DNA barcoding (https://boldsystems.org; Ratnasingham et al., 2024), and two new sequences of *Lasioglossum angustifrons*. DNA extraction, PCR amplification, and sequencing were conducted by the Canadian Centre for DNA Barcoding, Guelph, using standardised high-throughput protocols (Ivanova et al., 2006; deWaard et al., 2008; http://ccdb.ca/resource). Sequences were uploaded to BOLD (HASAR027-24; HASAR059-24). Among all the *Lasioglossum* data available in BOLD, we selected those from the subgenus *Hemihalictus* (Cockerell, 1897) that were longer than 300 bp, had no gaps, and overlapped with our two sequences. Moreover, we examined six sequences deposited under the name *Lasioglossum strictifrons* (Vachal, 1895), whose identification was found to be uncertain during a preliminary survey of online databases. *Halictus scabiosae* (Rossi, 1790), was chosen as an outgroup to root the tree.

COI sequences were aligned using the MAFFT algorithm implemented in Geneious Prime version 2025.1.3 (https://www.geneious.com). A Maximum Likelihood (ML) phylogenetic tree was built with IQTree Web (Trifinopoulos et al., 2016) (http://iqtree.cibiv.univie.ac.at/) using the Ultrafast Bootstrap (UFB) method and the SH-aLRT branch test, both with 1,000 replicates. The Transitional model 2 (TIM2) parameter was automatically selected as the best substitution model by ModelFinder (implemented in IQTree) due to its lowest Bayesian Information Criterion (BIC) scores.

Interspecific p-distances were calculated using MEGA11 software (Tamura et al., 2021). P-distances were calculated only between *L. angustifrons* and the taxa identified as its closest relatives based on the phylogenetic tree: *L. punctatissimum* and *L. angusticeps* (Perkins, 1895). Furthermore, as there was reason to suspect that some sequences deposited under the name *L. strictifrons* in fact corresponded to specimens of *L. angustrifrons*, p-distances were also calculated between these two groups.

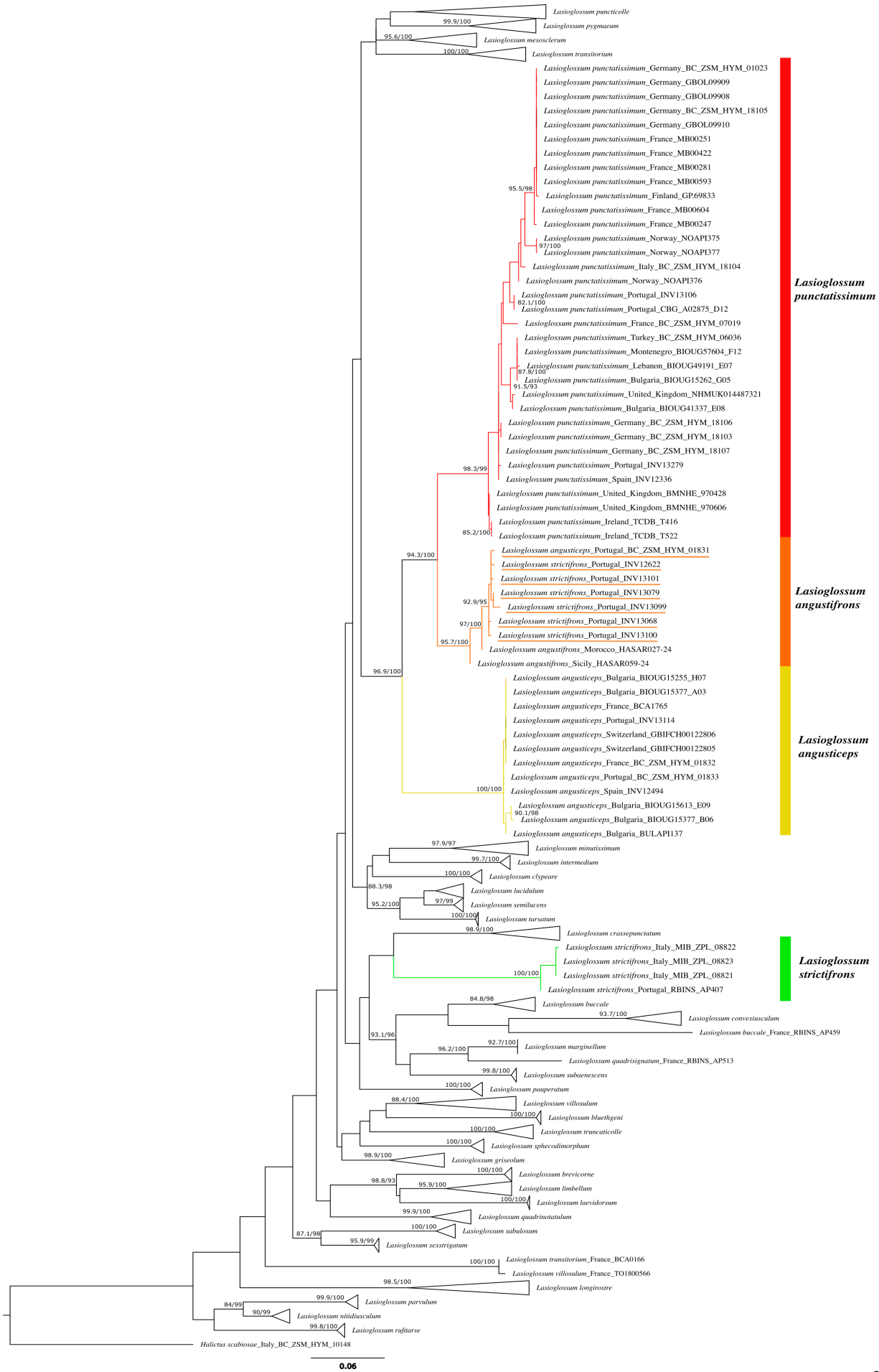
To support the taxonomic hypotheses, we performed three different Species Delimitation Models (SDM): (i) Assemble Species by Automatic Partition (ASAP, Puillandre et al., 2021); (ii) multirate Poisson Tree Process (mPTP, Kapli et al., 2017) and (iii) *ad hoc* nucleotide distance threshold (Sonet et al., 2013). ASAP is based on pairwise genetic distances and it provides several partitions ranked according to a scoring system (Puillandre et al., 2021). COI alignment was analysed using the ASAP web server (https://bioinfo.mnhn.fr/abi/public/asap/asapold.html). Kimura (K80) ts/tv (Kimura, 1980) was selected as the nucleotide substitution model, and all the other parameters were left as default. mPTP provides a delimitation model based on an existing Maximum Likelihood tree (Kapli et al., 2017). We used as input the ML tree generated with IQTree web, leaving the other settings as default. *ad hoc* sets a distance threshold calculated ad hoc on our data and on this basis defines the taxonomic groups (Sonet et al., 2013). For the ad hoc nucleotide distance threshold, the R package *spider* v1.5.0 (Brown et al., 2012; R Core Team, 2024) was used, and the threshold optimisation analysis was estimated using the R function *localMinima*. COI nucleotide sequences were clustered with the ad hoc threshold using the function *tclust*.

RESULTS

Molecular phylogeny and species delimitation

The final dataset consists of 568 sequences of COI belonging to 36 species of *Lasioglossum* (*Hemialictus*). The clade of *Lasioglossum angustifrons* (9 specimens) is well

Fig. 1 (right page). COI Maximum Likelihood tree showing phylogenetic relationships between species of the subgenus *Hemihalictus*. Clades corresponding to *L. punctatissimum*, *L. angustifrons*, *L. angusticeps* and *L. strictifrons* are highlighted with different colours. On the nodes, SH-aLRT branch test (left) and UFB values (right) are reported. Values <80 for SH-aLRT and <95 for UFB are omitted. Sequences with uncertain original identification that clustered in the *L. angustrifrons* clade are underlined in orange. The names of these sequences have not yet been corrected on BOLD. Clades not investigated are collapsed. The extended version of the tree is shown in Fig. S1.


Lasioglossum puncticolle
99.9/100
Lasioglossum pygmaeum
95.6/100
Lasioglossum mesosclerum
100/100
Lasioglossum transitorium
Lasioglossum punctatissimum_Germany_BC_ZSM_HYM_01023
Lasioglossum punctatissimum_Germany_GBOL09909
Lasioglossum punctatissimum_Germany_GBOL09908
Lasioglossum punctatissimum_Germany_BC_ZSM_HYM_18105
Lasioglossum punctatissimum_Germany_GBOL09910
Lasioglossum punctatissimum_France_MB00251
Lasioglossum punctatissimum_France_MB00422
Lasioglossum punctatissimum_France_MB00281
Lasioglossum punctatissimum_France_MB00593
95.5/98
Lasioglossum punctatissimum_Finland_GP.69833
Lasioglossum punctatissimum_France_MB00604
Lasioglossum punctatissimum_France_MB00247
Lasioglossum punctatissimum_Norway_NOAPI375
97/100
Lasioglossum punctatissimum_Norway_NOAPI377
Lasioglossum punctatissimum_Italy_BC_ZSM_HYM_18104
Lasioglossum punctatissimum_Norway_NOAPI376
Lasioglossum punctatissimum_Portugal_INV13106
82.1/100
Lasioglossum punctatissimum_Portugal_CBG_A02875_D12
Lasioglossum punctatissimum_France_BC_ZSM_HYM_07019
Lasioglossum punctatissimum_Turkey_BC_ZSM_HYM_06036
Lasioglossum punctatissimum_Montenegro_BIOUG57604_F12
Lasioglossum punctatissimum_Lebanon_BIOUG49191_E07
87.8/100
Lasioglossum punctatissimum_Bulgaria_BIOUG15262_G05
91.5/93
Lasioglossum punctatissimum_United_Kingdom_NHMUK014487321
Lasioglossum punctatissimum_Bulgaria_BIOUG41337_E08
Lasioglossum punctatissimum_Germany_BC_ZSM_HYM_18106
Lasioglossum punctatissimum_Germany_BC_ZSM_HYM_18103
Lasioglossum punctatissimum_Germany_BC_ZSM_HYM_18107
98.3/99
Lasioglossum punctatissimum_Portugal_INV13279
Lasioglossum punctatissimum_Spain_INV12336
Lasioglossum punctatissimum_United_Kingdom_BMNHE_970428
Lasioglossum punctatissimum_United_Kingdom_BMNHE_970606
Lasioglossum punctatissimum_Ireland_TCDB_T416
85.2/100
Lasioglossum punctatissimum_Ireland_TCDB_T522
94.3/100
Lasioglossum angusticeps_Portugal_BC_ZSM_HYM_01831
Lasioglossum strictifrons_Portugal_INV12622
Lasioglossum strictifrons_Portugal_INV13101
Lasioglossum strictifrons_Portugal_INV13079
92.9/95
Lasioglossum strictifrons_Portugal_INV13099
97/100
Lasioglossum strictifrons_Portugal_INV13068
Lasioglossum strictifrons_Portugal_INV13100
95.7/100
Lasioglossum angustifrons_Morocco_HASAR027-24
Lasioglossum angustifrons_Sicily_HASAR059-24
96.9/100
Lasioglossum angusticeps_Bulgaria_BIOUG15255_H07
Lasioglossum angusticeps_Bulgaria_BIOUG15377_A03
Lasioglossum angusticeps_France_BCA1765
Lasioglossum angusticeps_Portugal_INV13114
Lasioglossum angusticeps_Switzerland_GBIFCH00122806
Lasioglossum angusticeps_Switzerland_GBIFCH00122805
Lasioglossum angusticeps_France_BC_ZSM_HYM_01832
Lasioglossum angusticeps_Portugal_BC_ZSM_HYM_01833
100/100
Lasioglossum angusticeps_Spain_INV12494
Lasioglossum angusticeps_Bulgaria_BIOUG15613_E09
90.1/98
Lasioglossum angusticeps_Bulgaria_BIOUG15377_B06
Lasioglossum angusticeps_Bulgaria_BULAPI137
97.9/97
Lasioglossum minutissimum
99.7/100
Lasioglossum intermedium
100/100
Lasioglossum clypeare
88.3/98
Lasioglossum lucidulum
97/99
Lasioglossum semilucens
95.2/100
100/100
Lasioglossum tarsatum
98.9/100
Lasioglossum crassepunctatum
Lasioglossum strictifrons_Italy_MIB_ZPL_08822
Lasioglossum strictifrons_Italy_MIB_ZPL_08823
100/100
Lasioglossum strictifrons_Italy_MIB_ZPL_08821
Lasioglossum strictifrons_Portugal_RBINS_AP407
84.8/98
Lasioglossum buccale
93.7/100
Lasioglossum convexiusculum
Lasioglossum buccale_France_RBINS_AP459
93.1/96
92.7/100
Lasioglossum marginellum
96.2/100
Lasioglossum quadrisignatum_France_RBINS_AP513
99.8/100
Lasioglossum subaenescens
100/100
Lasioglossum pauperatum
88.4/100
Lasioglossum villosulum
100/100
Lasioglossum bluethgeni
100/100
Lasioglossum truncaticolle
100/100
Lasioglossum sphecodimorphum
98.9/100
Lasioglossum griseolum
100/100
Lasioglossum brevicorne
98.8/93
95.9/100
Lasioglossum limbellum
100/100
Lasioglossum laevidorsum
99.9/100
Lasioglossum quadrinotatulum
100/100
Lasioglossum sabulosum
87.1/98
95.9/99
Lasioglossum sexstrigatum
100/100
Lasioglossum transitorium_France_BCA0166
Lasioglossum villosulum_France_TO1800566
98.5/100
Lasioglossum longirostre
99.9/100
Lasioglossum parvulum
84/99
90/99
Lasioglossum nitidiusculum
99.8/100
Lasioglossum rufitarse
Halictus scabiosae_Italy_BC_ZSM_HYM_10148
0.06
Lasioglossum punctatissimum
Lasioglossum angustifrons
Lasioglossum angusticeps
Lasioglossum strictifrons

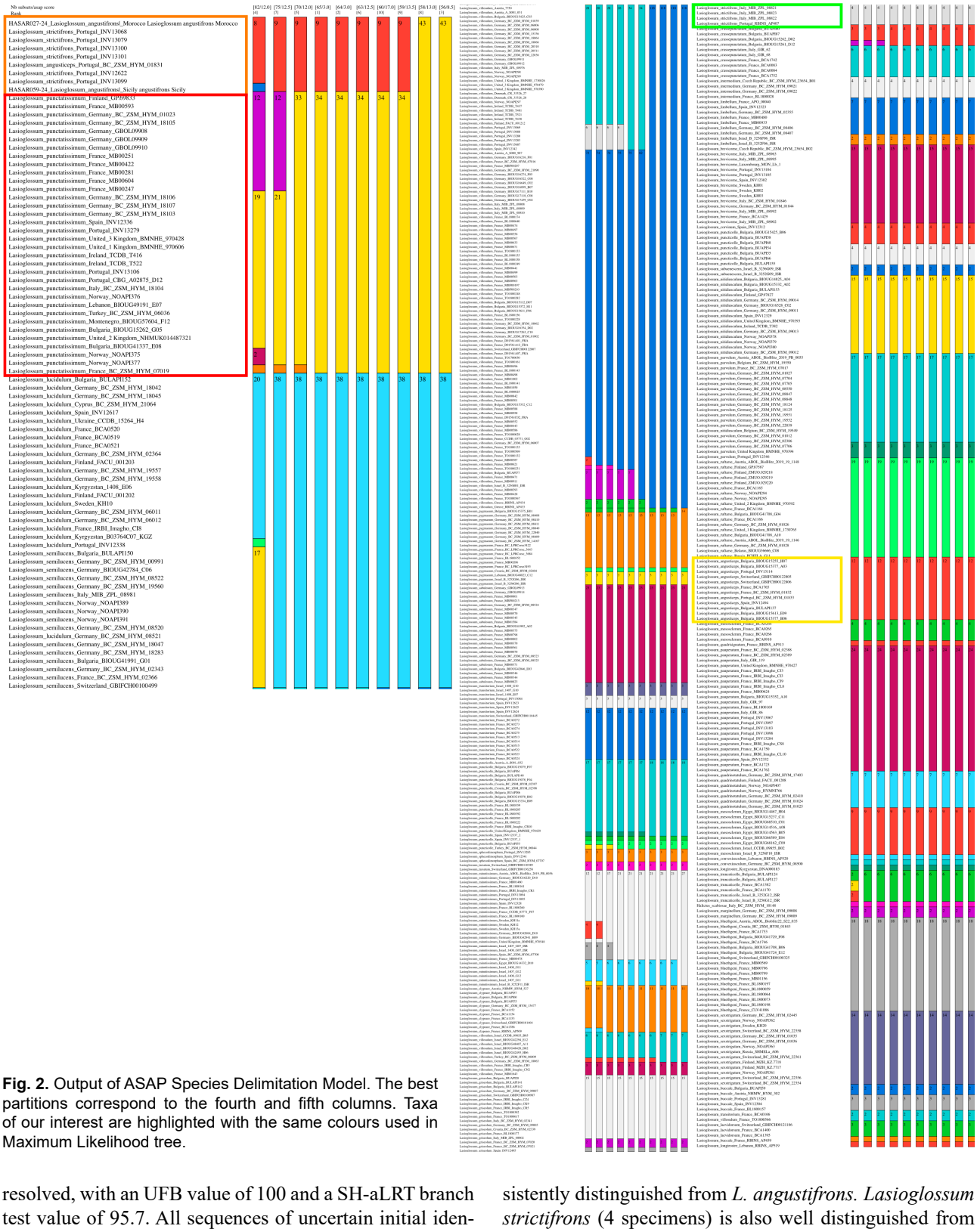


Fig. 2. Output of ASAP Species Delimitation Model. The best partitions correspond to the fourth and fifth columns. Taxa of our interest are highlighted with the same colours used in Maximum Likelihood tree.

resolved, with an UFB value of 100 and a SH-aLRT branch test value of 95.7. All sequences of uncertain initial identification as *L. strictifrons* cluster together with the two new *L. angustifrons* sequences. A sequence from Portugal, labelled as *Lasioglossum angusticeps*, also cluster in this clade, suggesting a possible mistake in the identification of the specimen. *L. punctatissimum* (34 specimens) and *L. angusticeps* (12 specimens) clades are well supported (UFB = 100; SH-aLRT = 98.3 and 100 respectively) and consistently distinguished from *L. angustifrons*. *Lasioglossum strictifrons* (4 specimens) is also well distinguished from the three previous species, quite phylogenetically distant, and highly supported (UFB and SH-aLRT = 100; Fig. 1).

P-distances between *L. angustifrons* and the three species *L. punctatissimum, L. angusticeps,* and *L. strictifrons* are respectively 8.1%, 5.7% and 11.2%.

The two best partitions generated by the ASAP model, with a score of 3, identified 65 and 64 subsets. Both parti-

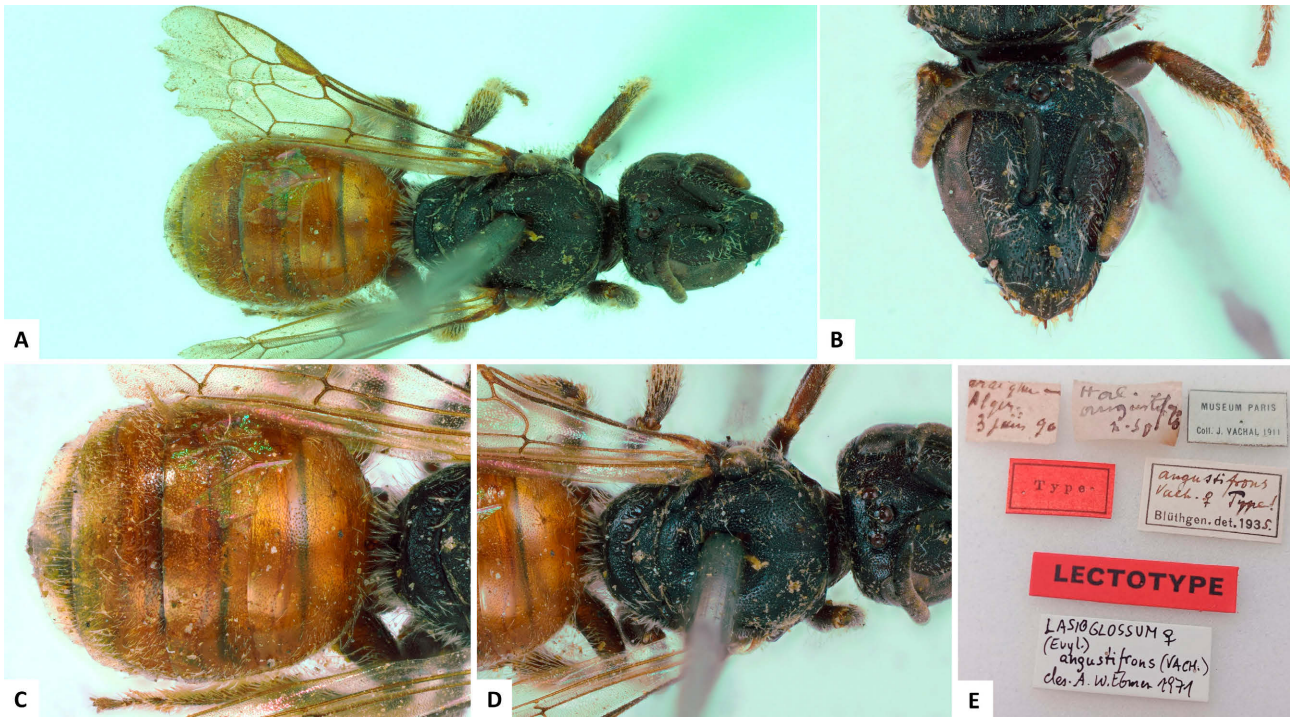


Fig. 3. *Halictus angustifrons* Vachal, 1892, lectotype, ♀ (MNHN). A – habitus in dorsal view, B – head in frontal view, C – mesosoma in dorsal view, D – metasoma in dorsal view, E – labels.

tions classified all sequences clustered in *L. angustifrons* clade as a separate species (Fig. 2). mPTP detected 48 species, grouping the *L. angustifrons* clade as a separate species. The *ad hoc* model returned the same result, identifying 71 species.

Taxonomic accounts

Genus *Lasioglossum* Curtis, 1833

Lasioglossum (*Hemihalictus*) *punctatissimum* (Schenck, 1853)

Hylaeus punctatissimus Schenck, 1853: 149; ♀, type locality not specified (Germany) [SMF, lectotype, designated by Ebmer (1975), not examined].

= *Hylaeus flavitarsis* Schenck, 1853: 165–166; ♂, type locality not specified (Germany) [MWNH, lectotype, designated by Ebmer (1975), not examined].

= *Halictus simillimus* Schenck, 1868: 306; ♂, type locality Wiesbaden (Germany) [SMF, lectotype, designated by Ebmer (1975), not examined].

= *Halictus porcus* Morawitz, 1872: 369–370; ♀, nec ♂, type locality Graz (Austria) [ZIN, lectotypes, designated by Astafurova & Proshchalykin (2018), not examined].

= *Halictus rubescens* Schenck, 1873: 259; ♀, type locality not specified (Germany) [not preserved].

= *Halictus longiceps* Saunders, 1879: 200; ♀, ♂, type locality Chobham (England) [NHMUK, not examined].

= *Halictus tinitinensis* Cockerell, 1938: 81–82; ♀, type locality Tinitine (Morocco) [NHMUK, not examined].

Combination as *Lasioglossum punctatissimum angustifrons* by Ebmer (1985): 290–291.

Non-type material examined. See supplementary material (Table S1).

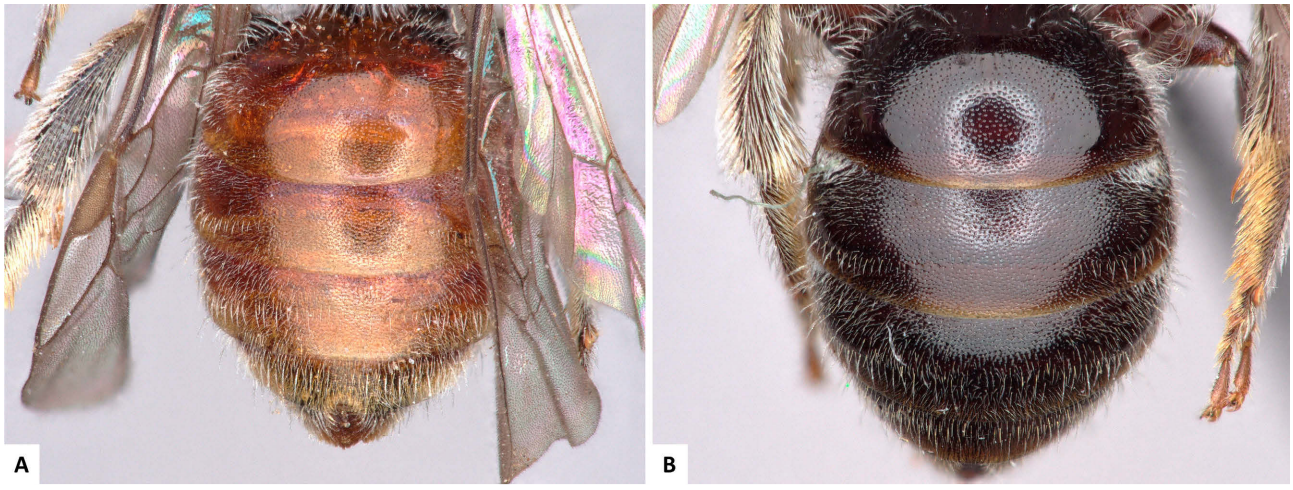


Fig. 4. A – *Lasioglossum angustifrons*, ♀, metasoma, dorsal view; B – *Lasioglossum punctatissimum*, ♀, metasoma, dorsal view.

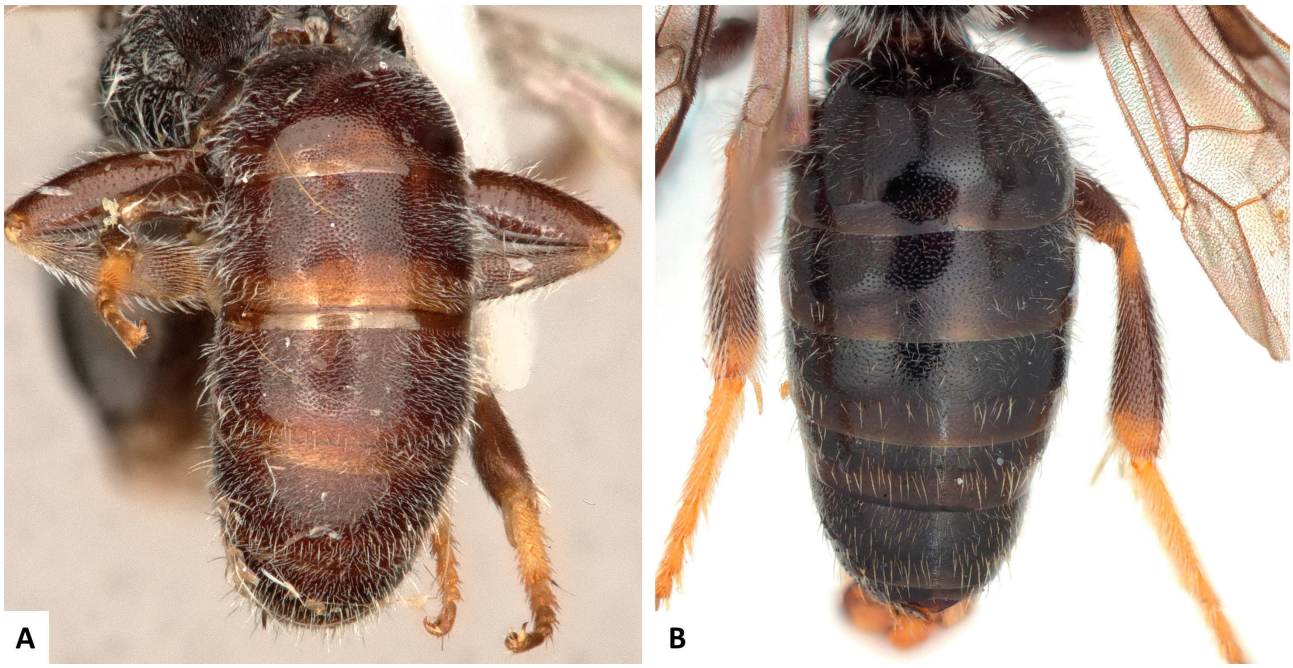


Fig. 5. A – *Lasioglossum angustifrons*, ♂, metasoma, dorsal view; B – *Lasioglossum punctatissimum*, ♂, metasoma, dorsal view.

Distribution

Lasioglossum punctatissimum occurs throughout the western Palearctic, stretching from Ireland in the west to the Ural Mountains in the east, and from Morocco south-eastwards to Iran, reaching as far north as Finland.

Lasioglossum (*Hemihalictus*) *angustifrons* stat. nov. (Vachal, 1892)

(Fig. 3)

Halictus angustifrons Vachal, 1892: 22–23; ♀, type locality Algeri (Algeria) [MNHN, lectotype, designated by Ebmer (1971), examined]. Lectotype of *Halictus angustifrons* Vachal: Araiqma 3 juin 90 // *Hal. angustifrons* 1.50 // Museum Paris Coll. J. VACHAL 1911 // Type // *angustifrons* Vach. ♀ Type! Blüthgen.det. 1935. // LECTOTYPE // *Lasioglossum (Evyl.) angustifrons* (VACH.) des. A.W. Ebmer 1971.

= *Halictus rubescens* Pérez, 1895: 55–56; ♀, type locality western North Africa [not preserved].

Non-type material examined. See supplementary material (Table S1).

Diagnostic characters

The most evident difference between *Lasioglossum angustifrons* and *L. punctatissimum* lies in the reddish colouration of the metasomal terga in the former species (Fig. 4).

In females of *L. angustifrons*, the disc of T1 is usually entirely orange-reddish to dark brick-red (Fig. 4), though the convex basal part may occasionally remain black. The following terga (T2–T4) (Fig. 4) are predominantly red, sometimes with small dark lateral spots, while T5 is almost entirely black. Some specimens show a more extensive darkening of the metasoma, with only the discs of T1 and T2 and the posterior margins retaining a reddish tint.

In males, the reddish colouration of the metasoma is sometimes less extensive. Besides the always reddish pos-

Fig. 6. A – *Lasioglossum angustifrons*, ♀, scutum, dorsal view; B – *Lasioglossum punctatissimum*, ♀, scutum, dorsal view.

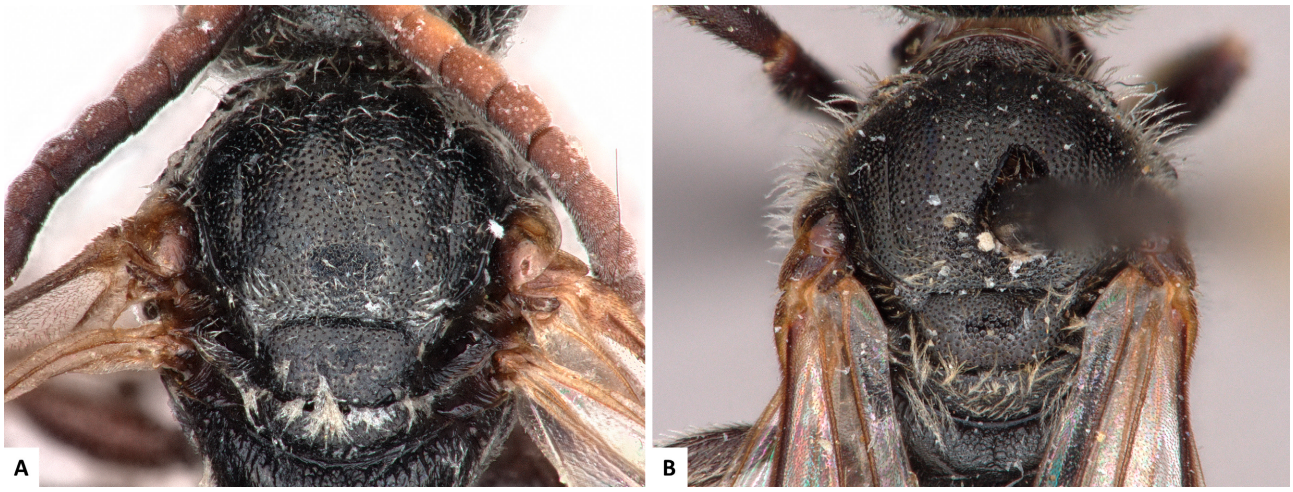


Fig. 7. A – *Lasioglossum angustifrons*, ♂, scutum, dorsal view; B – *Lasioglossum punctatissimum*, ♂, scutum, dorsal view.

terior margins of T1–T4, only the discs of T1 and T2 often display a faint reddish hue (Fig. 5A).

In *L. punctatissimum*, the metasoma is entirely black (Fig. 5B) except for the translucent posterior margin, which is never reddish and narrower than in *L. angustifrons*.

Moreover, in both sexes, *L. angustifrons* shows finer and denser punctation on the scutum compared to *L. punctatissimum* (Figs 6–7).

According to Ebmer (1985), males can also be distinguished by the fine longitudinal striation of the gonocoxites, which is clearly developed only anterolaterally in *Lasioglossum angustifrons*. Elsewhere, the outer surface is polished (Fig. 8A). This contrasts with *L. punctatissimum*, in which the gonocoxite is entirely striated (Fig. 8B). Diagnostic characters are summarised in Table 1.

Ecology

Lasioglossum angustifrons seems to be associated with coastal habitats. Across its range, the species is predominantly found near the shoreline, suggesting adaptations to maritime-influenced ecosystems and a possible sensitivity to arid inland conditions. However, a limited number of

Table 1. Determination table to morphologically distinguish *Lasioglossum angustifrons* and *L. punctatissimum* specimens.

Characters	*Lasioglossum angustifrons*	*Lasioglossum punctatissimum*
Scutum punctation (♂ & ♀)	Finer in comparison, interspaces as 1–2.5 punctures	Coarser in comparison, interspaces as 2–3.5 punctures
Disc of T1 (♂ & ♀)	Usually completely orangish-reddish or dark brick-red, sometimes convex part of T1 black	Entirely black
Posterior margin of T1 (♂ & ♀)	Translucent, orangish or reddish	Translucent, from light brown to yellowish
T2–T4 (♂ & ♀)	Usually predominantly orangish-reddish, sometimes with small dark lateral spots; posterior margin always reddish	Entirely black, except for the translucent tergal margins, which are never reddish and narrower than in *L. angustifrons*
Gonocoxite (♂)	Fine longitudinal striation only anteriorly, elsewhere polished	Entirely striated

Fig. 8. A – *Lasioglossum angustifrons*, ♂, genital capsule, dorsal view; B – *Lasioglossum punctatissimum*, ♂, genital capsule, dorsal view.

Fig. 9. Distributions of *Lasioglossum angustifrons* (red triangle) and *Lasioglossum punctatissimum* (green triangle) across the West Palearctic region based on examined material.

inland records in Morocco, from Tinghir, Ouarzazate, and Souss-Massa, indicate occasional deviations from the outlined coastal distribution, possibly reflecting rare dispersal events or localised microhabitats that meet specific ecological requirements. These few inland occurrences highlight knowledge gaps regarding habitat tolerance and dispersal capability. Further targeted surveys and ecological studies are necessary to better understand the environmental parameters shaping the distribution of this species and to clarify the significance of these records.

Distribution

Western North Africa (Morocco, Algeria, Tunisia), Italy (Sicily) and the Iberian Peninsula (Fig. 9).

DISCUSSION

Our analysis demonstrates that *Lasioglossum angustifrons* is best treated as a species rather than a subspecies of *L. punctatissimum*. Molecular evidence places *L. angustifrons* in an independent well-supported clade, clearly separated from *L. punctatissimum* by sizeable genetic distances and high bootstrap values. Morphological inspection corroborates this division: *L. angustifrons* shows a markedly finer, denser punctation on the scutum and a distinctive metasomal colour pattern, features long accepted as species-level diagnostics within *Lasioglossum* (Ebmer, 1970, 1971; Pesenko, 2007). Finally, the sympatric distribution of the two species in the Western Mediterranean basin does not support the hypothesis of the presence of two morphologically distinguished and allopatric entities as proposed by Ebmer (1985). This is a classic biogeographical pattern already observed in other bee clades (Michez et al., 2025).

By merging genetic and morphological datasets, our study eliminates lingering taxonomic ambiguity and strengthens the case for recognising *L. angustifrons* as a distinct species. Similar integrative frameworks have proven decisive in resolving other cryptic bee complexes (Pauly, 2015, 2019; Gardner & Gibbs, 2020), and the present work reinforces their value. Precise species delimitation is not merely academic: it underpins effective pollinator conservation and refines our broader understanding of biodiversity within the genus *Lasioglossum*.

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Supplemetary material follows (Table S1 and Fig. S1) on next pages.

Table S1. Non type material examined.

Species	Sex	Number	Country	Locality	Long.	Lat.	Altitude	Date	Legit	Det.	Collection	Original	
Lasioglossum punctatissimum	M	1	Greece	Crete, Nikiforos Fokas	35.350324	24.358934	5 m	20/06/23	Benda D.	Flaminio S.	NMPC	yes	
Lasioglossum punctatissimum	F	1	Greece	Crete, Georgiopouli	35.35540	24.25401	19 m	23/06/23	Benda D.	Flaminio S.	NMPC	yes	
Lasioglossum angustifrons	F	3	Morocco	Tinghir prov, Ait Sedrate, Sahl el Gharbia	31.195723	–6.205409	1368 m	27/03/19	Benda D.	Flaminio S.	NMPC	yes	
Lasioglossum angustifrons	F	1	Morocco	Ouarzazate	30.954363	–6.868202	1121 m	27/03/19	Benda D.	Flaminio S.	NMPC	yes	
Lasioglossum punctatissimum	F	3	Italy	Roma, Tenuta di Castelporziano, Grotta Romagnola	41.7541	12.4305		25/08/88	Cerretti P.	Nobile V.	MZUR	no	
Lasioglossum punctatissimum	F	1	Italy	Roma, Via dell'Acqua Traversa, 143	41.9546	12.4435		31/07/16	Corcos D., Caruso V.	Mei M.	MZUR	yes	
Lasioglossum punctatissimum	F	1	Italy	Pisciotta	40.108062425	15.234014999		19/05/31		Ebmer A.W.	FSEC	yes	
Lasioglossum punctatissimum	F	1	Italy	Portici	40.8148498275	14.34886545		06/04/17		Ebmer A.W.	FSEC	yes	
Lasioglossum punctatissimum	F	1	IT	Castelvetro	44.505475	10.946818		19210920		Bluthgen	FSEC	yes	det. 1935, val. 2022
Lasioglossum punctatissimum	F	2	Israel	Mata	31.7174	35.0622		13/03/24	Lofchick A.	Flaminio S.	FSEC	no	
Lasioglossum punctatissimum	F	1	Morocco	Souss-Massa, Tafraoute, Imskrn (5 km SE Tanalt)	29.744343	–9.114773		13/03/22	Wood T.	Flaminio S.	TJWC	yes	
Lasioglossum punctatissimum	F	1	Greece	Ag. Georgios	40.701516	23.646589		2023	Flaminio S.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	Greece	Kato Nevrokopi	41.292768	24.007231		2023	Flaminio S.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	Italy	Norchia (VT)	42.33846	11.948146		2022	Selis M.	Flaminio S.	MSC	yes	
Lasioglossum punctatissimum	F	2	Italy	Bomarzo (VT), Tevere	42.513164	12.274482		2022	Selis M.	Flaminio S.	MSC	yes	
Lasioglossum punctatissimum	F	2	Italy	Bomarzo (VT), Tevere	42.513164	12.274482		2022	Selis M.	Flaminio S.	MSC	yes	
Lasioglossum punctatissimum	F	1	Austria	Grammatneusiedl Niederösterreich	48.018899	16.48879		1995		Flaminio S.	NMW	yes	
Lasioglossum punctatissimum	M	1	Portugal	berg in buurt van Covide	41.742737	–8.170815		09/07/20	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	M	1	Portugal	Slaappl. Rivier Pinheiro novo	41.9585	–7.158633		09/07/20	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	M	1	Portugal	Slaappl. Rivier Pinheiro novo	41.9585	–7.158633		09/07/20	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	F	1	Italy	Ozein Aosta vallei	45.676173	7.230545		28/06/16	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	F	1	Poland	op.pl. Spoor Miesjce Mocy Bialowieza	52.71841	23.834693		22/06/12	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	F	1	Poland	op.pl. Spoor Miesjce Mocy Bialowieza	52.71841	23.834693		22/06/12	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	F	1	Poland	dorpje bij huisje Teremiski	52.737254	23.764571		20/06/15	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum punctatissimum	F	1	Poland	Red Marsh Grzedy Bierbza	53.614659	22.78955		24/06/15	Janssen K.	Flaminio S.	KJPC	yes	
Lasioglossum angustifrons	F	1	Morocco	Sidi Boukil	32.2277	–4.7143		31/07/19	Ihsane A, Sentil A	Flaminio S.	SFPC	yes	
Lasioglossum angustifrons	F	3	Italy	Sicily, Foce Simeto	37.4003	15.0890		13/09/19	Catania R.	Flaminio S.	SFPC	no	
Lasioglossum angustifrons	F	2	Morocco	Bouknadei	34.0634	–6.6278		21/10/19	Sentil A.	Flaminio S.	SFPC	yes	
Lasioglossum angustifrons	F	1	Morocco	Sidi Boukil	32.2287	–4.7058		17/05/19	Sentil A.	Flaminio S.	SFPC	yes	
Lasioglossum angustifrons	F	2	Italy	Sicily, Fiumefreddo	37.7930	15.2079		31/05/22	Catania R.	Flaminio S.	SFPC	no	
Lasioglossum angustifrons	F	1	Morocco	Bouknadei	34.0634	–6.624934		13/07/18	Sentil A.	Flaminio S.	SFPC	yes	
Lasioglossum angustifrons	F	1	Morocco	Haddada	34.149856	–6.54176		10/07/18	Hamroud L.	Flaminio S.	SFPC	yes	
Lasioglossum angustifrons	F	5	Spain	Alicante, Moraira	38.6880	0.1345		06/05/89	Wahis R.	Flaminio S.	SFPC	no	
Lasioglossum punctatissimum	F	5	Italy	Liguria, Vado Ligure	44.2691	8.4398		16/05/16	Monterastelli E.	Flaminio S.	SFPC	no	
Lasioglossum punctatissimum	F	2	Ukraine	Kiev	50.4500	30.5233		25/06/10	Nesterov M.	Flaminio S.	SFPC	no	
Lasioglossum punctatissimum	M	3	Ukraine	Kiev	50.4500	30.5233		25/06/10	Nesterov M.	Flaminio S.	SFPC	no	
Lasioglossum punctatissimum	F	1	Italy	Friuli, Udine	46.0711	13.2346		10/06/22	Cargnus E.	Flaminio S.	SFPC	no	
Lasioglossum punctatissimum	F	2	Italy	Calabria, Caporizzuto	38.9089	17.1447		21/04/22	Flaminio S.	Flaminio S.	SFPC	yes	
Lasioglossum punctatissimum	F	1	Bulgaria	Debar, 40km E Plovdiv	42.1500	25,202		27/06/22	Halada M.	Flaminio S.	SFPC	yes	
Lasioglossum punctatissimum	F	1	Italy	Premosello Chiovenda	45.0423	50.97296		21/07/21	Mosini A.	Flaminio S.	SFPC	yes	
Lasioglossum punctatissimum	F	1	France	Var, Gonfaron, Gasqui	43.3456	6.2664		07/07/97	Dermeuldre I.	Flaminio S.	SFPC	yes	
Lasioglossum punctatissimum	F	1	Morocco	Azour Ouarg	30.9264	–8.8403		21/05/98	Rasmont P.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	Morocco	Taliouine	30.2204	–8.4428		01/06/98	Rasmont P.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	France	St. Julien-en-Born	44.0636	–1.2242		22/06/96	Barbier Y.	Flaminio S.	UMONS	no	
Lasioglossum punctatissimum	F	5	France	Var, Gonfaron, Notre-Dame-du-Figuier	43.3045	6.3091		17/05/86	Rasmont P.	Flaminio S.	UMONS	no	
Lasioglossum punctatissimum	F	1	France	Var, Montmeyan	43.6950	6.0389		14/05/98	Doye L.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	France	Var, Flassans-sur-Issole	43.3478	6.2386		13/05/97	Flagothier D.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	France	Landes, Castets	43.8833	–1.1458		06/09/93	Tomasovic G.	Flaminio S.	UMONS	no	
Lasioglossum punctatissimum	F	4	Italy	Latina, Aprilia	41.5830	12.6500		31/07/93	Terzo M.	Flaminio S.	UMONS	no	
Lasioglossum punctatissimum	F	1	Spain	Lleida, Balaguer	41.8758	0.8508		11/05/21	Wood T.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	France	Var, Les Mayons	43.2881	6.3861		14/05/97	Lecomte S.	Flaminio S.	UMONS	yes	
Lasioglossum punctatissimum	F	1	Belgium	Namur, Treignes	50.0927	4.8675		10/04/91	Longo	Flaminio S.	UMONS	no	
Lasioglossum angustifrons	F	1	Morocco	Sidi Boukil	32.2283	–4.7054		03/08/19	Sentil A.	Flaminio S.	UMONS	yes	
Lasioglossum angustifrons	F	1	Morocco	Ait Sais	32.2433	–4.65		17/04/19	Sentil A.	Flaminio S.	UMONS	yes	
Lasioglossum angustifrons	F	1	Morocco	Haddada	34.1216	–6.5628		08/05/19	Hamroud L.	Flaminio S.	UMONS	yes	
Lasioglossum angustifrons	F	1	Morocco	Haddada	34.1283	–6.5592		26/07/19	Hamroud L.	Flaminio S.	UMONS	yes	
Lasioglossum angustifrons	M	3	Spain	Alicante, Moraira	38.6880	0.1345		06/05/89	Wahis R.	Flaminio S.	SFPC	no	

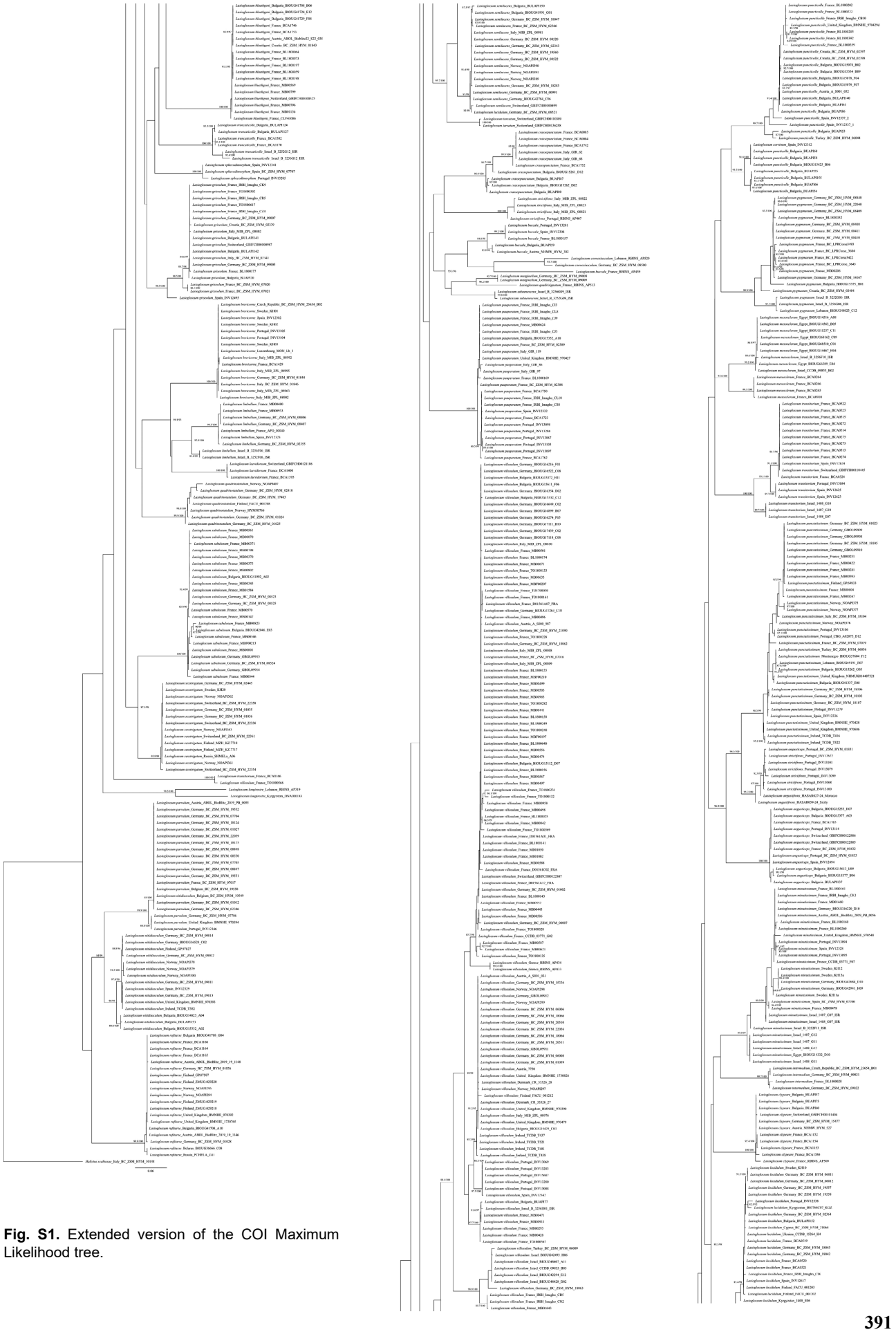

Fig. S1. Extended version of the COI Maximum Likelihood tree.