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Neotype designation (female) of *Amegilla* (*Amegilla*) *quadrifasciata* (VILLERS, 1789) (Anthophila, Anthophoridae) – historical background, morphometric validation, description of the male

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A b s t r a c t : The collection of the French entomologist Charles Joseph Villers, who described *Apis quadrifasciata* VILLERS, 1789 (now *Amegilla quadrifasciata*), was deposited after his death in the Musée des Confluences, Lyon (France), in 1810 but later destroyed over time (H. Labrique, CCEC, pers. comm.). Therefore, it was necessary to designate and describe a neotype of *Am. quadrifasciata* to guarantee the principles of stability established by the ICZN (1999). A historical review of the taxonomical status of *Am. quadrifasciata*, including synonyms, is given. As it is known that the types of *Am. quadrifasciata* originated from the southern part of France, the neotype was also chosen from this area. For validation, a univariate and multivariate morphometric analysis of 16 females from Europe and North Africa was performed according to BAUR & LEUENBERGER (2011) and BAUR et al. (2014) and compared with the values of the neotype (24 meristic parameters). All morphometric parameters of the neotype are in the range of the reference values. Besides the morphometric data, 95 non-meristic morphological characters were also used for neotype characterisation and documented by numerous high-resolution photographs. In addition, a description of the male from the same locality as the neotype was given, and morphometric values of this male were validated by univariate and multivariate analysis of four males from Europe and North Africa.

Key words : taxonomy, systematics, type validation, univariate and multivariate analyses, synonyms

Introduction

Amegilla (*Amegilla*) *quadrifasciata* (VILLERS, 1789)¹ has a transpalaeartic distribution. The area extends from Portugal across North Africa, southern and eastern Europe, Ukraine and southern Russia to Siberia and further across Asia Minor, the Caucasus, Central Asia, northern China and Mongolia to Japan and Primorye (the southern Russian far east). The northernmost distribution border leads from Luxembourg and central Germany to central Poland, and the southernmost border crosses Sudan, Ethiopia, Yemen and northern India (SCHEUCHL & WILLNER 2016). The westernmost detections of *Am. quadrifasciata* have been in the Canary Islands (GRIBODO 1883, FRIESE 1897, DUSMET Y ALONSO 1924, BISCHOFF 1937, LIEFTINCK 1958, BAEZ & ORTEGA 1978, WOLF 1980, HOHMANN et al.

¹ In contrast to BROOKS (1988) and other authors, who cited 'de Villers' as the author's name, I follow MICHENER (2007) and will write 'Villers' without the 'de'.

1993), where the species, also classified as *Am. quadrifasciata*, has been recorded on all islands (HOHMANN et al. 1993, unpublished observations A. Kratochwil). A molecular genetic comparison of the populations of the Madeira Archipelago (Madeira Island, Porto Santo) and the Canary Islands with those from different countries in mainland Europe is in preparation (KRATOCHWIL et al., in prep.).

The type of *Am. quadrifasciata* (VILLERS, 1789), formerly *Apis quadrifasciata* VILLERS, 1789, was described by Charles Joseph Devillers (de Villers, Villers), born 24 July 1724, in Rennes (France) and died 3 January 1810, in Lyon (France). He was a French naturalist and member (professor) of the 'Académie des Sciences, Belles-Lettres et Arts de Lyon' from 1753 to 1810. Besides entomology, he was also interested in physics, astronomy, mathematics and botany (CRÉPEL 2017). With his wife he visited in numerous entomological excursions southern France (MULSANT 1840).

Under the title 'Caroli Linnaei entomologia', Villers published a four-volume work in octavo format with 11 plates that is often cited in connection with the writings of Linnaeus but is in fact a wide-ranging overview comprising the publications of numerous entomologists and containing original descriptions of species from southern parts of France (VILLERS 1789). It summarises the descriptions of all insect species known and named by entomologists up to 1789: C. G. Scopoli (1723-1788), E. L. Geoffroy (1725-1810), C. de Geer (1720-1778), J. Ch. Fabricius (1745-1778), F. Schrank (1747-1835) and others, as well as new species, all systematically ordered according to the Linnean system (WEIDNER 1980, PANTALEONI 2010). This fact is significant because the starting point of the zoological nomenclature was defined as 1 January 1758 (ICZN Article 3.1). The first publication to be recognised by the International Code (with exception of 'Clerck's Aranei Svecici') is the 'Systema Naturae, 10th edition' of Linnaeus, published in two volumes in 1758 and 1759 (ICZN 1999). Article 3.2 of the ICZN code states that older information (descriptions, illustrations) may be used. In this context, VILLERS (1789) gave an overview of all insect species known before 1 January 1758. Among the newly described species is *Ap. quadrifasciata* VILLERS, 1789. After the death of Villers, the collection, including all type material, came to the Musée des Confluences, Lyon (France), in 1810. Numerous removals, looting during the revolutionary period, destruction after violent storms, and other incidents destroyed many old collections, including the collection of Villers and all its types (H. Labrique, CCEC, pers. comm.). The principles of stability established by the ICZN (1999), therefore, necessitate the designation of a neotype for *Am. quadrifasciata*. The following points were analysed as part of this study:

- Description of *Apis quadrifasciata* by VILLERS (1789)
- Historical review of the taxonomic status of *Amegilla quadrifasciata*, including synonyms
- Criteria for the selection of a neotype specimen and validation using univariate and multivariate methods
- Criteria for the selection of a male specimen and validation using univariate and multivariate methods
- Description of the neotype (female)
- Description of the male
- Concluding remarks.

Material and methods

Specimens examined

A total of 17♀ and 5♂ were studied. The appendix lists the specimens analysed (identity code, acronym of depository, locality, date of collection, collector, sex, determination, determinator, further comments). All specimens are deposited in the following collections:

CKprivate collection A. Kratochwil, Osnabrück (Germany)

OLML.....Oberösterreichisches Landesmuseum, Linz (Austria)

Enquiries were made to the following museums as part of this study:

CASCalifornia Academy of Sciences, San Francisco, California (USA)

CCEC.....Centre de Conservation et d'Étude des Collections du Musée des Confluences, Lyon (France)

EMEC.....Essig Museum of Entomology, University of California, Berkeley, California (USA)

MRSN.....Museo Regionale di Scienze Naturali, Turin (Italy)

NHNV.....Naturhistorisches Museum Wien, Wien (Austria)

NHMUK.....The Natural History Museum Natural History Museum, London (United Kingdom)

NMBENatural History Museum Bern (Switzerland)

NMNH.....National Museum of Natural History, Washington D.C. (USA).

Morphometric and morphological analyses

In all, 24 morphometric (meristic) and 95 morphological (non-meristic) features were analysed with a modular stereomicroscope Wild M3Z, Heerbrugg, Switzerland, with a 25x eyepiece (16.25x, 40x, 62.5x and 100x). Detailed photo documentation is available for all specimens studied (phototube for Wild M3Z with Canon EOS 7D Mark II, photo stacking with 50-100 shots per image with FOTO Stacker Version 1.6/29 2017; BOLTNEV & KACHER 2017). Unless otherwise stated, the photos were produced by the author. The EAZYDRAW (2020) programme was used for photo preparation.

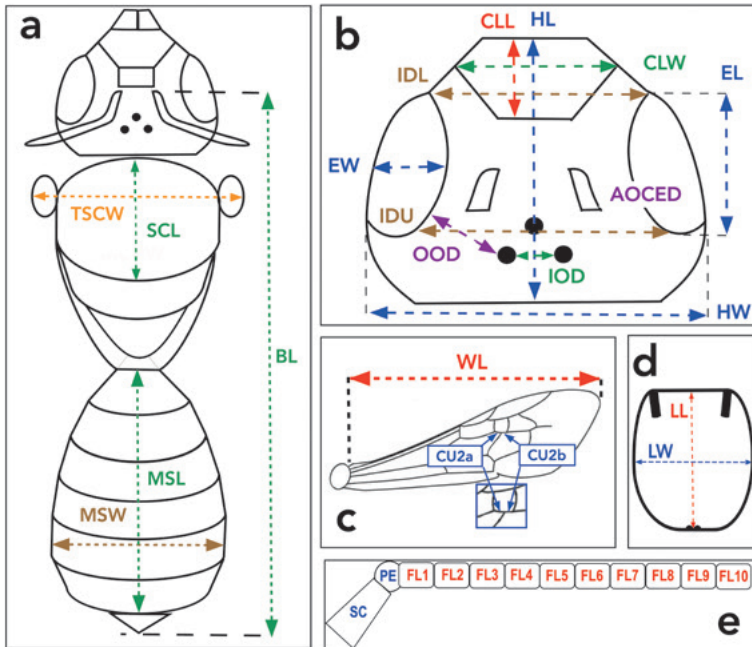
Morphometric (meristic) analyses

The morphometric features are characterised in Table 1 and Fig. 1 (using terms according to MICHENER 2007; KRATOCHWIL 2020, 2021).

Morphometric multivariate analyses were carried out by multivariate ratio analysis (MRA) according to BAUR & LEUENBERGER (2011) and BAUR et al. (2014), offering methods of principal component analysis (PCA) and linear discriminant analysis (LDA). In the shape PCA of the MRA, the size axis was calculated separately from the PCA as an isometric variable representing the geometric mean of all variables. The intra-group regression lines are shown in the scatter plot (BAUR & LEUENBERGER 2011). The LDA Ratio Extractor was used to extract the two best ratios of the morphometric features. The analyses were carried out with R CORE TEAM (2016) version 3.6.0. The versions of the R scripts by BAUR et al. (2014, 'Supplementary material') were used with the help of corrections and adjustments by H. Baur (NMBE).

Table 1: Abbreviations, character name, definition and magnification of the 24 parameters used for the morphometric analyses; definition of parameters and method of measurements according to MICHENER (2007).

Abbreviation	Character name	Definition	Magnification
BL	Body length	Length from antennal base to tip of the pygidium	16.25x
CLL	Clypeus length	Maximal central length	62.5x
CLW	Clypeus width	Maximal width	62.5x
CU2a	Submarginal cell 2, length a	Distance 1st submarginal cross vein to 1st recurrent vein	40x
CU2b	Submarginal cell 2, length b	Distance 1st recurrent vein to 2nd submarginal cross vein	40x
EL	Eye length	Maximal length (area with ommatidia, without eye ring)	40x
EW	Eye width	Maximal width	40x
FL1, FL2, FL3	Flagellomere 1, 2, 3 length	Lateral view, central distance in length, maximal width	100x
HL	Head length	length from top of vertex to apical margin of clypeus	40x
HW	Head width	Maximal width in frontal view	40x
IDL	Interocular lower distance	Distance between the lower inner edge of the left and right eye	40x
IDU	Interocular upper distance	Distance between the upper inner edge of the left and right eye	40x
IOD	Interocellar distance	Distance between the posterior ocelli	62.5x
LL	Labrum length	Central length	100x
LW	Labrum width	Central width	100x
MTL	Metasoma length	Length from base of 1st tergite to tip of pygidium	16.25x
MTW	Metasoma width	Maximal width	16.25x
OCD	Ocelloccipital distance	Distance between posterior ocellus to preoccipital ridge	62.5x
OOD	Ocellocular distance	Distance between outer ocellus and compound eye	62.5x
SCL	Scutum length	Maximal central length	16.25x
TSCW	Tegulae-scutum width	Maximal scutum width including tegulae	16.25x
WL	Wing length	Maximal length of the forewing from wing base to tip	25x



Figs 1a-e: Ranges of measurements of various morphometric parameters (abbreviations, character names, definitions; see Table 1): (a) body, (b) head, (c) wing, (d) labrum, (e) antenna (in males FL1-FL11).

Boxplots were constructed using the boxplot function in R statistics (R CORE TEAM 2016). The lower and upper parts of the boxes are the 25th and the 75th percentiles (lower quartile and upper quartile), and the central markers indicate the median (the 50th percentile). The ends of the vertical lines represent the minimum and maximum values.

Morphological (non-meristic) analyses

The following 95 morphological (non-meristic) features for females and males were characterised (using terms according to MICHENER 2007; KRATOCHWIL 2020, 2021):

Structure : Head: CL (shape, shine, puncturing, midline, midline shape), GEN, LA (shape, puncturing). Mesosoma: SC, SCU (puncturing). Metasoma: T1-T6 (each, puncturing), S1-S6 (each, puncturing), PY (shape, puncturing), GE.

Colour : Head: FL1, FL2, FL3-FL11 (in total), HE (in total), MA, SCA. Mesosoma: BA1-BA3 (each), DI1-DI3 (each), FE1-3 (each), FL1, FL2, FL3-FL11 (in total), MT1-MT3 (each), PE, SCU, TI1-TI3 (each). Metasoma: T1-T6 (each), S1-S6 (each), T3 thorn, W, W vein.

Pubescence : Head: VE, FR, IA, PA, CL, LA, GEN. Mesosoma: SC, SCU, PSC, PR, MES, FL, ML, HL. Metasoma: T1-T6 (each), TP, S1-S6 (each), PY.

Abbreviations

Morphological features: AN = antenna(e), BA = basitarsus, DI = distitarsus, CL = clypeus, EY = compound eye, FE = femur, FL = flagellum, flagellomere(s), FO = fore leg, FR = frons, GE = genitalia, GEN = genal area or genae, HE = head, HL = hind leg, IA = interantennal area, LA = labrum, MA = mandible(s), ME = metasoma, MES = mesepisternum, ML = mid leg, MS = mesosoma, MT = mediotarsus, mediotarsi, OC = ocellus, PA = paraocular area, PE = pedicellus, PD = puncture diameter, PDI = puncture distance, PR = propodeum, PSC = postscutellum, PY = pygidium, S = sternum, SA = supraclypeal area, SC = scutum, SCA = scapus, SCU = scutellum, SCA = scapus, T = tergite, TI = tibia, TP = tibial plate, VE = vertex, W = wing(s); further abbreviations see Table 1 legend.

Morphometric analyses: LDA = linear discriminant analysis; MRS = Multivariate Ratio Analysis; PC1, PC2 = Principal Component Analysis 1st axis, 2nd axis.

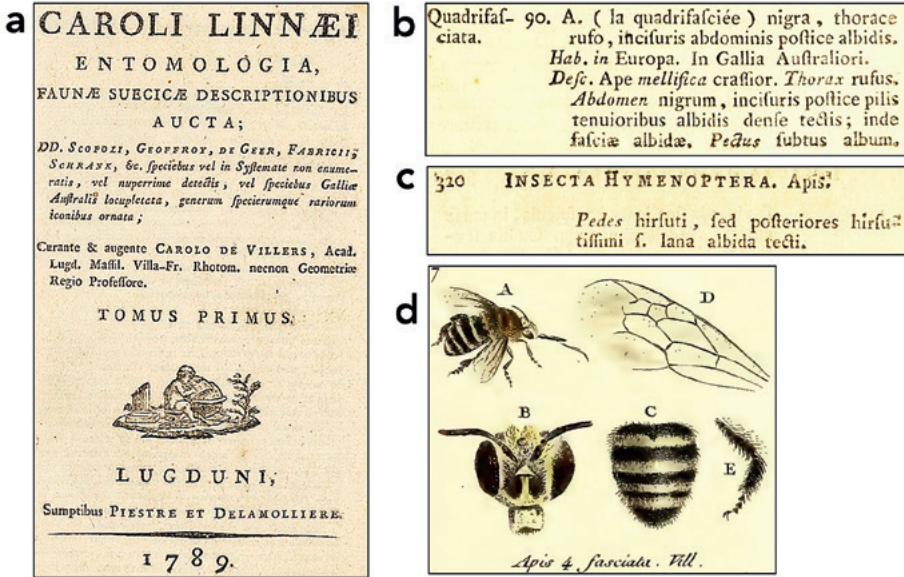
Taxonomical abbreviations: *Am* = *Amegilla*, *An* = *Anthophora*, *And* = *Andrena*, *Ap* = *Apis*, *Me* = *Megilla*.

Results and discussion

Description of *Apis quadrifasciata* by VILLERS (1789)

VILLERS (1789) published the description of *Ap. quadrifasciata* in the third volume of 'Caroli Linnaei Entomologia' on pages 309-310 (Fig. 2). He gave this species the Latin name '*Quadrifasciata*' ('four-banded') due to the end-banding of the tergites, supplemented in brackets with the French name 'la quadrifascié'. The black cuticular colouration, the reddish pubescence of the thorax and the white abdominal bands are mentioned as a brief

characterisation; the detailed description (desc. = latin abbreviation for 'descriptio') characterises the species as larger than *Ap. mellifica*, with a black and hairy abdomen, with dense white hair bands, a white pubescence of the legs and a strong white pubescence of the hind legs. The colouration of the metatarsus hairs is not clear from the species description. He listed the type locality of this species as 'Gallia Australiori' (southern part of France).



Figs 2a-d: (a) Title page of VILLERS (1789), third volume of 'Caroli Linnaei Entomologia', (b, c) description of *Ap. quadrifasciata* on pages 309-310, (d) first illustration with legend in COQUEBERT (1804): A = *Apis quadrifasciata*, magnitudine naturali (natural size), B = caput (head), C = abdomen, D = Ala antica (hind wing), E = pes posticus (hind leg).

Historical review of the taxonomic status of *Amegilla quadrifasciata*

The taxonomic status of *Am. quadrifasciata* and the specification of synonyms by FRIESE (1897), BROOKS (1988), MICHENER (2007) and EARDLEY & URBAN (2010) have not yet been analysed in detail because of the very confusing complexity of taxa names. This is partly due to the frequently changing genus names, which are based on the further development of the system and the selection of taxonomical criteria. Many authors also simply adopted the supposed synonyms without critical analysis. In addition, taxa with authors were often given under the valid species name without taxonomical relevance. These are in fact no synonyms, but literature sources in which the species is mentioned. In the following section I proceed chronologically. The genus names are based on the respective authors.

FABRICIUS (1793) did not mention *Ap. quadrifasciata* VILLERS, 1789, but he described a separate species, *Ap. nidulans*, which was also characterised by FRIESE (1897), BROOKS (1988) and MICHENER (2007) as a younger synonym of *Ap. quadrifasciata* VILLERS, 1789. The epithet '*nidulans*' in the species description by FABRICIUS (1793) means 'shining',

which can only refer to the shiny black tergites. FABRICIUS (1793) referred to, among other morphological features, the white bands of the tergites. Additionally, the body size should correspond to the size of *Anthidium manicatum*. As habitat he mentioned the loamy areas of Gaul (Gallia). He defined the distribution area more broadly than did VILLERS (1789). The species description of *Ap. nidulans* does not include the hair colouration of the metatarsus.

The German entomologist and bee specialist Joseph Kriechbaumer concluded that *Ap. quadrifasciata* VILLERS, 1789 could probably be a nomen dubium, a name of doubtful application (KRIECHBAUMER 1877). He noted that, according to the description by VILLERS (1789), *Ap. quadrifasciata* could also correspond to *Ap. garrula* ROSSI, 1790 or *Ap. albigena* LEPELETIER, 1841. KRIECHBAUMER (1877) assigned *Ap. garrula* and *Ap. albigena* to the genus *Megilla*². VILLERS (1789) did not indicate the colour of the hairs of the posterior metatarsus, which is black in *Ap. quadrifasciata* and white in the other two species; this was why KRIECHBAUMER (1877) had doubts concerning the validity of *Am. quadrifasciata*. According to KRIECHBAUMER (1877), however, it is also possible that VILLERS (1789) simply paid no attention to the black pubescence and therefore did not mention it. At that time, a more comprehensive comparative analysis with other similar species was uncommon. According to KRIECHBAUMER (1877), however, *Ap. nidulans* would also be a nomen dubium, as there is no information on the colouration of the hairs of the metatarsus.

FABRICIUS (1798) used the name *Ap. nidulans* a second time, which was also pointed out by FRIESE (1897). This homonym, however, is a *Bombus* species, as he writes: 'similar in habitus to *Bombus (Apis) pratorum* with occurrence in 'America boreali' (Northern part of the Americas)'.

The decisive innovation in Fabricius's classification was his consideration of the morphology of the mouthparts (FABRICIUS 1775). Over time, he refined his system and renamed *Ap. nitidula* as *Centris nidulans* (FABRICIUS, 1804) after newly describing the genus *Centris*. He also renamed the second species he had originally described as *Ap. nidulans* as *Bombus nidulans* and confirmed this correction with the name 'ano *nidulans*' (FABRICIUS 1804). According to FRANKLIN (1912), *Bombus nidulans* is a junior synonym of *B. pensylvanicus* DE GEER, 1773.

The first illustration of *Ap. quadrifasciata* was published in COQUEBERT (1804) (Fig. 2d). The French entomologist Jean Antoine de Montbret Coquebert (1753-1825) attached drawings to the insect species in this volume, which he found in the museum in Paris to which Fabricius had already given corresponding descriptions (COQUEBERT 1804). He enabled a direct link between the description of Villers and that of Fabricius. The specimen COQUEBERT (1804) used for his drawing came from the collection of Desfontaines (Mus. Dom. Desfontaines), which was later placed in the MNHN, but this part of the MNHN collection is presumed lost (ZIMSEN 1964).

René Louiche Desfontaines (1750-1833) was a French botanist and explorer. On a two-

² Depending on the reference, both the old and the current valid generic names are given. The genera *Podalirius* LATREILLE, 1802 and *Megilla* FABRICIUS, 1804 are now synonyms of *Anthophora* LATREILLE, 1803. *Amegilla* FRIESE, 1897 is today regarded as genus of its own (BROOKS 1988, MICHENER 2007).

year trip to Tunisia and Algeria, he collected mainly plant species, but also insect specimens and objects from other scientific disciplines (ANONYMOUS 1933). It is highly probable that the illustrated specimen of *Ap. quadrifasciata* by COQUEBERT (1804) originated from this collecting excursion. COQUEBERT (1804) identified the distribution area of *Ap. quadrifasciata* as 'Barbaria', and, according to ZIMSEN (1964), the specimens collected by Desfontaines originated in Algeria and Tunisia. COQUEBERT (1804) offered a detailed description and characterised the pubescence of the legs ('pedes nigri, femoribus, tibiis quatuor primis, tarsis anticis, externe griseo hirsutis; femoribus posticis magis hirsutis'). Only the metatarsi of the two fore legs ('tarsis anticis') are covered with light-coloured hairs. Fig. 2d (E) shows a hind leg with black metatarsal hairs. This proves that COQUEBERT (1804) was referring to specimens of *Ap. quadrifasciata* VILLERS, 1789.

It remains a question whether *Ap. quadrifasciata* sensu Villers and *Ap. nidulans* sensu Fabricius should be categorised as *nomina nuda*, as KRIECHBAUMER (1877) suggested. In the case, however, the name *Ap. quadrifasciata* VILLERS (1789) would also be retained by COQUEBERT (1804), as he only supplemented the description of Villers.

The German entomologist Johann Karl Wilhelm Illiger synonymised *Ce. nidulans* (FABRICIUS, 1804) with *Andrena nidulans* (ILLIGER, 1806) based on a male from Portugal. BROOKS (1988) did not mention this in his monograph of the Anthophorini nor did GUSENLEITNER & SCHWARZ (2002) include *And. nidulans* on the global checklist.

ILLIGER (1806) mentioned *Me. fuliginosa* from Madeira, although this is *Am. quadrifasciata maderae* (SICHEL, 1868). BROOKS (1988) listed *Me. fuliginosa* as *nomen nudum* because a description is missing. A second species, synonymised with *Am. quadrifasciata* by ILLIGER (1806) in BROOKS (1988) and classified as *nomen nudum*, is *Me. scalaris*. Although the distribution area (e.g., Portugal, Italy) given by ILLIGER (1806) is correct, BROOKS (1988) does not explain how he came to this conclusion without a more detailed analysis.

The Italian entomologist Maximilian Spinola (1780-1857) was the first to assign *Ap. quadrifasciata* to the genus *Anthophora* (FRIESE, 1897). The description of the female and male given in SPINOLA (1806), however, is imprecise. SPINOLA (1806) mentioned in his publication the name 'true *quadrifasciata*' (probably meaning *Ap. quadrifasciata* VILLERS, 1789), but in his collection, the specimens are labelled under the synonym *An. nidulans* FABRICIUS (Spinola collection Box 119, CASOLARI & CASOLARI 1980). There are eight specimens in the Spinola collection: six come from Spinola himself (five from Liguria, one from Italy), and two from the collection of the French entomologist Amédée Louis Michel Le Peletier, Comte de Saint-Fargeau (Lepelletier de St. Fargeau, 1770-1845). Spinola acquired the collection from Lepeletier (PASSERIN D'ENTRÈVES 1980, ROSA & XU 2014). Both specimens originate from Oran, Algeria (CASOLARI & CASOLARI 1980).

The German entomologist Johann Christoph Friedrich Klug (1775-1856) did not adopt the new classification of *Anthophora*, but used the genus name *Megilla* (KLUG, 1817).

The German entomologist Germar (1786-1953) listed in GERMAR (1817) *Am. quadrifasciata* and mentioned the general southern European distribution. He was probably the first to refer to the illustration by COQUEBERT (1804). He described *Me. subterranea* synonymised with *Ap. quadrifasciata* by FRIESE (1897). GERMAR (1826) published an illustration that clearly shows that it cannot be *Ap. quadrifasciata* but rather *Anthophora canescens* BRULLÉ, 1832.

SCHEUCHL & WILLNER (2016) treated *An. canescens* with *Podalirius nigrocinctus* (LEPELETIER, 1841) as synonym, and RASMONT (2024) categorised *Me. subterranea* as nomen praeoccupandum.

LEPELETIER (1841) was the first to comprehensively and precisely described *An. nidulans* (female, male). He detailed the colouration and pattern of the clypeus and labrum, as well as the mandible, and described the hair colour of the head, the base of the tergites and the hair banding of the tergites, the terminal tergite and the legs. LEPELETIER (1841) listed *An. nidulans* V. and as junior synonyms *Ce. nidulans* (FABRICIUS, 1804) and *Ap. quadrifasciata* VILLERS, 1789. The 'V.' after the species name means 'ex visu' ('as seen'). Two specimens (female and male) are in the MRSN collection of Spinola in Turin, Italy (CASOLARI & CASOLARI 1980). LEPELETIER (1841) mentioned that they were collected in Algeria by Jean-Marie Léon Dufour (1780-1865), a French physician and naturalist. Dufour was a botanist but also an entomologist who wrote numerous publications on arthropods (spiders, beetles).

The French entomologist Pierre-Hippolyte Lucas (1814-1899) also mentioned *An. nidulans* and referred to Villers, Fabricius and Lepeletier (LUCAS 1849a). He described localities in Algeria and stated that the species occurred frequently near Algier, as well as Constantine, Mila, Bône (today Annaba) and in the neighbourhood of Lacalle (today El Kala). Remarkably, LUCAS (1849b) provided the first detailed illustrations of *An. nidulans*: mandibles, mouthparts and the first, second and third pairs of legs. There is, however, no overall illustration of the specimen in total view. Another special feature is that LUCAS (1849a, b) also described *An. albigena* in detail and provided a coloured overview drawing.

The Prussian biologist and explorer Alexander Eduard Friedrich Eversmann (1794-1860) presented a short description of the female and the male of *An. quadrifasciata* (EVERSMANN 1852). He was the second taxonomist after Spinola to use the generic name *Anthophora*. EVERSMANN (1852) characterised the posterior metatarsi as dark-haired. He also, however, described a variety with white metatarsal hairs and a smaller body size. This was why FRIESE (1897) named this variety var. *nana*, but EVERSMANN (1852) did not use this name. This variety is obviously *An. albigena*, which is not listed in EVERSMANN (1852).

The German entomologist Adolph Schenck (1803-1878) mentioned *An. nidulans*, referring to LEPELETIER (1841). SCHENCK (1859) integrated the female into an identification key for *Anthophora*. He mentioned the black hairs of the metatarsi.

The Austrian zoologist Georg von Frauenfeld (1807-1873) collected specimens on the island of Madeira during the 1857 Novara expedition (SICHEL 1867). The German-born, French physician and entomologist Frédéric Jules Sichel (1802-1868) validly described female and male specimens as *An. maderae* SICHEL, 1867. These specimens are in the collections of the NHMV. A lecto- and paralectotype designation is in preparation (KRATOCHWIL in prep.). ILLIGER (1806) already mentioned *Me. fuliginosa* from Madeira, which corresponds to *An. maderae*.

The American entomologist John Bernhardt Smith (1858-1912) mentioned the specimens from Madeira together with those of France, Algeria, Italy and Albania under *An. nidulans*. SMITH (1853) characterised the specimens from Madeira as follows: 'have markings, as well as the pubescence similarly distributed, but the latter [from Madeira] is more or less fulvous' (i.e., dull orange, brownish-yellow or tawny). SICHEL (1867) knew this literature source from SMITH (1853), and he was also aware that specimens from Madeira had been

deposited in the private collections of Smith and the Danish entomologist Christian Drewsen (1799-1896). According to SMITH (1853), the specimens from Madeira are black varieties of *An. nidulans* (*An. quadrifasciata*).

The Italian entomologist Giovanni Gribodo (1846-1924) compared *An. maderae* with *An. quadrifasciata* and concluded that *An. maderae* should be a separate species because of the density of its tergite bands (GRIBODO 1883).

The German entomologist Johann Dietrich Alfken (1862-1945) also accepted the species status of *An. maderae* (ALFKEN 1940), but the Dutch entomologist Maurits Anne Lieftinck (1904-1985) classified *A. maderae* as a synonym of *Ap. quadrifasciata* (LIEFTINCK 1956, 1958), as did BROOKS (1988) and ASCHER & PICKERING (2020). According to KRATOCHWIL et al. (2018), *An. maderae* is a subspecies of *Am. quadrifasciata*. This subspecies is a melanistic taxon with own morphological characteristics although molecular investigations have to confirm the affiliation with *Am. quadrifasciata* (KRATOCHWIL in prep.).

The French entomologist Jean Antoine Dours (1824-1874) dealt extensively with *An. quadrifasciata* in his monograph on *Anthophora* (DOURS 1869). The initial plan was to publish this monograph together with Frédéric Jules Sichel, who, like Dours, carried out analyses with many specimens. As the two could not reach an agreement in one case, the monograph was published under the name of Dours alone. The problem was *An. albigena*, which Dours regarded as a separate species, while Sichel considered it a variety of *An. quadrifasciata*.

DOURS (1869) had compared so many specimens that he was able to differentiate subspecies and varieties, which he attributed to various environmental factors, e.g., altitude and temperature. He summarised the variations under albinisms (white colouring), melanisms (dark colouring), erythrism (red colouring) and flavisms (yellow to gold colouring). For example, he characterised the synonym *Ap. nidulans* sensu Fabricius as having grey thorax hairs and white abdominal bands and *Ap. quadrifasciata* sensu Villers as having reddish thorax hairs and white hairs on the mesepisternum. In addition to a short summary in Latin, DOURS (1869) gave a particularly detailed description with high accuracy of the females and males in French, which is translated here in English:

'Female: Black. Clypeus white, except for two more or less large square spots, which are black. Labrum yellow with a small black spot on each side of the base. Mandibles yellow, black at the tip. Facial hairs ash grey, more or less reddish. Thorax covered with reddish, brown or ashy hairs, depending on how fresh the subject is; underneath these hairs are white. The abdomen is black and covered with a few, short, close-fitting hairs that are pale yellow or ashen. Each tergite with a stripe of hairs of this colour, which varies from bright white to ferruginous; last segment black in the middle, white on the sides. Hair on the legs white or reddish-brown ruffled on top, hind tarsi black. Wings slightly smoky, ribs brown'.

According to DOURS (1869), *An. quadrifasciata* is a species to which he assigned other species as morphologically close in two tribes. He classified the species as varieties. In his view, however, these are not 'varieties' as the term is used today, but rather morphologically close species. In tribus 1, the two posterior metatarsi have black hairs, and in tribus 2 the metatarsus has white hairs. Under tribus 1 he listed the following two species, among others: *An. maderae* SICHEL, Madeira, today subspecies of *Am. quadrifasciata* (KRATOCHWIL et al. 2018, KRATOCHWIL in prep.) and *An. albescens* DOURS, Algeria, junior synonym of *Am. quadrifasciata* according to BROOKS (1988).

The Russian entomologist Oktawiucz Wincenty Radoszkowski (1820-1895) described a new species as *An. mervensis*, which was found in Turkmenistan (Merv) and has a red colouration of the hairs of the thorax (RADOSZKOWSKI 1893). His description also applies to *Am. quadrifasciata* (e.g., FRIESE 1897, ASCHER & PICKERING 2020).

Anthophora mediterranea described by ALFKEN (1927) is also only a colour form with light-red to fox-red thorax hairs distributed on Mallorca and in mainland Spain. COCKERELL (1930) described *An. quadrifasciata teneriffensis* for Tenerife. New studies, including molecular genetic analyses, have proven that this is a separate species (KRATOCHWIL et al. in prep.).

The Austrian entomologist Hermann Priesner (1891-1974) described *An. litorana* from western Egypt and the Sinai Peninsula (PRIESNER 1957). BROOKS (1988) classified this species as a synonym of *Am. quadrifasciata*. According to SCHWARZ & GUSENLEITNER (2001), however, *An. klugi*, also described by PRIESNER (1957), is a separate species that was synonymised with *Am. quadrifasciata* (VILLERS, 1789) by BROOKS (1988).

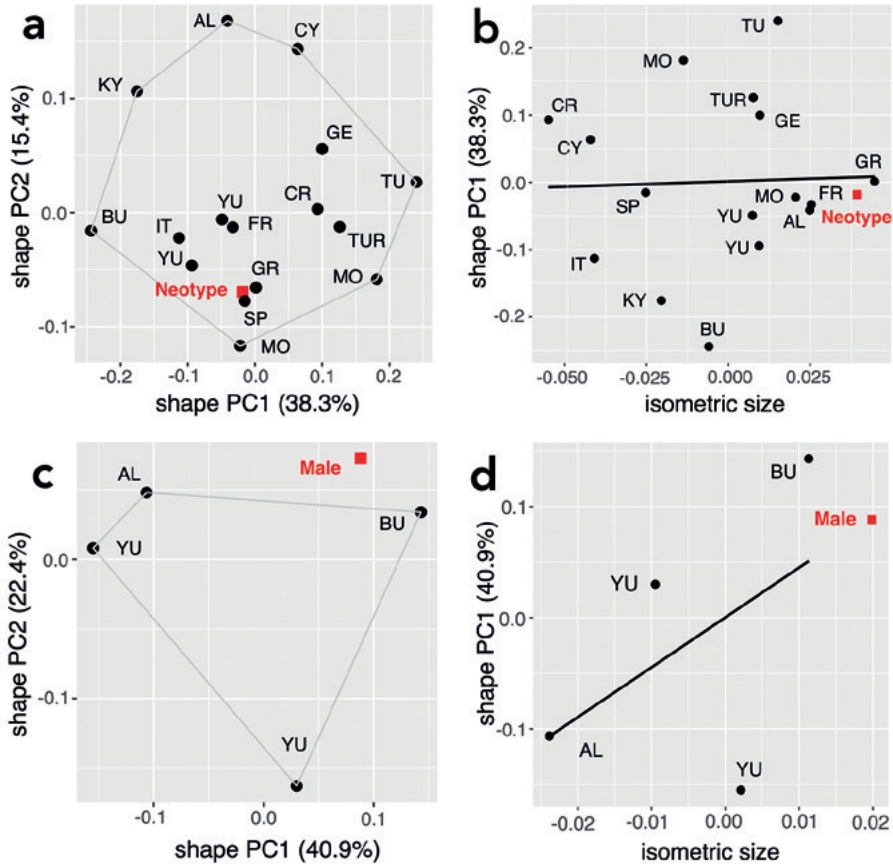
The American entomologist Theodore Dru Alison Cockerell (1866-1948), his wife Wilmatte Porter Cockerell and Alice Mackie collected bees in Morocco in 1930 (COCKERELL 1931a). COCKERELL (1931b) published the results and mentioned a female of *An. quadrifasciata*, collected years ago by A. Théry (1896-1913), as well as specimens (both sexes) from Ifrane and Asni collected by Cockerell, his wife and A. Mackie. COCKERELL (1931b) also mentioned that the German entomologist Heinrich Friese (1860-1948) had informed him by letter in November 1929 that he had designated *An. quadrifasciata* as the type for the subgenus *Amegilla* FRIESE, 1897. COCKERELL (1931b) was the first who published this.

FRIESE (1897) listed *Am. quadrifasciata* under the genus *Podalirius*, FRIESE (1909) later under *Anthophora*. SANDHOUSE (1943), BROOKS (1988) and MICHENER (2007) stated that COCKERELL (1931b) had designated *An. quadrifasciata* VILLERS, 1789 as the type species for the genus (subgenus) *Amegilla*.

Criteria for the selection of the neotype and male specimen and validation using univariate and multivariate methods

VILLERS (1789) described *Apis quadrifasciata* by specimens from the southern part of France. Therefore, a female and a male from this region were selected for the description of a neotype. For validation, the neotype was compared with other specimens from the whole distribution area using multivariate and univariate analyses. Concerning multivariate analyses, specimens originating from 13 countries were included in the comparison. In the diagram of the shape PC1 and shape PC2, the value of the neotype is included in the positions of all points (Fig. 3a) and in the calculation of shape PC1 and isosize axes, and the value has a location in the immediate vicinity of the regression line (Fig. 3b).

Although only a few male individuals were available for multivariate analysis, the value of the male specimen is very close to the values of three European localities (Fig. 3c). The first PC axis (first shape axis) plotted against the isometric size axis (geometric mean of all variables) represents the more accurate value and in this case corresponds to the regression line (Fig. 3d). The male specimen can be classified as typical in morphometric values.



Figs 3a-d: (a) PCA of females, computed on the co-variance matrix of log-transformed data; PC2 plotted against PC1 (corresponding to allometric size axis). (b) Shape PCA of female MRA, computed on the co-variance matrix of log-transformed and size corrected data; PC1 plotted against isometric size (geometric mean of all variables). (c) PCA of males; PC2 plotted against PC1. (d) Shape PCA of male MRA, plotted against isometric size. Abbreviations: Algeria (AL), Bulgaria (BU), Crete (CR), Cyprus (CY), France (FR), Germany (GE), Greece (GR), Italy (IT), Kyrgyzstan (KY), Morocco (MO), Spain (SP), Tunisia (TU), Turkey (TUR), former borders of Yugoslavia (YU).

Univariate analyses were performed with nine indices concerning females and males. The neotype is in all cases within the 25th and the 75th percentiles of all examined females with European distribution (Fig. 4). The value of the male specimen deviated slightly in only one case (EL/EW) (Fig. 5). Although only four males were available for comparison, this exception may be due to the small number of individuals analysed.

Both the multivariate and univariate analyses show that the values of morphometric parameters of the neotype and the male specimen can be regarded as characteristic of the European and North African populations.

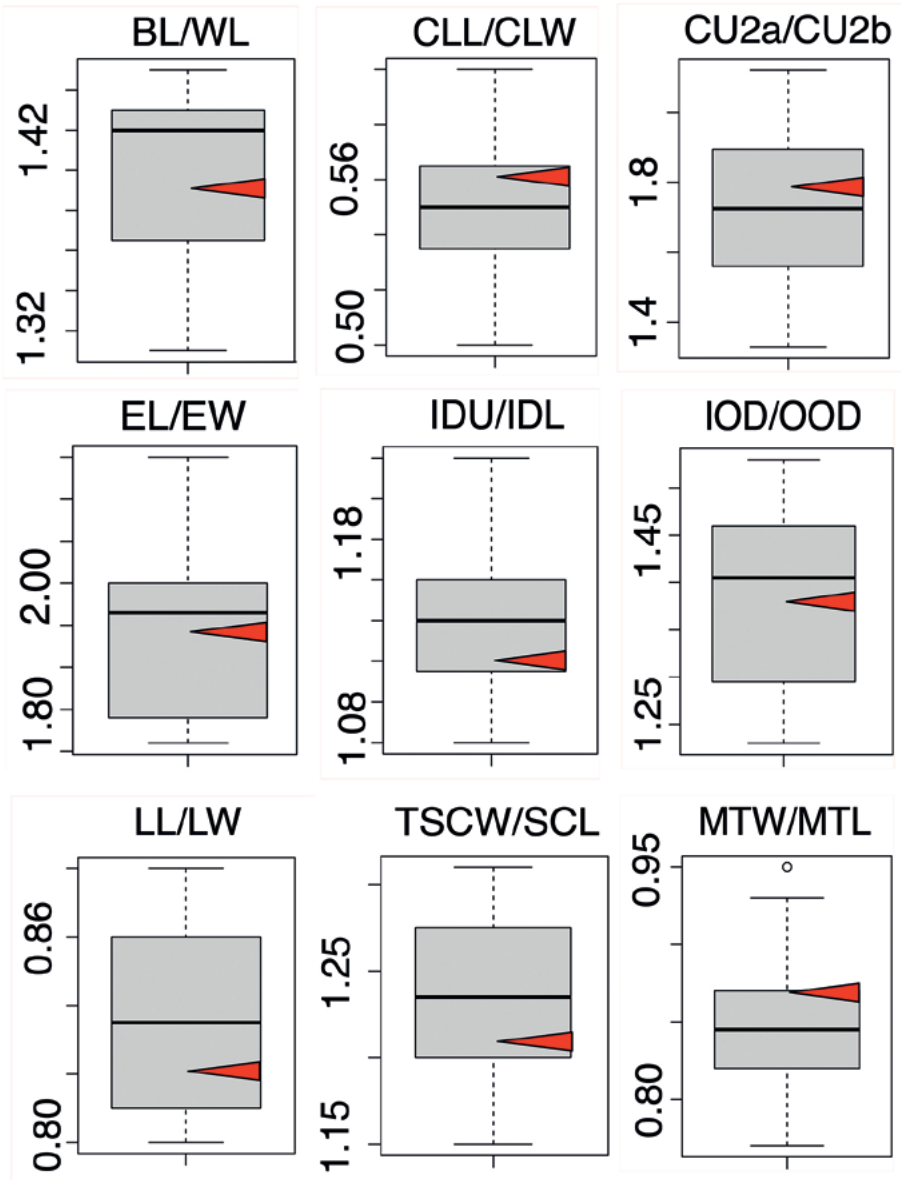


Fig. 4: Boxplots of nine morphometric indices of females: The boxes indicate the 25th and 75th percentiles of the examined females ($N = 16$), and the red triangle characterises the value of the neotype. For abbreviations, see Table 1.

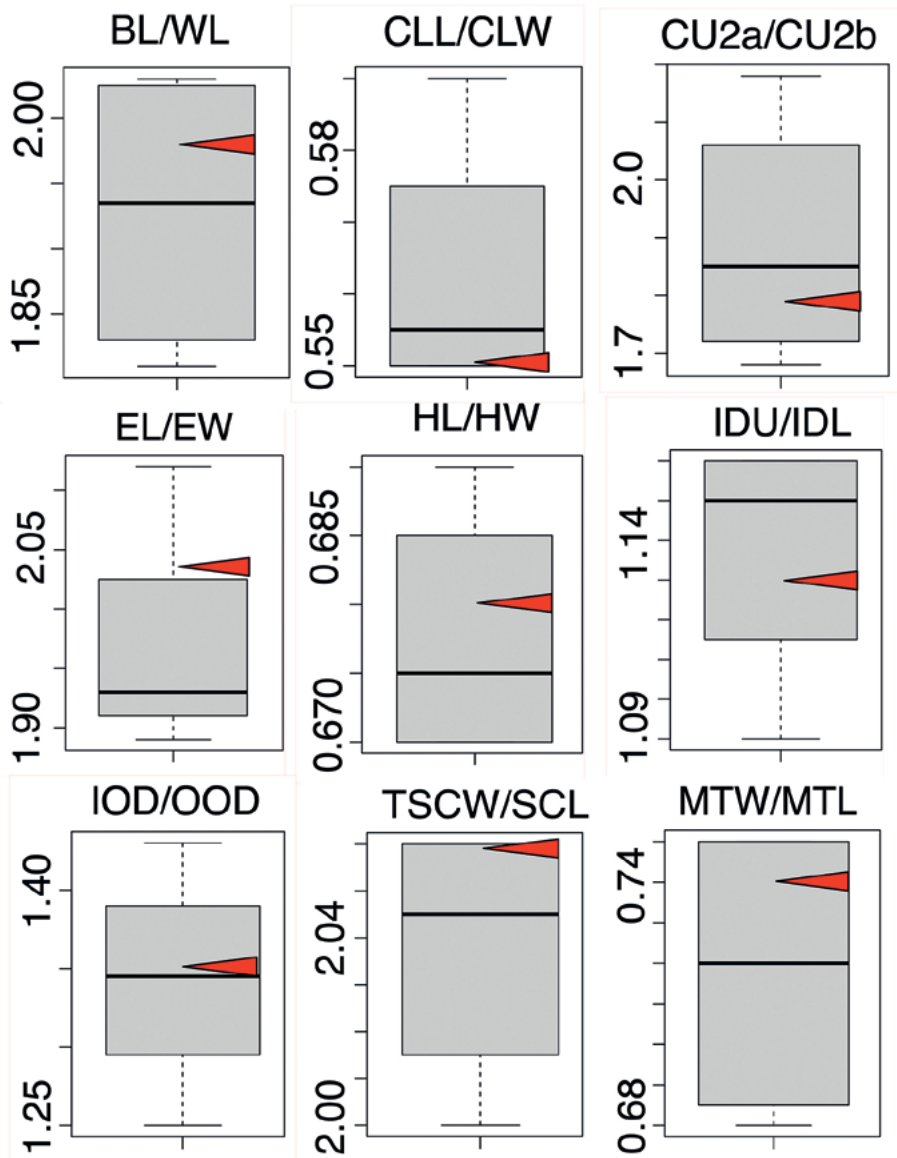


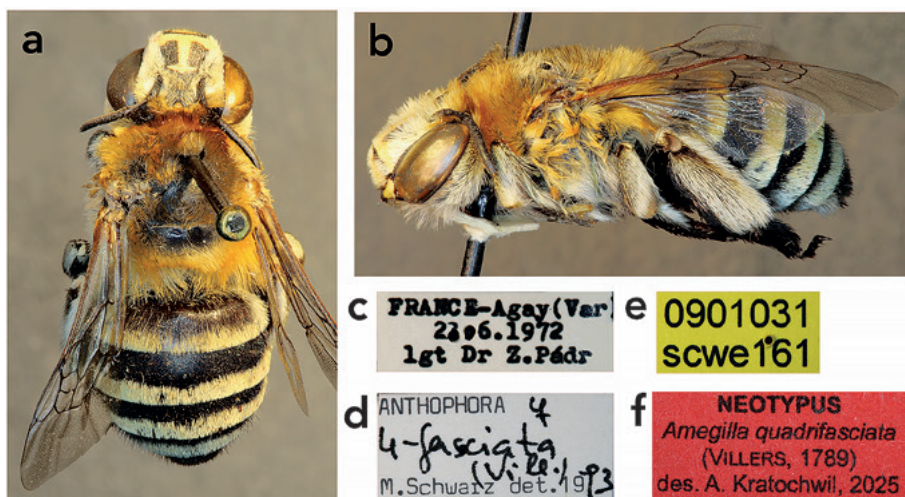
Fig. 5: Boxplots of nine morphometric indices of males: The boxes indicate the 25th and 75th percentiles of the examined males ($N = 4$), and the red triangle characterises the value of the male specimen. For abbreviations, see Table 1.

Neotype (female)

Neotype deposited in OLML and hereby designated. The neotype is pinned with the following labels: 'Agay (Var), 23.06.1972, Dr C. Pádr leg.', '*Anthophora 4-fasciata* (VILL.),

♀, M. Schwarz det. 1993', label Wildbienenkataster Baden-Württemberg, Germany '0901031scwe161'; Ident. No. FR1.

Figs 6a-f shows the neotype specimen in dorsal and side views, including labels. The morphometric values of the neotype are listed in Table 2 and compared with the values of 16 females from different countries in Europe. For these, the mean value, the standard deviation and the highest and lowest values are given. All values are in the range of the values of the 16♀♀ from the regions of the distribution area.



Figs 6a-f: Neotype of *Amegilla quadrifasciata*: (a) dorsal view, (b) side view, (c) collector's label, (d) determination label, (e) label Wildbienenkataster Baden-Württemberg, Germany, (f) designation label.

Head:

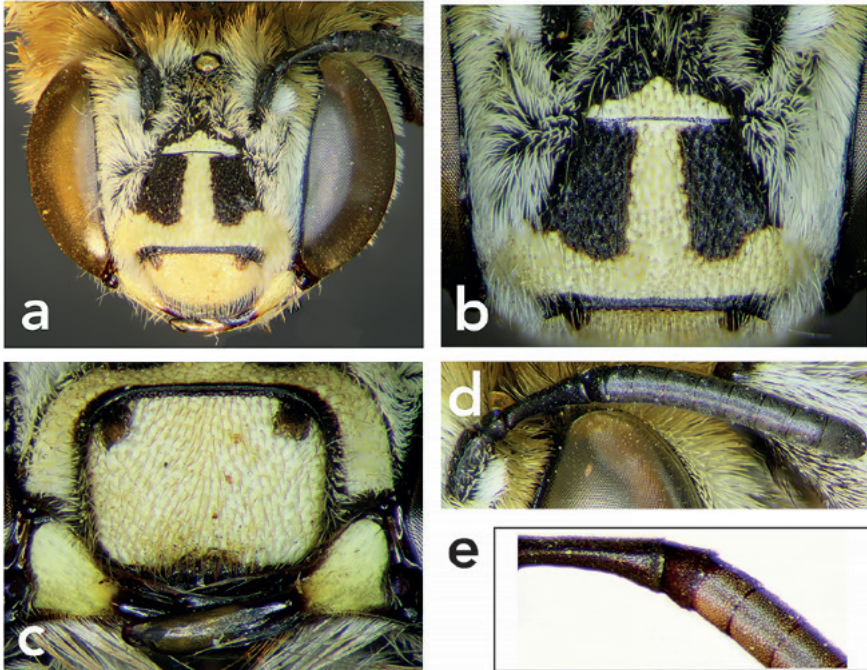
Structure, colour, puncturing: The HE is wider than long (HI/HW index = 0.65) (Fig. 7a). It has a black cuticle except for CL, LA, SA and MA base (Figs 7b, c), which are white-yellowish (ivory) in colour. The SA is characterised by a white-yellowish coloured triangle and a black base (Fig. 7b).

The CL is wider than long (CLL/CLW index = 0.56), flattened to slightly convex in shape and has a slight lustre (Fig. 7b). The CL is ivory to white-yellowish and has two large black basal spots that are bulging on the inside in the anterior region. Both basal spots are separated centrally by an ivory to white-yellowish midline. The front edge of the CL is coloured black, narrow in the centre and wider at the corners. The puncturing of the SA and CL is dense and flat in the centre, with a PD of 27 µm and a PDI of 27-41 µm and laterally with a PD and PDI of 27-54 µm. The punctures are partly elongated and often converge. The puncture form combs, especially laterally.

The LA is wider than long (LL/LW index = 0.82), rounded at the corners (Fig. 7c) and has a slightly raised carina, which is rimmed centrally. It is ivory to light-yellowish in colour and has a small black spot at the base on each side. Like the CL, LA is characterised by irregularly large, flat punctures. The punctures often converge and form a network of irregular, shiny ridges.

Table 2: Morphometric values of the neotype and comparison of the values of 16 ♀♀ from different countries in Europe similar to Figs 3a-d (mean value, standard deviation, highest and lowest values).

characters	neotype	mean \pm SD, max, min females for comparison	characters	neotype	mean \pm SD, max, min females for comparison
BL	14.00	13.90 \pm 0.63, 14.80, 12.40	IDL	2.70	2.60 \pm 0.08, 2.70, 2.44
BL/WL	1.39	1.40 \pm 0.04, 1.45, 1.31	IDU	3.02	2.96 \pm 0.12, 3.12, 2.70
CLL	1.43	1.35 \pm 0.05, 1.43, 1.27	IDU/IDL	1.12	1.14 \pm 0.04, 1.22, 1.08
CLL/CLW	0.56	0.55 \pm 0.03, 0.60, 0.50	IOD	0.99	1.00 \pm 0.05, 1.07, 0.94
CLW	2.54	2.46 \pm 0.10, 2.60, 2.28	IOD/OOD	1.38	1.38 \pm 0.10, 1.53, 1.23
CU2a	0.56	0.49 \pm 0.04, 0.57, 0.42	LL	1.37	1.34 \pm 0.06, 1.43, 1.27
CU2a/CU2b	1.78	1.72 \pm 0.22, 2.12, 1.33	LL/LW	0.82	0.84 \pm 0.03, 0.88, 0.80
CU2b	0.31	0.28 \pm 0.03, 0.33, 0.23	LW	1.66	1.60 \pm 0.04, 1.69, 1.53
EL	3.12	3.03 \pm 0.07, 3.12, 2.86	MTL	7.20	7.02 \pm 0.45, 8.00, 6.00
EL/EW	1.94	1.94 \pm 0.10, 2.15, 1.81	MTW	6.24	5.95 \pm 0.19, 6.16, 5.60
EW	1.61	1.56 \pm 0.09, 1.72, 1.40	MTW/MTL	0.87	0.85 \pm 0.05, 0.95, 0.77
FL1	0.71	0.70 \pm 0.02, 0.73, 0.65	OCED	0.34	0.32 \pm 0.02, 0.35, 0.29
FL2	0.22	0.21 \pm 0.02, 0.24, 0.18	OOD	0.72	0.72 \pm 0.03, 0.77, 0.68
FL3	0.24	0.24 \pm 0.01, 0.27, 0.22	SCL	4.78	4.30 \pm 0.20, 4.63, 3.95
HL	3.38	3.34 \pm 0.13, 3.64, 3.12	TSCW	5.77	5.30 \pm 0.19, 5.56, 4.94
HL/HW	0.65	0.67 \pm 0.02, 0.71, 0.64	TSCW/SCL	1.21	1.23 \pm 0.05, 1.31, 1.15
HW	5.20	5.00 \pm 0.13, 5.20, 4.73	WL	10.08	9.92 \pm 0.36, 10.72, 9.36



Figs 7a-e: Head of *Amegilla quadrifasciata* female (neotype): (a) head in total, (b) clypeus, (c) labrum and mandibles, (d) antenna, (e) antenna sideview.

The MA is coloured yellow at the base (about one third of the entire MA length), brown to blackish towards the centre and reddish in the anterior region (Fig. 7c).

The EY has an EL/EW index of 1.94. The compound eyes hardly converge ventrally (IDU/IDL index = 1.12) (Fig. 7a).

The AN is dark coloured, and the SC, PE and FL1 are black and slightly ore-coloured. FL2-FL10 are black and slightly ore-coloured dorsally (Fig. 7d), due to very fine and short hairs that are brown to light brown ventrally (Fig. 7e). The FL1 is about three times as long as FL2 and the other FL (FL1: FL2: FL3 = 3.2: 1.0: 1.1).

Pubescence: The VE is covered with few long brown hairs in the upper area and mainly characterised by a dense golden-yellowish pubescence. In the FR area, the hairs are yellowish to ivory-coloured and downward-curved (about a quarter to half the length of the VE hair) (Fig. 7a). In SA, the hairs are loose and longer and much more erect than the FR hairs. The base and backside of the SCA have dense whitish hairs (half the length of the VE hairs) (Fig. 7b). In the upper PA, the hairs are the same as those of the FR in colour and length (Fig. 7a). From the base of the AN, the PA pubescence is shorter and ivory-coloured. On the CL, longer whitish yellowish hairs only occur laterally; in the centre is a very loose, fine, yellowish (partly lighter, partly darker) and very short pubescence, with hairs bent downwards (Fig. 7b). The LA is hairy like the clypeus but appears much more silver (Fig. 7c).

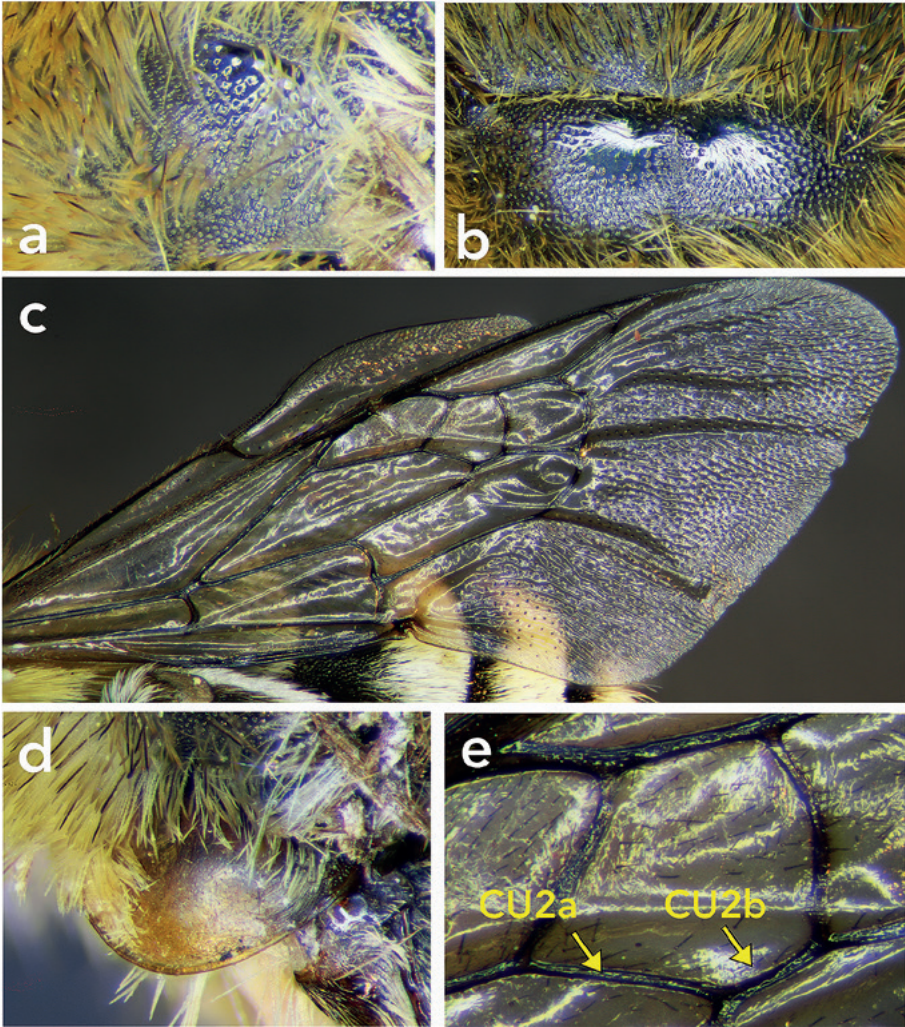
The GN has white-yellowish hairs on its upper side and ivory to white hairs on its lower side. Near the posterior side of the EY is a short, dense, white-yellowish pubescence in the upper area that becomes longer downwards and turns into an ivory-white to white pubescence (Fig. 6b).

M e s o s o m a :

Structure, colour, puncturing: The SC is black; the ME is oval. The thorax has an TSCW/SCL index of 1.21. The SC is densely and finely punctured both laterally (PD and PDI = 14 μ m) and centrally (PD = 28 μ m and PDI = 14 μ m). The punctures are oval and merge and have raised margins (Fig. 8a). Laterally, there are small areas with larger punctures (PD = 41 μ m) and a larger PDI (Fig. 8a). The SCU is strongly shiny and unpunctured on the left and right sides in the centre but separated by a strongly punctured midline. From the shiny and unpunctured areas, the puncturing increases and the PDI decreases towards the edges (Fig. 8b).

The WL of the neotype is 10.08 mm, and the BL/WL index is 1.39. Both values correspond to the average values of the European and North African specimens. The wings are tinted (smoky), and the veins are black to dark reddish-brown (Fig. 8c). The tegulae are dark to light brown (Fig. 8d). In the Anthophorini, within the submarginal cell 2 (cubital cell 2), the distance from the first submarginal cross vein to the first recurrent vein (CU2a) and the distance of the first recurrent vein to the second submarginal cross vein (CU2b) is a characteristic feature (Fig. 8e). The CU2a/CU2b index is 1.78 and thus of average value.

The FE and TI of all pairs of legs are black to reddish-brown, and the BA, MT and DI are black to reddish-brown on the outside and partly orange-red on the inside (Figs 9a, b). The outer spurs of the BA2 and BA3 are black (Figs 9c, d).

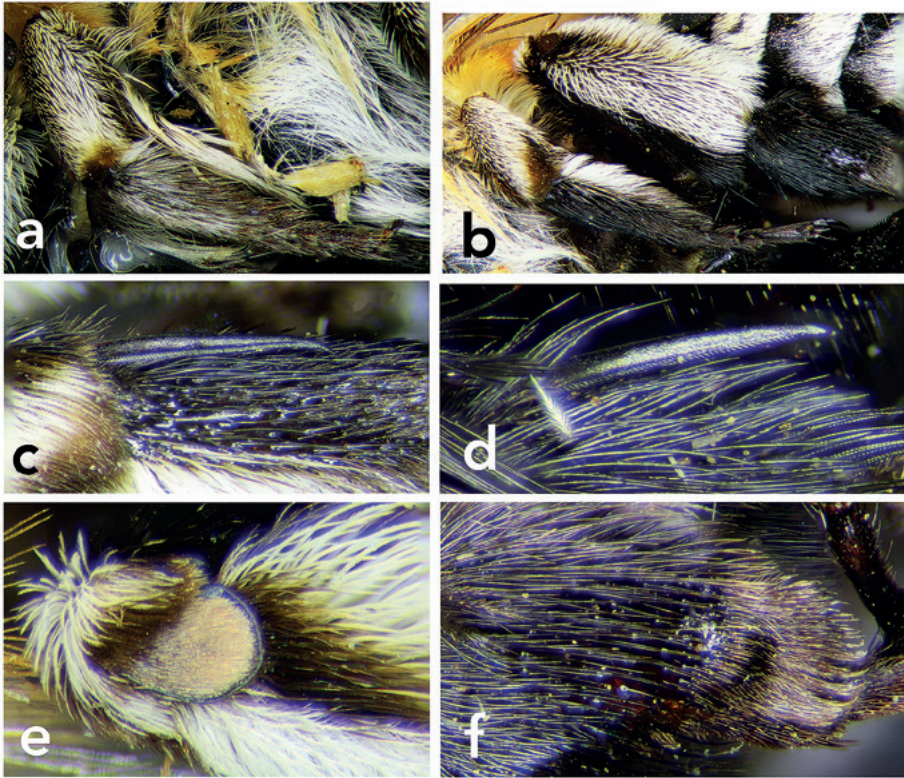


Figs 8a-e: *Amegilla quadrifasciata* (neotype): (a) thorax side, (b) scutellum, (c) front wing, (d) tegula, (e) cubital cell 2 (CU2a and CU2b: see text).

Pubescence: The SC has a reddish-yellowish golden pubescence that is much patchier in the centre, denser laterally and interspersed throughout the whole area with a few black hairs of equal length (Figs 6a, b). The SCU, PSC and PR have a hair colour similar to that of the SC, but only the SCU shows some black hairs interspersed. The SCU is hairy only on the posterior margin. The PR has a long and dense pubescence. The MES has yellowish hairs on top that become whitish, longer and denser downwards.

The FE of FO is outside more or less hair-free except for some very fine and short yellowish hairs. The FE has inside long and light-brownish hairs basally followed by some darker hairs and long whitish hairs and some long black hairs ventrally. Outside, the TI is

covered with whitish hairs (Fig. 9a); these are patchy and shorter basally and denser and longer apically. Dorsally, there is a row of black hairs. There are blackish and yellowish-brownish hairs at the apical end. Inside TI is more or less hair-free, with only a few very short yellowish hairs. The BA has outside basally a few whitish hairs with some yellowish hairs interspersed. Yellowish hairs reach the apex. Inside, there is a dense reddish-brownish pubescence. These hairs are longer ventrally. The MT and DI have some whitish and dark-brownish hairs outside and reddish-brownish hairs inside.



Figs 9a-f: *Amegilla quadrifasciata* (neotype): (a) fore leg (tibia, basitarsus, mediotarsi, distitarsus), (b) middle and hind leg, (c) tibia outer spine of the middle leg, (d) tibia outer spine of the hind leg, (e) tibial plate, (f) penicillus.

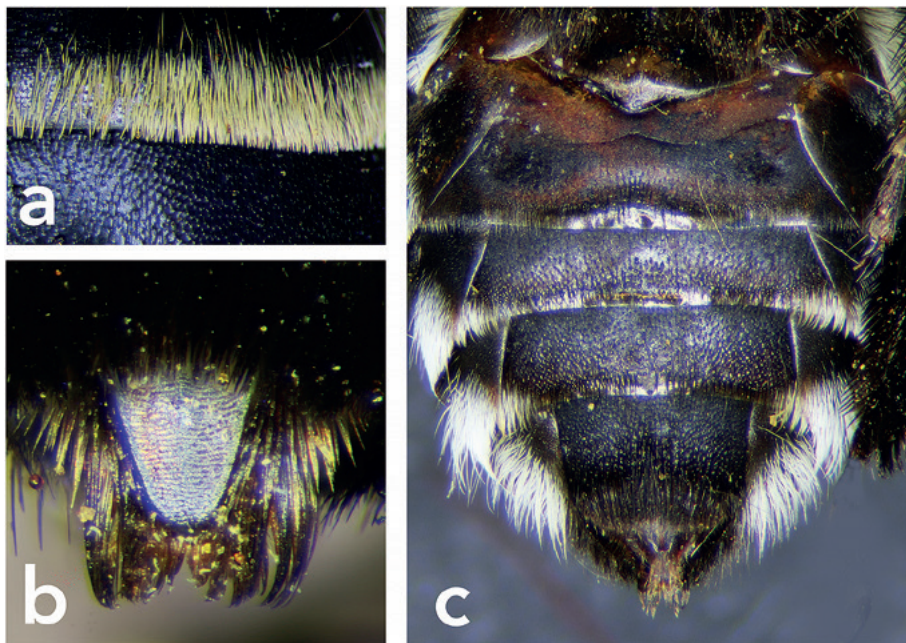
The FE of ML has outside ventrally a characteristic row of dense black hair and basically a whitish hair patch. Inside, there are only very few short, light-brownish hairs with a large hair-free area. Inside, there are long, dirty-brownish hairs ventrally. Outside TI is covered with whitish hairs, but they are more extensive and denser than in the FO (Fig. 9b). These hairs are shorter and patchy basally and denser and longer apically. Ventrally, there is a row of blackish hair. There are blackish and yellowish-brownish hairs at the apex. Inside TI has few light-brownish hairs. The BA has a loose blackish and brownish pubescence, inside reddish-brownish hairs and white hairs ventrally followed by dirty-brownish hairs. The MT and DI have some dark-brownish hairs outside and reddish-brownish hairs inside.

The FE of HL has a pubescence similar to that of the ML. Outside T1 is covered with long and dense whitish hairs (Fig. 9b). Dorsally, there is a row of long black hair. Inside is covered with shorter brownish hairs, ventrally with long and dense black hairs.

The BA outside is characterised by long, loose black hairs. Inside, there are dense reddish-brownish hairs. Dorsally and ventrally, there are long black hairs (basally longer than apically). The basitibial plate is dark brown at the base and light brown apically (Fig. 9e), and the penicillus is light brown (Fig. 9f). The MT and DI are similar to the ML.

Metasoma :

Structure, colour, puncturing: The ME is oval and has an MTW/MTL index of 0.87. The cuticle is black and partially dark reddish-brown, and the depressions are partially metallic reddish-green. The T1 has a flat puncture pattern, with a PD of 0.14 μm and PDI of 0.14-0.28 μm . The T2 is black, and very small areas are also translucent reddish-brown. The depressions are as in the T1. T2-T4 have a PD 0.14 μm with a PDI of 0.14-0.42. At the base and centre, the PDI are larger and apically smaller (Fig. 10a). The depression of the T4 is broader than those of T1-T3. The T5 is basically black and apically reddish. The PY is black, partly brownish, elongated oval and apically rounded, with a slightly raised lateral margin. The surface is covered with fine transverse stripes (Fig. 10b). S1-S5 are reddish to reddish-brown, with loose puncturing (Fig. 10c).



Figs 10a-c: *Amegilla quadrifasciata* (neotype): (a) section of right abdominal area with hair band of the T1 and basal area of the T2, (b) pygidium, (c) sternites.

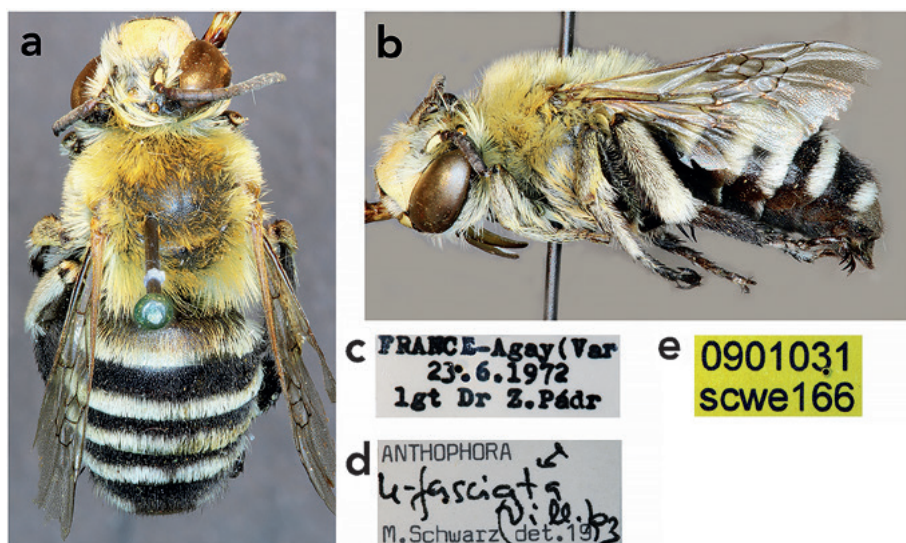
Pubescence: The T1 has long whitish to ivory-coloured hairs apically, with only a few long hairs centrally (Fig. 6a). The yellowish to ivory-coloured bands cover the entirety of

the depressions. There are very short, close-fitting black hairs on the entire T area with exception of the depressions. The pubescence of T2-T4 is similar to that of the T1 but without the basally and centrally longer hairs. The T5 has long black-brown hairs centrally and long white hairs laterally. The T6 is characterised next to the PY with two tufts of parallel black hairs. S1-S4 have rows of apically fine light-brownish hair. The S3 and S4 show lateral tufts of whitish hairs and rows of light-brownish hair apically (Fig. 10c). The hair row is most strongly developed on the S5, partly interspersed with pale hairs.

Description of the male

The studied male specimen is pinned with the following labels: 'Agay (Var), 23.06.1972, Dr C. Pádr leg.', '*Anthophora 4-fasciata* (VILL.), ♂, M. Schwarz det. 1993', logo Wildbienenkataster Baden-Württemberg, Germany, '0901031scwe166'; Ident. No. FR3; deposited in OLML.

Fig. 11 shows the male specimen in dorsal and side views, including labels.



Figs 11a-e: Male of *Amegilla quadrifasciata*: (a) dorsal view, (b) side view, (c) collector's label, (d) determination label, (e) label Wildbienenkataster Baden-Württemberg, Germany.

The morphometric values of the male are listed in Table 3 and compared with those of four males from different countries in Europe and North Africa. All values are in the range of the values of the four males from regions of the distribution area.

Head:

Structure, colour, puncturing: As in the female, the HE is wider than long (HI/HW index = 0.67) (Fig. 12a). It also has a black cuticle except for CL, LA, SA, base of MA and upper side of the first antennal segment (Fig. 12a), which is white-yellowish. As in the female, the SA is characterised by a white-yellowish (ivory) triangle (Fig. 12a).

The CL is wider than long (CLL/CLW index = 0.54) and more or less flattened to slightly

convex in shape (Fig. 12b). It is white-yellowish (ivory) and has two small black basal stripes on the basal margin, which is trapezoidally thickened below. The anterior margin of the CL is black, as in females. The punctuation of the SA and CL is dense and flat in the centre, with a PD of 27 μm and a PDI of 27-41 μm , and laterally, with a PD and a PDI of 27-54 μm . The punctures are partly elongated and often converge. They form combs, especially laterally, with a slight lustre. Some of the punctures are elongated and converge. There is no puncture-free median line in the CL.

Table 3: Morphometric values of the male and comparison of the values of four males from different countries in Europe and North Africa, similar to Fig. 2 (mean value, standard deviation, highest and lowest values).

characters	male	mean \pm SD, max, min males for comparison	characters	male	mean \pm SD, max, min males for comparison
BL	14.72	15.54 \pm 0.41, 14.08, 13.12	IDL	2.93	2.30 \pm 0.07, 2.39, 2.24
BL/WL	1.98	1.93 \pm 0.11, 2.03, 1.81	IDU	2.70	2.61 \pm 0.03, 2.65, 2.60
CLL	1.27	1.25 \pm 0.06, 1.30, 1.17	IDU/IDL	1.13	1.14 \pm 0.03, 1.16, 1.09
CLL/CLW	0.54	0.56 \pm 0.02, 0.59, 0.55	IOD	0.60	0.64 \pm 0.01, 0.65, 0.64
CLW	2.34	2.22 \pm 0.08, 2.31, 2.11	IOD/OOD	1.45	1.34 \pm 0.07, 1.43, 1.25
CU2a	0.48	0.47 \pm 0.04, 0.50, 0.43	LL	1.20	1.21 \pm 0.05, 1.27, 1.17
CU2a/CU2b	1.52	1.89 \pm 0.22, 2.18, 1.68	LL/LW	0.80	0.85 \pm 0.02, 0.87, 0.82
CU2b	0.31	0.25 \pm 0.03, 0.29, 0.23	LW	1.50	1.43 \pm 0.03, 1.46, 1.40
EL	2.86	2.81 \pm 0.04, 2.86, 2.75	MTL	7.36	7.22 \pm 0.26, 7.52, 6.98
EL/EW	2.12	1.97 \pm 0.10, 2.12, 1.89	MTW	5.44	5.18 \pm 0.10, 5.28, 5.04
EW	1.35	1.43 \pm 0.05, 1.46, 1.35	MTW/MTL	0.74	0.72 \pm 0.04, 0.75, 0.68
FL1	0.41	0.47 \pm 0.01, 0.49, 0.46	OCED	0.33	0.32 \pm 0.02, 0.34, 0.30
FL2	0.22	0.24 \pm 0.01, 0.26, 0.23	OOD	0.60	0.64 \pm 0.01, 0.65, 0.64
FL3	0.35	0.36 \pm 0.01, 0.37, 0.34	SCL	3.85	3.91 \pm 0.05, 3.95, 3.85
HL	3.12	3.04 \pm 0.05, 3.07, 2.96	TSCW	4.84	4.85 \pm 0.14, 4.99, 4.68
HL/HW	0.67	0.68 \pm 0.01, 0.69, 0.67	TSCW/SCL	2.00	2.03 \pm 0.03, 2.06, 2.00
HW	4.68	4.50 \pm 0.12, 4.58, 4.32	WL	9.28	8.80 \pm 0.59, 9.52, 8.24

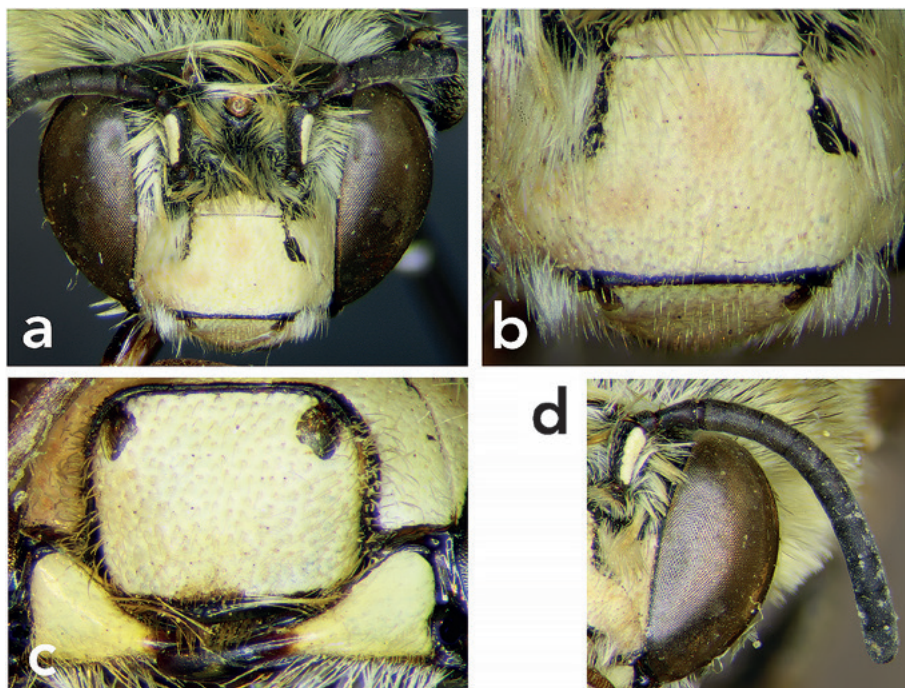
The LA is wider than long (LL/LW index = 0.80) and rounded at the corners (Fig. 12c). It has a slightly raised carina apically, that is slightly rimmed in the centre. The LA is ivory to white and light-yellowish and has a small black spot basolaterally. Similar to the CL, it is punctured irregularly large and flat. Here, too, the punctures often converge and form a network of irregular, shiny ridges. The average PD is 27 μm .

The MA are coloured white-yellowish at the base up to the half of the MA, and the rest up to the tip is blackish-brownish to reddish (Fig. 12c). They are curved, slightly crossing apically and with a subapical inner tooth. The EY have an EL/EW index of 2.12. They hardly converge (IDU/IDL index 1.13) (Fig. 12a).

The AN is dark-coloured, and the SC has, in contrast to the females, an elongated yellow spot on the side and is otherwise dark to blackish or slightly ore-coloured. The PE is black. The FL1 is black, and the FL2 is dorsally black, slightly ore-coloured, and ventrally apically dark brown, then light brown in colour. Remaining FL are black dorsally, slightly ore-coloured and light brown ventrally (Fig. 12d). The FL1 is almost twice as long as FL2, and the other FL is about one and a half times longer (FL1: FL2: FL3 = 1.9: 1.0: 1.6).

Pubescence: The VE is covered with few long brown hairs in the upper area and mainly characterised by a dense yellowish, partly golden-yellowish pubescence. In the FR area, the hairs are yellowish to ivory-coloured and similar to those of the females, downward-curved (about a quarter to half the length of the VE hair) (Fig. 12a). In the SA the hairs are concentrated basally and are loose and longer and much more erect than the FR hairs. The base and backside of SC have dense, white-yellowish hairs (half the length of the VE hairs) (Fig. 12a). In the upper PA, the hairs are the same as those of the FR in colour and length (Fig. 12a). From the base of the AN, the PA pubescence is long and ivory-coloured. On the CL, longer whitish-yellowish hairs occur only laterally; in the centre, there is a very loose, fine, yellowish-silver and very short pubescence, with hairs bent downwards (Fig. 12b). The LA is hairy like the clypeus (Fig. 12c).

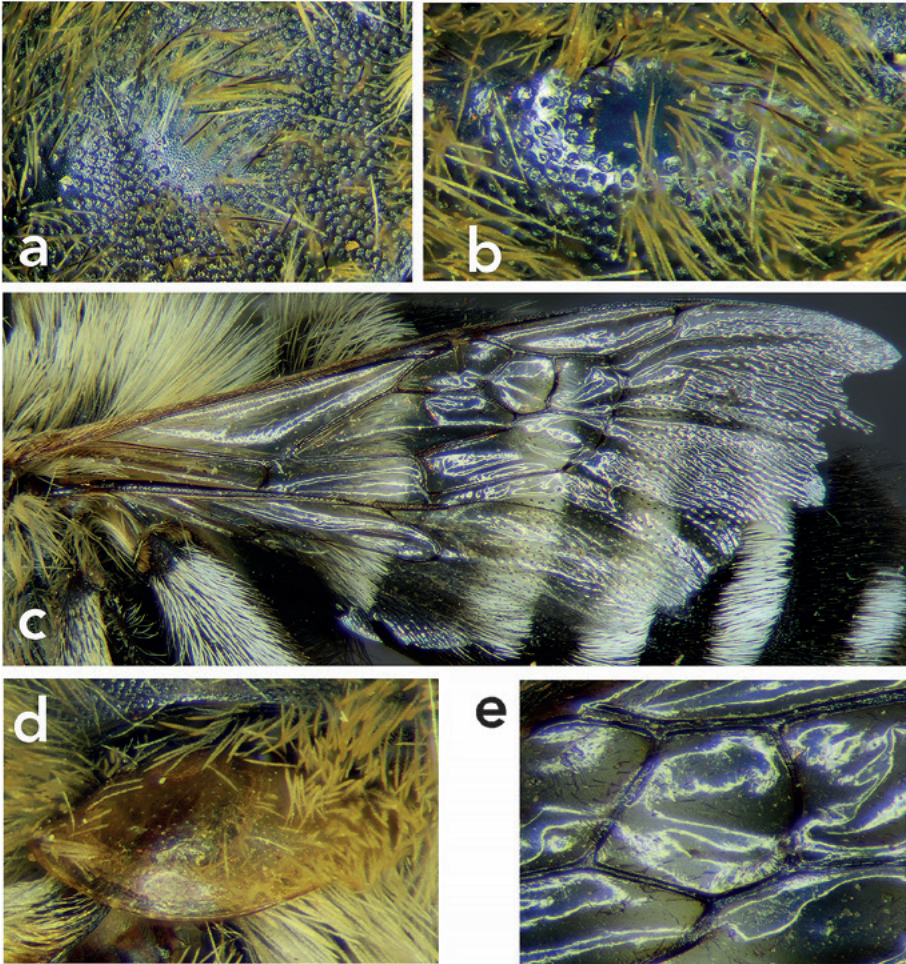
The GN has white-yellowish hairs on the upper side and ivory to white hairs on the lower side. Near the posterior side of the EY is a short, dense, white-yellowish pubescence in the upper area that becomes longer downwards and turns into an ivory-white to white pubescence (Fig. 11b).



Figs 12a-d: Head of *Amegilla quadrifasciata* (male): (a) head in total, (b) clypeus, (c) labrum and mandibles, (d) antenna.

Mesosoma :

Structure, colour, puncturing: The thorax has an TSCW/SCL index of 2.00. The SC is black and densely and finely punctured both laterally (PD and PDI = 14 μ m) and centrally (PD = 28 μ m and PDI = 14 μ m). The punctures are oval, merge and have raised edges (Fig. 13a). Laterally and centrally are small areas with a larger PD (41 μ m) and a



Figs 13a-e: Male of *Amegilla quadrifasciata*: (a) thorax side, (b) scutellum, (c) front wing, (d) tegula, (e) cubital cell 2.

larger PDI (Fig. 13a). The thoracic surface is dull and only slightly shiny. In contrast, the centre of the SCU is very shiny and without punctures. Laterally, there is a strong punctation ($PD = 54 \mu m$) (Fig. 13b).

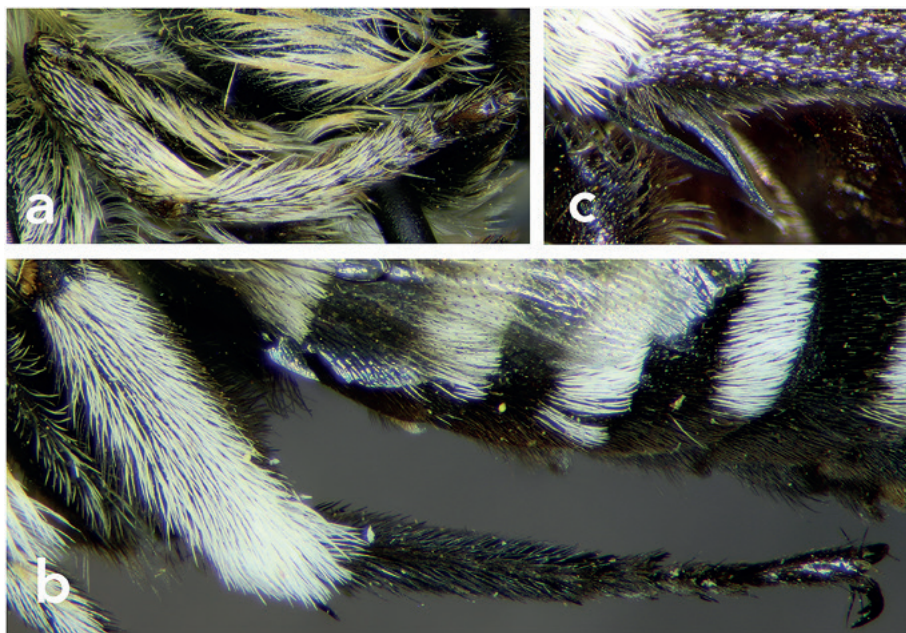
The W are slightly tinted (smoky), with black to dark reddish-brown veins (Fig. 13c). The WL of the male is 9.28 mm, and the BL/WL index is 1.98. Both values correspond to the average values (Table 3). The tegulae are dark at the base and light brown at the margins (Fig. 13d). The CU2a/CU2b index is 1.52 and thus of average value (Table 3).

The FE, TI, BA, MT and DI of all pairs of legs are black to reddish-brown; the BA, MT and DI are black to reddish-brown outside (Figs 11b, 14a-c). The outer spurs of the BA2 and BA3 are black (Fig. 14c).

Pubescence: The MS has a reddish-yellowish golden pubescence (Figs 11a, b) that is very patchy in the centre, denser laterally and interspersed with a few black hairs of equal length (Figs 13a, b). The SCU, PSC and PR are hairy like the MS, but the PR is longer and denser. The MES has pale yellowish, weakly feathered hairs that become more whitish, longer and denser towards the base.

The FE of the FO is more or less hair-free outside except for some very fine, short, yellowish hairs. The FE has some dark hairs inside and long whitish hairs ventrally. Outside TI is covered with whitish hairs (Fig. 14a); these are patchy and shorter basally and denser and longer apically. Dorsally there is a row of dense black hairs. They are blackish and yellowish-brownish short hairs at the apical end. Inside TI is more or less hair-free with only a few very short yellowish hairs. The BA has whitish hairs outside. Inside is a dense reddish-brownish pubescence. The MT and DI have some whitish and dark-brownish hairs outside and reddish-brownish hairs inside.

The FE of the ML has outside ventrally a characteristic row of dense black hair. Inside, there are only very few short light-brownish hairs with a large hair-free area. Ventrally there are long, dirty-brownish hairs inside. Outside TI is covered with whitish hairs (Fig. 11b). These hairs are shorter and sparser basally and denser and longer apically. Ventrally there is a blackish hair row. Inside TI has few light-brownish hairs. The BA has a loose blackish and brownish pubescence outside, blackish to reddish-brownish hairs inside and white hairs ventrally. The MT and DI have some dark brownish hairs outside and reddish-brownish hairs inside.



Figs 14a-c: Male of *Amegilla quadrifasciata*: (a) fore leg (tibia, basitarsus, mediotarsi, distitarsus), (b) hind leg, (c) outer spine of hind tibia.

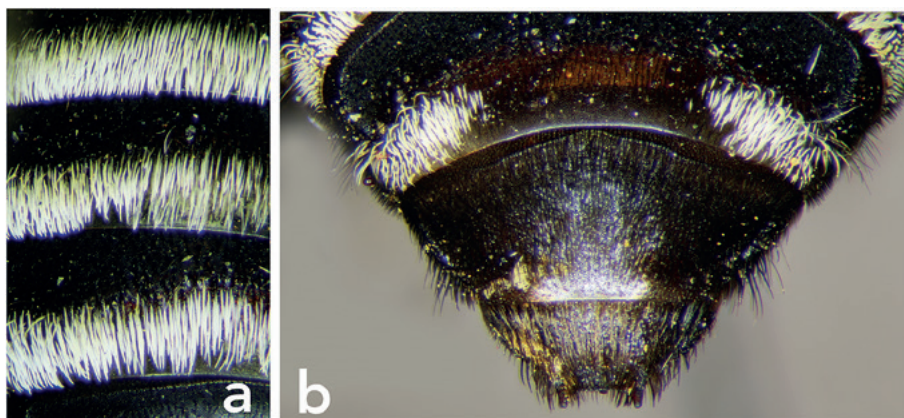
The FE of the HL has a pubescence similar to that of the ML. Outside TI is covered with long and dense whitish hairs but not so extensively as in females (Fig. 14b). Dorsally there is a row of long black hair. Inside is covered with shorter brownish hairs and ventrally with long, dense black hairs.

Outside BA is characterised by long, loose black hairs. Inside are dense reddish-brown hairs. Dorsally and ventrally, there are long black hairs (basally longer than apically). The MT and DI are similar to those of the ML.

Metasoma :

Structure, colour, puncturing: The ME is oval in shape and has an MTW/MTL index of 0.74. The cuticle is dark reddish-brown to black, and the depressions are partially metallic reddish-green in colour.

The T1 has a flat puncture pattern with a PD of 0.14 μm and a PDI of 0.14-0.28 μm . The T2 is black, with a slight bluish tinge; the depression is coloured as in the T1. T2-T4 are more densely punctured, with a more or less puncture-sized distance. T2-T4 have a PD of 0.14 μm and a PDI of 0.14-0.42. At the base and centre, PDI are larger, but smaller apically. The depression of the T4 is broader than those of T1-T3. T5 is basically black and apically reddish. The T6 and T7 are reddish (Fig. 15b). S1-S5 are reddish to reddish-brown, with loose puncturing.

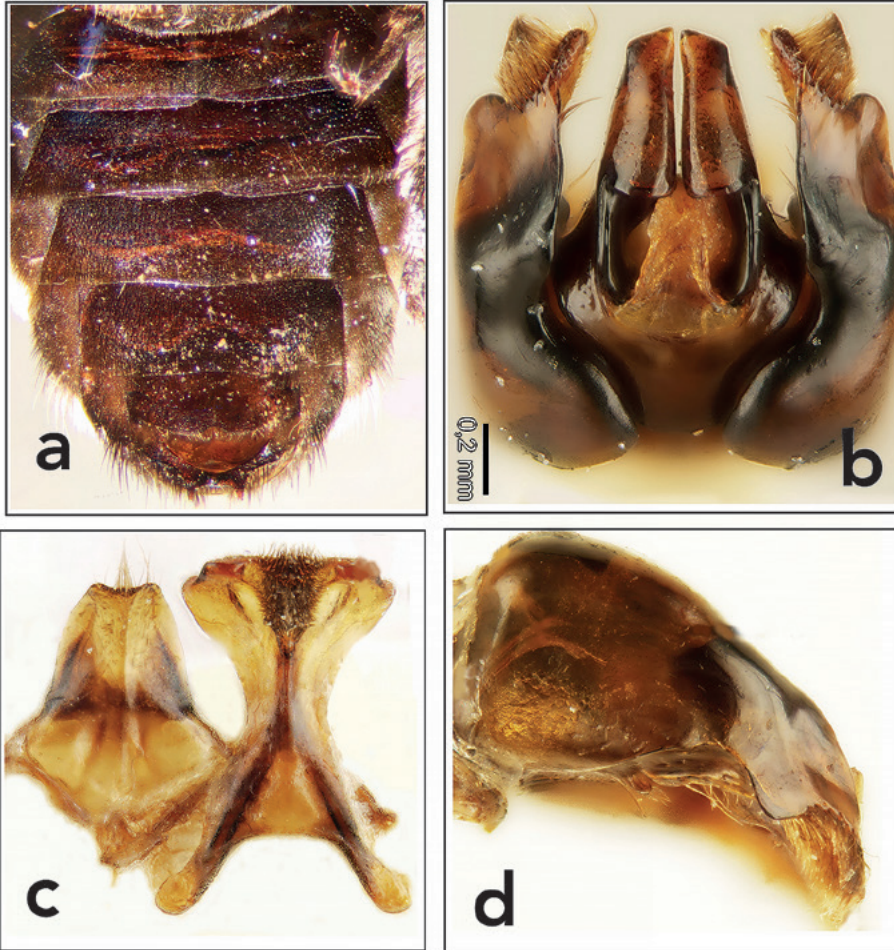


Figs 15a-b: Male of *Amegilla quadrifasciata*: (a) section of right abdominal area with bands of the T1 and T2, (b) end tergites.

Pubescence: The T1 has long whitish to ivory-coloured hairs apically (Fig. 11a, Fig. 15a). The yellowish to ivory-coloured hair bands covers the entire depression, and in the centre hair bands are more patchy, but laterally wider in front. There are a few, short, close-fitting black hairs across the entire TE area with the exception of the depressions. The pubescence of T2-T4 is similar to that of the T1. The T5 is long and black-brown in the centre and white and with long hairs laterally (Fig. 15b). The T6 has black-brown hairs with yellowish hairs in the centre. S1-S6 are very sparsely covered by dirty-brownish hairs (Fig 16a).

The genitalia are compact and appear almost square-shaped in dorsal view (Fig. 16b). The gonocoxite has an inner basal margin and is thickened and slightly curved. At the rounded

apex of the gonocoxite are thicker black hairs inside and some thinner yellowish hairs outside (Fig. 16d). The short gonostylus, which ends with the valves, is hairy outside. It is about three times longer than wide. The ST7 and ST8 are documented in Fig. 16c.



Figs 16a-b: Male of *Amegilla quadrifasciata*: (a) sternites, (b) genital dorsal, (c) ST7, ST8, (d) genital lateral.

Concluding remarks

Kriechbaumer's opinion that *Ap. quadrifasciata* VILLERS, 1789 is a nomen nudum (KRIECHBAUMER 1877) is not tenable. The same applies to *Ap. nidulans* FABRICIUS, 1793, which must be classified as a junior synonym of *Ap. quadrifasciata*. COQUEBERT (1804) supplemented the description of VILLERS (1789) and clarified the hair colour of the metatarsus with an illustration. References and information in SPINOLA (1806), GERMAR

(1817), LUCAS (1849a, 1849b), SCHENCK (1859), DOURS (1869) and other authors can be taken as indicators that *Ap. quadrifasciata* is the original and valid species name. DOURS (1869) published a particularly detailed description of the female and the male.

The analysis carried out here shows that *Am. quadrifasciata* is a polymorphic species in terms of colouration. Whether these colour forms can be geographically delimited or also occur within populations or nearby populations will require a separate analysis.

COCKERELL (1931b) referred to the designation only as type species for the genus (subgenus) *Anthophora*, which can be done independently of the existence of a holotype or syntype (C. Rasmussen, pers. comm.). In this respect, the description of a neotype is a separate and independent process (see also ICZN code Art. 67.2).

After the death of Villers, the collection, including the types, came to the Musée des Confluences, Lyon (France) in 1810. Since the entire collection of Villers and all its types were later destroyed (H. Labrique, CCEC, pers. comm.) it is necessary to establish a neotype of *Am. quadrifasciata* to guarantee the principles of stability promoted by the ICZN (1999). As it is known that the types of *Ap. quadrifasciata* originate from the southern part of France, the neotype should also originate from this area. For validation, a univariate and multivariate morphometric analysis of 16♀♀ from Europe and North Africa was carried out and compared with the values of the neotype. For all parameters, the neotype values are within the range of the reference values. Such a validation has not yet been carried out for neotype descriptions. It should be introduced as a standard, especially for species with a large distribution area.

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Zusammenfassung

Die Sammlung des französischen Entomologen Villers, der *Apis quadrifasciata* VILLERS, 1789 (jetzt *Amegilla quadrifasciata*) beschrieb, wurde nach seinem Tod im Jahr 1810 im Musée des Confluences in Lyon (Frankreich) hinterlegt. Die Sammlung von Villers und alle ihre Typen wurden zerstört (H. Labrique, CCEC, pers. Mitt.). Daher war es notwendig, einen Neotypus von *Am. quadrifasciata* zu designieren und zu beschreiben, um die von der ICZN (1999) geforderten Stabilitätsprinzipien zu gewährleisten. Es wird ein historischer Überblick über den taxonomischen Status von *Am. quadrifasciata* einschließlich der Synonyme gegeben. Da bekannt ist, dass die Typen von *Am. quadrifasciata* aus dem südlichen Frankreich stammten, wurde der Neotypus auch aus dieser Region gewählt. Zur Validierung wurde eine univariate und multivariate morphometrische Analyse von 16♀♀ aus Europa und Nordafrika nach BAUR & LEUENBERGER (2011) und BAUR et al. (2014) durchgeführt und mit den Werten des Neotypus (24 meristische Parameter) verglichen. Alle morphometrischen Parameter des Neotypus befinden sich im Bereich der Referenzwerte. Neben den

morphometrischen Daten wurden 95 nicht meristische morphologische Merkmale zur Charakterisierung des Neotypus herangezogen und durch zahlreiche hochauflösende Fotos dokumentiert. Zusätzlich wurde eine Beschreibung des Männchens vom selben Fundort wie der Neotypus gegeben, einschließlich einer univariaten und multivariaten Analyse von vier Männchen aus Europa und Nordafrika zur Validierung.

References

- ALFKEN J.D. (1927): Über einige Arten der *Anthophora quadrifasciata*-Gruppe (Hym.). — Entomologische Nachrichten **16** (2): 120-122.
- ALFKEN J.D. (1940): Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad Juli – August 1935. XXV. Hymenoptera: *Prosopis*, *Andrena*, *Anthophora*, *Megachile* und *Osmia*. — Arkiv för zoologi (Uppsala) **32** (4): 1-2.
- ANONYMOUS (1933): René Louiche Desfontaines, 1751-1833. — Nature **132**: 741.
- ASCHER J. & J. PICKERING (2020): Discover Life's bee species guide and world checklist. Available from <http://www.discoverlife.org> [Accessed on 1 January 2025].
- BÁEZ M. & G. ORTEGA (1978): Lista preliminar de los Himenópteros de las Islas Canarias. — Boletín de la Asociación Española de Entomología **2**: 185-199.
- BAUR H., KRANZ-BALTENSPERGER Y., CRUAUD A., RASPLIUS J.-Y., TIMOKHOV A.V. & V.E. GOKHAN (2014): Morphometric analysis and taxonomic revision of *Anisopteromalus* RUSCHKA (Hymenoptera: Chalcidoidea: Pteromalidae) – An integrative approach. — Systematic Entomology **39**: 691-709.
- BAUR H. & C. LEUENBERGER (2011): Analysis of ratios in multivariate morphometry. — Systematic Biology **60**: 813-825.
- BISCHOFF H. (1937): Hymenoptera aculeata (excl. Formicidae und Halictinae) von den Kanarischen Inseln. — Societas Scientiarum Fennica Commentationes Biologicae **6** (10): 1-3.
- BOLTNEV A. & O. KACHER (2017): FOTO Stacker Version 1.6 (29).
- BROOKS W. (1988): Systematics and phylogeny of the anthophorine bees (Hymenoptera: Anthophoridae; Anthophorini). — University of Kansas Science Bulletin **53** (9): 436-575.
- CASOLARI C. & M.R. CASOLARI (1980): Collezione Imenotterologica di Massimiliano Spinola - Cataloghi I. — Museo Regionale di Scienze Naturali di Torino, Torino, 165 pp.
- COCKERELL T.D.A. (1930): *Anthophora* in the Canary Islands. — The Entomologist **63**: 18-19.
- COCKERELL T.D.A. (1931a): Wild bees of Morocco. — Natural History. The Journal of the American Museum of Natural History **31** (3): 310-317.
- COCKERELL T.D.A. (1931b): Descriptions and records of bees CXXVI. — The annals and magazine of natural history, zoology, botany and geology **10** (3): 273-282.
- COQUEBERT A.J. (1804): Illustratio Iconographica Insectorum qua in Musaeis parisinis observavit et in lucem edidit John. Christ. Fabricius, Praemissis ejusdem descriptionibus; Accedunt Species plurimae, vel minus aut nondum cognitae. Tabularum Decas Tertia. — Typis petri Didot Natu Majoris, Parisiis, 92-142.
- CRÉPEL P. (2017): Devillers Charles Joseph (1724-1810), in Dominique Saint-Pierre (dir.), Dictionnaire historique des académiciens de Lyon 1700-2016. — Editions de l'Académie (4, avenue Adolphe Max, 69005 Lyon), 438-441.
- DOURS J.M.A. (1869): Monographie iconographique du genre *Anthophora* LAT. — Imp. Lenol-Herouart, Amiens, 210 pp. 2 plates.
- DUSMET Y ALONSO J.M. (1924): Algunos himenópteros de Canarias. — Boletín de la Sociedad Española de Historia Natural **24**: 455-458.

- EARDLEY C. & R. URBAN (2010): Catalogue of Afrotropical bees (Hymenoptera: Apoidea: Apiformes). — *Zootaxa* **2455** (1): 1-548.
- EASYDRAW (2020): Vector drawing software. Vers. 9.8.1. — Dekorra Optics LLC, Wisconsin, USA.
- EVERSMANN E. (1852): Fauna Hymenopterologica Volgo-Uralensis (Continuatio). — Bulletin de la Société Impériale de Naturaliste de Moscou **25** (3): 1-137.
- FABRICIUS J.C. (1775): Systema entomologiae, sistens insectorum classes, ordines, genera, species adiectis synonymis, locis, descriptionibus, observationibus. — Flensburgi et Lipsiae: Korte, 832 pp.
- FABRICIUS J.C. (1793): Entomologia Systematica Emandata et Aucta. Secundum Classes, Ordines, Genera, Species Adiectis Synonymis, Locis, Observationibus Descriptionibus. Tome 2. — apud Proft et Storch, Hafniae, 520 pp.
- FABRICIUS J.C. (1798): Supplementum Entomologiae. — apud Proft et Storch, Hafniae, 572 pp.
- FABRICIUS J.C. (1804): Systema Piezatorum: secundum ordines, genera, species, adiectis synonymis, locis, observationibus, descriptionibus. — Brunsvigae, Carolum Reichard, 439 pp.
- FRANKLIN H.J. (1912): The Bombidae of the new world. — Transactions of the American Entomological Society **28**: 177-486.
- FRIESE H. (1897): Die Bienen Europa's (Apidae europaeae) nach ihren Gattungen, Arten und Varietäten auf vergleichend morphologisch-biologischer Grundlage. Theil III. Solitäre Apiden. Genus *Podalirius*. — Berlin (Friedländer & Sohn), 316 pp.
- GERMAR E.F. (1817): Reise nach Dalmatien und in das Gebiet von Ragusa. — Leipzig & Altenburg (Brockhaus), 323 pp.
- GERMAR E.F. (1826): Fauna Insectorum Europae 9. — Halae: C. A. Kümmel, 24 pp. 25 pls.
- GRIBODO G. (1883): Le crociere dell Yacht 'Corsaro' del capitano Armatore Enrico d'Albertis. IV. Imenotteri. — Annali del Museo civico di Storia Naturale di Genova **18**: 684-690.
- GUSENLEITNER F. & M. SCHWARZ (2002): Weltweite Checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andreninae, *Andrena*). — Entomofauna Supplement **12**: 1280 pp.
- HOHMANN H., LA ROCHE F., ORTEGA G. & J. BARQUIN (1993): Bienen, Wespen und Ameisen der Kanarischen Inseln (Insecta: Hymenoptera: Aculeata). — Veröffentlichungen aus dem Übersee-Museum Bremen, Naturwissenschaften **12** (1): 14-465, (col.) pls. I-XII; **12** (2): 493-712.
- ILLIGER K. (1806): William Kirby's Familien der bienenartigen Insekten mit Zusätzen, Nachweisungen und Bemerkungen. — Magazin für Insektenkunde **5**: 28-175.
- ICZN (International Commission on Zoological Nomenclature) (1999): International Code of Zoological Nomenclature. Fourth edition. — International Trust for Zoological Nomenclature, London, 306 pp.
- KRATOCHWIL A. (2020): Revision of the *Andrena wollastoni* group (Hymenoptera, Anthophila, Andrenidae) from the Madeira Archipelago and the Canary Islands: upgrading of three former subspecies and a description of three new subspecies. — Linzer biologische Beiträge **52** (1): 161-244.
- KRATOCHWIL A. (2021): First record of a gynandromorph of *Osmia submicans* MORAWITZ, 1870 (Hymenoptera, Megachilidae) – characterisation by morphological and morphometric parameters and critical note on gynander classification. — Linzer biologische Beiträge **53** (1): 3-31.
- KRATOCHWIL A., SMIT J. & A. AGUIAR (2018): Updated checklist of the wild bees of the Madeira Archipelago (Hymenoptera: Apoidea: Anthophila). — Linzer biologische Beiträge **50** (2): 1213-1228.

- KRIECHBAUMER J. (1877): Drei südeuropäische *Megilla*-Arten. — Entomologische Nachrichten **3**: 87-92.
- LEPELETIER (DE SAINT FARGEAU) A.L.M. (1841): Histoire Naturelle des Insectes. Hyménoptères. Tome 2. — Librairie Encyclopédique de Roret, Paris, 680 pp.
- LIEFTINCK M.A. (1956): Revision of some oriental Anthophorine bees of the genus *Amegilla* FRIESE (Hymenoptera, Apoidea). — Zoologische Verhandelingen **30**: 1-41.
- LIEFTINCK M.A. (1958): A preliminary account of the Bees of Canary Islands (Hym. Apoidea). — Societas Scientiarum Fennica Commentationes Biologicae **18** (5): 1-34.
- LUCAS H. (1849a): Histoire Naturelle des Animaux Articulés. Troisième Partie. Insectes. — In: Exploration scientifiques de l'Algérie pendant les années 1840, 1844, 1842. — Publiée par Ordre du Gouvernement et avec le Concours d'une Commission Académique. Sciences Physiques. Emprimerie Nationale Zoologie III, 344 pp.
- LUCAS H. (1849b): Histoire naturelle des animaux articulés: Insectes. Atlas. — Publiée par Ordre du Gouvernement et avec le Concours d'une Commission Académique. Sciences Physiques. Emprimerie Nationale Zoologie. 97 plates.
- MICHENER C.D. (2007): The Bees of the World (2nd ed.). — Johns Hopkins University Press, Baltimore, 953 pp.
- MULSANT E. (1840): Notice sur C.-J. de Villers. — Annales de la Société d'Agriculture de Lyon **3**: 243-253.
- PANTALEONI R.A. (2010): Nomenclatural roots of Neuropterida: Linnaeus' era. — Proceedings of the 10th International Symposium on Neuropterology, Piran, Vol. **2008**: 215-229.
- PASSERIN D'ENTRÈVES P. (1983): Faunae Ligusticae Fragmenta – Insectorum Liguria species novae di Massimiliano Spinola: note bibliografiche. — Boll. Mus. Regionale Sci. Nat. Torino **1**: 215-226.
- PRIESNER H. (1957): A review of the *Anthophora* species of Egypt (Hymenoptera: Apidae). — Bulletin de la Société entomologique d'Égypte **41**: 1-115.
- R CORE TEAM (2016): R: A language and environment for statistical computing. — R Foundation for statistical computing, Vienna, Austria [WWW document]. R 3.6.0 GUI 1.70.
- RADOSZKOWSKY O. (1893): Faune hyménoptérologique Transcaspienne. (Suite et fin). — Horae Societatis Entomologicae Rossicae **27**: 38-81.
- RASMONT P. (2024): Atlas of the European Bees: genus *Anthophora*. 1st Edition. — STEP Project, Atlas Hymenoptera, Mons, Gembloux. <http://www.atlashymenoptera.net>.
- ROSA P. & Z. XU (2014): Annotated type catalogue of the Chrysididae (Insecta, Hymenoptera) deposited in the collection of Maximilian Spinola (1780-1857), Turin. — ZooKeys **471**: 1-96.
- SCHENCK A. (1859): Die nassauischen Bienen. Jahrbücher des Vereins für Naturkunde im Herzogthum Nassau **14**. — Niederner, Wiesbaden: 416 pp.
- SANDHOUSE G.A. (1943): The type species of the genera and subgenera of bees. — Proceedings of the United States National Museum **92**: 519-619.
- SCHEUCHL E. & W. WILLNER (2016): Taschenlexikon der Wildbienen Mitteleuropas: Alle Arten im Porträt. — Quelle & Meyer Verlag, Wiebelsheim, Germany: 920 pp.
- SCHWARZ M., & F. GUSENLEITNER (2001): Beitrag zur Kenntnis paläarktischer Anthophorini und Habropodini (Hymenoptera: Apidae). — Entomofauna, **22/6**: 53-92.
- SICHEL F.J. (1867): Hymenoptera mellifera. — In: Die Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wüllerstorff-Urbair. Zoologischer Theil, 2. Band, 1. Abtheilung, A., Hymenoptera (bearb. v. H. de Salissure). — Wien (k.-k. Hof- u. Staatsdruckerei), 143-156.

- SMITH F. (1853): Catalogue of hymenopterous insects in the collection of the British Museum. Part I. Andrenidae and Apidae. — Taylor and Francis: 465 pp., 12 plates.
- SPINOLA M. (1806): Insectorum Liguria species novae aut rariores, quas in agro ligustico nuper detexit, descripsit, et iconibus illustravit Maximilianus Spinola, adjecto catalogo specierum auctoribus jam enumeratarum, quae in eadem regione passim occurrunt. Tome 1. us [-2. us]... sumptibus auctoris.
- VILLERS C.D. (1789): Caroli Linnaei Entomologia, Faunae Suecicae Descriptionibus Aucta. D.D. Scopoli, Geoffroy, De Geer, Fabricii, Schrank etc. speciebus vel in Systemate non enumeratis, vel nuperrime detectis, vel speciebus Galliae Australis locupletata, generum specierumque rariorum iconibus ornate 3. Curante et augente Carolo de Villers, Acad. Lugd. Massil. Villa-Fr. Rhotom. Necnon Geometriae Regio Professore, 657 pp.
- WEIDNER H. (1980): Entomologische Schriften der Zeitgenossen und Schüler von Carolus Linnaeus. — Entomologische Mitteilungen Zoologisches Museum Hamburg 7 (108, 109): 309-379.
- WOLF H. (1980): Zur Kenntnis der Aculeaten-Fauna von Gran Canaria und Teneriffa. — Vieraea 9 (1-2): 65-78.
- ZIMSEN E. (1964): The Type Material of I. C. Fabricius. — Mumksgaard, Copenhagen: 445 pp.

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Appendix

Specimens examined

Details in the following order: Identification number (AL1, BU1...), collection (abbreviations see chapter "Material and Methods"), locality, date of detection, collector (leg.), determinant (det.) and original labelling, further comments; abbreviations of countries see Fig. 3.

AL: AL1 (OLML): Bord et Kiffan, 20.09.1981, Dr. T. Soldán, M. Schwarz det. 1993, *Anthophora 4-fasciata* (VILL.), ♀; **AL2** (OLML): Aures, Ain Zaatout, 26.-27.05.1971, A. Hoffer et J. Horák leg., probably *Amegilla quadrifasciata* (VILL.), ♂, labelled 2014, determined by Tkalcu, Biologiezentrum Linz, Austria (LI), Coll. Borek Tkalcu Eingang November 2013. **BU: BU1** (OLML): sept.-or. Kavarna, 05.07.1976, Tkalcu leg., probably *Amegilla quadrifasciata* (VILL.), ♂, labelled 2014, determined by Tkalcu, Biologiezentrum Linz, Austria (LI), Coll. Borek Tkalcu Eingang November 2013; **BU2** (OLML): sept.-or. Pobilita Kamani, 01.07.1976, Tkalcu leg., probably *Amegilla quadrifasciata* (VILL.), ♀, labelled 2014, determined by Tkalcu, Biologiezentrum Linz, Austria (LI), Coll. Borek Tkalcu Eingang November 2013. **CR: CR1** (OLML): Sitia, 17.-20.05.1963, J. Gusenleitner leg., *Anthophora quadrifasciata* (VILL.), ♀, P. W. Westrich 1985 det.; **CY: CY1** (CAK): 16 km NE Pophos, Kannaviou, 01.07.1987, A.W. Ebmer leg., *Anthophora quadrifasciata* (VILL.), ♀, P. W. Westrich 1988 det., logo Wildbienenkataster Bad.-Württ., Germany, 0901031scwe158. **FR: FR1** (OLML): Neotype A. Kratochwil 2025, Agay (Var), 23.06.1972, Dr C. Pádr leg., *Anthophora 4-fasciata* (Vill.), ♀, M. Schwarz det. 1993, logo Wildbienenkataster Bad.-Württ., Germany, 0901031scwe161; **FR2** (OLML): Agay (Var), 23.06.1972, Dr C. Pádr leg., *Anthophora 4-fasciata* (VILL.), ♀, M. Schwarz det. 1993; **FR3** (OLML): Agay (Var), 23.06.1972, Dr C. Pádr leg., *Anthophora 4-fasciata* (VILL.), ♂, M. Schwarz det. 1993, logo Wildbienenkataster Bad.-Württ., Germany, 0901031scwe166. **GE:**

GE1 (OLML): Mainfranken, 03.06.1946, J. Heinrich leg., *Anthophora 4-fasciata* (VILL.), ♀, OÖ Landesmuseum ex coll. F. Parre, Eingang 1993. **GR: GR1** (CAK): Santorin, north Imerovigli, 240 m, Nr. 175, N36°26'39.1", E25°25'39.2", 25.09.2014, A. Kratochwil leg., *Anthophora quadrfasciata* (VILL.), male, A. Kratochwil det.. **IT: IT1** (OLML): Capo di Noli, Liguria, 09.1991, *Anthophora 4-fasciata* (VILL.), ♀, M. Schwarz det. 1992. **KY: KY1** (OLML): sept. Con, Aryk (Frunze), 05.07.1983, ca 1050 m, Tkalcu leg., probably *Amegilla quadrfasciata* (VILL.), ♀, labelled 2014, determined by Tkalcu, Biologiezentrum Linz, Austria (LI), Coll. Borek Tkalcu Eingang November 2013. **MO: MO1** (OLML): 15 km SE Sefrou, 26.-27.05.1995, Mi Halada leg., *Amegilla (Amegilla) quadrfasciata* (VILLERS), ♀, P. Rasmont det. 2012; **MO2** (OLML), Taфраout, 1100 m, 23.04.1980, Perraudin, W. leg., *Amegilla quadrfasciata*, ♀, P. Rasmont det. 2001, coll. K. Warneke, OÖ Landesmuseum, Linz/Austria egg 93. **SP: SP1** (OLML): La Escala, Catalonien, 15.07.1974, E Heiss leg., *Anthophora quadrfasciata* (VILL.), ♀, P. W. Westrich 1985 det.. **TU: TU1** (CAK): 50-30 km S, Jendouba, 300m, 11.07.1979, A.W. Ebmer leg., *Anthophora quadrfasciata* (VILL.), ♀, P. W. Westrich 1985 det., logo Wildbienenkataster Bad.-Württ., Germany, 0901031scwe157. **TUR: TURI** (OLML): Urfa, 03.06.1968, J. Gusenleitner leg., *Anthophora quadrfasciata* (VILL.), ♀, P. Westrich det. 1985. **YU: YU1** (OLML) Cras Gera - Uleinj, 15.-20.07.1967, Dr Zdeněk Pádr leg., *Anthophora 4-fasciata* (VILL.), ♀, M. Schwarz det. 1993, **YU2** (OLML): Cras Gera - Uleinj, 15.-20.07.1967, Dr Zdeněk Pádr leg., *Anthophora 4-fasciata* (VILL.), ♀, M. Schwarz det. 1993; **YU3** (CAK): Island Losini, Sv. Jacob, 16.07.1971, A.W. Ebmer leg., *Amegilla quadrfasciata* (VILL.), ♂, P. Westrich det. 1985; **YU4** (CAK): Island Losini, Sv. Jacob, 16.07.1971, A. W. Ebmer leg., *Amegilla quadrfasciata* (VILL.), ♂, Tkalcu det., logo Wildbienenkataster Bad.-Württ., Germany, 0901031scwe169.

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