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Addition to the checklist of IUCN European wild bees (Hymenoptera: Apoidea)

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Summary. The present study is an update to the first Red List of European Bees published in 2014. The additional records are based on (i) comprehensive review of literature; (ii) new data provided by bee specialists in response to the publication of the first Red List; (iii) new developments in taxonomy of European bees including description of new cryptic species; (iv) new specimens from recent field collections. While the first Red List included a list of 1965 wild bee species with 75 genera, we found 86 additional species, while two more genera have been erected (*Seladonia* and *Vestitohalictus*), giving an updated total of 2051 species and 77 genera. The authors discuss the artificial framework of the study considered by International Union for Conservation of Nature (IUCN) to produce the first Red List and they propose the more meaningful West Palaearctic biogeographical region. For this whole region, a first estimation gives 3408 wild bee species in 105 genera. The next taxa have been erected from subspecies to species status: *Andrena* (*Euandrena*) *limosa* Warncke, 1969, **stat. n.**, *Andrena* (*Plastandrena*) *oligotricha* Mavromoustakis, 1952, **stat. n**.

Résumé. Ajouts à la liste de l'UICN des Abeilles sauvages d'Europe (Hymenoptera : Apoidea). Le présent travail est une mise-à-jour de la première Liste Rouge des Abeilles d'Europe publiée en 2014. Les données additionnelles sont basées (1) sur une révision exhaustive de la littérature ; (2) sur des nouvelles données communiquées par des spécialistes d'abeilles sauvages en réponse à cette publication initiale ; (3) sur de nouveaux développements de la taxonomie des abeilles d'Europe y compris la description de nouvelles espèces cryptiques ; (4) sur des spécimens récemment collectés sur le terrain. Alors que la première Liste Rouge comprenait 1965 espèces d'abeilles sauvages de 75 genres, nous avons trouvé 86 espèces supplémentaires tandis que deux genres additionnels ont été érigés (*Seladonia* et *Vestitohalictus*). Cela donne un total révisé de 2051 espèces en 77 genres. Les auteurs discutent du caractère artificiel de l'aire d'étude prise en compte par l'Union internationale pour la Conservation de la Nature (UICN) pour la première Liste Rouge et ils proposent la prise en compte plus pertinente d'une région ouest-paléarctique. Pour cette région entière, une première estimation donne 3408 espèces d'abeilles sauvages en 105 genres. Les taxons suivants ont été érigés de sous-espèces à espèces : *Andrena* (*Euandrena*) *limosa* Warncke, 1969, **stat. n.**, *Andrena* (*Plastandrena*) *oligotricha* Mavromoustakis, 1952, **stat. n.**

Keywords: pollinators; Red List; West Palaearctic region; nature conservation

Nieto et al. (2014) recently published the first ever Red List of European Bees including an updated comprehensive list of the bee species recorded in Europe (see Figure 1 for the definition of the geographical framework). Recent alternative checklists are available on line but differ in quality and objectives. The list presented in Fauna Europaea (Mitroiu et al. 2015) failed in not considering many taxonomic issues and presented different nomenclatural errors. The checklist of Kuhlmann et al. (2014) is detailed and mostly up-to-date. However, they do not cover exactly the same geographical framework as the IUCN one. The online catalogue on the Palaearctic osmiine bees is a comprehensive and up-to-date resource on taxonomic and distributional information of the tribe Osmiini (Müller 2016). Lastly the world checklist published in *Discover Life* does not present full information on the distribution of the bee species (Ascher & Pickering 2015). A big effort to address taxonomical issues and to present such extensive mapping information has been made by *Atlas Hymenoptera* (Rasmont & Haubruge 2016). It is almost comprehensive for several groups such as Anthophorini, Bombini, Melectini, Xylocopini (Apidae), Andrenidae, Halictidae and Melittidae but it remains fragmentary for the remaining groups (most other Apidae, Colletidae, Megachilidae).

The aim of the present work is to gather the taxonomical novelties that would allow the Red List of European Bees to be improved (Nieto et al. 2014). We additionally include a number of species that are not given in the IUCN Red List. Moreover, we propose several biogeographical notes and nomenclatural updates.

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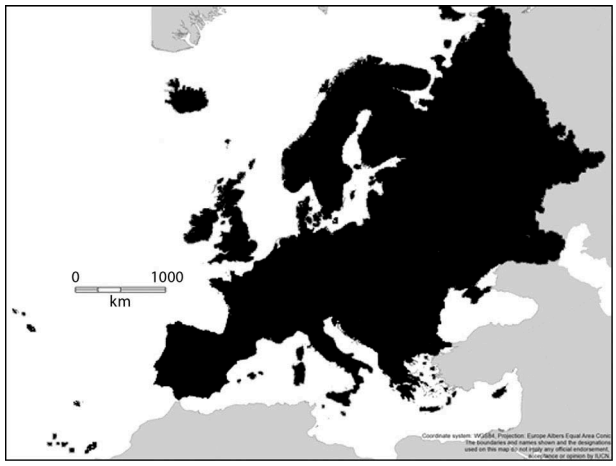

Figure 1. Geographic area covered by the IUCN Red List. It includes all European countries with the exception of the Caucasus area, but including also the European part of Turkey (west of Bosphorus) (after Nieto et al. 2014, with permission of the publisher). It includes the following peripheral islands: Azores, Canary islands, Madeira, Iceland, Svalbard, Novaya Zemlya, Cyprus, Malta, Crete, Pantelleria, Lampedusa.

Material and methods

New records of bee species for Europe have been possible based on (i) an additional review of literature; (ii) new information from bee specialists who contacted authors after the publication of Nieto et al. (2014) to fill some gaps; (iii) new results in European bee taxonomy including description of new cryptic species; (iv) additional specimens collected in recent field projects. These new field collections were conducted in the frame of several international projects over the last decades Assessing large scale risks for biodiversity with tested methods (ALARM), status and trends of European pollinators (STEP). Special attention has been paid for the Aegean Islands in Greece at the very margin of the geographical framework of the present study (Figure 1). An ongoing study of the pollinators of the Aegean Islands (Greece) (Petanidou et al. 2013) has resulted in many new records. Most preliminary citations from this area are summarized here while a comprehensive revision of this subregion is currently prepared by the second author (JD) and collaborators in the frame of the project POL-AEGIS (see Petanidou et al. 2013).

Results

List of additional species to the IUCN Red List of European wild bees

Andrenidae

Andrena (*Ulandrena*) *acerba* Warncke, 1967. Greece: cited from East Macedonia, Thrace and East Aegean Islands by Grace (2010) and Ascher & Pickering (2015); confirmed from Lesvos by JD.

Andrena (*Suandrena*) *aegypticola* Friese, 1899. Cyprus (Mavromoustakis 1954 as *Andrena larnacensis*; Grace 2010; Warncke *in litt*.).

Andrena (*Truncandrena*) *albopicta* Radoszkowski, 1874. European part of Russia: Perm Krai (Lykov 2008).

Andrena (*Nobandrena*) *asiatica* Friese, 1921. Recorded for many years from Lesvos, Samos and Kos; see studied material in Schuberth et al. (2001). Also collected in more recent years from Lesvos, see Grace (2010).

Andrena (*Simandrena*) *confinis* Stöckhert, 1930. Central and Eastern Europe. A well-recognizable species (Schmid-Egger & Scheuchl 1997; Schmid-Egger 2012), currently recorded from Germany to Greece. Often recorded as a synonym of *Andrena congruens* in the past, but species status has recently been confirmed by DNA barcoding (Schmidt et al. 2015).

Andrena (*Ulandrena*) *crecca* Warncke, 1965. Greece: East Aegean Islands (J. Devalez and E. Scheuchl, unpubl. data).

Andrena (*Chlorandrena*) *crepidis* Schwenninger, 2015. Cyprus, recently described by Schwenninger (2015).

Andrena (*Chlorandrena*) *curtivalvis* Morice, 1899. Spain, this N African species is cited from Spain by Schwenninger (2015).

Andrena (*Truncandrena*) *fuligula* Warncke, 1965. Greece: East Aegean Islands (confirmed by E. Scheuchl, pers. comm.).

Andrena (*Orandrena*) *garrula* Warncke, 1965. Turkey: European part of Turkey, near Edirne (Warncke 1974).

Andrena (*Parandrena*) *larisana* Warncke, 1965. Greece: Central Greece (Warncke 1965) and Aegean Islands (J. Devalez and E. Scheuchl, unpublished data). An Eastern Mediterranean species (Hazir et al. 2014). Formerly considered by Gusenleitner & Schwarz (2002) as a subspecies of *Andrena tunetana* Schmiedeknect, 1900, or even its synonym (e.g. Ascher & Pickering 2015) but with very distinctive morphology.

Andrena (*Euandrena*) *limosa* Warncke, 1969, **stat. n.** Greece: Aegean Islands (J. Devalez and E. Scheuchl, unpubl. data). This species was described as a subspecies of *Andrena rufitibialis* Friese, 1899, but it should be better considered as a distinct species following E. Scheuchl (pers. comm.).

Andrena (*Melandrena*) *nitidemula* Scheuchl & Hazir, 2012. Greece: recently described species, recorded from the East Aegean Islands (Samos) (Scheuchl & Hazir 2012).

Andrena (*Micrandrena*) *oedicnema* Warncke, 1975. Greece: Record in Europe (Greece) from the distribution map in Gusenleitner & Schwarz (2002), no other record in literature.

Andrena (*Plastandrena*) *oligotricha* Mavromoustakis, 1952, **stat. n.** Cyprus (Mavromoustakis 1952), Greece: East Aegean Islands (confirmed by E. Scheuchl, pers. comm.). This species was described as subspecies of *Andrena bimaculata* (Kirby, 1802) but it should be better seen as a distinct species (E. Scheuchl, pers. comm.).

Andrena (*Fumandrena*) *querquedula* Warncke, 1975. Greece: East Aegean Islands (confirmed by E. Scheuchl, pers. comm.).

Andrena (*Truncandrena*) *rotundilabris* Morawitz, 1878. Greece: East Aegean Islands (Grace 2010, confirmed by E. Scheuchl, pers. comm.).

Andrena (*Carandrena*) *semiflava* Lebedev, 1932. European part of Russian Federation: Volgograd Province, Sarepta (Krasnoarmeysk) (Osytshnjuk et al. 2005).

Andrena (*Notandrena*) *stellaris* Warncke, 1965. Greece: East Aegean Islands (Grace 2010; Ascher & Pickering 2015; confirmed by E. Scheuchl, pers. comm.).

Andrena (*Truncandrena*) *ulula* Warncke, 1969. Greece: newly recorded from the Greek mainland (confirmed by E. Scheuchl, pers. comm.).

Andrena (*Graecandrena*) *walishanovi* Osytshnjuk, 1994. European part of Russian Federation: Volgograd Province (Osytshnjuk et al. 2008).

Panurginus corpanus (Warncke, 1972). Greece: East Macedonia, Thrace (Warncke 1972) and East Aegean Islands (J. Devalez and S. Patiny. unpubl. data).

Panurginus turcomanicus Popov, 1936. Cyprus (cited as *Panurgus* (*Panurginus*) *brullei bytinski* by Warncke 1972).

Panurgus oblitus Warncke, 1972. Greece: Rhodope Mountains, Patiny (2012j).

Apidae

Apinae. *Anthophora* (*Paramegilla*) *astragali* Morawitz, 1878. Russia, Verchnij Baskunchak (Astrachan), 1 ♀, 7. VI.2003, leg. Vishinskas V., det. G. Le Goff.

Anthophora (*Pyganthophora*) *testaceipes* Morawitz, 1888. Russia, Bashkortostan, Ufa 13.V.1957, Nikiforuk. Two locations cited in GBIF from Spain appear doubtful: Almeria, Maria (GBIFID = 767247774, 767247775, 767247776, 767247777, 767247778, 767247779, 767247780, 767247781, 767247782) and Castilla & Leon, Villabañez (GBIFID = 1092730060).

Bombus (*Alpinobombus*) *pyrrhopygus* Friese, 1902. Scandinavian alps, tundra of N Europe (and Siberia), Novaya Zemlja, Wrangel Island, Yakutia. This taxon has been erected to species status by Williams et al. (2015). It was formerly considered as a subspecies of *Bombus polaris* Curtis under the name *Bombus arcticus diabolicus* Friese (Løken 1973) or *Bombus polaris diabolicus* Friese (Rasmont & Iserbyt 2010–2014). Based on new data on cephalic secretion analysis, Brasero et al. (2017) do not confirm the species status of *pyrrhopygus* and continue to include it into *Bombus polaris*.

Bombus (*Bombus*) *renardi* Radoszkowski, 1884. Corsica, erected to species status by Lecocq et al. (2015). It was formerly considered as a subspecies of *Bombus lucorum* (Linnaeus, 1761).

Bombus (*Bombus*) *xanthopus* Kriechbaumer, 1870. Corsica, Isola Capraia, Isola d'Elba, erected to species status by Lecocq et al. (2015). It was formerly considered as a subspecies of *Bombus terrestris* (Linnaeus, 1758).

Eucera (*Atopeucera*) *flavicornis* Risch, 2003. Greece: East Aegean Islands (confirmed by S. Risch, pers. comm.).

Eucera (subg. *incertum*) *graeca* Radoszkowski, 1876. Greece: mainland (Vöth 1989) and Aegean Islands (J. Devalez and S. Risch, unpubl. data). Often recorded from the Balkan Peninsula under the name *E. proxima* (Pagnetti-Hummler 1912; Maidl 1922).

Eucera (*Hetereucera*) *sogdiana* Morawitz, 1875. Greece, Romania and Italy (Ascher & Pickering 2015) (the nomenclature of this taxon still remains unclear, S. Risch, pers. comm.).

Eucera (*Pareucera*) *matalae* Tkalců, 2003. Greece: described from Crete and probably Cretan endemic (Tkalců 2003).

Eucera (*Synhalonia*) *cressa* (Tkalců 1984). Greece: described from Crete and Karpathos and probably endemic (Tkalců 1984; Paulus 1997; Paulus & Hirth 2009).

Melecta (*Paracrocisa*) *guilochei* Dusmet Alonso, 1915. Greece: East Aegean Islands (Grace 2010; Rasmont 2016; confirmed by M. Schwarz, pers. comm.).

Nomadinae. *Nomada moravitzii* Radoszkowski, 1876. Greece: East Aegean Islands (confirmed by M. Schwarz, pers. comm.).

Nomada radoszkowskii Lozinski, 1922. Greece: East Aegean Islands (Grace 2010, confirmed by M. Schwarz).

Xylocopinae. *Xylocopa* (*Rhysoxylocopa*) *amedaei* Lepeletier, 1841. This species new for Europe is known from N Africa (Terzo & Rasmont 2014) has been recently recorded from Portugal by G. Le Goff: Algarve, Moinhos Velhos, Barragem da Bravura, 1 ♀, 15.IV.2014,on *Lavandula stoechas* L.

Xylocopa (*Mesotrichia*) *nigrita* (Fabricius, 1775). Recorded from Zakynthos, Greece and from Cadiz, Spain (Vicidomini 2006), This sub-Saharan species has been collected recently in Greece but Vicidomini (2006) found also ancient material from Cadiz (Spain). As observations have been repeated in different years and different locations, one can suspect that the species is now established in Europe after initial importation.

Xylocopa (*Koptortosoma*) *pubescens* Spinola, 1838. Cyprus (Grace 2010), Greece: Attica (Terzo & Rasmont 2014). Originating from the Near-East and Africa, this species is now well established in Cyprus and Greece. It has been recently cited from Cadiz region (Spain) (Ortiz-Sánchez & Pauly 2016).

Xylocopa (*Xylocopoides*) *virginica* (Linnaeus, 1771). This species native of N America has been repeatedly recorded from Warwickshire, England, not far from a Ministry of Defence facility importing many items from USA (Falk & Lewington 2015). As observations have been repeated in different years, one can suspect that the species is now established in Europe after initial importation.

Halictidae

Being currently under revision, the subgenera are not given for the genera *Halictus, Lasioglossum, Seladonia* and *Vestitohalictus*.

Dufourea (*Dufourea*) *similis* Friese, 1898. Spain: Canary Islands (Fuerteventura; Ebmer 1989), Balearic Islands (Formentera Island; Ebmer 1984).

Dufourea (*Dufourea*) *balearica* Ebmer, 2015. Recently described from Balearic Islands (Ebmer 2015; Pauly & Patiny 2015).

Halictus candiae Ebmer, 2014. Greece: newly described and Cretan endemic (Ebmer 2014).

Halictus minor Morawitz, 1876. Russia: Orenburg region (Pesenko 1984, p. 41; Pauly 2011b; Pauly et al. 2016).

Halictus pentheri Blüthgen, 1923. Bulgaria (Pirin Mt., Melnik, VI 1988, leg. U. Buchsbaum, 1 ♀, det. A. Ebmer; and V.G. Radchenko unpublished data); Continental Greece; East Aegean Islands (Grace 2010, confirmed by A. Ebmer).

Halictus rufipes (Fabricius, 1793). Southern Spain (Friese 1916; Blüthgen 1923a), Sardinia (Rasmont et al. 1995).

Halictus subsenilis Blüthgen, 1955. Cyprus (Ebmer 1975, 2014).

Lasioglossum aphrodite Ebmer, 2014. Cyprus: recently described endemic species (Ebmer 2014).

Lasioglossum andromeda Ebmer, 1978. Greece: Peloponnese (Ebmer 2011).

Lasioglossum asellum (Pérez, 1895). Spain (Blüthgen 1924).

Lasioglossum epipygiale (Blüthgen, 1924). Cyprus (Ebmer 2014).

Lasioglossum euxanthopus Pesenko, 1986. Greece: Aegean Islands, on Lesvos (Grace 2010, confirmed by A. Ebmer, pers. comm.).

Lasioglossum gilanum (Blüthgen, 1931). Ukraine: Crimea (Belogorsk; Ebmer 1978).

Lasioglossum hethiticum Ebmer, 1970. Greece: Aegean Islands, on Samos (Grace 2010; Ebmer 2011).

Lasioglossum kirgisicum Ebmer, 1972. South-eastern Europe: Ukraine (Lugansk; Ebmer 1972).

Lasioglossum longirostre (Morawitz, 1876). Greece: East Aegean Islands (Grace 2010; confirmed by A. Ebmer 2011).

Lasioglossum pressithorax Ebmer, 1974. Continental Greece (Ebmer 1974, p. 151, 2011); Aegean Islands, on Samos (Grace 2010; Ebmer 2011).

Lasioglossum prunellum (Warncke 1975). Greece (Chelmos; Ebmer 1978, p. 38, 2009); Continental Greece, from Falakro to the Taygetos (Grace 2010).

Lasioglossum salinum (Morawitz, 1876). Aegean Greece on Samos (Grace 2010, confirmed by A. Ebmer, pers. comm.).

Lasioglossum tungusicum Ebmer, 1978. Russia: Leningrad, Kirov, Kursk and Rostov Prov., Udmurtia (Pesenko 2006).

Nomiapis elegantissima (Popov, 1949). Russia: Astrakhan Province (Astafurova & Pesenko 2006; Astafurova 2014).

Nomiapis fugax (Morawitz, 1877). Cyprus (Pittioni 1950).

Nomioides (*Nomioides*) *chalybeatus* Blüthgen, 1934. Greece: East Aegean Islands (Grace 2010; confirmed by A. Ebmer, pers. comm.).

Seladonia cretella Pauly & Devalez, 2015. Greece: recently described from Crete and Karpathos islands (Pauly et al. 2015).

Seladonia gemmella Pauly, 2016g. Recently described from Spain and N Africa (Pauly et al. 2015).

Seladonia orientana Pauly & Devalez, 2015. Recently described from Spain, Italy, Greece, Turkey, Iran, Tajikistan and Kazakhstan (Pauly et al. 2015).

Seladonia phryganica Pauly & Devalez, 2015. Recently described from Eastern Mediterranean, from Greece to Israel, Iran, Tajikistan and Uzbekistan (Pauly et al. 2015).

Seladonia submediterranea Pauly, 2016g. Recently described from Iberian peninsula, France, Sardinia, the Netherlands, Germany, Austria, Croatia, Bulgaria, Romania, Crimea, Turkey, Iran (Pauly et al. 2015).

Vestitohalictus pseudomucoreus (Ebmer, 1975). Russia: Rostov (Yu.A.Pesenko, unpubl. data) and Volgograd regions (Pauly 2016i).

Vestitohalictus semiticus (Blüthgen 1955). Greece: East Aegean Islands (Ebmer 1988; Grace 2010; confirmed by A. Ebmer, pers. comm.).

Megachilidae

Anthidium (*Anthidium*) *caspicum* Morawitz, 1880. Greece: recorded from the mountains of continental Greece (Hartmann & Arens 1998).

Anthidium (*Gulanthidium*) *rotundum* Warncke, 1980. Greece: East Aegean Islands (Grace 2010; J. Devalez and G. Le Goff, unpubl. data).

Chelostoma (*Chelostoma*) *comosum* Müller, 2012. Cyprus: a recently described Eastern Mediterranean species (Müller 2012).

Eoanthidium (*Clistanthidium*) *nasicum* (Friese, 1917). Greece: East Aegean Islands (Grace 2010; Ascher & Pickering 2015; J. Devalez and G. Le Goff, unpubl. data).

Eoanthidium (*Eoanthidium*) *judaeense* (Mavromoustakis, 1945). Greece: East Aegean Islands (Ascher & Pickering 2015; J. Devalez, unpubl. data).

Hoplitis (*Micreriades*) *antalyae* Tkalců, 2000. Greece: East Aegean Islands (Grace 2010; Sedivy et al. 2013; Müller 2016).

Megachile (*Callomegachile*) *sculpturalis* Smith, 1853. After initial importation from E Asia this species recently established and expanding rapidly in Europe (S France, Italy, Switzerland, Germany) (Vereecken & Barbier 2009; Amiet 2012; Quaranta et al. 2014; Westrich et al. 2015).

Megachile (*Eutricharaea*) *anatolica* Rebmann, 1968. Greece: Peloponnese, Thessaly and Aegean Islands

(Rebmann 1968; Grace 2010; Standfuss & Standfuss 2012; Ascher & Pickering 2015).

Megachile (*Eutricharaea*) *minutissima* Radoszkowski, 1876. Greece: East Aegean Islands (J. Devalez, unpubl. data, confirmed by C. Praz, pers. comm.).

Megachile (*Eutricharaea*) *patellimana* Spinola, 1838. Cyprus (Pittioni Bee Collection; Pittioni 1950; Mavromoustakis 1951, 1953; Grace 2010).

Megachile (*Eutricharaea*) *tenuistriga* Alfken, 1938. Greece: Aegean Islands (J. Devalez unpubl. data, confirmed by C. Praz, pers. comm.).

Stelis (*Stelis*) *aculeata* Morawitz, 1880. Ukraine: Crimea (Fateryga et al. 2013).

Stelis (*Pseudostelis*) *denticulata* Friese, 1899. Greece: Aegean Islands (J. Devalez, unpubl. data).

Stenoheriades coelostoma (Benoist, 1935). Greece, Bulgaria and Croatia (Müller & Trunz 2014; Müller 2016). Previously recorded as *Stenoheriades asiatica* (Friese, 1921) or *Stenoheriades hofferi* (Tkalců, 1984) see (Müller & Trunz 2014; Müller 2016).

Stenoheriades maroccana (Benoist, 1928). Italy (Sicily) and Spain (Müller & Trunz 2014; Ascher & Pickering 2015; Müller 2016).

Melittidae

Dasypoda (*Dasypoda*) *morawitzi* Radchenko, 2016. Recently described by Radchenko (2016) from Ukraine (mainland and Crimea), European part of Russia from Caucasus to the south to St Petersburg to the north, Kazakhstan and Turkey: One of us (J. Devalez) also observed the species in Greece: East Aegean Islands. It has been recently cited also from Brandenburg (Germany) (Scheuchl & Schwenninger 2017).

Dasypoda (*Dasypoda*) *toroki* Michez, 2004. Ukraine: Crimea (Fateryga 2015).

Nomenclatural changes

Halictidae

Lasioglossum loetum (Brullé, 1840)

= *Lasioglossum laetum* auct. following Dalla Torre (1896, p. 65) (unjustified emendation)

Spain: this species has been known for a while from Canary Islands (Brullé 1839; Saunders 1903, 1904, as *Halictus dubius*; Blüthgen 1923b, 1937, 1958; Dusmet Alonso 1924; Lieftinck 1958; Ebmer & Gusenleitner 1972; Warncke 1975).

A main nomenclatural change deals with the subgeneric classification of Halictini. Following Pesenko (2004), Pauly (2016g, 2016i) and Pauly et al. (2015), the subgenera *Vestitohalictus* and *Seladonia* should be better erected as distinct genera.

Seladonia cephalica (Morawitz, 1873)
= *Halictus* (*Seladonia*) *cephalicus* Morawitz, 1873).
Seladonia confusa (Smith, 1853)
= *Halictus* (*Seladonia*) *confusus* Smith, 1853.
Seladonia gavarnica (Pérez, 1903)
= *Halictus* (*Seladonia*) *gavarnicus* Pérez, 1903.
Seladonia gemmea (Dours, 1872)
= *Halictus* (*Seladonia*) *gemmeus* Dours, 1872.
Seladonia kessleri (Bramson, 1879)
= *Halictus* (*Seladonia*) *kessleri* Bramson, 1879.
Seladonia leucahenea (Ebmer, 1972)
= *Halictus* (*Seladonia*) *leucaheneus* Ebmer, 1972.
Seladonia seladonia (Fabricius, 1794)
= *Halictus* (*Seladonia*) *seladonius* (Fabricius, 1794).
Seladonia semitecta (Morawitz, 1873)
= *Halictus* (*Seladonia*) *semitectus* Morawitz, 1873.
Seladonia smaragdula (Vachal, 1895)
= *Halictus* (*Seladonia*) *smaragdulus* Vachal, 1895.
Seladonia subaurata (Rossi, 1792)
= *Halictus* (*Seladonia*) *subauratus* (Rossi, 1792).
Seladonia tumulorum (Linnaeus, 1758)
= *Halictus* (*Seladonia*) *tumulorum* (Linnaeus, 1758).
Vestitohalictus concinnus (Brullé, 1839)
= *Halictus* (*Vestitohalictus*) *concinnus* Brullé, 1839.
Vestitohalictus cypricus (Blüthgen, 1937)
= *Halictus* (*Vestitohalictus*) *cypricus* Blüthgen, 1937.
Vestitohalictus inpilosus (Ebmer, 1975)
= *Halictus* (*Vestitohalictus*) *inpilosus* Ebmer, 1975.
Vestitohalictus microcardia (Pérez, 1896)
= *Halictus* (*Vestitohalictus*) *microcardia* Pérez, 1896.
Vestitohalictus pollinosus (Sichel, 1860)
= *Halictus* (*Vestitohalictus*) *pollinosus* Sichel, 1860.
Vestitohalictus tuberculatus (Blüthgen, 1924)
= *Halictus* (*Vestitohalictus*) *tuberculatus* Blüthgen, 1924.
Vestitohalictus vestitus (Lepeletier, 1841)
= *Halictus* (*Vestitohalictus*) *vestitus* Lepeletier, 1841.

Megachilidae

There are a number of misuses of gender within the genera *Coelioxys, Dioxys* and *Paradioxys*. Almost all publications still use feminine binominal names for these genera. The genera *Coelioxys, Dioxys* and *Paradioxys* are masculine names. The term "*oxys*" is the masculine singular nominative form of a Greek adjective, that has other two different forms for feminine "*oxeîa"* or neuter "*oxy"*. Therefore, all genera ending in "*-oxys*" are unambiguously masculine, regardless of their author's intent; it does not matter whether *Coelioxys* was originally combined with *conica*, or *Dioxys* with *cincta*. In the case of *Coelioxys, Dioxys* and *Paradioxys*, the pertinent ICZN Article 30.1.2 should be applied. It means that all epithets from these genera should be masculine (D. Yanega, pers. comm.).

Coelioxys acanthopyga Alfken, 1940 [no change]
Coelioxys acanthura (Illiger, 1806) [no change]
Coelioxys afer Lepeletier, 1841
= *Coelioxys afra* Lepeletier, 1841.
Coelioxys alatus Förster, 1853
= *Coelioxys alata* Förster, 1853.
Coelioxys argenteus Lepeletier, 1841
= *Coelioxys argentea* Lepeletier, 1841.
Coelioxys artemis Schwarz, 2001 [no change]
Coelioxys aurolimbatus Förster, 1853
= *Coelioxys aurolimbata* Förster, 1853.
Coelioxys brevis Eversmann, 1852 [no change]
Coelioxys caudatus Spinola, 1838
= *Coelioxys caudata* Spinola, 1838.
Coelioxys conoideus (Illiger, 1806)
= *Coelioxys conoidea* (Illiger, 1806).
Coelioxys coturnix Pérez, 1884 [no change]
Coelioxys decipiens Spinola, 1838 [no change]
Coelioxys echinatus Förster, 1853
= *Coelioxys echinata* Förster, 1853.
Coelioxys elegantulus Alfken, 1934
= *Coelioxys elegantula* Alfken, 1934.
Coelioxys elongatus Lepeletier, 1841
= *Coelioxys elongata* Lepeletier, 1841.
Coelioxys elongatulus Alfken, 1938
= *Coelioxys elongatula* Alfken, 1938.
Coelioxys elsei Schwarz, 2001 [no change]
Coelioxys emarginatus Förster, 1853
= *Coelioxys emarginata* Förster, 1853.
Coelioxys haemorrhoa Förster, 1853 [no change]
Coelioxys inermis (Kirby, 1802) [no change]
Coelioxys lanceolata Nylander, 1852.
Coelioxys mandibularis Nylander, 1848 [no change]
Coelioxys obtusus Pérez, 1884
= *Coelioxys obtusa* Pérez, 1884.
Coelioxys obtusispina Thomson, 1872 [no change]
Coelioxys osmiae Alfken, 1928 [no change]
Coelioxys polycentris Förster, 1853 [no change]
Coelioxys quadridentatus (Linnaeus, 1758)
= *Coelioxys quadridentata* (Linnaeus, 1758).
Coelioxys rufescens Lepeletier & Audinet-Serville, 1825 [no change]
Dioxys ardens Gerstäcker, 1869 [no change]
Dioxys atlanticus Saunders, 1904
= *Dioxys atlantica* Saunders, 1904.
Dioxys cinctus (Jurine, 1807)
= *Dioxys cincta* (Jurine, 1807).
Dioxys lanzarotensis Tkalců, 2001 [no change]
Dioxys moestus Costa, 1883
= *Dioxys moesta* Costa, 1883.
Dioxys pumilus Gerstäcker, 1869
= *Dioxys pumila* Gerstäcker, 1869.
Metadioxys graecus (Mocsáry, 1877)
= *Metadioxys graeca* (Mocsáry, 1877)
Paradioxys pannonicus (Mocsáry, 1877)
= *Paradioxys pannonica* (Mocsáry, 1877).

Species remaining unconfirmed or doubtful for IUCN Europe

Amegilla (*Micramegilla*) *glauca* (Alfken, 1926). Cyprus (Mavromoustakis 1949, 1951, 1953, 1957a, 1957b; Pittioni 1950) but could be a mere synonym of *Amegilla andresi* (Friese, 1914).

Andrena (*Micrandrena*) *virgata* Warncke, 1975. Greece (Lesvos) (Grace 2010) but not confirmed.

Chelostoma schlettereri (Friese, 1899). Greece (Ungricht et al. 2008), Aegean on Samos (Grace 2010). These records refer to another species recently described as *Chelostoma incognitum* Müller, 2012 (Müller 2012, 2016).

Colletes popovi Noskiewicz, 1936. Cited from European part of Russian Federation: Perm Krai (Lykov 2008). However, because of high risk of misidentification by confusion of the much more common *C. similis* and because this record is far outside its known range (M. Kuhlmann, pers. comm.), this record would need further confirmation.

Colletes rubellus Noskiewicz, 1936. Cyprus (Mavromoustakis 1949; Warncke 1978) but not confirmed.

Colletes uralensis Noskiewicz, 1936. European part of Russian Federation: Perm Krai (Lykov 2008). Proshchalykin and Kuhlmann (2015, p. 329) provide a map confirming the presence of this species in Kazakhstan, near the European part of Russia but outside the IUCN Europe area. The species would be very likely included in the West Palaearctic region but it not yet confirmed in IUCN area.

Eucera (*Eucera*) *vidua* Lepeletier, 1841. Spain (Ascher & Pickering 2015) but not confirmed.

Eucera (*incertae sedis*) *coangustata* (Dours, 1873). Spain (Ascher & Pickering 2015) but *Nomen dubium* (type lost).

Hoplitis (*Annosmia*) *eremophila* (Warncke, 1991). Greece (Grace 2010) but not confirmed (Müller 2016).

Hoplitis (*Annosmia*) *uncaticornis* (Stanek, 1969). Greece (Ungricht et al. 2008; Grace 2010) but misinterpretations, see Müller (2016).

Hoplitis (*Anthocopa*) *unispina* (Alfken, 1935). Greece (Ungricht et al. 2008; Grace 2010) but misinterpretations, see (Müller 2016).

Lasioglossum masculum (Pérez, 1895). Russia (Ural) (Lykov 2008) under the name *Halictus leucopymatus* Dalla Torre, but highly doubtful.

Megachile (*Eutricharaea*) *albipila* Pérez, 1896. Greece (Ornosa et al. 2007; Grace 2010) but N African species, probably misinterpretation (C. Praz, pers. comm.)

Megachile (*Chalicodoma*) *asiatica* Morawitz, 1875. Continental Greece (Friese 1898; Grace 2010) but unpublished synonym of *Megachile montenegrensis* Dours, 1873 (C. Praz, pers. comm.).

Megachile (*Eutricharaea*) *striatella* Rebmann, 1968. Spain (Ascher & Pickering 2015) and continental Greece (Grace 2010) but doubtful according to G. Le Goff (pers. comm.). Requires confirmation.

Megachile (*Pseudomegachile*) *flavipes* Spinola, 1838. Greece: Aegean Islands, Crete and Cyprus (Ornosa et al. 2007; Grace 2010; Ascher & Pickering 2015; Le Goff, pers. comm.). The records of the Aegean Islands refer to the very similar and closely related *Megachile farinosa* Smith, 1853. It looks likely that records of *Megachile flavipes* from Greece actually refer to *Megachile farinosa*.

Nomada krueperi Schmiedeknecht, 1882. Described from Greece (Schmiedeknecht 1882; Mavromoustakis 1963). Type lost (Alexander & Schwarz 1994); *nomen dubium* after J. Smit (pers. comm.).

Seladonia lucidipennis (Smith, 1853). Portugal and Romania (Kuhlmann et al. 2014) but these records likely result from a misidentification. Similar records of the species [under the name *Halictus variipes* – unjustified emendation given by Dalla Torre (1896, p. 90) for *Halictus varipes* Morawitz, 1876] from "Dalmatien" (Lombardei), Sicily and Ukraine (Crimea) by Strand (1909, p. 18) is misidentification, and from Spain (as *Halictus varipes*) by Diniz (1959, p. 34) belongs to *Seladonia smaragdula* (see Ebmer 1979, p. 130).

Seladonia verticalis (Blüthgen, 1931). Ukraine and Austria (Kuhlmann et al. 2014) but there is no valid data from Ukraine (Crimea). The citation from Austria is very likely the result of a misidentification as the species mainly lives in Turkish mountains with very different ecology.

Vestitohalictus pulvereus (Morawitz, 1874). Cyprus (Ebmer 1988, p. 576) and Greece (Lesvos) (Grace 2010, J. Devalez, unpubl. data). Ukraine: Dnipropetrovsk, Kherson regions and Crimea (Proshchalykin & Astafurova 2012). This taxon is most likely the eastern subspecies of *Vestitohalictus vestitus.*

Xylocopa (*Koptortosoma*) *caffra* (Linnaeus, 1767). Recorded from Greece, Zakynthos (Vicidomini 2006), but this observation could be the result of casual unsuccessful importation.

Discussion

Table 1 presents the differences in number of species and genera between the IUCN Red List (Nieto et al. 2014) and the present updates. Most of the species added here to the checklist of Red List of European wild bees were recorded at the very edge of Europe, where they are inconspicuous. There are some exceptions: *Bombus renardi, B. pyrrhopygus* and *B. xanthopus* are recently restored to the species status (Lecocq et al. 2015; Williams et al. 2015), on the basis of genetic and chemical data; *Andrena crepidis, Dasypoda morawitzi* and five *Seladonia* species are new for science (Pauly et al. 2015; Schwenninger 2015; Radchenko 2016).

The large carpenter bees seem to take advantage of increasing goods importation and maybe also global warming. *Xylocopa amedaei*, so far known from N Africa only, has been recorded recently for the first time from S Portugal (Le Goff, pers. comm.). Another species, *Xylocopa pubescens*, is now well established in Greece and it will likely become more widespread in the future (Terzo & Rasmont 2014; J. Devalez, pers. obs.) As this species appeared in Greece in the surroundings of the Piraeus harbour, it looks likely that it is the result of anthropogenic importation. However, as it also increased its distribution all along the south coast of Turkey coming from its original distribution in N Africa, Israel and Lebanon, we cannot exclude that the recent arrival of this species in Europe is a spontaneous event. Falk and Lewington (2015) also cite *Xylocopa virginica* that has been recorded several times in England (Warwickshire) after a very likely importation from N America. Vicidomini (2006) still cited two more large carpenter bees new for Europe, *Xylocopa caffra* and *X. nigrita* so far known from Sub-Saharan Africa, but these are still questionably established in Europe. Another exotic species now well established in Europe is the large *Megachile sculpturalis* Smith. There is no doubt that the species originating from SE Asia arrived through the Marseille harbour. It is now rapidly invading the European continent (Vereecken & Barbier 2009).

Toward a checklist of the West Palaearctic bees

About the IUCN limits of Europe. The practical limits of Europe as used by IUCN (Nieto et al. 2014) are very artificial (Figure 1). It does not fit with any biogeographical nor traditional definition of Europe. On one hand, it includes such southern islands as Canary archipelago and Cyprus; on the other hand, it excludes the continental areas adjacent to these islands, respectively Morocco and Turkey (Asian part). Even the Caucasus that is generally taken as the traditional geographical limit of Europe is excluded from this framework.

These IUCN limits of Europe should be seen as mostly pragmatic, following some of the choices of Flora Europaea (Tutin et al. 1964). There are, nevertheless, some significant differences between the IUCN limits and the Flora Europaea ones (Figure 2). IUCN includes all Atlantic islands, including Canary, Madeira, Azores, Iceland, Faeroes, Svalbard, Franz Josef Land, Kolguyev and Novaya Zemlya, Sporades, Chios, Lesvos, Rhodes and Cyprus, while of these islands Flora Europaea only retained

Table 1. Number of wild bee species in IUCN area compared to West Palaearctic region (WP, area between 26° and 72° latitude north and from 32° longitude west to 62° longitude east; Figure 3). The second column indicates the number of species recorded in Nieto et al. (2014) and the newly recorded number of species, separated by a "+".

Taxon	IUCN Europe + update	WP	References
ANDRENIDAE			
Andrena	423 + 21	598	Gusenleitner and Schwarz (2002), Rasmont et al. (2013)
Avpanurgus		1	Patiny (2012a)
Camptopoeum	4	19	Patiny (2012b)
Clavipanurgus	1	11	Patiny (2012c)
Flavipanurgus	6	6	Patiny (2012d)
Flavomeliturgula		8	Patiny (2012e)
Gasparinahla		1	Patiny (2012f)
Melitturga	6	11	Patiny (2012g)
Meliturgula		1	Patiny (2012h)
Panurginus	12 + 2	20	Patiny (2012i)
Panurgus	12 + 1	35	Patiny (2012j)
Plesiopanurgus		4	Patiny (2012k)
Simpanurgus	1	1	Patiny (2012l)
Total Andrenidae	**465 + 24**	**716**	
APIDAE			
Aethammobates		1	Kuhlmann et al. (2014)
Amegilla	11	36	Rasmont (2014a)
Ammobates	14	33	Kuhlmann et al. (2014)
Ammobatoides	4	6	Kuhlmann et al. (2014)
Ancyla	7	10	Rasmont and Dehon (2014a)
Anthophora	76 + 2	179	Rasmont (2014b)
Apis	1	2	Pauly (2015a)
Biastes	3	4	Kuhlmann et al. (2014)
Bombus	68 + 3	81	Rasmont and Iserbyt (2010–2014)
Braunsapis		2	Kuhlmann et al. (2014)
Ceratina	27	42	Terzo and Rasmont (2011)
Chiasmognathus	1	5	Kuhlmann et al. (2014)
Compsomelissa		2	Kuhlmann et al. (2014)
Cubitalia	2	7	Rasmont (2014c)
Epeoloides	1	1	Kuhlmann et al. (2014)
Epeolus	17	17	Kuhlmann et al. (2014)
Eucera	82 + 4	132	Kuhlmann et al. (2014)
Exoneuridia		2	Terzo (2011)
Habropoda	3	7	Rasmont (2014d)
Melecta	21 + 1	39	Rasmont (2016)
Nomada	179 + 2	219	Kuhlmann et al. (2014)
Parammobatodes	2	4	Kuhlmann et al. (2014)
Pasites	1	1	Kuhlmann et al. (2014)
Schmiedeknechtia	1	5	Kuhlmann et al. (2014)
Spinopasites		1	Kuhlmann et al. (2014)
Tarsalia	2	4	Rasmont and Dehon (2014b)
Tetralonia	1	1	Kuhlmann et al. (2014)
Tetraloniella	19	29	Kuhlmann et al. (2014)
Thyreomelecta		5	Rasmont (2014e)
Thyreus	12	25	Rasmont (2014f)
Triepeolus	1	1	Kuhlmann et al. (2014)
Xylocopa	5 + 4	23	Terzo and Rasmont (2014)
Total Apidae	**561 + 16**	**926**	
COLLETIDAE			
Colletes	60	116	Kuhlmann et al. (2014)
Hylaeus	86	154	Kuhlmann et al. (2014)
Total Colletidae	**146**	**270**	
HALICTIDAE			
Ceylalictus	1	4	Pauly (2011a)
Crocisaspidia		1	Pauly (2016a)
Dufourea	18 + 2	49	Ebmer (1984), Astafurova (2013), Pauly and Patiny (2015)
Halictus	45 + 5	66	Pauly et al. (2016)

(*continued*)

Table 1. (*Continued*).

Taxon	IUCN Europe + update	WP	References
Lasioglossum	162 + 13	277	Pauly (2016b, 2016c, 2016d, 2016e)
Leuconomia		1	Pauly (2000)
Lipotriches		1	Pauly (2016f)
Nomiapis	6 + 2	10	Pauly (2015b)
Morawitzia		3	Pauly (2012)
Nomioides	4 + 1	29	Pauly (2011c)
Pseudapis		16	Pauly (2013), Astafurova (2013, 2014)
Rophites	8	14	Pauly and Patiny (2011), Astafurova (2013, 2014)
Rophitoides	2	4	Pauly (2011d) Astafurova (2013, 2014)
Seladonia	11 + 5	32	Pauly et al. (2015), Pauly (2016g)
Sphecodes	47	47	Bogush and Straka (2012), Pauly (2014)
Systropha	2	7	Patiny and Pauly (2011), Astafurova (2013, 2014)
Thrincohalictus	1	1	Pauly (2016h)
Vestitohalictus	7 + 2	23	Pauly (2016i)
Total Halictidae	**314 + 30**	**585**	
MELITTIDAE			
Dasypoda	16 + 2	29	Michez et al. (2004), Michez (2012a), Radchenko (2016)
Macropis	3	4	Michez and Patiny (2005), Michez (2012b)
Melitta	18	21	Michez and Eardley (2007), Michez (2012c), Michez et al. (2012)
Eremaphanta		4	Michez and Patiny (2006), Michez (2011)
Promelitta		1	Michez et al. (2007), Michez (2010)
Total Melittidae	**37 + 2**	**59**	
MEGACHILIDAE			
Afranthidium	3	9	Ungricht et al. (2008), Kuhlmann et al. (2014)
Aglaoapis	1	1	Kuhlmann et al. (2014)
Allodioxys		4	Kuhlmann et al. (2014)
Anthidiellum	2	4	Kuhlmann et al. (2014)
Anthidium	15 + 2	37	Kuhlmann et al. (2014)
Chelostoma	24 + 1	40	Ungricht et al. (2008), Kuhlmann et al. (2014)
Coelioxys	28	34	Kuhlmann et al. (2014)
Dioxys	6	9	Kuhlmann et al. (2014)
Ensliniana	1	1	Kuhlmann et al. (2014)
Eoanthidium	2 + 2	6	Kuhlmann et al. (2014)
Eudioxys		1	Kuhlmann et al. (2014)
Fidelia		1	Kuhlmann et al. (2014)
Haetosmia	2	2	Ungricht et al. (2008), Kuhlmann et al. (2014)
Heriades	6	11	Ungricht et al. (2008), Kuhlmann et al. (2014)
Hofferia	1	2	Ungricht et al. (2008), Kuhlmann et al. (2014)
Hoplitis	100 + 1	236	Ungricht et al. (2008), Kuhlmann et al. (2014)
Icteranthidium	5	11	Kuhlmann et al. (2014)
Lithurgus	3	4	Kuhlmann et al. (2014)
Megachile	81 + 5	162	Kuhlmann et al. (2014)
Metadioxys	1	3	Kuhlmann et al. (2014)
Ochreriades		1	Ungricht et al. (2008), Kuhlmann et al. (2014)
Osmia	101	158	Ungricht et al. (2008), Kuhlmann et al. (2014)
Pachyanthidium		2	Kuhlmann et al. (2014)
Paradioxys	1	1	Kuhlmann et al. (2014)
Pararhophites		1	Kuhlmann et al. (2014)
Prodioxys		3	Kuhlmann et al. (2014)
Protosmia	13	26	Ungricht et al. (2008), Kuhlmann et al. (2014)
Pseudoanthidium	9	20	Kuhlmann et al. (2014)
Pseudoheriades		2	Ungricht et al. (2008), Kuhlmann et al. (2014)
Radoszkowskiana		4	Kuhlmann et al. (2014)
Rhodanthidium	7	13	Kuhlmann et al. (2014)
Stelis	22 + 2	28	Kuhlmann et al. (2014)
Stenoheriades	2 + 1	5	Ungricht et al. (2008), Kuhlmann et al. (2014)
Trachusa	6	8	Kuhlmann et al. (2014)
Wainia		2	Ungricht et al. (2008), Kuhlmann et al. (2014)
Total Megachilidae	**442 + 14**	**852**	
Total number of species	**1965 + 86 = 2051**	**3408**	
Total number of genera	**77**	**105**	

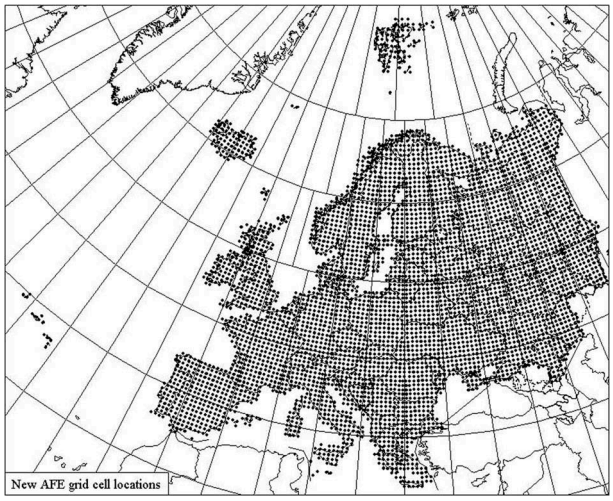

Figure 2. Geographic area covered by Atlas Florae Europaeae (after Atlas Florae Europaeae 2015, with permission of the publisher).

Azores, Iceland, Faeroes, Svalbard, Franz Josef Land and Kolguyev, so excluding Novaya Zemlya, Canary, Madeira, Sporades, Chios, Lesvos, Rhodes and Cyprus. There are still some discrepancies between these limits in south-east Europe: both projects exclude the Caucasus region (while the limit of Europe is normally seen as the crest of the Caucasian Mountains). IUCN excludes the whole region south of a line that approximately joins Rostov-on-Don to the south border of the Astrakhan region and also the Kazakhstan area to the west of the Ural River, but it nevertheless includes the oblasts of Astrakhan and Orenburg, and still more astonishingly a large area beyond S Ural at the east of Magnitogorsk. Flora Europaea is more inclusive in the Ural region, as it retains all of the Krasnodar and Rostov regions, all of Kalmykia and all the Kazakhstan part of Europe west of Ural River, thus cutting the studied area at the Ural River (the traditional limit of Europe). However, it is less inclusive in the south-east as it does not include most of the East Aegean Islands and Cyprus. These discrepancies could produce differences as they concern very large areas, rich in species.

The inclusion or exclusion of Svalbard and Franz Josef Land makes no difference as there are no wild bees on these islands. There are also very few species on Faeroes and Azores. However, Macaronesian, East Aegean Islands and Cyprus are areas with a very rich wild bee fauna, and including or excluding them could add or subtract hundreds of species, including endemics.

In all cases, these limits appear very arbitrary, with no biogeographical background. Valid biogeographical limits should be larger and include N Africa, the Near-East and Caucasus, as these areas include most of the main European fauna and flora refugia, now often designed as "biodiversity hotspots" (see e.g. Williams 2004; Manvelyan 2013). This European region extended to its more natural limits forms the West Palaearctic region.

Limits of the West Palaearctic region. There are various possible interpretations of the limits of the West Palaearctic region that may vary with the groups that are considered (e.g. De Lattin 1967). In all cases, the whole Near-East (as defined by Zohary 1973) should be included in the West Palaearctic, as well as N Africa. Further discussion can be finding in Snow and Perrins (1998), Masseti and Bruner (2009), van Steenis and Lucas (2011), van Steenis et al. (2016).

A convenient solution would be to define West Palaearctic as an area extending from 26° to 72° latitude north and from 32° longitude west to 62° longitude east (Figure 3). To make things simple, we will name this "West Palaearctic Frame" (WPF), thus avoiding the difficulty of adjusting this regional concept to some mountains, deserts or rivers. Of course, this frame is very inclusive, as it includes some (mostly desert) areas east of the Caspian Sea that clearly belong to Central Asia. Such a frame is nevertheless very convenient because it includes all biodiversity hotspots that clearly belong to West Palaearctic (e.g. the temperate forest areas of N Iran; see Zohary 1973) and also because it makes mapping and computing easy. Using the term "frame" clearly indicates that it does not pretend to fit with "natural" regions.

Differences between the wild bee faunas of IUCN Europe and West Palaearctic. For most wild bee groups, the WPF fauna is not yet well known (Patiny et al. 2009). It should therefore be of immediate interest to assess the total number of species that could be expected for this area. Table 1 provides a first rough estimation of the total bee fauna of the WPF. While the IUCN Europe includes 2051 species, the WPF includes 3408. This last number, however, is likely underestimated. Indeed, some Near-East areas still remain poorly known, as it is the case for Iran where we should expect hundreds more species.

A checklist of West Palaearctic bees is urgently needed. Such a work would require a widely cooperative project. The best starting point would likely be the Kuhlmann et al. (2014) online checklist. This project has already integrated a wide contribution of the most competent experts.

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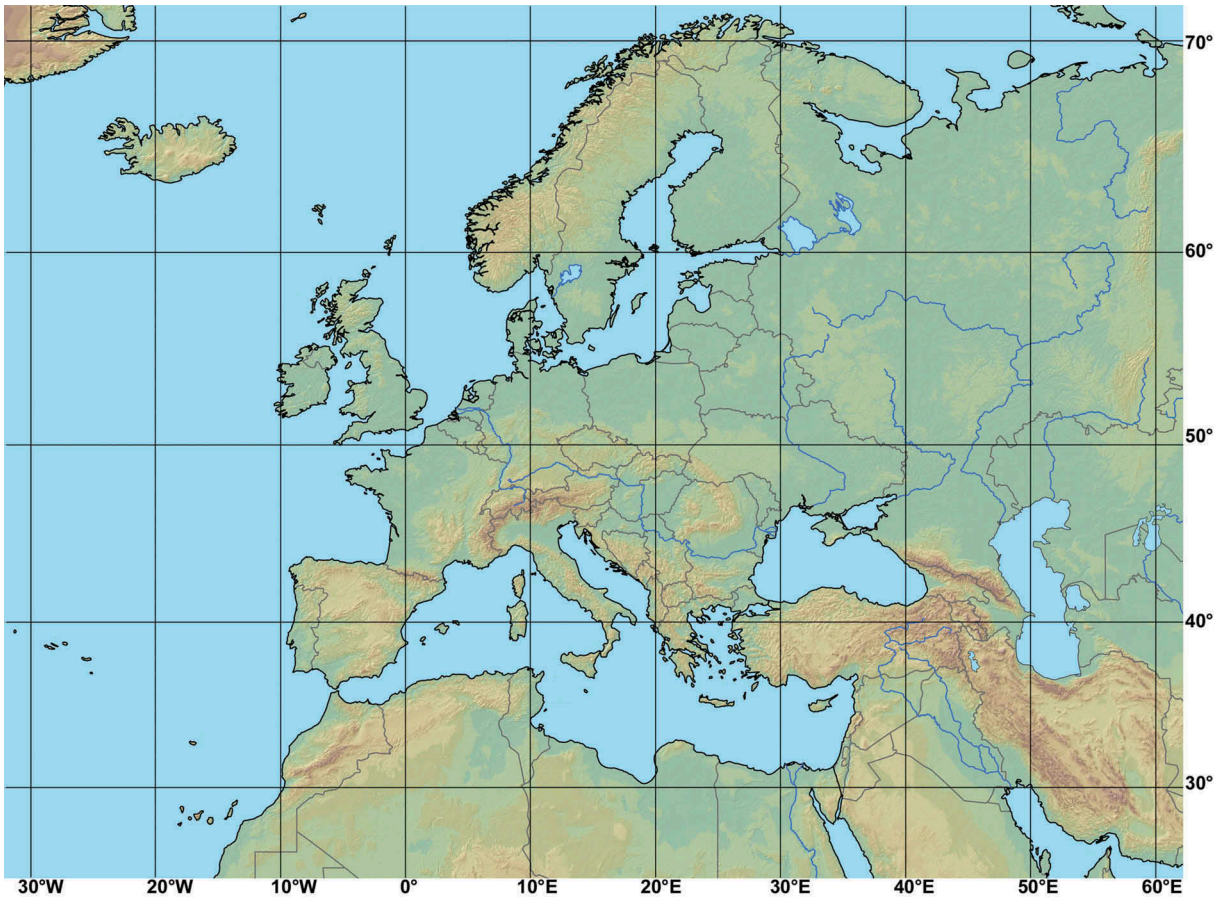

Figure 3. West Palaearctic Frame defined as the area between 26° and 72° latitude north and from 32° longitude west to 62° longitude east.

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