Entomofauna

ZEITSCHRIFT FÜR ENTOMOLOGIE

Band 26, Heft 27: 473-492 ISSN 0250-4413 Ansfelden, 31. Dezember 2005

Osmia chrysolepta sp. nov., a new bee of the subgenus *Hemiosmia* TKALCŮ, 1975 with notes on the identification and distribution of species closely related to *O.* (*Hemiosmia*) *balearica* SCHMIEDEKNECHT, 1885 (Hymenoptera, Apoidea, Megachilidae)

Volker HAESELER

Abstract

Osmia (*Hemiosmia*) *chrysolepta* sp. nov., is described, illustrated and compared with other species of the subgenus *Hemiosmia* TKALCŮ, 1975. Detailed information is given to distinguish the females of *O. uncicornis* PÉREZ, 1895 and *O. anceps* PÉREZ, 1895 (= *pulchra* TKALCŮ, 1975 syn. nov.). A lectotype is designated for *O. balearica* SCHMIEDEKNECHT, 1885. A key to the species of the subgenus *Hemiosmia* is given. *Osmia* (*Hemiosmia*) *balearica* is known from Spain, *O. chrysolepta* from Israel, Jordan and (?) Egypt, *O. anceps* from Libya and Tunisia, and *O. uncicornis* from the South of Portugal and Spain and from Morocco.

Key words: Jordan, Israel, *Osmia* (*Hemiosmia*) *chrysolepta* sp. nov., Megachilidae, taxonomy

Key words: Jordan, Israel, *Osmia* (*Hemiosmia*) *chrysolepta* sp. nov., Megachilidae, taxonomy

Zusammenfassung

Osmia (*Hemiosmia*) *chrysolepta* sp. nov. wird beschrieben und mit den anderen bekannten Arten des Subgenus *Hemiosmia* TKALCŮ, 1975 verglichen. Zur Unterscheidung der Weibchen von *O. uncicornis* PÉREZ, 1895 und *O. anceps* PÉREZ, 1895 (= *pulchra* TKALCŮ, 1975 syn. nov.) werden detaillierte Hinweise gegeben. Für *Osmia balearica* SCHMIEDEKNECHT, 1885 wird ein Lectotypus festgelegt. Für die bekannten Arten des Subgenus *Hemiosmia* wird eine Bestimmungstabelle geliefert. Von *O.* (*Hemiosmia*) *balearica* liegen Nachweise aus Spanien, von *O. chrysolepta* aus Israel, Jordanien und (?) Ägypten, von *O. anceps* aus Libyen und Tunesien und von *O. uncicornis* aus dem Süden der Iberischen Halbinsel (Portugal und Spanien) sowie aus Marokko vor.

1. Introduction

TKALCŮ (1975) established the subgenus *Hemiosmia* for the species closely related to *Osmia argyropyga* PÉREZ, 1879. GRISWOLD & MICHENER (1998) synonymized *Osmia* (*Hemiosmia*) TKALCŮ, 1975, and *Osmia* (*Exosmia*) TKALCŮ, 1979, but the present study follows VAN DER ZANDEN (1987, 1988), WARNCKE (1988: 397) and TKALCŮ (in litt. 2004), who consider *Hemiosmia* and *Exosmia* as valid subgenera. *Hemiosmia* species form a small group - the males being distinctly characteristic - within the more than 180 Palaearctic species and subspecies of the genus *Osmia* PANZER, 1806 (cf. VAN DER ZANDEN 1988).

Osmia argyropyga, *O. uncicornis* PÉREZ, 1895 and *O. anceps* PÉREZ, 1895 (= *pulchra* TKALCŮ, 1975 syn. nov.), which are closely related to *O. balearica* SCHMIEDEKNECHT, 1895, occur in relatively small areas of the Western Mediterranean and adjacent regions (TKALCŮ 1975, VAN DER ZANDEN 1983). *Osmia balearica*, however, is reported to occur also in Sicily (s. GIORDANI SOIKA 1944, PAGLIANO 1995) Israel, Jordan and Egypt (DUCKE 1900, MAVROMOUSTAKIS 1948). In the Western Mediterranean *O. balearica* is recorded for the Baleares and the coastal region of the Iberian Peninsula (VAN DER ZANDEN 1983, own records). The regional occurrence of the species closely related to *O. balearica*, the dependence of *O. balearica* on coastal dunes of Majorca and the Mediterranean coast of the Iberian Peninsula, as well as sceptical comments concerning the occurrence of *O. balearica* also in Palestine and Egypt (TKALCŮ 1975), gave rise to the present study.

2. Material, literature

Origin of the examined material

Museum collections

M Berlin..... Museum für Naturkunde der Humboldt-Universität Berlin (Dr. F. Koch)

M Bremen..... Überseemuseum Bremen (H. Riemann)

M Leiden..... Nationaal Natuurhistorisch Museum Leiden, Department of Entomology (Prof. Dr. C. van Achterberg)

M Paris..... Muséum National d'Histoire Naturelle (Claire Villemant)

M Linz..... Oberösterreichisches Landesmuseum Linz (Mag. F. Gusenleitner)

M Zürich..... Eidgenössische Technische Hochschule Zürich, Institut f. Pflanzenwissenschaften, Angew. Entomologie / Hauptsammlung (Dr. A. Müller)

Private collections

c H ..... coll. V. Haeseler (Oldenburg)

c K ..... coll. M. Kuhlmann (Münster)

c M..... coll. A. Müller (Zürich)

c S ..... coll. M. Schwarz (Ansfelden)

c W..... coll. H. Wolf (Plettenberg)

Abbreviations used below: G = J. Gusenleitner, S = M. Schwarz, T = H. Teunissen, W = K. WARNCKE, Wo = H. Wolf, Z = G. van der Zanden; * = locality cannot be determined; in "..." exact data on labels; in [...] annotations given by the author.

Terms for the main parts of the body follows MICHENER (2000).

Osmia anceps PÉREZ, 1895

Osmia anceps PÉREZ, 1895: 11, ♀: Lectotype ♀ (Mus. Paris), Tunisia (not Algeria), Médénin; designated by TKALCŮ (1975: 46), (studied).

Osmia pulchra TKALCŮ, 1975: 46f., ♂: Holotype ♂ (Mus. Paris); Tunisia: Gafsa, 9.3.09, coll. J. VACHAL Mus. Paris, (studied): **syn. nov.**

Additional literature: DUCKE (1900: 138): *Osmia balearica* SCHMIEDKN.: Tunis; VAN DER ZANDEN (1983): [Compare details of *O. balearica* in the present study.]; VAN DER ZANDEN (1994: 171): *Osmia pulchra* TKALCŮ, 1975: 2♂♂, 15. u. 23.3.1986, 15 km east of Tabarka, Tunisia; 1♂, 28.3.1982, Giado, Libya (S.Z.). [M Leiden: 2 specimens (see below)].

Material examined: 15♀♀, 11♂♂ (♀♀: 24.3.-6.5.; ♂♂: 16.2.-7.5.)

c K: - Tunisia: Djerba N33°49'52", E11°02'15" 3♀♀, 1♂ 2.-13.3.1999 (KUHLMANN).

c S: - Tunisia: Djerba N33°49'52", E11°02'15" 2♀♀, 1♂ 2.-13.3.1999 (KUHLMANN); Ins. Djerba, 14 km SE Houmt Souk, N33°50'11°00' 1♂ 7.5.1992 (S); Djerba, peninsula Rass Rmel (beach/dunes/salt set-aside areas) 1♀ [worn edge of the anterior clypeus; from there without impunctate stripe] 13.4.1994 (WILLAND); 30 km E Médénine N33°24'10°50' 1♀ 6.5.1992 (S).

M Berlin: - Libya: Tripolis 1♀ (M. QUEDENFELDT); Tunisia: Tunis merid. 1♀ (coll. FRIESE, det. FRIESE 1915 *O. rosea* FR.).

M Bremen: - Tunisia: Sousse 1♀ 2.4.1989 (HOHMANN).

M Leiden: - Libya: Omg. Tripoli/z.Suwani 1♀ 24.3.1976 (KRUSEMAN); Jadu (= Giado) 1♂ 28.3.82; Tunisia: 1 km E Tabarka 1♀ 9.4.1994 (DANIELSSON); 15 km E Tabarka 1♂ 20.-25.3.1986 (Zool. Mus. Copenhagen); Nefta 1♂ 14.-16.3.1986 (Zool. Mus. Copenhagen).

M Linz: - Tunisia: 30 km S Zarzis 1♂ 16.2.92, 1♂ 24.2.92, 1♂ 28.2.1992 (W); 30 km N Médénine 1♂ 20.2.1992 (W).

M Paris: - Tunisia: 1♂ "Museum Paris coll. J. Vachal 1911", "Holotypus *Osmia pulchra* TK. ♂ TKALCŮ det.", "Holotype" [red label]. [The following labels, see TKALCŮ (1975: 46), are missing: "Gafsa 9.3.09", "? *balearica* SCHMIEDK."]; 1♀ " o " [blue label], "Médenin", "*anceps* J.P. Barb. p.11", "Museum Paris coll. J. PÉREZ 1915", "Lectotype" [red label, designated by TKALCŮ]; 1♀ "Médenin" [greenish label], "Museum Paris coll. J. VACHAL 1911", 1♀ "647", "Médenin 3.95", "*Osmia anceps* ♀ PÉREZ, Type", "Museum Paris coll. J. VACHAL 1911".

Osmia balearica SCHMIEDEKNECHT, 1885

Osmia balearica SCHMIEDEKNECHT, 1885: Apid. europ. II: 902, ♀, 918 ♂

Additional literature: DUCKE (1900: 138): *Osmia balearica*: In der coll. FRIESE sah ich Exemplare von den Balearen, Tunis und Ägypten; FRIESE (1911: 89): *Osmia balearica*; GIORDANI-SOIKA (1944: 19): *O. balearica* 1♀ 20.4. für Palermo/Sicily (20.4.), [This specimen, Mus. Zürich, is *Osmia aurulenta* (PANZER, 1799) (A. MÜLLER, in litt. 2002)]; STANĚK (1965: 193f.): *Osmia balearica*; VAN DER ZANDEN (1983: 136): *Osmia balearica*: Spain: Marbella 2♀♀ 15.5.1959; Valle Niza, Malaga, 2♀♀ 23.5.1962; Barcelona 1♀ 8.6.1962; El Saler, Valencia, 1♀, 1♂ 5.4.1969. Morocco: El Monzel 1♀ 23.5.1970, Rabat 1♀ 19.4.1974; Port Lyautey, Mendia, 1♀ 23.4.1947. Libya: S.Suwani/Tripolis 2♀♀ 24.3.1976. - [Marbella 2♀♀,Valle Niza/Malaga 2♀♀, Port Lyautey, Mendia (Morocco) 1♀ proved to be *O. uncicornis*, 1♂ of El Saler/Valencia is *O. balearica*, 1♀ of S.Suwani/Tripolis is *O. anceps*.]

Material examined: 47♀♀, 47♂♂ (♀♀: 15.3.-19.4.; ♂♂ 12.3.-13.4.)

c H: - Spain: N-Mallorca: Playa de Muro NE Ca'n Picafort 8♀♀, 7♂♂ 28.3.91, 1♀, 9♂♂ 29.3.91, 1♀ 23.5.94; Ca'n Picafort 1♀, 1♂ 31.3.89 (RIEMANN); Dünenber. Cala Guyá b. Cala Rajada 4♀♀, 7♂♂ 10.4.92, 1♀ 14.4.1992, 2♀♀, 2♂♂ 7.4.93, 1♂ 14.4.93, 2♀♀ 21.5.94; Cala Mesquida, 4 km NW Cala Rajada 1♀ 9.4.93; S-Mallorca: Arenal de la Rapita 1♀ 19.4.81 (SICK); E Sant Jordi 1♀ 15.4.81 (SICK); Strand b. Ses Covetes SE La Rapita 1♂ 23.3.91; Costa del Sol: Roquetas de Mar, 16 km SW Almeria, 3♀♀ 8.4.80, 4♀♀, 4♂♂ 26.3.83, 2♂♂ 31.3.83; 36 km WSW Almeria, Dünen bei Guardias Viejas 1♀, 2♂♂ 11.4.90; 20 km SE Almeria, Dünen bei Cabo de Gata 1♀, 1♂ 13.4.87.

M Berlin: - Spain: Albufera Valencia 1♂ 12.3.1926; Mallorca 3♀♀, 3♂♂ (1♀ "Prat. b. Palma", 1♀ "Palma", 1♀ "Mallorca", 1♂ "Mallorca", 1♂ "coll. SCHMIEDEKN.", 1♂ "Mallorca Palma SCHMIEDEKN.", "23151" [= Dehesa de la Albufera]. [This ♂ is designated as "Lectotypus *Osmia balearica* SCHMIEDEKNECHT, 1885, V. HAESELER 2005".]

M Leiden: - Spain: Valencia: near Benidorm 1♀ 1.-26.4.1982 (Univ. Leiden RMNH); Palma de Mallorca 1♀ Mus. Paris, coll. E. ANDRÉ 1914; Cabo de Gata SE Almeria 1♀ 15.3.1988 (T); Valencia: El Saler 1♂ 8.4.69.

M Paris: - Spain: Mallorca 5♀♀, 3♂♂ coll. J. PÉREZ 1915 [2♀♀ with distinct semicircular indentation on the anterior clypeal edge]; Mallorca 1♀ 8.4.83, coll. J. VACHAL 1911; Palma de Mallorca 2♀♀, 1♂, coll. E. ANDRÉ 1914; Baleares 1♀, 1♂, [♀: head fixed with glue, without antennae; ♂: head without antennae, metasoma with segments 1 and 2 only, legs complete] coll. E. ANDRÉ 1898.

Osmia chrysolepta sp. nov.

Literature: DUCKE (1900: 138): *Osmia balearica*: In der coll. FRIESE sah ich Exemplare von den Balearen, Tunis und Ägypten. MAVROMOUSTAKIS (1948: 215): *Osmia balearica* SCHMIEDEKNECHT: - [Palestine] Bat Yam, 2♀♀, 13.2.41 (BYTINSKI-SALZ).

Examined material: 12♀♀, 22♂♂ (♀♀: 5.3.-31.5.; ♂♂: 5.3.-31.5.)

c S: - Israel: M. Michael 2♀♀, 12♂♂ 25.3.88 (K. GUICHARD); Netanya 1♀ 18.4.1980 (LUCAS?); Tel-Aviv 3♀♀, 1♂ 24.-26.3.88, 1♀ 3.-10.4.1988 (K. GUICHARD). - Palestine: Bat Jain 1♂ 2.3. (BYTINSKI-SALZ). - Jordan: 80 km NE Aqaba (Amman rd.) 1♂ 8.4.89 (G).

M Berlin: - Egypt?: * Hunka (Hanka ?) Mare 1♂ (coll. ALFKEN, det. ALFKEN 1932: *O. balearica*).

M Leiden: - Israel: Bat Yam (S Tel Aviv) 1♀, 1♂ 31.5.1965 (SCHLAEFLE); * Preveo ? Aevea 1♀ (coll. KUGLER) 30.4.1963 ?; * Zikhron Yá Aqov 1♂ (coll. L. FISHELSOHN) 15.5.1960.

M Linz: - Israel: Nahariya 1♀ Mai 1976 (T. OSTEN). - Jordan: 80 km NE Aqaba (Amman rd.) 2♂♂ 8.4.89, 1♀ 11.4.89, 1♂ 15.4.89 (all G).

M Zürich: - Israel: Bat Yam 1♀, 1♂ 31.5.65 (SCHLAEFLE).

Osmia uncicornis PÉREZ, 1895

Osmia uncicornis PÉREZ, 1895: 10-11, ♂

Additional literature: DUCKE (1900): *Osmia uncicornis* PÉREZ, 1895; BENOIST (1950): *Osmia anceps* PÉREZ: Port-Lyautey, Mehdia 3♀♀ 23.-26.5., Marrakech 2♀♀ 11.5., Asni 1♀ 17.5., Safi-Mogador 1♀ 23.4., Agadir 12♀♀ 24.-25.4.; TKALCŮ (1975): *Osmia uncicornis* PÉREZ, 1895: Marokko: Tanger 1♀, Spanien: Gibraltar: 2♂♂. - [All details with respect to *O. uncicornis*, especially Figs. 17 and 29 (see TKALCŮ 1975), refer to the ♀ from Tangier! The remarks concerning the ♀ from Médénin must be related to *O. anceps* (= *pulchra*)!]; VAN DER ZANDEN (1983): [Compare details of *O. balearica* in the present study.]

Examined material: 56♀♀, 57♂♂ (♀♀: 16.2.-4.7.; ♂♂: 13.2.-13.5.)

c H: - Morocco: Meknès/Ifran Park 1650 m, 1 ♀ 23.5.95 (C. KASSEBEER). - Spain: Costa del Sol, coastal dunes 14 km SSW Estepona 9 ♂♂ 14.4.1990; dunes, 4 km NW Tarifa 1 ♀, 2 ♂♂ 16.4.1990; at Torre Guadiaro, 24 km NE Algeciras, 3 ♀♀, 2 ♂♂ 10.4.1987, 1 ♀, 3 ♂♂ 17.4.1987, 1 ♀, 1 ♂ 26.3.1988, 4 ♂♂ 1.4.1988, 2 ♀♀ 2.4.1988; 1 ♀, 6 ♂♂ 23.3.89; at Torre Nueva, 10 km NNE Gibraltar, 1 ♂ 10.4.1987.

c S: - Portugal: Southwest coast at Carrapateira, 5 km N Vila do Bispo 1 ♀ 1.4.1997 (HARTMANN); Algarve, 3 km W Salema (= 18 km W Lagos) 1 ♂ 7.4.1997 (HARTMANN). - Spain: Costa del Sol, Estepona 2 ♀♀, 1 ♂ 1.-11.4.1985 (Wo). - Morocco: Ifrane 3 ♀♀ 1.-2.6.1995 (M. HALADA); Talmest 2 ♀♀ 10.5.1995 (M. HALADA); 12 km E Ifrane 1 ♀ 9.-10.5.1997 (J. HALADA).

c W: - Morocco: Ag. Biougra (210 m) 1 ♀ 2.3.1988 (V. LEFEBER); Massa-Tiznit 1 ♀ 26.2.1988 (V. LEFEBER).

M Berlin: - Morocco: Safi 1 ♂ 7.-8.5.26 (LINDBERG). - Spain: Pto. Real, 1 ♂ 4.33 (HERING). [Obviously not labelled correctly: Tunisia: Mittel-Tunis Hochplateau 1 ♀ (SPATZ).]

M Leiden: - Morocco: M. Atl. Ifrane 1 ♀ 5.6.1984 (LITH ?); Port Lyautey = Kenitra Mehdia 1 ♀ 23.5.1947 (DE BEAUMONT); Ag.: Biougra (210 m) 1 ♀ 2.3.1988 (V. LEFEBER: „nest onder graspol"); Rte Biougra Tafraout(e) 1 ♂ 13.2.1987, 1 ♀ 28.2.1988 (T); c. 15 km N Tiznit (Agadir rd.) *Eucalyptus* plantation roadside 1 ♂ 4.4.1983; 5 km S Taroudant (El Arba Assads rd.) 1 ♂ 2.4.1983. - Portugal: Cabo Raso (30 km W Lissabon) 1 ♂ 27.4.-2.5.1981 (MIKKOLA); Costa da Caparica, 4 km SW Lissabon 1 ♂ 15.3.1997 (ABENIUS); Umgebung Caparica 1 ♂ 13.5.1956 (N.F. DE ANDRADE). - Spain: Mazagón (Huelva) 18 ♀♀, 16 ♂♂ 11.4.1984 (T); Torremolinos 2 ♀♀ 17.6.1959 (VERHOEFF); Estepona 1 ♀, 1 ♂ 1.-11.4.1985 (Wo); Prov. Malaga: Marbella 2 ♀♀ 14./15.5.1959 (V.D. VECHT); Valle Niza 24 km E Malaga 2 ♀♀ 23.5.1962; Sanlúcar de Barrameda 1 ♀ 8.6.1962.

M Linz: - Morocco: Tanger 1 ♀ 4.7.1932 (A. NADIG); 18 km N Agadir 1 ♀ 2.4.1987 (G); 20 km N Tiznit 1 ♂ [hair of thorax dorsally and laterally in the same rusty red as terga] 24.3.1987 (G).

M Paris: - Tanger 1 ♀ (coll. J. de Gaulle 1919; det. TKALCŮ: *O. uncicornis*); Spain: Malaga 1 ♂ [without antennae] (coll. J. PÉREZ 1915).

M Zürich: - Morocco: Tanger 1 ♀ [worn: impunctate anterior edge of clypeus narrow] 4.7.1932 (A. NADIG).

3. Results

Altogether, 267 individuals of the "*Osmia balearica* group" from public and private collections were investigated. Animals from Israel and Jordan turned out to belong to a species so far unknown and are described herein as *Osmia chrysolepta* sp. nov. The examination of specimens obtained from the National Museum of Natural History in Paris and other specimens from North Africa proved to be *Osmia anceps* PÉREZ, 1895 (= *Osmia pulchra* TKALCŮ, 1975). The female from Médénine (Tunisia) marked as lectotype by TKALCŮ (1975: 46) and determined as *O. anceps* by PÉREZ, proved to be the ♀ of *O. pulchra* which had been described by TKALCŮ (1975) based on a ♂.

3.1. Description of *Osmia* (*Hemiosmia*) *chrysolepta* sp. nov.

Type material: Holotype. ♂ Israel: Tel-Aviv 24.-26.3.88 (leg. K. GUICHARD) (coll. SCHWARZ).

Paratypes. ♀♀, ♂♂: (coll. SCHWARZ): Israel: M. Michael 2♀♀, 12♂♂ 25.3.88 (leg. K. GUICHARD); Netanya 1♀ 18.4.1980 (leg. J.A.W. LUCAS?); Tel Aviv 3♀♀ 24.-26.3.88, 1♀ 3.- 10.4.1988 (all leg. K. GUICHARD); Palestine: Bat Jain 1♂ 2.3. (leg. BYTINSKI-SALZ); Jordan: 80 km NE Aqaba (Straße nach Amman) 1♂ 8.4.89 (leg. J. GUSENLEITNER). - (M Zürich): Israel: Bat Yam 1♀, 1♂ 31.5.65 (leg. W. SCHLAEFLE). - (M Leiden): Israel: Bat Yam (S Tel Aviv) 1♀, 1♂ 31.5.1965 (leg. W. SCHLAEFLE). - (M Linz): Jordan: 80 km NE Aqaba (Straße nach Amman) 2♂♂ 8.4.89, 1♀ 11.4.89, 1♂ 15.4.89 (all leg. J. GUSENLEITNER); Israel: Nahariya 1♀ May 1976 (leg. T. OSTEN).

Etymology: The name of the new species is derived from χρυσοῦς = gold-adorned, golden, gilded and λεπτός = thin, delicate, fine, slender.

Diagnosis: The ♀♀ and ♂♂ of *O. chrysolepta* sp. nov. can be most easily confused with the ♀♀ and ♂♂ of *O. balearica*. There is no difference in size between the ♀♀ and ♂♂. Both species are distinctly smaller than *O. uncicornis* but only slightly smaller than *O. anceps*. In contrast to *O. balearica*, the tibial spur of the forelegs in the ♀♀ and ♂♂ is pointed as in *O. uncicornis* and *O. anceps*. The vertex of *O. chrysolepta* ♀♀ is about as narrow as that of the ♀♀ of *O. balearica*. In contrast to the males of *O. balearica*, the ♂♂ of *O. chrysolepta* have no short thorn-like elevation next to the indentation at the end of the 5th sternum. The two median processes of the 6th tergum of the ♂♂ of *O. chrysolepta* are broadly truncate as opposed to the pointed processes in *O. uncicornis* and *O. anceps*. The 8th antennal segment of the *O. chrysolepta* ♂♂ is ventrally more prominent if compared to other species of the *O. balearica* group.

Description:

Female

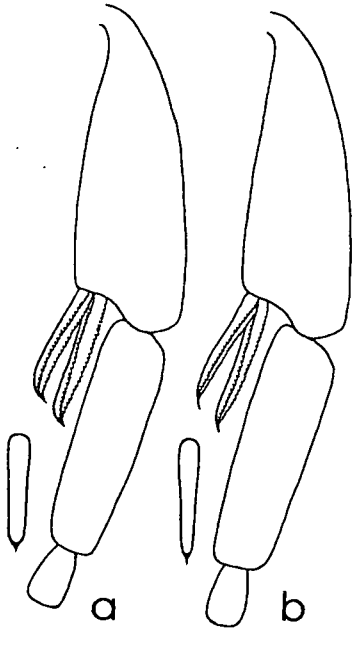
Body size: 9 mm, length of forewing: 7 mm

Head. Head only slightly broader than high, interior margins of compound eyes nearly parallel. Vertex narrow: Distance between anterior edge of median ocellus and posterior edge of head smaller than distance between exterior edges of both lateral ocelli. Only on vertex spaces between punctures larger than diameter of punctures and there also glossy. Clypeus densely punctate except for narrow, distinctly contrasting anterior edge; anterior edge smooth and shiny across one third of width of clypeus, at most as broad as base of 3rd antennal segment, spaces not glossy like the rest of head. Anterior edge of clypeus mostly straight. 12th antennal segment flattened towards apex and about 1.3 times longer than wide, antennal segments 8-11 square, 3rd antennal segment somewhat shorter than combined lengths of antennal segments 4 and 5.

More or less dense, long hairs almost right up to median ocellus, dense punctures clearly visible at a 20-fold magnification, hairs in middle and towards back of vertex longest, laterally shorter. Hairs on base of clypeus long, progressively shorter towards anterior edge, therefore apical area clearly visible.

Thorax. Scutum and scutellum densely punctate, extremely narrow spaces between punctures across large areas mostly not shiny, spaces slightly larger and moderately shiny only on central disc and towards posterior edge of scutum. Tegulae glossy, extensively punctate, spaces between punctures several times larger than punctures. Metanotum with

slightly weaker punctures than scutellum. Central area moderately glossy and frequently with a small, V-shaped furrow in central disc. Basal area of propodeum below metanotum more or less glossy, partially basally fine-grooved/laterally shagreened; rest of propodeum densely punctate except for lower central area of posterior surface of propodeum; spaces between punctures moderately glossy. Spur of front tibia (part of strigilis) at side distinctly pointed (Fig. 1b), as in *O. anceps* and *O. uncicornis*. Narrow spurs of hind legs tapering off from first third, spurs only weakly curved towards apices (Fig. 2b).



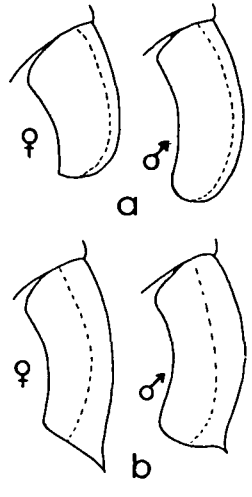


Fig. 1: Spurs of front tibia of(**a**) *Osmia balearica* and (**b**) *O. chrysolepta*.

Fig. 2: Spurs of hind tibia of (**a**) *Osmia balearica* and
(**b**) *O. chrysolepta* (on the left: ventral view of exterior spur).

Metasoma. Terga densely punctate almost to posterior margin, spaces between punctures somewhat larger and glossy on central discs, smaller and laterally not glossy. Hairs of terga as long as scape, somewhat denser and therefore weakly ligamentous at edges. Sterna less punctate or impunctate towards base and laterally.

Coloration: Integument mainly black, lighter only in few areas: Tegulae red-brown as spurs, also veins of wings and apices of tarsi, tibiae and partially on femora. Tarsomeres 2 to 4 sometimes red-brown throughout. - Pilosity uniformly gold-red to foxy-red.

M a l e

Body size: 9 mm, length of forewing: 7 mm

Head. As in ♂♂ of other species of *O. balearica* group, very dense pilosity on *O. chrysolepta* ♂♂ on front side of head, up to middle between base of antenna and median ocellus, mostly with length of at least 2/3 of scape length, anterior edge of clypeus distinctly semicircularly surpassed by hairs, which are as long as last two antennal segments. Hairs on vertex long but considerably thinner, which, in this area, makes dense punctures everywhere well visible; narrow, matt spaces between punctures smaller than diameter of punctures. In contrast to *O. balearica*, antennae more prominent on interior side of 8th segment (Fig. 3). Hairs on scape long, especially on underside, hairs of pedicel at most as long as its width. 3rd antennal segment with short pubescence on dorsal side, but with sparse protruding hairs on underside.

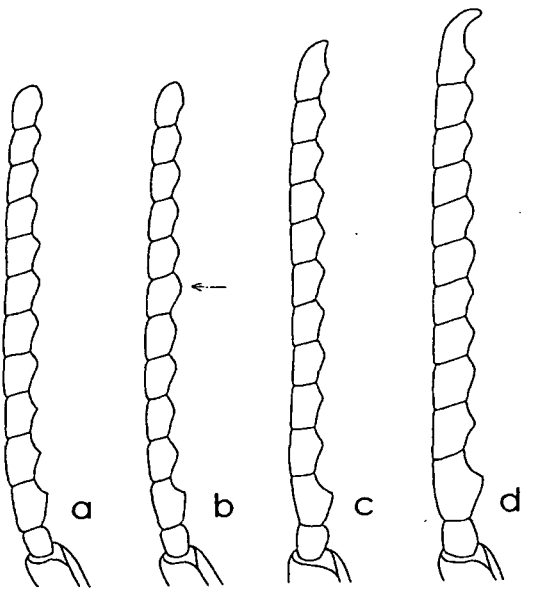


Fig. 3: Antennae of the ♂♂ of the *O. balearica* group: (**a**) *O. balearica*, (**b**) *O. chrysolepta*, (**c**) *O. anceps*, (**d**) *O. uncicornis*.

Thorax. Dense punctures clearly visible despite more or less dense pilosity, spaces between punctures smaller than diameter of punctures. Weak gloss only on central disc of scutum. Punctures diminishing on metanotum, impunctate central disc with weak gloss. Spur of forelegs tapering to a point as in *O. anceps* and *O. uncicornis*. Middle tibiae slightly curved. On underside of middle femur in central area a mostly inconspicuous, short keel. Spurs of hind tibiae narrow, their tips hardly curved.

Metasoma. Marginal zones of terga more densely pilose than disc and therefore streaked. Terga glossy between dense hair cover, rather sparsely and inconspicuously punctate except for apical margins. Impunctate margins fine-grooved/shagreened (at 25-fold

magnification). 6th tergum with four thorns, two middle ones truncate similar to those of *O. balearica*, lateral thorns pointed. Truncate keel before two central processes. 7th tergum prominent at center, truncate and slightly concave (Fig. 4). Sternum 5 right next to groove, without thorn-like processes characteristic of *O. balearica* ♂♂ (Fig. 5).

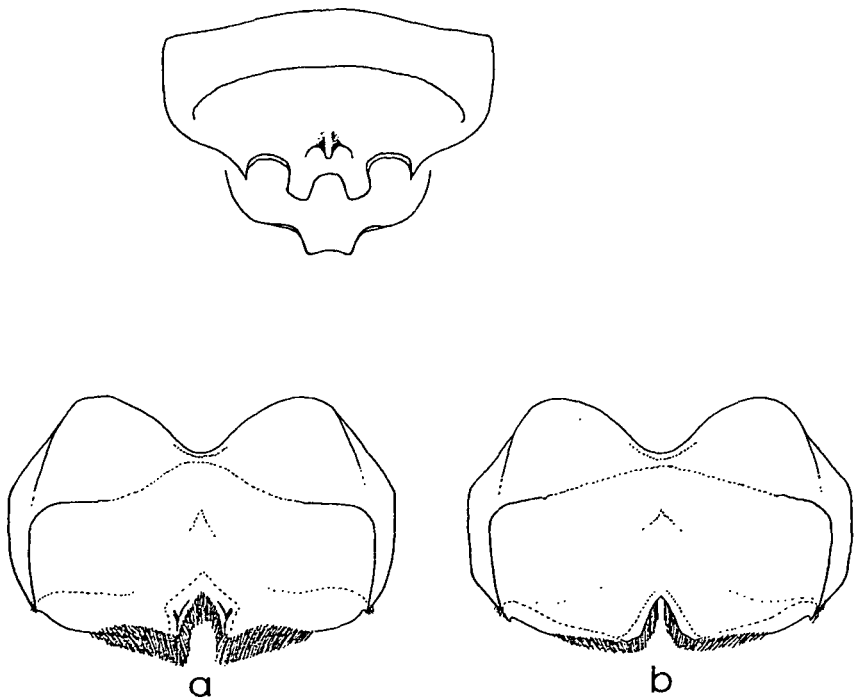


Fig. 4: 6th and 7th tergum of *O. chrysolepta*.

Fig. 5: Sternum 5 of (**a**) *O. balearica* and (**b**) *O. chrysolepta*.

Exterior branch of terminally bifurcate section of gonostylus only slightly longer than interior branch (cf. Fig. 6b), almost entire underside of final segment densely covered with long hairs.

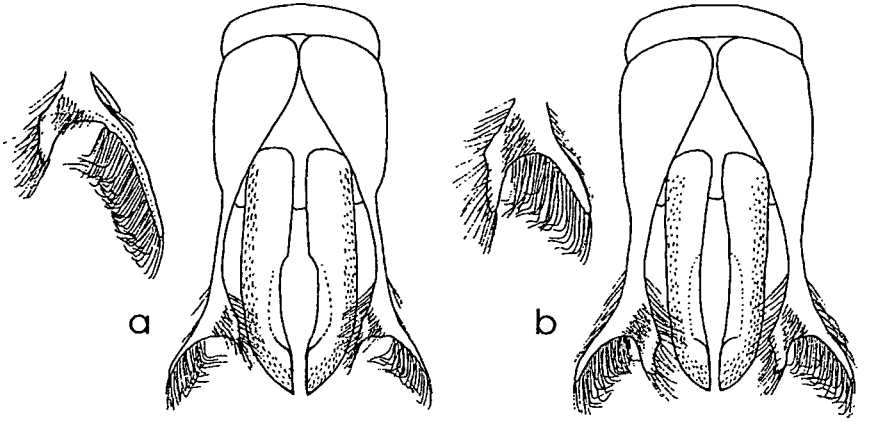


Fig. 6: Male genitalia of (**a**) *O. balearica*, (**b**) *O. chrysolepta* as well as respective apical section of gonostylus in top view.

Coloration: Integument mostly black, brown to light brown on following sections: Underside of antennal segments 4-11, outermost apex of foretibia, tarsomeres 3 and 4 of forelegs, tarsomeres 3 and 4 of middle and hind legs towards their apices as well as apex of tergum 7; veins light to dark brown, tegulae and tergal apices 1-5 light brown. - Pilosity. Snow-white hairs on head, prothorax and mesothorax, clearly contrasting with foxy-red hairs on scutellum, propodeum as well as metasoma.

3.2 Distinction between ♀♀ of *Osmia anceps* and *Osmia uncicornis*

The following statements are based on 56 ♀♀ of *O. uncicornis* from the South of Spain and Portugal as well as from Morocco, and on 15 ♀♀ of *O. anceps* from Tunisia and Libya.

Body size. *O. anceps* ♀♀: 9-10 mm; *O. uncicornis* ♀♀: 10-11 mm (of 56 *O. uncicornis* ♀♀ only one ♀ smaller than 10 mm, measuring 9 mm!)

While the ♂♂ of *O. anceps* and *O. uncicornis* are easy to distinguish, the ♀♀ do not show any remarkable differences. Only (1) the course of the condylar ridge of the mandible, (2) the length and shape of the final antennal segment in proportion to the penultimate, (3) the width of the vertex (here, the area between the anterior edge of the median ocellus and the posterior edge of the head) as well as (4) - with reservations - the external spurs of the hind tibia can be used for distinction.

(1) Within the tooth area, the mandibles do not show any differences suitable for distinction. There are differences, however, in the course of the central keel (condylar ridge). It points to the upper mandibular corner and ends just shortly before it does in *O.*

anceps ♀♀ (Fig. 7a). In the ♀♀ of *O. uncicornis*, however, the central keel points to an area distinctly ahead of the upper mandibular edge (Fig. 7b).

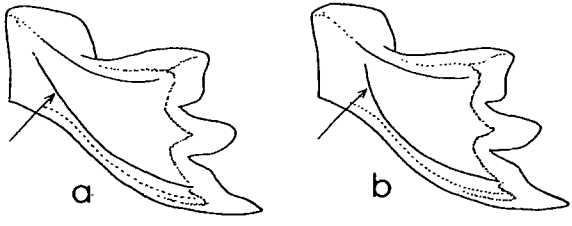


Fig. 7: Mandible of (a) *O. anceps* ♀ and (b) *O. uncicornis* ♀.

(2) As in the male specimens, in the ♀♀ there are also differences regarding the shape of the last antennal segment. For the most part, the 12th antennomere is distinctly shorter in *O. anceps* ♀♀ than in *O. uncicornis* ♀♀. The last antennal segment in *O. anceps* ♀♀ is at most 1.5 times longer than broad and, hence, hardly 1.3 times longer than the penultimate antennomere (Fig. 8a), whereas the last antennal segment in *O. uncicornis* ♀♀ is distinctly longer. From a lateral view, the last antennal segment is flattened towards the apex. While the flattened area begins behind the basal third in *O. uncicornis*, the somewhat less pronounced tapering of the last antennal segment begins only in the middle of the last antennal segment in *O. anceps* ♀♀. The tiny keel on the antennal apex pointing laterally to the antennal base is sometimes only just visible in *O. anceps* ♀♀, but is often more prominent in *O. uncicornis* ♀♀ and then reaches at least 1/3 of the length of the last antennal segment (Fig. 8b).

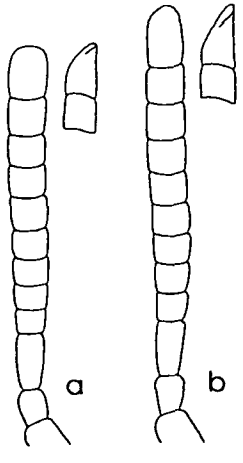


Fig. 8: Top side of flagellum and lateral view of 11th and 12th antennomere of (a) *O. anceps* ♀ and (b) *O. uncicornis* ♀.

(3) The vertex is less prominent in *O. anceps* ♀♀ than in ♀♀ of *O. uncicornis*. Measuring the distance between the anterior edge of the median ocellus and the posterior edge of the head (= A) and the distance between the exterior edges of the lateral ocelli (= B) in the 15 *O. anceps* ♀♀ yielded an average ratio of A : B = 1.01 (min. = 0.93, max. = 1.11; SD = 0.041). For 35 usable *O. uncicornis* ♀♀, the values were significantly higher: A : B = 1.11 (min. = 1.01, max. = 1.22).

A separation of the specimens of *O. uncicornis* from the south or southwest of the Iberian Peninsula from the specimens from Morocco reveals significant differences ($p < 0.001$): Specimens from Portugal and Spain: A : B = 1.14 (min. = 1.10, max. = 1.22; SD = 0.033 [n = 19]), specimens from Morocco: A : B = 1.08 (min. = 1.01, max. = 1.15; SD = 0.042 [n = 16]).

Hence, the most remarkable prominence of the vertex is found in the female specimens from Spain and Portugal.

(4) The inward curvature of the spur of hind tibia is less pronounced in *O. anceps* ♀♀ than in *O. uncicornis* ♀♀.

In both species, the spur of the foreleg is tapering to a point. - At the anterior clypeal edge, a narrow zone is impunctate and glossy; in older specimens punctures may just reach the anterior edge. The anterior clypeal edge is mostly glossy over larger areas in *O. anceps* ♀♀.

3.3. Unusual clypeus shape in *Osmia balearica* ♀♀ from Majorca

Among the total of 47 *O. balearica* ♀♀ studied from Majorca and the eastern part of the Costa del Sol, two ♀♀ from Majorca are conspicuous because of a completely atypical clypeal shape. In both ♀♀ the middle of the anterior clypeal edge shows a distinct semicircular indentation (Fig. 9).

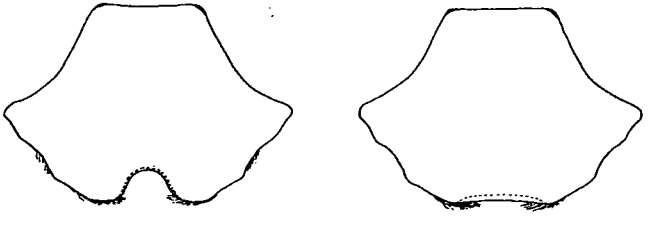


Fig. 9: Different shape of the anterior clypeal edge in *O. balearica* ♀♀ from Majorca.

3.4. Key for the species of the subgenus *Hemiosmia* TKALCŮ, 1975
(sensu TKALCŮ 1975)

♀♀

1 Pilosity snow-white all over ..... *O. argyropyga*
Distribution: Northwestern Africa (BENOIST 1950), southern France, northern Italy, Spain.

- Pilosity foxy-red to golden red 2

2 Foretibial spur rounded (Fig. 1a) ..... *O. balearica*
Distribution: Baleares, Spanish Mediterranean Coast (Almeria to Barcelona).

- Foretibial spur with point (Fig. 1b) 3

3 Distance between anterior edge of median ocellus and posterior edge of head smaller than distance between exterior edges of both lateral ocelli (Fig. 10: A < B); hindtibial spur narrow, only in basal area as broad as basis of 3rd antennal segment, end slightly curved (Fig. 2b) ..... *O. chrysolepta* sp. nov.
Distribution: Israel/Jordan/(? Egypt)

- Vertex: A > and = B, respectively (Fig. 10); hindtibial spur broad, also towards the end (as far as before the tip) as broad as or broader than base of 3rd antennal segment, end mostly with pronounced curvature (Fig. 2a). 4

4 Basis of central keel (condylar ridge) of mandible pointing to upper corner of mandible (Fig. 7a); 12th antennal segment at most 1.5 times longer than broad or less than 1.5 times smaller than 11th antennal segment; tip of hindtibial spur slightly curved from a lateral view; vertex: A virtually the same as B (A : B = 1.03) ..... *O. anceps*
Distribution: Tunisia, Libya

- Basis of central keel pointing to a position ahead of the upper corner of mandible (Fig. 7b); 12th antennal segment at least 1.6 times longer than broad or at least 1.5 times longer than 11th antennal segment; tip of hindtibial spur distinctly curved from a lateral view; vertex: A > B (often A : B ratio > 1.15) ..... *O. uncicornis*
Distribution: Morocco (coastal region and higher up), coastal region of Portugal and Spain.

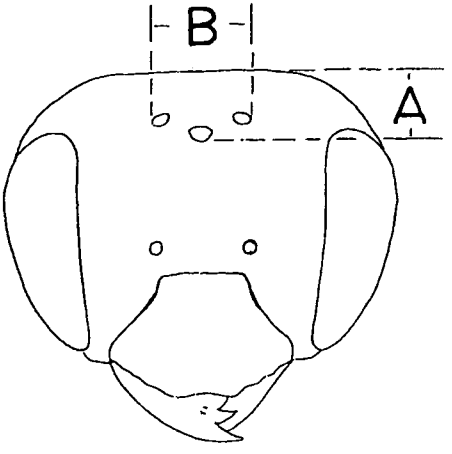


Fig. 10: Distances measured to determine the width of the vertex (**A** = distance from anterior edge of the median ocellus to the posterior edge of the head, **B** = distance between the exterior edges of lateral ocelli).

♂♂

♂♂ can be clearly identified even without genital preparation. However, genital preparation is very helpful for an immediate assignment to the subgenus *Hemiosmia*.

1 Antennal segments 10-13 normally cylindrical, without bumps ..... *O. argyropyga*

\- Flagellum more or less protruding ventrally (Fig. 3) 2

2 Sternum 5 next to apical incision with one thorn-like process on both sides (Fig. 5a); foretibial spur rounded (Fig. 1a) ..... *O. balearica*

\- Sternum 5 without thorn-like processes next to apical incision (Fig. 5b); foretibial spur with tip (Fig. 1b) 3

3 Antennal apex hook-like (Fig. 3d) ..... *O. uncicornis*

\- Other antennal tip 4

4 Antennal apex as in Fig. 3c; 8th antennal segment not specially prominent ventrally; midfemura ventromedially with distinct keel-like elevation ..... *O. anceps*

\- Antennal apex as in Fig. 3b; 8th antennal segment specially prominent ventrally; midfemora ventromedially with only trace of elevation..... *O. chrysolepta* sp. nov.

4. Discussion

According to TKALCŮ (1975: 34), little is known about the life history and geographical distribution of species in the subgenus *Hemiosmia*. It appears that they occur rather locally and (perhaps except for *O. balearica*) even extremely rarely, because they rank among rarities even in the largest collections of Natural History Museums. Altogether, 15 ♀♀, 11 ♂♂ of *Osmia anceps* (= *pulchra*), 47 ♀♀, 47 ♂♂ of *Osmia balearica*, 12 ♀♀, 22 ♂♂ of *O. chrysolepta*, and 56 ♀♀, 57 ♂♂ of *O. uncicornis* were studied. Thus a comparatively large number of specimens of these rare species could be examined.

Osmia balearica and *O. chrysolepta* proved to be distinctly smaller species as compared to *O. uncicornis*. While the hair covering in ♀♀ of the species of the *O. balearica* group treated here is uniformly russet to golden red, the hair colours of ♂♂ partially show striking differences. For example, the snow-white hair covering the head, pronotum and mesothorax in ♂♂ of *O. chrysolepta* contrasts with the russet hair on the propodeum, scutellum and metasoma. A similar, sharply contrasting white hair covering is also found in ♂♂ of *O. anceps*. However, the hair covering the head behind the ocelli may be slightly golden yellow; in this species, foxy-red hair may also occur in the posterior part of the mesopleura. On the other hand, ♂♂ of *O. balearica* and *O. uncicornis* - except for the white hair covering the legs - are mainly foxy-red. Only the head and the anterior part of the thorax can be somewhat lighter-coloured, particularly in older ♂♂.

Owing to their characteristic antennae, even without the preparation of ♂♂ genitalia can be clearly determined using the identification key. Furthermore, the apices of the 6th tergum are differently shaped: The two central appendices in *O. balearica* and *O. chrysolepta* are truncate, but are more or less pointed in *O. anceps* and *O. uncicornis* (cf. TKALCŮ 1975).

While ♂♂ of *Hemiosmia* (sensu TKALCŮ 1975) can be identified without problems, ♀♀ of *O. uncicornis* and *O. anceps* can only be identified by small differences based on the material available so far. Among other things, the course of the central keel of the mandibles and the length of the final antennal segment (also by comparison with the preceding two flagellomeres) can be used for determination. Similar to ♂♂ of *O. uncicornis*, mostly the distal flagellomere is distinctly longer in ♀♀ of *O. uncicornis* than in ♀♀ of *O. anceps*. The width of the apex, which is useful in distinguishing ♀♀ of *O. balearica* and *O. chrysolepta* from ♀♀ of *O. uncicornis* and *O. anceps*, is obviously only of limited use for the distinction of ♀♀ of *O. uncicornis* and *O. anceps*. This is also true of the flexion of the tip of the external spur on the hind tibia.

According to TKALCŮ (1975), the ♀♀ of *O. anceps* and *O. uncicornis* cannot be distinguished. The statements on *O. uncicornis* (text and particularly Figs. 17 and 29) are based solely on the ♀ recorded from Tangier! The distinctly smaller ♀ of *O. anceps* recorded from Médénine (Tunisia), which TKALCŮ designated as lectotype, was obviously not taken into further consideration. That would explain why TKALCŮ (1975) synonymized *O. anceps* with *O. uncicornis*.

Among the 30 ♀♀ of *O. balearica* from Majorca, two ♀♀ are conspicuous because of an uncommonly deep clypeal indentation, which cannot be explained by wear of the anterior clypeal edge. For solitary wasps of the genus *Ancistrocerus* (WESMAEL, 1836), among others, uncommon clypeal indentations were repeatedly reported (e.g. BLÜTHGEN

1966, FÄSTER 1961). BLÜTHGEN (1958: 37) assumes that infestation by Mermetidae in the larval stage is responsible for such monstrosities. The cause of clypeal indentation in ♀♀ of *O. balearica* on Majorca is as yet unknown.

VAN DER ZANDEN (1983, 1994) made several statements about the distribution of the species in the *O. balearica* group. For instance, VAN DER ZANDEN (1983) reports that *O. balearica* does not only occur on the mainland neighbouring the Baleares (Marbella, Niza Valley in Malaga, Barcelona, El Saler, Valencia), but also in North Africa (Morocco: El Monzel, Rabat, Port Lyautey, Mendia; Libya: S. Suwani, Tripolis). These statements are surprising because he is simultaneously referring to the article of TKALCŮ (1975), in which *O. uncicornis* and *O. anceps* (= *pulchra*) are listed as good species besides *O. balearica*, and they were never corrected in later publications (cf. VAN DER ZANDEN 1988, 1994). In the Leiden collection, which includes the *Osmia* of the *O. balearica* group from VAN DER ZANDEN's collection, all material was found under *O. balearica*.

While all available material from the Eastern Mediterranean coastal region of the Iberian Peninsula proved to be *O. balearica*, the material from the western part of the Costa del Sol to Lisbon and from Morocco turned out to be *O. uncicornis* (Fig. 11). The specimens from Libya and Tunisia proved to be *O. anceps* (= *pulchra*) - except for one ♀ which had obviously been labeled incorrectly.

There are no records from the region between Libya and Palestine. The old statement for Egypt (DUCKE 1900, FRIESE 1911, MAVROMOUSTAKIS 1948 among others) has not been confirmed up to now. DUCKE (1900: 138) refers to specimens that he claimed to have seen in the collection of FRIESE from the Baleares, Tunis and Egypt. However, there is no record from Egypt in the collection of FRIESE of the Museum of Berlin. But there is one specimen in the collection of ALFKEN, for which the site of discovery could not be localized.

The currently known locations of collections of the four species of the *O. balearica* group are distributed across relatively small areas of the Mediterranean and Atlantic coastal region and partially also across bordering areas. However, *O. balearica* has so far been reported exclusively from the Mediterranean coastal region of the Iberian Peninsula and of the Baleares (beach embankments, coastal dunes). There, the populations of this and other *Osmia* species are extremely threatened because of serious anthropogenic disturbance (cf. HAESELER 1989, 1998). The three other species, however, have been recorded from bordering areas as well (Fig. 11).

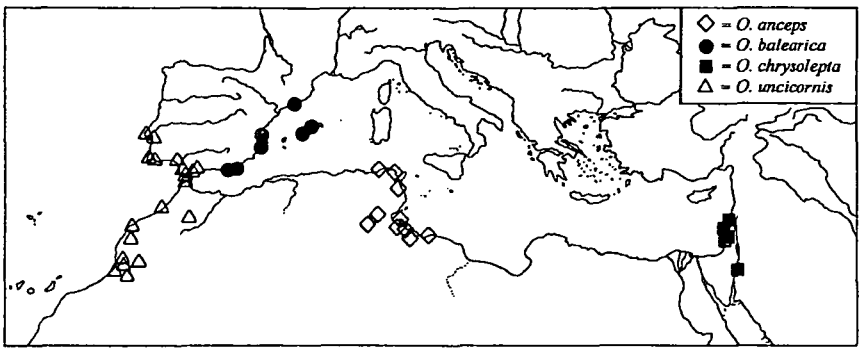


Fig. 11: Distribution of the species of the *O. balearica* group.

Osmia uncicornis has been found in Northwest Africa from the coastal zone up to an altitude of 1,600 m above sea level. This distribution suggests that the specimens might represent different taxa - similar to *O. alticola* BENOIST, 1922 and *O. maritima* FRIESE, 1885. However, no ♂ from higher habitats of the interior could so far be examined. Hence, for the time being it has to be assumed that in Northwest Africa *O. uncicornis* occurs from the coastal zone up to low mountainous regions. The question of whether *O. uncicornis* also occurs higher up in the Sierra Nevada in southern Spain remains open. Up to the present moment, this species has only been found in the coastal region of the Iberian Peninsula.

SCHMIEDEKNECHT and FRIESE found "... quite a lot of specimens [of *Osmia balearica*] in the so-called Prat near Palma de Mallorca, a swampy, dune-like and undeveloped area" (SCHMIEDEKNECHT 1885). Details concerning the nesting behaviour are not included in the description of the species. However, together with six other species, *O. balearica* is mentioned as a species nesting in shells of *Helicosmia* THOMSON, 1872 (SCHMIEDEKNECHT 1885: 22, 888). This statement may have been the cause for the later erroneous information on the nesting behaviour (POULTON 1916, FRIESE 1923, MICHENER 2000 among others): *O. balearica* and also *O. uncicornis* do not nest in empty shells but in sandy areas, just as *O. maritima* does (cf. HAESELER 1982).

Acknowledgements

I am grateful to Mrs. Claire Villemant (Paris), Prof. Dr. Ing. C. van Achterberg (Leiden), Mag. F. Gusenleitner (Linz), Dr. F. Koch (Berlin), Dr. J. Kopelke (Frankfurt), Dr. M. Kuhlmann (Münster), Dr. A. Müller (Zürich), Prof. Dr. G. Pagliano (Turin), M. Schwarz (Ansfelden) as well as Stud.-Dir. i.R. H. Wolf (Plettenberg) for providing the material investigated and/or information. Additionally, I would like to thank the following colleagues who supplied material that was taken into consideration in the present study: C. Kassebeer (Kiel), H. Riemann (Bremen) and Dr. F. SICK (Kiel). Furthermore, I am especially obliged to Mr. F. Gusenleitner, Mr. M. Schwarz and Mr. B. Tkalců (Prague) for supplementary information, to whom I owe it that the present work was carried out. – Two anonymous referees made helpful comments on the manuscript.

References

BENOIST R. (1950): Hyménoptères récoltés par une mission suisse au Maroc (1947) Apidae, Megachilidae. – Bull. Soc. Sci. Nat. Maroc **30**: 183-193.

BLÜTHGEN P. (1958): Oplomerocephalie, eine pathologische Erscheinungsform bei gewissen Eumeniden (Hym., Diploptera). – Zool. Anz. **160**: 36-38.

BLÜTHGEN P. (1966): Neue Fälle von Oplomerocephalie bei Eumenidae-Arten (Hym., Diploptera). – NachrBl. Bayer. Ent. **15**: 76-80.

DUCKE A. (1900): Die Bienengattung *Osmia* PANZ. – Ber. Naturwiss. Ges. Innsbruck **25** (1899/1900): 1-323.

FÄSTER K. (1961): Bestimmungstabellen der Nord- und Mitteleuropäischen Faltenwespen (Diplopteryga LATR.), 2. *Ancistrocerus* WESM. – Ent. Meddr. **31**: 7-20.

FRIESE H. (1911): Apidae I. Megachilinae. – In: Das Tierreich. Im Auftrag der Königl. Preuß. Akademie der Wissenschaften zu Berlin herausgegeben von Franz Eilhard Schulze. 28th delivery XXVI + 440 pp., Berlin, Verlag von R. Friedländer und Sohn.

FRIESE H. (1923): Die europäischen Bienen. Das Leben und Wirken unserer Blumenwespen. – Berlin/Leipzig 456 pp.

GIORDANI SOIKA A. (1944): Risultati di raccoltae imenotterologiche in Sicilia. – Istituto di Zoologia e di Anatomia comparata della Università di Modena: 5-21.

GRISWOLD T.L. & C.D. MICHENER (1998): The classification of the Osmiini of the eastern hemisphere (Hymenoptera, Megachilidae). – J. Kansas Entomol. Soc. **70** (1997): 207-253.

HAESELER V. (1982): Zur Bionomie der Küstendünen bewohnenden Biene *Osmia maritima* FRIESE (Hymenopteren: Apoidea: Megachilidae). – Zool. Jahrb. Syst. **109**: 117-144.

HAESELER V. (1989): The situation of the invertebrate fauna of coastal dunes and sandy coasts in the western Mediterranean (France, Spain). – In: VAN DER MEULEN, F. et al. (Eds), Perspectives in coastal dune management: 125-131. The Hague.

HAESELER V. (1997): *Osmia rutila*, a wild bee occurring in the coastal area of the southwest Mediterranean where it is now in danger of extinction. – In: GARCIA NOVO F., CRAWFORD R.M.M. & M.C. DIAS BARRADAS (Eds), The Ecology and Conservation of European Dunes. – Sciencias **38**: 1-375. Univ. de Sevilla: 169-183.

MAVROMOUSTAKIS G.A. (1948): Further contributions to our knowledge of the bees (Hymenoptera Apoidea) of Palestine. – Ann. Mag. nat. Hist., Ser. **12**: 1: 213-224.

MICHENER C.D. (2000): The bees of the world. – Baltimore, Maryland 913 pp.

PAGLIANO G. (1994): Hymenoptera Apoidea. – In: MINELLI A., RUFFO S. & S. LA POSTA (Eds), Checklist delle specie della fauna italiana **106**: 1-25. Calderini, Bologna.

PÉREZ J. (1895) : Espèces nouvelles de Mellifères de Barbarie (diagnoses préliminaires). – 65 pp., Bordeaux imprimerie G. Gounouilhou.

POULTON (1916): Nest-building instincts of bees of the genera *Osmia* and *Anthidium*. – Proc. R. Ent. Soc. London XXVIII-XXXVIII.

SCHMIEDEKNECHT O. (1885-86): Apidae europaeae (Die Bienen Europa's) per Genera, Species et Varietates, Dispositae atque Descriptae, Tomus II. Genus *Osmia*. – Sumtibus auctoris. Prostat Berolini apud R. Friedländer & filium. (1885), 867-930; (1886), 931-1071, Charts 17.

STANĚK E. (1965): Beitrag zur Kenntnis der Solitärbienen der Gattung *Osmia* PANZ. des westlichen Mediterraneums. – Boll. Ist. Entomol. Univ. Bologna **27** (1964-1965): 193-214.

TKALCŮ B. (1975): Die *Osmia*-Arten der Untergattung *Hemiosmia* subgen. n. (Hymenoptera, Apoidea, Megachilidae). – Acta ent. bohemoslov. **72**: 34-49.

VAN DER ZANDEN G. (1983): Taxonomische und faunistische Bemerkungen zu einigen paläarktischen Bauchsammler-Arten (Insecta, Hymenoptera, Apoidea, Megachilidae). – Faun. Abh. Mus. Tierk. Dresden **10**: 125-139.

VAN DER ZANDEN G. (1987): Neue paläarktische Taxa der Familie Megachilidae (Insecta, Hymenoptera, Apoidea). – Reichenbachia **25**: 73-83.

VAN DER ZANDEN G. (1988): Beitrag zur Systematik und Nomenklatur der paläarktischen Osmiini, mit Angaben über ihre Verbreitung. – Zool. Meded. Leiden **62**: 113-133.

VAN DER ZANDEN G. (1994): Neue Arten und Unterarten, eine neue Untergattung und einige neue Fälle von Synonymie der paläarktischen Bauchsammler (Insecta: Hymenoptera: Apoidea: Megachilidae). – Reichenbachia **30**: 167-172.

WARNCKE K. (1988): Die Bienengattung *Osmia* PANZER, 1806, ihre Systematik in der Westpaläarktis und ihre Verbreitung in der Türkei. 2. und 3.: Die Untergattungen *Tergosmia* und *Exosmia*. – Entomofauna **9**: 389-403.

Author's address:
Prof. Dr. Volker HAESELER,
Carl von Ossietzky Universität, Fakultät V,
Institut f. Biologie und Umweltwissenschaften,
AG Terr. Ökologie, D-26111 Oldenburg, Germany.
e-mail: volker.haeseler@uni-oldenburg.de

Druck, Eigentümer, Herausgeber, Verleger und für den Inhalt verantwortlich:
Maximilian SCHWARZ, Konsulent für Wissenschaft der O.Ö. Landesregierung,
Eibenweg 6, A-4052 Ansfelden, E-Mail: maxschwarz@tele2.at.
Redaktion: Erich DILLER, ZSM, Münchhausenstraße 21, D-81247 München;
Fritz GUSENLEITNER, Lungitzerstr. 51, A-4222 St. Georgen/Gusen;
Wolfgang SCHACHT, Scherrerstraße 8, D-82296 Schöngeising;
Erika SCHARNHOP, Himbeerschlag 2, D-80935 München;
Johannes SCHUBERTH, Mannertstraße 15, D-80997 München;
Emma SCHWARZ, Eibenweg 6, A-4052 Ansfelden;
Thomas WITT, Tengstraße 33, D-80796 München.
Adresse: Entomofauna (ZSM), Münchhausenstr. 21, D-81247 München; Tel. (089) 8107-0, Fax 8107-300.