

**ANDRENA SCOTICA PERKINS IS THE VALID NAME
FOR THE WIDESPREAD EUROPEAN TAXON PREVIOUSLY
REFERRED TO AS ANDRENA CARANTONICA PÉREZ
(HYMENOPTERA: ANDRENIDAE)**

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ABSTRACT

The bee genus *Andrena* is both species-rich and taxonomically challenging due to inter- and intra-specific variation, particularly for bivoltine taxa. One such case involves the subgenus *Hoplendrena*. Two species within this subgenus are widespread across the West Palearctic, one of which is bivoltine and the other usually univoltine. The two species have been regularly confused, and the correct name to apply to each taxon has not been clear, as only spring-flying males can be confidently identified using morphological characters. Though the name *A. trimmerana* (Kirby, 1802) is now confidently applied to the bivoltine taxon, the use of the name *A. carantonica* Pérez, 1902 to apply to the usually univoltine taxon is controversial. Examination of the female type of *A. carantonica* demonstrates that it cannot morphologically be assigned to either taxon with confidence, though the probable collection date of late June or July strongly suggests conspecificity with *A. trimmerana*. *Andrena carantonica* is therefore considered a **nomen dubium**. The earliest available name for the usually univoltine taxon, and for which male material is available, is *Andrena scotica* Perkins, 1916 **sp. resurr.** A male lectotype is designated for *Andrena scotica*. A female lectotype is designated for *A. trimmerana*, and a male lectotype for *A. spinigera* (Kirby, 1802), this name being an established synonym of *A. trimmerana*. *Andrena jacobii* Perkins, 1921 **syn. nov.** and *Andrena jacobii* var. *johnsoni* Perkins, 1921 **syn. nov.** are synonymised with *Andrena scotica*. These findings resolve one of the longest-running outstanding nomenclatural issues in European bees, and provide a stable taxonomic base for future study.

INTRODUCTION

The bee genus *Andrena* is highly species rich, comprising around 1,600 species globally (Gusenleitner & Schwarz 2002, Ascher & Pickering, 2020). It is predominantly distributed throughout the Holarctic, and is an almost ubiquitous

component of bee faunas in this region. Though the greatest *Andrena* diversity is found in Mediterranean areas, it is the most speciose genus across most Holarctic faunas, even in countries with relatively small faunas such as the United Kingdom (Gusenleitner & Schwarz, 2002; Else & Edwards, 2018; Lhomme *et al.*, 2020).

As well as showing considerable species richness, *Andrena* can also show great variation and plasticity within a species. This can be seen in the morphological variation between spring and summer generations of bivoltine species, usually most clearly seen in the male sex, for example the colouration of the male facial hair. One group of *Andrena* well known for its inter-generational variation is *Hoplandrena*, a derived Old World subgenus containing 13 species in the West Palaearctic (Kuhlmann *et al.*, 2021; Pisanty *et al.*, 2022). Individuals can show huge colour variation between generations, and males vary in the number of mandibular teeth and the presence and length of genal spines on the face (see below). This has led to a larger than usual number of synonyms for *Andrena* species, with different generations each receiving at least one name.

Within *Hoplandrena*, the greatest number of synonymous names can be found for the bivoltine taxa *A. trimmerana* (Kirby, 1802) and *A. rosae* Panzer, 1801, both of which have been greatly confused, including with each other (e.g. Perkins, 1890). Though the status of *A. rosae* as a distinct bivoltine species is now largely established (Reemer *et al.*, 2008; Schmidt *et al.*, 2015; Gueuning *et al.*, 2020), confusion persists around the use of *A. trimmerana* because of the existence of a very closely related but usually univoltine taxon (hereafter referred to simply as the univoltine taxon), currently often referred to as *A. carantonica* Pérez, 1902. Though the two taxa, which are generally thought of as bivoltine and univoltine, have been considered distinct by most authors during the 20th century (though see Warncke, 1986), they are difficult to consistently separate morphologically or using conventional cytochrome oxidase I (COI) DNA barcoding (Schmidt *et al.*, 2015). Males of the univoltine taxon and of the summer generation of the bivoltine taxon have bidentate mandibles (mandibles with an inner subapical tooth), allowing separation from males of the spring generation of the strictly bivoltine taxon, which have unidentate mandibles. In addition, spring-generation males of the bivoltine taxon have a long and narrow genal spine, but this is absent or reduced in the univoltine taxon. However, the second generation of males of the bivoltine taxon have bidentate mandibles and lack a genal spine, therefore resulting in an inability to unambiguously separate summer flying male specimens morphologically. Though several characters have been suggested (e.g. Amiet *et al.*, 2010; Falk & Lewington, 2015), there does not appear to be a way to consistently separate female specimens across their range.

Recent molecular advances using Ultra-Conserved Elements (UCEs) strongly support the position that there are two reproductively isolated taxa in Switzerland, one univoltine, flying in April-June, and one bivoltine, flying predominantly in March-April and again in July-August (Gueuning *et al.*, 2020). The approach of Gueuning *et al.* (2020) generated UCEs and COI from the same individuals, allowing for the two techniques to be compared. Use of COI barcoding supported the existence of two genetically differentiated taxa but revealed the univoltine taxon (referred to in this publication as *A. carantonica*) to form a clade that was nested within a paraphyletic grade composed of individuals of the bivoltine taxon (*A. trimmerana*). The more powerful UCE approach that generates genetic sequences from hundreds of different nuclear loci unambiguously recovered two reciprocally monophyletic clades corresponding to the bivoltine and univoltine taxon.

However, there have been recent reports from Germany, Switzerland, and the United Kingdom of the univoltine species appearing in August and September,

adding additional complexity to this issue. Though demonstrating and confirming the existence of two taxa, it was not the objective of Gueuning *et al.* (2020) to deal with the nomenclatural problems surrounding the univoltine taxon. It is therefore the purpose of this paper to clarify the correct name that should be applied to it, given the long history of taxonomic confusion, and also to clarify the taxonomic identity of late-emerging specimens.

METHODS

In order to resolve the existing nomenclatural confusion, a history of the use and interpretation of the names applied to this group of species is presented. The type material of the most relevant names (in this case, *A. trimmerana*, *A. trimmerana* var. *scotica* Perkins, 1916 and *A. carantonica* Pérez, 1902) was examined, and taxonomic conclusions were drawn.

Photographs were taken using an Olympus E-M1 Mark II with a 60 mm macro lens. Photographs were stacked using Zerene Stacker 1.04 (Zerene Systems, USA) and plates were prepared in GNU Image Manipulation Program (GIMP) 2.10. Post-processing of some images was made in Photoshop Elements (Adobe Systems, USA) in order to improve lighting to highlight specific characters.

Though not forming reciprocally monophyletic clades, COI barcoding is still diagnostic to separate the univoltine and bivoltine taxa. Taking advantage of this, sequences were generated from 25 specimens whose identity could be assigned morphologically and by phenology, collected from Germany, Spain, Sweden, Switzerland, and the UK, including one late summer-flying individual that morphologically corresponded to the univoltine taxon, within the limits of morphological separation of these taxa (see identification key below). An additional 20 mtDNA sequences of the two taxa and *Andrena rosae* (as an outgroup) were downloaded from NCBI's GenBank; all sequences of the two taxa with a length >600 bp long were included. Nine COI sequences (a few low-quality, short sequences were excluded) analysed by Gueuning *et al.* (2020) were also included to allow direct comparison with UCE-based phylogenies and species delimitation.

To generate mtDNA sequences from specimens, DNA was extracted from a single leg or thorax using a high salt protocol (Paxton *et al.*, 1996) and amplified at the COI using standard barcoding primers (Folmer *et al.*, 1994) and standard protocols recommended by BOLD (<http://www.boldsystems.org>). Initial sequencing attempts revealed that the sequencing of amplicons generated using the standard barcoding primers yielded high quality sequences for the bivoltine taxon, but not for the univoltine one. In the latter, numerous double peaks were visible, suggesting NUMT co-amplification, as is often the case in *Andrena* (Praz *et al.*, 2022), or co-amplification of symbiont *Wolbachia*. We thus designed the following specific primers based on available COI sequences of species of *Hoplandrena*: COX_Hoplandr_F (CTW TAC TTC ATT TTC GCT ATR TGA G) and COX_Hoplandr_R (TA ART GTT GRT ATA GAA TAG GGT CTC). These primers yielded high quality sequences of a 651-bp fragment nested within the standard barcoding fragment of COI for all *Hoplandrena* species investigated. The PCR conditions for these primers were the following: 4 minutes at 94°C, then 35 cycles of 45 seconds at 94°C, 45 seconds at 55°C, 45 seconds at 72°C, with a final step of 7 minutes at 72°C. DNA sequences were generated commercially on an Illumina autosequencer, then used to interrogate the BOLD database using BOLD's search function and NCBI's database using BLAST (<https://blast.ncbi.nlm.nih.gov/>). All 25 sequences generated were devoid of stop codons, gave high query coverage (>98%)

and high sequence identity (>99%) to *A. trimmerana* or *A. scotica* (see Results), suggesting they were of high quality.

Phylogenetic and evolutionary analysis of the 56 sequences (including two *Andrena rosae* as an outgroup) were conducted using RAxML 8.2.10 (Stamatakis, 2014) (GTR+G model with three partitions corresponding to the three nucleotide positions) after alignment in MAFFT (Katoh & Standley, 2013).

Abbreviations

MNHN = Muséum national d'Histoire naturelle, Paris, France

NHMUK = Natural History Museum, London, United Kingdom

OUMNH = Oxford University Museum of Natural History, Oxford, United Kingdom

ZMHB = Museum für Naturkunde, Berlin, Germany

RESULTS

COI barcoding

The univoltine taxon constituted a monophyletic clade nested within *A. trimmerana* sequences i.e. mtDNA sequences for *A. trimmerana* are paraphyletic (Fig. 1). Given that Gueuning *et al.* (2020) unambiguously demonstrated the existence of two genetically differentiated taxa with largely overlapping ranges in Switzerland using UCEs, and the COI barcodes used by Gueuning *et al.* are contained within the phylogeny presented here, the newly sequenced specimens can be assigned to the same taxa as those of Gueuning *et al.* Based on their UCE analysis, the paraphyletic *A. trimmerana* sequences do not represent different taxa, and can be found in sympatry. For example, barcode sequences POLLE295-19 and POLLE1675-19 were collected from the same site in the Loire valley in France but fell into the two different *A. trimmerana* clades (Fig. 1).

The sequence of one summer-flying female identified morphologically as *A. scotica* (MEBEE014-22, collected 5 August 2018 in London, UK) placed the individual within *A. scotica* (Fig. 1), evidence that this species is also occasionally bivoltine, or at least that individuals can emerge in late summer to autumn. Whether or not they can successfully complete their lifecycle and reproduce this late in the season is unknown.

History of the names applied to the Andrena trimmerana complex

Kirby (1802) described two putative taxa in his monograph on English bees, *Andrena trimmerana* and *A. spinigera*. *Andrena trimmerana* was described from female material collected in May and August (“*Hab.* Barhamiae in floribus Augusto medio 1799 semel lecta, β bis in floribus horti mense Maio”). *Andrena spinigera* was described from male material. The collection period is not specified as for *A. trimmerana*, but since the habitat was described as “*Hab.* Barhamiae in *Salicum* amentis rarissima”, it can be presumed that this species was captured in the spring time when *Salix* blooms. Importantly, Kirby noted that the female *A. trimmerana* had tibial scopae that were black above and white below, and that the male *A. spinigera* specimen possessed a long filiform spine at the base of the mandible and, importantly, an edentate [unidentate] mandible.

The allocation of two names to different generations of the same species resulted in confusion for over a period of 100 years, for two principal reasons. The first is simply

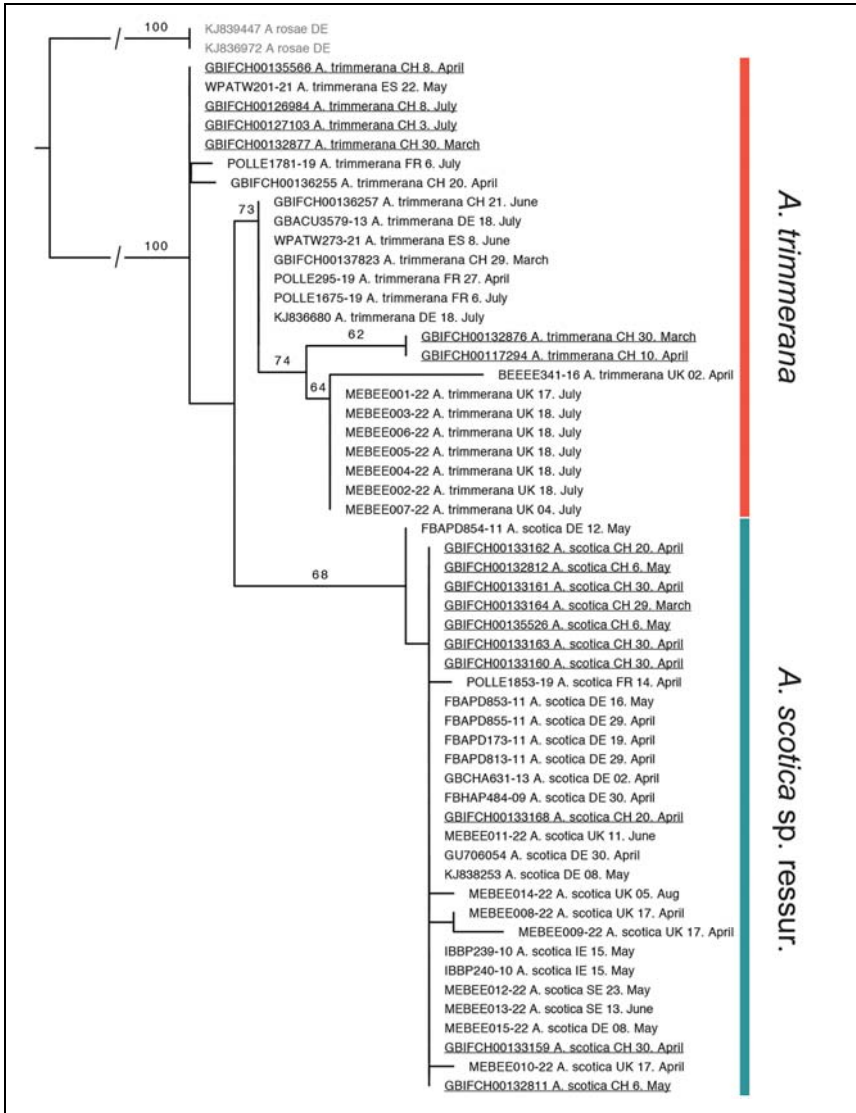


Fig. 1. Phylogenetic tree of *Andrena* (*Hoplاندrena*) species based on COI barcode sequences of 56 *Andrena* specimens (682 positions in the final dataset) inferred by Maximum Likelihood applying a GTR + G model and three partitions. The tree with the highest log likelihood is shown, and the percentage of trees (> 50%) in which the associated taxa clustered together is given next to the branches (1000 bootstraps). The tree is drawn to scale, with branch lengths measured in number of substitutions per site; the tree was rooted along the branch connecting *Andrena rosae* with the other two taxa; this branch was shortened (indicated by oblique bars). German (DE), Spanish (ES), Swedish (SE), Swiss (CH) and United Kingdom (UK) sequences commence with their unique code, their species name, country code and date of collection.

that they were not recognised as the same taxon, as illustrated by Friese (1887) who, when describing *A. dragana* Friese, 1887 (= *A. trimmerana*, see full synonymy below), mentions that the female is similar to *A. trimmerana* and the male to *A. spinigera*. The second more important source of confusion is that the name *A. trimmerana* became incorrectly applied to the univoltine taxon. This can be seen in Alfken (1911), who described *A. trimmerana* as univoltine, “*einer Frühjahrs-generation mit dunklem Hinterleib*” [a spring generation with dark abdomen]. He then went on to describe the red-marked *A. anglica* Alfken, 1911 (= *A. trimmerana*) as the second generation of *A. spinigera*, not knowing that *A. trimmerana* was itself described from the summer generation. This error is repeated by Perkins (1913) who translated Alfken’s key, and added further comments, stating that “*Andrena trimmerana*, K. is single brooded always”. Importantly, he describes the ventral part of the tibial scopa as consisting of “almost silvery whiteness”.

Perkins (1916) continued his work on this group, maintaining the use of the name *A. trimmerana* for the univoltine taxon. Noticing variation in the hair colouration, he described a variety *A. trimmerana* var. *scotica* from Scotland. However, one year later his inspection of the Kirby type collection revealed the error in the application of the name *A. trimmerana* (Perkins, 1917). Perkins realised that the single female specimen remaining in Kirby’s collection (one of an unknown number of syntypes) was collected in August, not during the spring. Though Kirby wrote that the ventral part of the tibial scopa was white (“*subtus albida*”), a character that was subsequently used to associate this name with the univoltine taxa, the scopa of the type specimen itself was discoloured, as “it frequently becomes so from pollen” (Perkins, 1917). Perkins concludes that “deplorable as we must consider it, that *A. spinigera* K. (No. 63) must be known as *A. trimmerana* K. (No. 57) = *anglica* Alfken”. In this recognition of the conspecificity of *A. trimmerana* and *A. spinigera*, Perkins was acting as first reviser, and thus *A. trimmerana* has priority over *A. spinigera* (ICZN 1999, Article 24.2.1). Four years later, he proposed the name *A. jacobi* Perkins, 1921 as a replacement name for *A. trimmerana* auct. (Perkins, 1921). This name *A. jacobi* entered into broader use to apply to the univoltine taxon, for example in Stöckhert’s major key to the *Andrena* of Central and Northern Europe, with *A. trimmerana* used to apply to the spring and summer generations of the bivoltine taxon (Stöckhert, 1930), but also more recently (Westrich, 1989).

The Kirby Collection is preserved in the NHMUK, and the type material of *A. trimmerana* was examined by us (TJW and ME). The single female syntype of *A. trimmerana* that is present in Kirby’s collection is in poor condition, as is to be expected of a specimen that is at least 220 years old. It conforms to the description of Kirby, including the silvery colour of the ventral hairs of the hind tibial scopa, as noted by Perkins (1917). As it is not clear that the work of Perkins constitutes a lectotype designation, and the specimen is not automatically the holotype since Kirby (1802) mentioned other specimens, the specimen housed in the NHMUK is designated as a lectotype. The same applies to *A. spinigera*, and so a male specimen is here designated as a lectotype in order that the names are unambiguously fixed on the specimens examined by Perkins. Unfortunately the lectotype specimen of *A. spinigera* is missing its head, but it carries a label with the number ‘63’, referring to its numerical reference in Kirby (1802, see Perkins 1917), so we can be confident that this is the specimen described by Kirby.

The matter would seem to have been clarified. However, Warncke (1967) proposed a major change, which was that the priority name for the univoltine taxon should be *A. carantonica*. Warncke noted that Pérez was right to see another taxon, and that this was also clarified by Perkins, therefore synonymising *A. jacobi* with

A. carantonica. Importantly, Warncke maintained a two-species concept at this point, as can be seen in later revisions such as his revision of the Iberian *Andrena* fauna (Warncke, 1976) and the distribution maps he produced for his West Palaearctic revision (see Gusenleitner & Schwarz, 2002). However, Warncke (1986) seemed to abandon this two-species concept, listing *A. trimmerana* as a bivoltine subspecies of *A. sabulosa* Scopoli, 1763 in an ultimately speculative combination, as the collection of Scopoli has been lost. This proposed name or combination was not accepted, and Warncke died in 1993.

Though Warncke (1967) listed the taxon *scotica* as a variety of *A. jacobii* and therefore as a synonym of *A. carantonica*, a formal synonymy of *A. scotica* with *A. carantonica* was confirmed by Schwarz *et al.* (1996) after Warncke's death. Because of this nomenclatural confusion and turnover, a variety of names and species concepts have been used in more recent publications, such as *spinigera-jacobii-trimmerana* (Schmid-Egger & Scheuchl, 1997), *spinigera-carantonica-trimmerana* (Amiet *et al.* 2010), *scotica-trimmerana* (Falk & Lewington, 2015; Westrich, 2018), and *carantonica-trimmerana* (Gueuning *et al.*, 2020).

Examination of the lectotype of Andrena carantonica Pérez, 1902

Material examined: FRANCE: Royan, [undated], 1♀, lectotype designated by K. Warncke, Pérez Collection, MNHN, Paris (illustrated Figs 2–5).

Pérez (1902) gives the type locality as Saint-Georges-de-Didonne, and whilst this locality is not indicated on the label of the lectotype female, this locality is within



Figs 2–5. *Andrena carantonica* Pérez, 1902 lectotype. 2. labels; 3. female lateral habitus; 4. female face; 5. female terga.

2 km of the centre of the town of Royan and so Warncke's (1967) lectotype designation is considered to be valid. The specimen also bears no label with details of the collection date, and so it is assumed that Warncke took the month of July (VII) that he used in his 1967 publication from Pérez's original paper [fin juin et juillet].

In his original description, Pérez immediately notes that the species is very difficult to distinguish from "*A. trimmerana*" (which in line with peer authors would be *A. trimmerana auct.*, and actually refers to the univoltine taxon), and proceeds to give a description of the female in relative terms based on the punctuation, pubescence, the sculpturing of the propodeal triangle, and the degree to which the tergal margins are depressed. In the male sex, he describes the genital spine as very small to absent, and gives some characters relating to the strength of the punctuation and the shape of the anal cell of the wing. This description is completely inadequate to allow for morphological separation of the two taxa, given the inherent difficulty in separating this species pair. Additionally, the ecological data strongly suggest that this material corresponds to the second generation of *A. trimmerana*. In Pérez's unpublished catalogue (accessible at <https://science.mnhn.fr/catalogue/ey-bib-perez1/page/301>, entry 1651), he wrote "*St George-de-Didone, la* ♀ très comm.! dans la 1^{ere} quinzaine de juillet 1900, sur le *Tilia argentea*, au jardin, et sur les fusains. Fin juin 1901, 3♀, et 1^{er} jour de juillet, plusieurs ♀ et ♂ tilleul, ♂ fusains, tous usés. Recueille le pollen de la Ronce." This pattern of emergence and use of summer flowering trees and shrubs strongly matches the behaviour of the second generation of *A. trimmerana* which forages strongly from '*la Ronce*', in English, bramble (*Rubus fruticosus* agg., Wood & Roberts, 2017).

Following the definitions of *nomina dubia* collated by Mones (1989), principally "The name of a nominal species for which available evidence is insufficient to permit recognition of the zoological species to which it was applied", more succinctly summarised in the ICZN code (ICZN 1999) as "A Latin term meaning "a name of unknown or doubtful application", and given the difficulty in correctly placing female material of this complex without genetic data, *A. carantonica* should be considered to be a *nomen dubium*. We associate these female specimens with *A. trimmerana* because of the slightly red-marked terga, the summer flight period, and Pérez's description of its behaviour, all of which are consistent with the bivoltine nature and colouration patterns of usual *A. trimmerana* material, but this should be considered a probabilistic association.

Examination of the type series of Andrena trimmerana var. scotica Perkins, 1916

Type specimens were located in the Oxford University Museum of Natural History (one of the possible type repositories listed by Gusenleitner & Schwarz, 2002) using evidence from the original literature and archived collection photographs. In the original description, Perkins (1916) states that at least one of the specimens of *trimmerana var. scotica* was from Loch Rannoch and housed in Frederick Smith's collection. The number of specimens is not stated, but as characters are given for both sexes the type series must consist of at least a single example of each sex.

The Frederick Smith collection of British Hymenoptera is housed at the OUMNH and was incorporated into the main British collection in 2009. Archived photographs of the original layout show four specimens standing over a cabinet label written in Smith's distinctive hand, reading '*Trimmerana* Perth. (var?)' One of these specimens is a female bearing a label 'Loch Rannoch' written by Smith and there can be little doubt this is one of the specimens referred to by Perkins (1916) in his description of var. *scotica*. A further female and a male are labelled 'Perthsh.'; it is reasonable to

assume these are also part of the original type series given Perkins' description of male and female characters, and because Loch Rannoch itself is found within Perthshire the specimens therefore come from the same population. The closing remark by Perkins (1916) of 'and a similar form occurs in Ireland' probably refers to the fourth specimen, labelled 'Dublin, Ireland'. This specimen is considered to be part of the original collection of Smith, but is not considered to be a syntype given the closing remark of Perkins.

Though Perkins described *A. scotica* as a variety, we do not consider this name to be infrasubspecific. ICZN (1999, Article 45.6.1.) states that a name "is infrasubspecific if its author expressly gave it infrasubspecific rank, or if the content of the work unambiguously reveals that the name was proposed for an infrasubspecific entity". Furthermore, Article 45.6.4. (ICZN 1999) clarifies that a name "is subspecific if first published before 1961 and its author expressly used one of the terms "variety" or "form" (including use of the terms "var.", "forma", "v." and "f."), unless its author also expressly gave it infrasubspecific rank, or the content of the work unambiguously reveals that the name was proposed for an infrasubspecific entity, in which case it is infrasubspecific". Perkins (1916) description of *A. scotica* as a variety therefore meets the criteria to be considered as a subspecific, and therefore an available taxon name.

Given that the original description was presumably based on at least one male and two females, a lectotype is designated here. The male specimen was chosen because it displays the single invariant and unambiguous character that allows separation from spring males of *A. trimmerana* and *A. scotica*, namely the bidentate mandibles. Even without this, one can be confident that material from Scotland represents the univoltine taxon as the bivoltine taxon has never been recorded from Scotland (Falk & Lewington, 2015; Else & Edwards, 2018).

Lectotype male (here designated, illustrated Figs 6–9), labelled as follows: 'Perthsh.' [in handwriting of F. Smith], 'Standing over label 'Trimmerana Perthsh. (var?)' in F. Smith colln. OUMNH-2009-028', 'LECTOTYPE *Andrena trimmerana* var. *scotica* Perkins, 1916 des. T. Wood 2022', 'TYPE HYME 2762-1 *Andrena trimmerana* var. *scotica* Perkins, 1916 HOPE ENT. COLL., OUMNH'.

Additional non-examined type material nominally belonging to Andrena trimmerana

Lepeletier (1841) described *Andrena fusca* Lepeletier, 1841 from Algeria in North Africa. Searches in the MNHN have not allowed location of this specimen. All examined specimens of this species pair from North Africa belong to *A. trimmerana* (see map in Gusenleitner & Schwarz, 2002, also Lhomme *et al.*, 2020).

Dours (1872) described two taxa *Andrena arietina* Dours, 1872 and *Andrena ustulata* Dours, 1872 from Algeria that have been assigned to *A. trimmerana*. The Dours collection was destroyed, and all of these types are lost. As for *A. fusca*, these names are expected to apply to *A. trimmerana*.

Schmiedeknecht (1883) described *Andrena lombardica* Schmiedeknecht, 1883 from Italy. This type material is lost. Some unrecognised Schmiedeknecht *Andrena* type material (Pérez, *in litt.*) has been located in the Naturalis Biodiversity Center in Leiden (the Netherlands), which will be published soon (TJW, *in prep*), but this does not include any specimens corresponding to either *A. trimmerana* or *A. scotica*. No definitive answer can be drawn from the original description. We therefore treat *A. lombardica* as a *nomen dubium*.



Figs 6–9. *Andrena scotica* Perkins, 1916 lectotype. 6. labels; 7. male lateral habitus; 8. male dorsal habitus; 9. male face.

Friese (1887) described *Andrena dragana* Friese, 1887 from modern day Slovenia. Based on the description of the male, this taxon is clearly the spring generation of *A. trimmerana* due to the unidentate mandibles.

Alfken (1911) described *Andrena anglica* Alfken, 1911 from England. This taxon corresponds to the summer generation of *A. trimmerana*, as Alfken was following the pre-Perkins (1917) interpretation of the name *A. trimmerana* (see Introduction).

Replacement names

Following the discovery of the incorrect use of the name *A. trimmerana* (Perkins, 1917), Perkins (1921) proposed the replacement name *A. jacobi* for *A. trimmerana* auctorum nec. Kirby. As a name published before 1931 it is available because it contains an ‘indication’ that it is a replacement name (ICZN 1999, Article 12.2.3). This follows Article 11.10 ‘Deliberate employment of misidentifications’, whereby in deliberately referring to *A. trimmerana* auctorum, Perkins established the name *A. jacobi* for the univoltine taxon misinterpreted as *A. trimmerana* by European authors. Following Article 72.4.2, the type material for *A. jacobi* could therefore consist of any misidentified specimen identified as *A. trimmerana* by any European author between 1802–1921. Given that the original description clearly refers to the univoltine taxon, we place *A. jacobi* in synonymy with *A. scotica*. Designation of a lectotype is not considered necessary given these circumstances.

In the same publication Perkins (1921) described *A. jacobi* var. *johnsoni* based on material from Ireland provided by W.F. Johnson, without further details of sampling localities. Following the same logic, this name is also placed in synonymy with *A. scotica*. This varietal form probably referred to specimens with darker vestiture that can be collected in Ireland (e.g. Else & Edwards, 2018). Designation of a lectotype is also not currently possible as the location of these specimens is unclear, and designation of a neotype is considered unnecessary.

Updated taxonomic synonymy

***Andrena (Hoplandrena) trimmerana* (Kirby, 1802)**

Melitta Trimmerana Kirby, 1802: Monogr. apum Angl., v2. p.116 [England, NHMUK, examined]. Lectotype ♀, by present designation.

Melitta spinigera Kirby, 1802: Monogr. apum Angl., p.123 [England, NHMUK, examined]. Lectotype ♂, by present designation.

Andrena fusca Lepeletier, 1841: Hist. nat. Insect. Hymen., p.253 [Algeria, ?MNHN, not examined]

Andrena arietina Dours, 1872: Revue Mag. Zool., p. 396 [Algeria] ?type lost

Andrena ustulata Dours, 1872: Revue Mag. Zool. p432 [Algeria] ?type lost

Andrena lombardica Schmiedeknecht, 1883: Apid. Europ. p674 [Italy] ?type lost

Andrena Dragana Friese, 1887: Természetr. Füz. p23 [Slovenia, ZMHB, not examined]

Andrena anglica Alfken, 1911: Dt. ent. Z., p458 [England, ZMHB or OUMNH, not examined]

?*Andrena Carantonica* Pérez, 1902: P.-v. Soc. linn. Bordeaux, p.175 [France, MNHN, examined] **nomen dubium**

***Andrena (Hoplandrena) scotica* Perkins, 1916 spec. resurr.**

?*Apis sabulosa* Scopoli, 1763: Entom. Carn., p. 300 **nomen dubium** [Austria] type lost

?*Apis degener* Scopoli, 1770: Annus hist. nat., p. 13 **nomen dubium** [Austria] type lost

?*Apis acris* Harris, 1776: Expos. English Insects **nomen dubium** [England] type lost

?*Apis lutulenta* Gmelin, 1790: Linné, Syst. nat., (Ed. 13), p. 2790 **nomen dubium** [Germany] type lost

Andrena trimmerana v. *scotica* Perkins, 1916: Ent. mon. mag., p. 15 [Scotland, OUMNH, examined]. Lectotype ♂, by present designation.

Andrena jacobi Perkins, 1921 nom. nov. for *A. trimmerana* auctorum nec. Kirby: Ent. mon. mag., p. 39 [no type locality] **syn. nov.**

Andrena jacobi v. *johnsoni* Perkins, 1921: Ent. mon. mag., p. 39 [Ireland] ?type lost **syn. nov.**

Suggested earlier names for *A. scotica* were proposed by Warncke (1986), but these cannot be confirmed because types were never designated and collections have been lost, the descriptions alone do not allow for unambiguous determination, and no subsequent authors have followed these proposals (see Gusenleitner & Schwarz, 2002). As no material is available for study, we follow the interpretation of Gusenleitner & Schwarz (2002) and consider them all to be *nomina dubia*.

Identification key to European Andrena (Hoplandrena)

Taking the taxonomic changes discussed above, morphological characters are illustrated in Schmid-Egger & Scheuchl (1997), Amiet *et al.* (2010), Falk & Lewington (2015), and Else & Edwards (2018).

1. Females 2
– Males 8
2. Hind tarsi golden-orange, hind tibiae golden-orange or dark 3
– Both hind tibiae and tarsi dark 4
3. Hind tibiae golden-orange. Clypeus medially with a clearly raised longitudinal impunctate area, this area smooth and shining, strongly contrasting the remaining parts of the clypeus which are densely punctate ***ferox* Smith, 1847**
– Hind tibiae dark. Clypeus with faint impunctate longitudinal line medially, but this is not raised and not shiny, therefore not strongly contrasting with the remaining parts of the clypeus which are regularly punctate ***bucephala* Stephens, 1846**
4. A3 clearly exceeding length of A4+5 5
– A3 not clearly exceeding length of A4+5, usually as long as or slightly shorter than A4+5 6
5. Body covered in dark black hairs. Scutum uniformly shagreened, dull ***clusia* Warncke, 1966**
– Body covered in light brown hairs, at most with some dark brown hairs on the face. Scutum shagreened, but medially with a small circular area with reduced shagreenation, this area therefore weakly shining ***nuptialis* Pérez, 1902**
6. Metasomal terga with short hairs, most clearly seen in profile on T2-3 with hairs not exceeding width of flagellum. Tergal discs often extensively red-marked ***rosae* Panzer, 1801**
– Metasomal terga with extensive and abundant long hairs, most clearly seen in profile on T2-3 with hairs clearly exceeding width of flagellum. Tergal discs red-marked or not 7

The following two taxa cannot be consistently separated across Europe using morphological characters. Knowledge of local colour forms, phenology, and association with males can aid identification, but certainty can only be achieved with molecular techniques. Indicative characters are given here, but these cannot be used in isolation.

7. Tergal discs can be marked with red, particularly in the summer generation, but can also be entirely dark, tergal margins vary from dark to somewhat red-marked. Tibial scopa in fresh specimens dark dorsally and golden ventrally, but this can be ambiguous and fade to silver in older specimens or pinned material. Facial hair can be dark, particularly in the spring generation, the summer generation usually has lighter facial hair. Bivoltine, usually flying March–May and July–August, with phenology depending on local conditions. Usually with a Mediterranean and Atlantic distribution extending north to Britain and Ireland, less commonly encountered in the more central parts of Europe, absent from Northern and most of Eastern Europe. In Germany, more or less limited to the south-west ***trimmerana* (Kirby, 1802)**
– Tergal discs usually without red markings, tergal margins vary from dark to somewhat red-marked. Tibial scopa in fresh specimens usually dark dorsally and

silver ventrally. Usually with light brown facial hair. Usually univoltine, flying April to mid-June, with sporadic emergence in August and September. Usually with a continental European distribution north to Britain, Ireland, and Fennoscandia and east to Russia, rare in Mediterranean Europe and here confined to mountains

..... *scotica* Perkins, 1916

8. A3 as long or longer than A4 9
 – A3 shorter than A4 11

9. Genital capsule and S8 complex; penis valves grossly broadened, occupying almost all the space between the gonostyli, the gonostyli themselves extremely thin with a tapering point, S8 produced into ‘Y’ shaped extension, apically clearly and deeply emarginate *bucephala* Stephens, 1846

– Genital capsule and S8 simple, penis valves not grossly broadened, with clearly visible space separating them from the gonostyli, the gonostyli themselves are unremarkable, not narrowed, apex broadly rounded, S8 simple, apically truncate 10

10. Face, mesepisternum, propodeum, metasoma, and ventral surface of body with uniformly black hairs. Scutum uniformly shagreened, dull . . . *clusia* Warncke, 1966

– Body usually without black hairs. If black hairs are present on the face, they are intermixed with some pale hairs, and uniformly black hairs do not extend to the other parts of the body. Scutum shagreened, but medially with a small circular area with reduced shagreenation, this area therefore weakly shining *nuptialis* Pérez, 1902

11. A3 not so short, approximately $\frac{1}{2}$ the length of A4. Hind tibiae golden-orange. T1–2 with marginal areas usually lightened orange-red *ferox* Smith, 1847

– A3 very short, at most $\frac{1}{4}$ the length of A4. Hind tibiae dark. Tergal margins lightened or not 12

12. S8 truncate, lacking apical emargination *rosae* Panzer, 1801

– S8 with clear apical emargination 13

13. Mandibles unidentate, lacking an inner subapical tooth. Gena usually with a long spine. Flying only in the spring (March–April, May in southern European mountains) *trimmerana* (Kirby, 1802) (spring generation)

– Mandibles bidentate, with an inner subapical tooth. Gena usually without a spine, sometimes with a very short spine. Flying in the spring or the summer 14

14. Flying in the spring (usually April–May). Facial pubescence long

..... *scotica* Perkins, 1916

– Flying in the summer (usually mid-June to July). Facial pubescence short

..... *trimmerana* (Kirby, 1802) (summer generation)

DISCUSSION

Despite being one of the most common European spring-flying bees, surprisingly it seems that *A. scotica* is the earliest available name that can be unequivocally applied to this univoltine taxon. This remarkable turn of events was even lamented by Perkins himself, writing: “As to *trimmerana* Auct. nec. K., I do not know what synonymic names may be available for use. It would certainly be unfortunate should

some varietal name, such as var. *scotica*, have to be used for the typical form” (Perkins, 1917).

Along with recent major taxonomic and nomenclatural revisions to European members of *Andrena* subgenus *Taeniandrena* (Praz *et al.*, 2022), our current findings illustrate the extent to which problems persist in our understanding of the European *Andrena* and indeed the wider bee fauna. Though the European bee fauna is the best studied globally, the problem presented here arises from too great a number of proposed names, and a lack of careful study of old original type material that allowed the use of *A. trimmerana auctorum nec.* Kirby to persist for over a century. Ongoing future revisions to the European and West Palaearctic bee fauna are likely to find additional cases of misapplied names for these same reasons; it is therefore imperative to resolve these issues as soon as possible in order to provide a stable nomenclatural base for scientific study, given that interest in studying, recording, and monitoring European bees has never been higher.

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REFERENCES

- Alfken, J. D. 1911. Apidologische Studien. (Hym.). Deutsche Entomologische Zeitschrift, 457–466.
- Amiet, F., Hermann, M., Müller, A. & Neumeyer, R. 2010. Apidae 6: *Andrena*, *Melitturga*, *Panurginus*, *Panurgus*. Centre Suisse de Cartographie de la Faune (CSCF)/Schweizerische Entomologische Gesellschaft (SEG), Neuchâtel, 318 pp.
- Ascher, J. S. & Pickering, J. 2020. Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). http://www.discoverlife.org/mp/20q?guide=Apoidea_species
- Dours, J. A. 1872. Hyménoptères nouveaux du bassin Méditerranéen. Revue et magasin de zoologie pure et appliquée, 23, 293–311, 349–359, 396–399, 419–434.
- Else, G. R. & Edwards, M. E. 2018. *Handbook of the Bees of the British Isles*. The Ray Society, London, 775 pp.
- Falk, S. & Lewington, R. 2015. *Field guide to the bees of Great Britain and Ireland*. Bloomsbury Publishing, London, 432 pp.
- Folmer, O., Black, M., Hoeh, W., Lutz, R. & Vriegenhoek, R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* 3: 294–299.
- Friese, H. 1887. Species aliquot novae generis *Andrena* Fabr. *Természetrzaji Füzetek* 11: 21–26.
- Gueuning, M., Frey, J. E. & Praz, C. 2020. Ultraconserved yet informative for species delimitation: Ultraconserved elements resolve long-standing systematic enigma in Central European bees. *Molecular Ecology* 29: 4203–4220.
- Gusenleitner, F. & Schwarz, M. 2002. Weltweite Checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andreninae, *Andrena*). Entomofauna, Supplement 10, 1–1280.

- ICZN (International Commission on Zoological Nomenclature) 1999. *International Code of Zoological Nomenclature. Fourth Edition*. The International Trust for Zoological Nomenclature, London, xxix + 306 pp.
- Katoh, K. & Standley, D. M. 2013. MAFFT multiple sequence alignment software version 7: improvements in performance and usability. *Molecular Biology and Evolution* **30**: 772–780.
- Kirby, W. 1802. *Monographia Apum Angliae*. II. Ipswich, United Kingdom, 388 pp.
- Kuhlmann, M. *et al.*, co-authors as listed in “Contributors” 2021. Checklist of the Western Palaearctic Bees (Hymenoptera: Apoidea: Anthophila). <http://westpalbees.myspecies.info>
- Lepeletier, A. 1841. *Histoire naturelle des Insectes. Hyménoptères*. Bd. 2, Roret, Paris, France, 680pp.
- Lhomme, P., Michez, D., Christmann, S., Scheuchl, E., El Abdouni, I., Hamroud, L., Insane, O., Sentil, A., Chrif Smaili, M., Schwarz, M., Dathe, H.H., Straka, J., Pauly, A., Schmid-Egger, C., Patiny, S., Terzo, M., Müller, A., Praz, C., Risch, S., Kasperek, M., Kuhlmann, M., Wood, T.J., Bogusch, P., Ascher, J. & Rasmont, P. 2020. The wild bees (Hymenoptera: Apoidea) of Morocco. *Zootaxa* **4892**: 1–159.
- Mones, A. 1989. *Nomen dubium vs. nomen vanum*. *Journal of Vertebrate Paleontology* **9**: 232–234.
- Nieto, A., Roberts, S. P. M., Kemp J., *et al.* 2014. *European Red List of bees*. Publication Office of the European Union, Luxembourg.
- Paxton, R. J., Thorén, P. A., Tengö, J., Estoup, A. & Pamilo, P. 1996. Mating structure and nestmate relatedness in a communal bee, *Andrena jacobii* (Hymenoptera: Andrenidae), using microsatellites. *Molecular Ecology* **5**: 511–519.
- Pérez, J. 1902. Espèces nouvelles de Mellifères (paléarctiques). *Procès-verbaux Société linnéenne de Bordeaux* **57**: 174–180.
- Perkins, R. C. L. 1890. Note on *Andrena trimmerana*, Kirby, and *Andrena rosae* Panz. *Entomologist's Monthly Magazine* **26**: 206–208.
- Perkins, R. C. L. 1913. The races of *Andrena rosae*. *Entomologist's Monthly Magazine* **49**: 10–13.
- Perkins, R. C. L. 1916. *Andrena trimmerana* K., and its allies. *Entomologist's Monthly Magazine* **52**: 13–15.
- Perkins, R. C. L. 1917. On the Kirby collection of *Sphecodes*, *Nomada*, *Andrena*, and *Cilissa*, with the description of a species of *Sphecodes* hitherto unrecorded from Britain. *Entomologist's Monthly Magazine* **53**: 45–52.
- Perkins, R. C. L. 1921. *Andrena jacobii* n.n. for *A. trimmerana* auct. and a new Irish variety of this species. *Entomologist's Monthly Magazine* **7**: 39–40.
- Pisanty, G., Richter, R., Martin, T., Dettman, J. & Cardinal, S. 2022. Molecular phylogeny and historical biogeography of andrenine bees (Hymenoptera: Andrenidae). *Molecular Phylogenetics and Evolution* **170**: 107151.
- Praz, C., Genoud, D., Vaucher, K., Bénon, D., Monks, J. & Wood, T. J. 2022. Unexpected levels of cryptic diversity in European bees of the genus *Andrena* subgenus *Taeniandrena* (Hymenoptera: Andrenidae): implications for conservation. *Journal of Hymenoptera Research*, in press.
- Reemer, M., Groenenberg, D. S. J., van Achterberg, C. & Peeters, T. M. J. 2008. Taxonomic assessment of *Andrena rosae* and *A. stragulata* by DNA-sequencing (Hymenoptera: Apoidea: Andrenidae). *Entomologia Generalis* **31**: 21–32.
- Schmid-Egger, C. & Scheuchl, E. 1997. *Illustrierte Bestimmungstabellen der Wildbienen Deutschlands und Österreichs und Berücksichtigung der Arten der Schweiz*. Band III Andrenidae. Apollo Books, Denmark, 180 pp.
- Schmidt, S., Schmid-Egger, C., Morinère, J., Haszprunar, G. & Hebert, P. D. N. 2015. DNA barcoding largely supports 250 years of classical taxonomy: identifications for Central European bees (Hymenoptera, Apoidea *partim*). *Molecular Ecology Resources* **15**: 985–1000.
- Schmiedeknecht, O. 1883. *Apidae Europaeae (Die Bienen Europas) per genera, species et varietates dispositae atque descriptae. Tomus I*. Nomada, Bombus, Psithyrus et Andrena. Gumperda & Berlin, Germany, 866 pp.
- Stamatakis, A. 2014. RAXML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. *Bioinformatics* **30**: 1312–1313.

- Stöckhert, E. 1930. *Andrena* Fabr. In: Schmiedeknecht, O. (Ed.), *Die Hymenopteren Nord- und Mitteleuropas*, pp. 897–986. Gustav Fischer, Jena, Germany.
- Schwarz, M., Gusenleitner, F., Westrich, P. & Dathe, H.H. 1996. Katalog der Bienen Österreichs, Deutschlands und der Schweiz (Hymenoptera: Apidae). *Entomofauna*, Supplement 8, 1–398.
- Warncke, K. 1967. Beitrag zur Klärung paläarktischer *Andrena*-Arten. *Eos* **43**: 171–318.
- Warncke, K. 1976. Die Bienengattung *Andrena* F., 1775, in Iberien (Hym. Apidae). Teil B. *Eos* **50**: 119–223.
- Warncke, K. 1986. Die Wildbienen Mitteleuropas ihre gültigen Namen und ihre Verbreitung (Insecta: Hymenoptera). *Entomofauna Supplement* **3**, 1–128.
- Westrich, P. 1989. *Die Wildbienen Baden-Württembergs*. Eugen Ulmer, Stuttgart, Germany, 972 pp.
- Westrich, P. 2018. *Die Wildbienen Deutschlands*. Eugen Ulmer, Stuttgart, Germany, 824 pp.
- Wood, T.J. & Roberts, S.P.M. 2017. An assessment of historical and contemporary diet breadth in polylectic *Andrena* bee species. *Biological Conservation* **215**: 72–80.
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SHORT COMMUNICATIONS

***Myllaena kraatzi* Sharp (Coleoptera: Staphylinidae) in Devon** – A female of this species was found in *Sphagnum* in a flush mire close to the River Lyd at Bearwalls, South Devon (VC 3) (SX5284) on the 21.iv.2022. This appears to be the first record for Devon and a major westerly range extension. Other significant captures included *Stenus melanarius* Stephens – first county record since 1911, and *Philonthus nigrata* (Gravenhorst) – first county record since 1963. – JONTY DENTON, 31 Thorn Lane, Four Marks, Hants GU34 5BX.

***Eubria palustris* (Coleoptera: Psephenidae) in the New Forest** – Adults of this species were swept from bushes and emergent vegetation from a calcareous seepage at Stony Moors (SZ2199) on 6.vi.2022. Remarkably these are the first from the New Forest but are undoubtedly a long overlooked relict population as the site is also one of the only English sites for the RDB1 limoniid crane fly *Idioptera sexguttata* (Dale) (which was also abundant) and home to several extremely scarce plants.

The previous Hampshire records came from Milford-on-Sea in 1923 (J.E. Black and J.J. Walker). There is also an Environment Agency record from the Meon Valley near Warnford Park (SU6252) on 26.ix.2005. – JONTY DENTON, 31 Thorn Lane, Four Marks, Hants GU34 5BX.