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THE BEES OF MADEIRA (HYMENOPTERA, APOIDEA)

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ABSTRACT. We record the presence of the bee species *Andrena cyanomicans*, *Stelis ornatula*, *Hoplitis ochraceicornis*, and *Xylocopa* sp. from the Madeiran archipelago. The other species and subspecies of bees previously recorded from Madeira and Porto Santo are *Andrena maderensis maderensis*, *Andrena wollastoni wollastoni*, *Amegilla maderae*, *Apis mellifera*, *Bombus maderensis*, *Bombus ruderatus*, *Halictus frontalis*, *Hoplitis acuticornis*, *Hylaeus maderensis*, *Lasioglossum villosulum*, *Lasioglossum wollastoni*, *Megachile versicolor*, *Osmia latreillei iberoafricana*, *Osmia madeirensis*, and *Osmia niveata*. Thus, a total of 19 bee species have so far been recorded from Madeira and Porto Santo. Six of them (32%) are endemic to the Madeiran archipelago. In a checklist of the species we give previous references, some taxonomic remarks, and brief biological notes. As in most other terrestrial groups of Madeira studied so far, the bee fauna of Madeira is of Western palaearctic origin.

RESUMO. AS ABELHAS (HYMENOPTERA APOIDEA) DA MADEIRA. Assinalamos, pela primeira vez, a presença das espécies *Andrena cyanomicans*, *Stelis ornatula*, *Hoplitis ochraceicornis*, e *Xylocopa* sp. no arquipélago da Madeira. As outras espécies e subespécies já registadas são *Andrena maderensis maderensis*, *Andrena maderensis portosanctana*, *Andrena wollastoni wollastoni*, *Amegilla maderae*, *Apis*

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mellifera, Bombus maderensis, Bombus ruderatus, Halictus frontalis, Hoplitis acuticornis, Hylaeus maderensis, Lasioglossum villosulum, Lasioglossum wollastoni, Megachile versicolor, Osmia latreillei iberoafricana, Osmia madeirensis e *Osmia niveata*. Assim, um total de 19 espécies de abelhas passa a ser conhecido no arquipélago da Madeira. Seis delas (32%) são endémicas. Numa lista das espécies são apresentadas as referências anteriores e breves notas taxonómicas e biológicas. Como a maioria dos grupos de animais terrestres estudados na Madeira, as abelhas da Madeira têm a sua origem na região paleárctica ocidental.

INTRODUCTION

The Madeira archipelago, about 630 km west of Africa in the northeastern Atlantic Ocean at 32.44° N and 16.58° W, arose during the tertiary period from the bottom of the sea up to 1862 m above sea-level by volcanic activities (MITCHELL-THOMÉ 1976). It consists of Madeira proper, Porto Santo (41 km^2) 45 km northeast of it and the three small Ilhas Desertas 20 km southeast of it. The main island has an area of 728 km^2. Its terrain is generally rugged and dissected by deep ravines and gorges. The warm-humid climate is influenced by the trade winds and allows a rich vegetation on Madeira island. The central parts of the island harbour remnants of the „Laurissilva“ forest, a wet forest with *Laurus* trees as the characteristic and dominant species.

Porto Santo is much lower and considerably drier than Madeira, with a smoother landscape, lacking sharp ridges and deep gorges. The highest point is the Pico do Facho (517 m) in the eastern part of the island. The southern coast of Porto Santo boasts the only extensive sandy beach (9 km) in the Madeiran archipelago. It is narrow along its whole length and a characteristic sand dune vegetation is limited to a small area.

Extensive material of the superfamily of Apoidea (Hymenoptera) from Madeira was first taken in 1847 and the following years by the coleopterist T. VERNON WOLLASTON. The literature on bees of Madeira is widely scattered and, with few exceptions, dates from the first half of the century (SAUNDERS 1903, COCKERELL 1921, 1922, ALFKEN 1940, BLÜTHGEN 1940). Since then little attention has been given to the Madeiran bees. Between 1992 and 1998, the authors collected bees on Madeira and Porto Santo. We here note the presence of four species previously unrecorded from the archipelago and give a checklist of the bee species of Madeira, with notes on their biology.

MATERIAL AND METHODS

Specimens were caught by handnet at many different localities on Madeira and Porto Santo. The island of Porto Santo was visited in three collecting trips: September 15-22 1994, March 17-21 1997, and May 7-10 1997.

Initially, P. W. sent specimens for identification or confirmation of identification to the late Dr. K. WARNCKE. These specimens are now lost. They can no longer be found in his

collection, which is at the Biologiezentrum des OÖ Landesmuseums, Linz, Austria.

Voucher specimens of most species have been deposited in the Museu Municipal (História Natural) at Funchal, Madeira, under the registration numbers MMF 26621-26638 and in the Zoologische Staatssammlung, München, Germany. A few specimens were also deposited in the Naturkundemuseum, Stuttgart, Germany. Additional material is in the private collections of M. FELLENDORF, S. ROBERTS and G. van der ZANDEN.

Species list

Family Colletidae

Hylaeus (Paraprosopis) maderensis COCKERELL 1921

Madeiran references: SAUNDERS (1903), COCKERELL (1921), ALFKEN (1940), WARNCKE (1970), ERLANDSSON (1983).

Taxonomic remarks: SAUNDERS (1903) called this "*Prosopis* sp. ? allied to *signata*". ALFKEN (1940) called it *Prosopis atra* Saunders. WARNCKE (1970) called it *Prosopis pictipes* Nyl ssp. *madeirensis* COCKERELL. WARNCKE (1992a) called it *Prosopis pictipes atra* Saunders, without ever having seen specimens from Madeira. In his paper on the species of the genus *Hylaeus* in Europe, DATHE (1980) does not mention *Hylaeus maderensis*. The male of *Hylaeus maderensis* Cockerell is described and figured in ERLANDSSON (1983).

Distribution: An endemic species of Madeira (ERLANDSSON 1983).

Biological remarks: Previous authors have collected this species from June to August. We caught *Hylaeus maderensis* middle of May, June and July at Garajau and Reis Magos (south coast of Madeira) on the endemic *Aeonium glutinosum* and in August a male on *Rubus* sp. next to a levada, Lombada dos Marinheiros.

Specimens: One female was deposited at the Staatliche Naturkundemuseum at Stuttgart and a male and a female at the Museu Municipal do Funchal. The holotype (a female) is in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum.

Family Halictidae

Halictus (Halictus) frontalis SMITH 1853

Madeiran references: SAUNDERS (1903), COCKERELL (1921), BLÜTHGEN (1930, 1940).

Taxonomic remarks: *Halictus* sp. (?) of SAUNDERS (1903), *Halictus sepositus* of COCKERELL (1921) is a junior synonym, as shown by BLÜTHGEN (1930: p. 71).

Distribution: An endemic species of Madeira. SMITH (1853) erroneously cites

"Africa" as the type locality (EBMER, pers. comm.).

Biological remarks: The collection of H. HOHMANN contains a female from early April at Lombo de S. João (19 km NW of Funchal). The collection of J. SMIT contains eleven females from Rabaçal, Achada do Poiso, Fontes, Poço de Neve, Lombada dos Marinheiros, João Ferino collected in July. We have captured thirteen females and six males in May at Camacha and at Seixal, and in August at Curral das Freiras (altitude 1000 m) and 2 km south of Ribeiro Frio (altitude 1100 m) and at Poiso (altitude 1000 m) and in September at Camacha.

Specimens: One male and one female have been deposited at the Museu Municipal do Funchal. The holotype of *Halictus frontalis* Smith is in the collection of the Natural History Museum, London. COCKERELL's types of *H. sepositus* (a male and two females) are in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum.

Lasioglossum (Evylaeus) wollastoni (COCKERELL 1922)

Madeiran references: SAUNDERS (1903), COCKERELL (1922), BLÜTHGEN (1940).

Taxonomic remarks: SAUNDERS (1903) recorded this as "*Halictus* n. sp., allied to *morio*". COCKERELL (1922) described it as *Halictus wollastoni*.

Distribution: *Lasioglossum wollastoni* (COCKERELL 1922) is an endemic species of Madeira and Porto Santo islands (EBMER, pers. comm.).

Biological remarks: We have captured 21 males and 15 females at the Madeiran localities Caniço, Reis Magos, Camacha, Pico do Facho, Poiso, Santo da Serra, Chão da Ribeira, Porto Moniz, Ponta de São Lourenço and Pico do Arieiro during the months of January, February, May, July, August, and September and from Porto Santo island in May. The collection of H. HOHMANN contains seven females from April at several places on Madeira and Porto Santo. Some males were caught on *Euphorbia paralias* in the sand dunes of Porto Santo. Males and females were caught on the endemic plant *Aeonium glutinosum*.

Specimens: A male and a female have been deposited at the Naturkundemuseum Stuttgart and the Museu Municipal do Funchal.

Lasioglossum (Evylaeus) villosulum (KIRBY 1802)

Madeiran references: SAUNDERS (1903), BLÜTHGEN (1940).

Distribution: Madeira and Porto Santo, from Great Britain, Ireland and Finland south to the Azores, the Canary Islands, North Africa to Arabia and Mongolia, Northern Japan, Manchuria (EBMER 1988).

Biological remarks: We have captured four males and 45 females at the Madeiran localities Caniço, Reis Magos, Camacha, Poiso, Portela, Santana, Chão da Ribeira, Encumeda and Funchal in March, April, May, August and September, and on Porto Santo island in September. One of the four males was caught on the endemic plant *Aeonium glutinosum*.

Specimens: Two females each have been deposited at the Museu Municipal do Funchal and the Naturkundemuseum Stuttgart.

Family Andrenidae

Andrena (Suandrena) cyanomicans PÉREZ 1895

Madeiran references: **new record for Porto Santo.**

Distribution: Previously recorded from Spain, Morocco, Tunisia, Egypt and Israel (DYLEWSKA 1983, WARNCKE 1980, cf. HOHMANN et al. 1993).

Biological remarks: We have captured three females on the sand dune plant *Cakile maritima* and on *Raphanus* sp. (Brassicaceae) in Porto Santo, 18.-20. March 1997. The private collection of G. JAESCHKE (now with C. SAURE) contains two females from Porto Santo, 18 March 1994.

Specimens: One female has been deposited at the Zoologische Staatssammlung, Munich.

Andrena (Suandrena) maderensis COCKERELL 1922

Distribution of the sp.: The species *Andrena maderensis* occurs on Madeira island, Porto Santo island, the Canary Islands and Morocco (WARNCKE 1968).

- ***Andrena maderensis maderensis*** COCKERELL 1922

Madeiran references: SAUNDERS (1903), COCKERELL (1922), WARNCKE (1967, 1968).

Taxonomic remark: SAUNDERS (1903) recorded this as *Andrena bimaculata*, Kirby ? var. (COCKERELL 1922). COCKERELL called it *Andrena maderensis*.

Distribution: According to present knowledge, the subspecies *Andrena maderensis maderensis* is endemic to Madeira island (cf. remark to *A. m. portosanctana* below).

Biological remarks: We have collected six males and twenty two females from Madeira island, the males from Gaula on 16.3.1997, the females from March to June at Funchal, Reis Magos, Gaula, Camacha, Santo da Serra, and Porto Moniz. In March and April, the species was particularly common on cabbage (*Brassica* sp.) and on *Rapistrum rugosum*, in May and June on *Raphanus raphanistrum* (both Brassicaceae). *A. maderensis* and *A. wollastoni* apparently are the principal pollinators of cabbage plants on Madeira. COCKERELL (1922) says for *A. portosanctana* "near the south side of Pico do Castello, January 1921, at flowers of *Oxalis cernua* and *Calendula* 3 females". *O. cernua* is now called *O. pes-caprae*.

Specimens: One female has been deposited at the Museu Municipal do Funchal. Another female has been deposited at the collection of the Naturkundemuseum Stuttgart. There are two males and four females in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum.

Andrena (Micrandrena) wollastoni COCKERELL 1922

Distribution of the sp.: Madeira and the western Canary Islands (WARNCKE 1968).

- ***Andrena wollastoni wollastoni*** COCKERELL 1922

Madeiran references: SICHEL (1867), SAUNDERS (1903), COCKERELL (1922),

ALFKEN (1940), WARNCKE (1968).

Taxonomic remarks: cf. *Andrena parvula* of SICHEL (1867), SAUNDERS (1903) called the species *Andrena minutula*, ALFKEN (1940) called it *A. verticalis* (WARNCKE 1968).

Distribution: According to present knowledge, the subspecies *Andrena wollastoni wollastoni* Cockerell 1922 is endemic to the Madeiran archipelago, the subspecies *acuta* and *catula* are found on the Canary Islands (WARNCKE 1968).

Biological remarks: According to WARNCKE (1968), the first generation is in flight in February and March, the second generation from May to July (a statement apparently based on the Canarian specimens available to WARNCKE). We have collected 32 males and 67 females at Funchal, Caniço, Gaula, Paul da Serra, Porto Moniz, Achada da Cruz, Ribeiro Frio, and Porto Santo island between the months of March and May.GEOFF MARTIN of the Natural History Museum of London (pers. comm.) captured a female at Fajã da Nogueira (altitude 500m) end of July. In March, the species was particularly common on blooming cabbage (*Brassica* sp.) on Madeira and on Porto Santo. *A. wollastoni* apparently is one of the principal pollinators of cabbage on the Madeiran archipelago. In March 1997, on Porto Santo island, the species was common on the endemic *Echium candicans* and *Echium nervosum* (Boraginaceae) and visited the Brassicaceae *Cakile maritima* and cf. *Sinapis* sp. The species also visits *Reseda luteola* (Resedaceae). A large number of males and females emerged from hundreds of closely spaced small circular holes in bare ground below *Geranium* in a garden on Porto Santo island in March 1997. COCKERELL (1922) observed a female on flowers of *Euphorbia* sp.

Specimens: A male and a female have been deposited at the Museu Municipal do Funchal and the Naturkundemuseum Stuttgart, respectively. There are several males and females in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum and in the British Museum (Natural History), London.

Family Megachilidae

Stelis (Stelis) ornatula (KLUG 1807)

Madeiran references: **new record for Madeira.**

Distribution: Previously known from Europe between 40° and 62° N. and eastwards into Asia (WARNCKE 1981).

Biological remarks: J. Smit captured a single female near Fontes (1200 m altidude) on the 16th of July 1997. *S. ornatula* is a cleptoparasitic species of various megachilid bees.

Specimens: The specimen is in the private collection of J. SMIT, Arnhem, Holland.

Osmia (Chalcosmia) niveata (FABRICIUS 1804)

[= ***Osmia fulviventris*** (PANZER 1798)]

Distribution of the sp.: Previously known from the Canary Islands, North Africa, Europe, and Central Asia (HOHMANN et al. 1993).

- ***Osmia niveata fulviventris*** (PANZER 1798)

Madeiran references: SMITH (1876).

Taxonomic remark: Smith called it *Osmia fulviventris* (PANZER 1798).

Distribution: Europäisches Festland, Kanaren (PETERS 1975).

Biological remarks: We have captured 13 males and 27 females between the months of March and May at Caniço, Reis Magos and Funchal. In March 1997, the species was particularly common on Downy Thistle (*Galactites tomentosa*, Asteraceae). The private collection of J. SMIT contains two females captured in the Botanical Garden of Funchal in July.

Specimens: A male and a female have been deposited at the Museu Municipal do Funchal and at the Staatliche Naturkundemuseum at Stuttgart. One female and one male (14.3.1989, Corujeira/Madeira, 525 m, J. A. W. LUCAS leg.) are in the Warncke collection, which is now at the Biologiezentrum des OÖ Landesmuseums, Linz, Austria. One female (14.5.1989, Machico) is in the collection of the Nationaal Natuurhistorisch Museum at Leiden, the Netherlands. A male and a female (10.4.1994, Ribeira Brava) are in the collection of H. HOHMANN.

Osmia (Chalcosmia) latreillei (SPINOLA 1806)

Distribution of the sp.: The species occurs on the Canary Islands, Madeira, Porto Santo, North Africa and South Europe (HOHMANN et al. 1993).

Biological remarks: Some information on the biology of this species in Egypt is given by WAFA & EL-BERRY (1971a/b).

- ***Osmia latreillei iberoafricana*** PETERS 1975

Madeiran reference: SAUNDERS (1903).

Taxonomic remarks: SAUNDERS (1903) called it *Osmia latreillei*. A specimen from Madeira was identified as the subspecies *iberoafricana* by K. WARNCKE (pers. comm. to P.W.).

Distribution: The subspecies occurs on the Iberian peninsula and North Africa (PETERS 1975).

Biological remarks: We have captured three male and five females in March, May and June on Pico do Arieiro, Madeira island, and on Porto Santo island.

Specimens: A male and a female have been deposited at the Museu Municipal do Funchal. Three females (23.5.1989, Porto Santo) are in the collection of the Nationaal Natuurhistorisch Museum at Leiden, the Netherlands. One female (15.3.1989, Ribeira Brava/Madeira, J. A. W. LUCAS leg.) is in the WARNCKE collection, now at the Biologiezentrum des OÖ Landesmuseums, Linz, Austria. Another female (17.3.1985, Porto Santo) is in the NILSSON collection, Uppsala, and three more females (23.5.1989, Porto Santo) are in the collection at Leiden. The collection of H. HOHMANN contains three males and five females from Porto Santo (April 1994). There are four males and four females from Madeira in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum.

Osmia (Chalcosmia) madeirensis Van der ZANDEN 1991

Madeiran references: Van der ZANDEN (1991a).

Taxonomic remarks: Two specimens of this species in the collection of the Zoologische Museum in Berlin bear labels by FRIESE calling them *O. latreillei* and labels with "*Osmia (Chalc.) maderensis* Bischoff, n. sp."but were never described (van der ZANDEN 1991a, p. 172).

Distribution: An endemic species of the island of Madeira.

Biological remarks: In the original description of the species, van der ZANDEN (1991a) reported six specimens from April and May, caught at "Cenigel" and "Junchal" - the correct location names presumably being Caniçal and Funchal. In addition, we have captured four males and seven females at Caniço, João Ferino, Porto da Cruz, Porto Moniz and Seixal in March, April, and May. The collection of J. SMIT contains two females captured at Fontes in July.

Specimens: A female and a male have been deposited at the Museu Municipal do Funchal.

Hoplitis (Alcidamea) acuticornis (DUFOUR & PERRIS 1840)

Madeiran references: ALFKEN (1940).

Taxonomic remarks: ALFKEN (1940) called the species *Osmia acuticornis*. We follow MICHENER et al. (1994) who moved the subgenus *Alcidamea* to *Hoplitis*. Die von uns untersuchten Exemplare (see below) sind der Nominatunterart zuzurechnen.

Distribution: Southern Europe, Canary Islands, Near East (HOHMANN et al. 1993).

Biological remarks: ALFKEN (1940) collected a male and a female at Rabaçal (1080 m) 17 July to 4 August. We have not collected additional individuals of this species during the present survey. The collection of J. SMIT contains a male and a female captured at Fontes and Lombada dos Marinheiros in July.

Hoplitis (Hoplitis) ochraceicornis (FERTON 1902)

Madeiran references: **new record for Madeira.**

Distribution: Spain, Southern France, Northern Italy, Macedonia (WARNCKE 1992b).

Specimens: 1 female, 10.-28.5.1989, Caniçal, coll. van der ZANDEN.

Megachile (Megachile) versicolor SMITH 1844

Madeiran reference: ALFKEN (1940), cf. SAUNDERS (1903).

Taxonomic remarks: ALFKEN (1940) used the name *Megachile versicolor* F. Sm. var. hibernica R. C. L. PERK., which is probably a misspelling of ‘hiberniae’ PERKINS 1925. This variety has only been recorded from Ireland and Finland, probably because other authors did not follow Perkins’ distinction of "varieties". Unfortunately ALFKEN (1940) missed to comment on the Wollaston specimen called *M. semispleta* by COCKERELL, which may be a *M. versicolor* (see taxonomic remarks for *M. semispleta*).

Distribution: Ireland, England, Sweden, Finland, Central Europe (WESTRICH 1990).

Biological remarks: ALFKEN (1940) reports a male and three females from Rabaçal (1080 m), 17 July to 4 August. We have not collected additional individuals during this survey, but the collection of J. SMIT contains two males and three females from Poço da Neve, July 1997.

Family Anthophoridae

Amegilla (Amegilla) maderae (SICHEL 1867)

Madeiran references: SICHEL (1867), SAUNDERS (1903), ALFKEN (1940).

Taxonomic remarks: Described as *Anthophora maderae* by SICHEL (1867); reduced to varietal status within *Anthophora quadrifasciata* (VILLERS 1789) by DOURS (1869). Friese (1897) described *Amegilla* in his monograph of the genus *Podalirius* as a subgenus; this is now regarded by some as a separate genus (e. g. LIEFTINCK 1956, BROOKS 1988). Saunders (1903) used the name *Podalirius quadrifasciatus*.

Distribution: *Amegilla maderae* (SICHEL 1867) is endemic to the Madeira island group, including Porto Santo and the Desertas (vid. P. W.).

Biological remarks: From 1992 to 1998, this was by far the most conspicuous bee (apart from the honey bee) in the gardens of Madeira and Porto Santo. In 1996, after an extraordinarily wet winter, the species was quite rare. In 1998, it had recovered its former frequency. One of the authors (P. W.) has seen both sexes in flight from the end of January to November on the south coast of Madeira. Two nesting aggregations were observed: an aggregation at the Miradouro (lookout point) near Ribeira Brava consisted of holes in dry bare soil, and was active as early as the beginning of April (A. KRATOCHWIL, pers. comm.), and still active at the end of May (P. W., pers. obs.); another aggregation, in a meadow in Funchal with large patches of bare soil, was active at the end of September (C. M. and M. F., pers. obs.). *Amegilla maderae* visits a large number of plants from different families, such as the two endemic *Echium candicans* and *Echium nervosum* (Boraginaceae), *Echium plantagineum* (Boraginaceae), *Rosmarinus officinalis* (Lamiaceae), blooming cabbage (*Brassica* sp., Brassicaceae), *Cakile maritima* (Brassicaceae), *Galactites tomentosa* (Asteraceae), *Cichorium endivia* (Asteraceae), *Agapanthus praecox* (Liliaceae), *Tipuana tipu* (Fabaceae).

Specimens: Many specimens of this species are already in the collection of the Museu Municipal do Funchal. A female has been deposited at the Naturkundemuseum Stuttgart. A number of specimens from Madeira and adjacent islands are in the collection of the Natural History Museum, London and six males and three females are in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum.

Xylocopa sp.

Madeiran references: **new record for Madeira**.

Taxonomic and biological remarks: During an excursion with students from Madeira

university, one of the authors (P. W.) observed a large individual of the genus *Xylocopa* in Quinta Magnolia, a public garden in Funchal, in June 1994. The possibility that a species of this size had not yet been recorded did not enter PW's mind and he therefore released the animal after demonstrating it to the students. The animal resembled *X. violacea* (LINNAEUS 1758) in size and general appearance. Various attempts to find the species again were unsuccessful. Several Madeiran people interested in insects (one of them, ISAMBERTO SILVA, with a large private collection of Madeiran insects) stated that they had never seen this species, when they were shown a photo of *Xylocopa violacea* from France. The species is probably a recent introduction and the question of whether it has established a breeding population in Madeira at present remains unresolved.

Family Apidae

Apis mellifera LINNAEUS 1758

Madeiran reference: SICHEL (1867).

Taxonomic remarks: A few animals checked at both the south coast and the north coast of Madeira belonged to the race "carnica" (B. MÜLLER, pers. comm.). Thus, the species has probably been introduced to the island by man.

Biological remarks: This is by far the most common bee in Madeira and Porto Santo. It is in flight the whole year. Bees are raised throughout the island and local honey is highly esteemed.

Bombus (Megabombus) ruderatus (FABRICIUS 1775)

Madeiran references: FABRICIUS (1775), SICHEL (1867), SMITH (1876), SAUNDERS (1903).

Taxonomic remarks: There has been some confusion over the identity of this common species. There are several specimens in the Hope Entomological collections, Oxford Museum, collected from Madeira by T. V. WOLLASTON in the mid-nineteenth century. These are labelled *Bombus ruderatus* by SMITH. Underneath them, in SAUNDERS' hand, is another label identifying them as *B. hortorum*, and it is under the latter name that SAUNDERS published in 1903. Our new material can be referred to *B. ruderatus* and all previous records of *B. hortorum* from Madeira are likely to be in error. ERLANDSSON (1979) strangely does not list this species in his key to the Macaronesian *Bombus*, even though it is quite common on Madeira.

Distribution: While *B. hortorum* is of more northern distribution, not certainly recorded from south of the Pyrenees, *B. ruderatus* is more widespread in the western Palaearctic, from southern Sweden southwards to the Mediterranean (including north Africa) and east to the Caspian Sea. In addition to Madeira island, it is also known from the Azores (P. WILLIAMS, NHML, pers. comm.). We did not find the species on Porto Santo island, despite searching for it.

Biological remarks: On Madeira, the species is in flight the whole year. It visits flowers of many different genera and families, for instance blooming cabbage (*Brassica* sp., Brassicaceae), *Hibiscus rosa-sinensis* (Malvaceae), *Borago officinalis* (Boraginaceae), the endemic *Echium candicans* (Boraginaceae), *Echium plantagineum* (Boraginaceae), *Psoralea bituminosa* (Fabaceae), *Tropaeolum majus* (Tropaeolaceae), *Opuntia tuna* (Cactaceae), *Bougainvillea* (Nyctaginaceae). In June it is common on *Agapanthus praecox* (Liliaceae), while the second Madeiran bumblebee species, *Bombus maderensis*, has not been seen on this plant.

Specimens: There are several specimens in the T. V. WOLLASTON collection, Hope Entomological collections, Oxford University Museum. A female has been deposited at the Museu Municipal do Funchal. A male and three females are in the collection of H. HOHMANN.

Bombus (Bombus) maderensis ERLANDSSON 1979

Madeiran references: ERLANDSSON (1979).

Taxonomic remarks: According to ERLANDSSON (1979), BISCHOFF (1937) called this species *Bombus terrestris* var. ferrugineus Schmiedeknecht, but in fact no Madeiran bees are mentioned in this publication on Hymenoptera from the Canary Islands. WARNCKE (in litt. to P. W.) called the species "*B. terrestris maderensis* Erlandsson" but Erlandsson has given what appears to be a valid description of differences of the species not only in colour but also in morphology.

Distribution: Endemic to the Madeiran archipelago (ERLANDSSON 1979).

Biological remarks: The species is quite common on Madeira island and in flight the whole year. The species visits plants of many different genera and families, such as the endemic *Echium nervosum* (Boraginaceae), the endemic *Echium candicans* (Boraginaceae), *Echium plantagineum* (Boraginaceae), the endemic *Geranium madeirense* (Geraniaceae), *Cercis siliquastrum* (Caesalpiniaceae), *Psoralea bituminosa* (Fabaceae), *Galactites tomentosa* (Asteraceae), *Carpobrotus edulis* (Aizoazeae), *Bougainvillea* (Nyctaginaceae). We did not find the species on Porto Santo island, despite searching for it.

Specimens: A female has been deposited at the Museu Municipal do Funchal.

Doubtful records and species with uncertain taxonomical status:
(The following taxa are not included in the discussion.)

Halictus (Halictus) scabiosae (ROSSI 1790)

Madeiran reference: SICHEL (1867).

Distribution: Western palaearctic; from Marocco to Rhodes and Bosporus, occasionally in Central Europe (EBMER 1988).

Remarks: SICHEL (1867) recorded two females from Madeira. Even though these bees are quite conspicuous, they have never been recorded again. It is possible that SICHEL confused *H. scabiosae* with *Halictus frontalis* Smith or maybe the locality where he caught the bees on his worldtour.

Andrena maderensis portosanctana COCKERELL 1922

Madeiran references: COCKERELL (1922).

Taxonomic remarks: COCKERELL (1922) described two species for the Madeiran archipelago, *Andrena maderensis* and *Andrena portosanctana*. According to WARNCKE (1967: 208; 1968) the latter is but a subspecies of *A. maderensis*, and the subspecies *Andrena maderensis maderensis* is endemic to Madeira island, whereas *Andrena maderensis portosanctana* is endemic to Porto Santo island. In view of the close proximity of these islands, this appears doubtful and requires further study.

Remarks: Except the three females COCKERELL (1922) mentioned, no other specimens have been recorded for Porto Santo. We were unable to collect the species on the island, despite a careful search at 17-21 March 1997 and 7-10 May 1997; blooming cabbages - a favourite plant of *Andrena maderensis* on Madeira island, were plentiful at these times, but no *Andrena maderensis* was seen on it on Porto Santo island.

Andrena (Zonandrena) flavipes PANZER 1799 (Family Andrenidae)

Madeiran reference: SICHEL (1867).

Taxonomic remark: SICHEL (1867) recorded this as *Andrena extricata?* Smith, which is a synonym for *Andrena flavipes* Panzer.

Distribution: Southern and Central Europe (WARNCKE 1981).

Remarks: Sichel recorded one single male from Madeira. To our knowledge this species has never been mentioned in any other publication. We were not able to collect new material though this species is quite conspicuous. Without checking the specimen, this record remains doubtful.

Megachile semispleta COCKERELL 1921 (Family Megachilidae)

Madeiran references: *Megachile*, sp. ? of SAUNDERS (1903), COCKERELL (1921) [the same specimen !].

Taxonomic remarks: COCKERELL described this species listing the locality merely as "Madeira". The type specimen, a male, was collected by T. V. WOLLASTON. COCKERELL (1921) states "As E. SAUNDERS remarked, it seems to be nearest to *M. versicolor*, Smith. SAUNDERS (1903) did indeed refer to a Megachile sp ?, and recording a male collected by T. V. WOLLASTON stated" In bad conditions but apparently closely allied to *versicolor*, Smith, with similar pale apical joints to the tarsi.“ Obviously this is the same specimen that ALFKEN (1940) mentions as *M. versicolor*: "Edw. Saunders bemerkt schon das Vorkommen der Art auf Madeira, l. c. [!] p. 216."

Thus it might well be possible, that *M. semispleta* COCKERELL 1921 is a junior synonym of *M. versicolor* SMITH 1844, but only a detailed study of the type specimen can decide this. *M. semispleta* was never recorded again after its description by COCKERELL.

Osmia (Caerulosmia) submicans MORAWITZ 1871 (Family Megachilidae)

Madeiran references: van der ZANDEN (1991b).

Distribution: Mediterranean Europe, North Africa, Canary Islands, occasionally in Central Europe (van der ZANDEN 1991b).

Remarks: van der ZANDEN (1991b, p. 66) wrote "Auf Madeira kommt eine Population vor, die sich sowohl von der Nominatform als auch von der Unterart *O. s. canaria* unterscheidet" (on Madeira, there exists a population that differs not only from the nominal form but also from the subspecies *O.s. canaria*). This statement was based on declarations made by H. G. TEUNISSEN to G. van der ZANDEN. However, as there are no specimens to confirm it - neither in the collection of H. G. TEUNISSEN (now at Leiden and recently checked by G. v. Z.) nor apparently anywhere else -, the record of *Osmia submicans* MORAWITZ 1871 from Madeira must remain doubtful.

Amegilla (Amegilla) quadrifasciata (VILLERS 1789) (Family Anthophoridae)

Madeiran reference: Along with *Amegilla maderae* SICHEL (1867) reported *A. quadrifasciata* for Madeira, represented by only one single male specimen.

Taxonomic remark: He separated the two species merely by a different coloration of the hairs. Presumably the male specimen was bleached.

Distribution: Mediterranean area, Canaries, warm regions of Central Europe, eastern up to Central Asia (HOHMANN, et al. 1993).

DISCUSSION

We have recorded the presence of the bees *Andrena cyanomicans*, *Stelis ornatula*, *Hoplitis ochraceicornis* and *Xylocopa* sp. from the Madeira archipelago for the first time. Fifteen other species of bee had previously been recorded there. Thus, a total of 19 bee species are now known from Madeira and Porto Santo. Six of these, *Hylaeus maderensis*, *Halictus frontalis*, *Lasioglossum wollastoni*, *Osmia madeirensis*, *Amegilla maderae* and *Bombus maderensis*, are endemic to the Madeiran archipelago, as are a further two subspecies, *Andrena maderensis maderensis* and *Andrena wollastoni wollastoni*.

The percentage of species endemic to Madeira varies considerably among the different groups of animals studied to date (BAEZ 1993). With about 32% of species endemic to the Madeira archipelago, the degree of endemism for bees is close to the overall value of about 27% (BAEZ 1993). Including the two endemic subspecies, there are 8 endemic taxa out of 19 (i. e. 42%).

Only one of the 19 species is a parasitic one (*Stelis ornatula*), whereas roughly a quarter of the continental European species are parasitic in the nests of other bees (WESTRICH 1989). When colonizing this remote island, the bees of Madeira apparently managed to leave their parasites behind. On the other hand, parasitic species arriving on Madeira may have been unable to colonize the island, because of the lack of appropriate host species. The known hosts of *Stelis ornatula* are five species of the genus *Osmia* (WESTRICH 1989, p. 873), none of which occur on Madeira. One (or several) of the three Madeiran *Osmia* species is

the likely host of *Stelis ornatula* on Madeira.

None of the bee species encountered on Madeira belongs to the African zoogeographic region (Aethiopis). As for most other terrestrial taxa studied to date (BAEZ 1993), the bee fauna of Madeira is of western palaearctic origin. The composition of the Madeiran bee fauna suggests a close biogeographic relationship to the Mediterranean and, to a lesser extent, Eurosiberian region.

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