

Order Hymenoptera, family Ampulicidae

Michael Ohl

INTRODUCTION

Ampulicidae, or cockroach wasps, with reference to their prey, are a small group of digger wasps of mainly tropical distribution. A few species like *Ampulex compressa* (Fabricius, 1781), the ‘emerald cockroach wasp’ or ‘jewel wasp’, are frequently bred in captivity due to its showy metallic colouration and attractive behaviour as a cockroach parasite (e.g. Veltmann & Wilhelm, 1991).

Ampulicidae is considered to represent the sister group to all 30.000+ species of Apoidea (bees and the paraphyletic Sphecidae sensu Bohart & Menke, 1976), or to be one of its basalmost lineages (Ohl & Spahn, 2010). About 200 species are currently known worldwide (Pulawski, 2010), but most parts of the world are in need of taxonomic revisions.

Within Apoidea, Ampulicidae can be readily identified by the combination of bifid or toothed tarsal claws, two midtibial spurs and the hindwing jugal lobe small or even absent. Other distinctive but variable features are the generally elongate body with long, slender legs, which are used for the running-jumping behavior, usually deeply impressed, long notauli, and an elongate, angular propodeum, with posterolateral tooth-like projections. Most *Ampulex* and *Trirogma*, including the Arabian species are distinctive by their blue-purple metallic body colouration. *Dolichurus* and all other ampulicid genera are largely black, in some species with white or red markings.

Many Ampulicidae exhibit a typical running-jumping behavior. They are very swift-moving and are frequently overlooked by collectors. As a consequence, species of Ampulicidae are essentially rare in collections until recently, when improved collecting methods (particularly Malaise traps) have revealed a remarkable amount of material even from remote areas of the world. This was also the case in the UAE and other Arabian countries. As an example, the genus *Dolichurus* has not been recorded from Arabia yet (except for being included in the key to Arabian apoid wasp genera by Guichard, 1986). The insect survey of the United Arab Emirates by A. van Harten resulted in more than 30 specimens of this genus, all collected in Malaise traps.

However, although the number of specimens of *Dolichurus* recently collected in Arabia is rather high as compared to the lack of any previous record, the total number of specimens of the family recorded from Arabia is still quite low. Based on a thorough search for specimens from Arabia in most of the relevant collections of the world and including the rich Malaise trap residues from the UAE provided by A. van Harten, less than 50 specimens of Ampulicidae representing four species could be found in total. Although the relatively small number of specimens from Arabia is likely to be a collecting artefact, the total number of Arabian species of Ampulicidae is probably very low.

MATERIALS AND METHODS

The terminology generally follows Bohart & Menke (1976), with some additions for Ampulicidae by Ohl & Spahn (2004) and particularly for *Dolichurus* by Ohl (2002) and Ohl et al. (2004). The crossvein between submarginal cell I and II in the forewing, which is obliterated in *Ampulex assimilis*, has been named the first intersubmarginal vein by Prentice (1998), which I adopt here.

Digital images were taken und modified using multilayer digital photography (Leica® DFC 490 digital camera on a Leica® Z16 ApoA with the software package Automontage by Syncroscopy®).

The specimens from the UAE are deposited in the California Academy of Sciences, San Francisco, USA (CAS), the personal collection of Christian Schmid-Egger, Berlin, Germany (CSE), the National Natural Historical Museum Naturalis, Leiden, the Netherlands (RMNH), the Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (SDEI), the United Arab Emirates Insect Collection (UAEIC), the Bohart Museum of Entomology, University of California, Davis, USA (UCD), and the Museum für Naturkunde, Berlin, Germany (ZMB).

SYSTEMATIC ACCOUNT

Key to genera and species of Ampulicidae from the Arabian Peninsula

1. Antennal base each with overhanging frontal lobe; lobe with distinct lateral carina. Apex of marginal cell curving away from wing margin. Metasternum Y-shaped with posterior arms markedly elongate. Petiole inserted between and on same level as hindcoxae *Ampulex* **2**
- Antennal bases together overlaid by single frontal platform, which might be medially depressed. Apex of marginal cell ending on wing margin. Metasternum emarginate posteriorly, but not with markedly elongate posterior arms. Petiole inserted above and somewhat behind hindcoxae **3**
2. Forewing with three complete submarginal cells. Mid and hindfemur red. Body length 19–24 mm *Ampulex compressa* (Fabricius)
- First intersubmarginal vein completely or almost completely obliterated, so forewing with apparently two submarginal cells. Legs completely metallic blue. Body length 10–18 mm *Ampulex assimilis* Kohl
3. Black, or black and red. Frontal platform shallowly concave. Forewing submarginal cell I about as long on media as submarginal cell II. Hindwing media diverging before cu-a *Dolichurus arabicus* nov. spec.
- Metallic blue. Frontal platform with markedly deep longitudinal groove. Forewing submarginal cell I on media more than twice as long as II. Hindwing media diverging after cu-a *Trirogma caerulea* Westwood

Genus *Ampulex* Jurine, 1807

Ampulex assimilis Kohl, 1893

Plates 1–2

Ampulex assimilis Kohl, 1893: 464, ♀. Lectotype: ♀, Iraq, Baghdad (NHMW), designated by de Beaumont, 1970: 395. – Morice, 1921: 76 (Iraq: Amara; description of male); de Beaumont, 1961: 2 (Iraq); Bohart and Menke, 1976: 77 (listed); Al-Ali, 1977: 92 (Iraq: Baghdad); Guichard, 1980: 224 (Oman: Rostaq).

Specimens examined: Al-Ajban, 2♂, 17–24.iv.2006, Malaise trap, leg. A. van Harten; 1♂, 9.iv–2.v.2006, Malaise trap, leg. A. van Harten. Hatta, 1♂, 20.x.1981, leg. C.G. Roche; 1♂, 13.xi.1981, leg. C.G. Roche (CAS, not personally examined but confirmed by W.J. Pulawski). OMAN: Northern Oman, Rostaq (Guichard, 1980: 224). Al-Buraimi [followed by "des Alfaya" but partly illegible], 2♀, 25.iv.1992, leg. S. A'Sahmsi (coll. University Muscat). Al-Amraat, 1♀, 15.iii.1990 (coll. University Muscat). Al-Hail, 1♀, 13.ii.1992, leg. A. Kadil (coll. University Muscat). Nizwa Wat., Jabal Al-Akhdar, Saiq, 1♂, 2.vii.1992, leg. H. Al-Nabhani (coll. University Muscat).



Plates 1–2. *Ampulex assimilis* Kohl, male, al-Ajban, UAE. 1: Lateral view; 2: Dorsal view.

Diagnosis: Within Arabian Ampulicidae, *Ampulex assimilis* is unique in having submarginal cells I and II fused, so that the forewing has apparently two submarginal cells only. Additionally, *A. assimilis* is the only Arabian ampulicid with a totally metallic-blue body colouration (tibiae and tarsi might be tinged with black).

Distribution: UAE (new record), Oman, Iraq. Recorded from Oman (Northern Oman, Rostaq) by Guichard (1980: 224)

***Ampulex compressa* (Fabricius, 1781)**

Plates 3–4

Sphex compressus Fabricius, 1781: 445, sex not indicated (as *compressa*, incorrect original termination).

Holotype or syntypes: India: Kerala: Malabar (BMNH).

Ampulex sinensis de Saussure, 1867: 43, ♂. Holotype or syntypes: ♂, China: Hong Kong (NHMW).

Chlorampulex striolata de Saussure, 1892: 446, ♀. Holotype or syntypes: ♀, Tanzania: Zanzibar: no specific locality (MHNG).

Specimens examined: None.

Diagnosis: *Ampulex compressa* can be readily identified by the combination of metallic blue, green or purple body colouration and non-metallic red mid- and hindfemora.

Distribution: Native of the Oriental and perhaps the Ethiopian region. *Ampulex compressa* has been (accidentally or intentionally) introduced to many countries and islands over the world (see e.g. Menke & Yustiz, 1983). However, the Arabian records are within the area of the original distribution.

Previous Arabian records of *Ampulex compressa* are from Yemen (Guiglia, 1964) and Saudi Arabia (Gadallah & Assery, 2004). None of the specimens were available for study, but upon my request, Neveen Gadallah re-examined the specimen from Saudi Arabia and confirmed its identity.

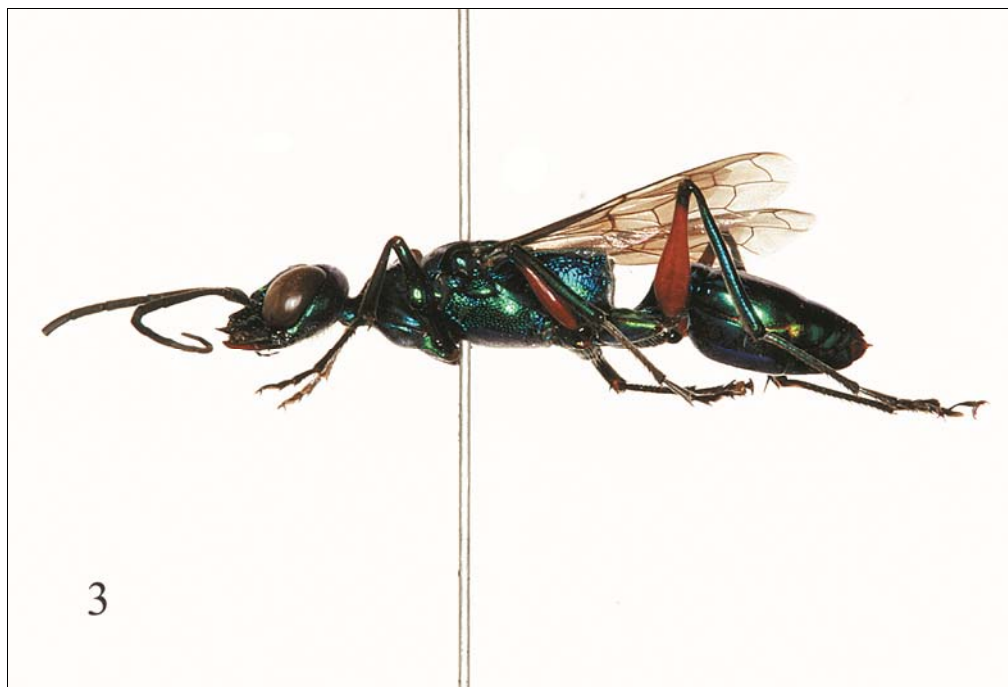
Genus ***Dolichurus*** Latreille, 1809

***Dolichurus arabicus* Ohl nov. spec.**

Plates 5–10

Specimens examined: Holotype: ♂, United Arab Emirates, al-Ajban, 24°36'N 55°01'E, 9.iv–2.v.2006, Malaise-trap, leg. A. van Harten (ZMB). Paratypes: 7♂, same data as holotype; 7♂, 7♀, same data as holotype but 7–28.xii.2005, 26.ii–2.iv.2006, 25.iii–2.iv.2006, 1.iv–2.v.2006, 9–16.iv.2006, 26.vi–25.vii.2006, 25.vii–7.viii.2006, 7–21.viii.2006. 1♀, Hatta, light trap, 8–26.iv.2006, leg. A. van Harten. 2♀, Wadi Madaq, Malaise trap, 19.x–16.xi.2006, 16.xi–26.xii.2006, leg. A. van Harten. 1♂, Bithnah, 19.x–16.xi.2006, Malaise trap, leg. A. van Harten. 3♂, Nakhali, Dubai, 28–30.iv.1984, 10.v.1984, leg. E.A. Sugden; 3♂, same data but 15–18.iv.1984, 25–28.iv.1984, Malaise trap. 2♀, Wadi Bih dam, 24.iii.2009, leg. A. van Harten. 2♂, Wadi Wurayah, 1–8.iv.2009, Malaise trap, leg. A. van Harten. OMAN: Wadi near Al-Ghul, S Nizwa, 22°53.04'N 57°31.12'E, 1♂, 16.xii.2003, leg. M. Ohl. Paratypes in CAS, CSE, RMNH, UAEIC, UCD, and ZMB

Diagnosis: *Dolichurus arabicus* nov. spec. is the only representative of the genus in Arabia. Females can be readily identified by the combination of predominantly orange mandibles, relatively dark tibiae, tarsi and antenna, lower mesopleuron irregularly punctured and with large shining interspaces of more than 1 puncture diameter, and tergum III about half red. The African *D. foroforo* Ohl, Fritz & Neumann, 2004 (Senegal to Ethiopia and Kenya) is most similar, but it has the lower mesopleuron densely, irregularly punctatorugose without markedly developed interspaces, and tergum III only narrowly red (not more than 0.25 tergal length). Additionally, tarsi, tibiae and antenna are markedly orange at least on the ventral face, with the dorsal side darker to a varying extent. In contrast, females of *D. arabicus* have the tibiae, tarsi and antenna pale to dark brown, with the dorsal face even darker.



Plates 3–4. *Ampulex compressa* (Fabricius), female, Indonesia. 3: Lateral view; 4: Dorsal view.

Males of *D. arabicus* have most of the mandibles, the anterior margin of the frontal platform, the antennae and the legs orange-yellow. The pronotal collar has two white markings on the lateral tubercles. This colour pattern is shared with *D. forofofo*, which differs from *D. arabicus* by the vertex punctation which is sparse and shallow in *D. forofofo* (punctures generally more than one diameter apart). In *D. arabicus*, the vertex punctation is also relatively shallow, but much denser (punctures generally less than one diameter apart).

Another species which geographically occurs close to Arabia is *D. haemorrhous* A. Costa, 1886. It was recorded from Gizeh, Egypt, by Pulawski (1964). The female of *D. haemorrhous* has tergum III almost totally black (half red in *D. arabicus*), terga I–III virtually impunctate (terga I–III with lateral patches of dense, coarse punctation), and the face below midocellus markedly sparsely punctate with large shiny areas (face densely punctatorugose throughout, also immediately below midocellus).

Description: Female: Black. The following are orange-yellow: Mandible (tip and base narrowly black), anterior clypeal margin, and about half of metasomal segment III and IV–VI completely. Tibiae, tarsi and antenna pale to dark brown. Forewing yellowish, hindwing almost hyaline. With six pairs of black, prominent macrosetae, one pair each on mandible, lateral portion of clypeus, median lobe of clypeus, on frons at base of frontal platform, on vertex laterally of ocelli, and on pronotal collar. Mandible tridentate. Clypeus almost shiny and asetose (except for macrosetae), free median clypeal lobe rather narrowly protruding, clypeal disk evenly convex, with an indistinct longitudinal median carina. Frons laterally of frontal platform obscured by dense silvery pubescence. Frontal platform broad, about as twice scapal width, anterior and lateral margin markedly bulging and shiny. Scape with sharp, shiny carina on ventral side. Flagellomere I $1.1\text{--}1.2\times$ as long as II, length of flagellomeres II–IV subequal, following flagellomeres becoming progressively shorter. Frons from base of frontal platform to level of lateral ocelli irregularly punctatorugose, rugulae more or less oriented to midocellus. Vertex sparsely and irregularly punctate behind lateral ocelli, punctures becoming markedly denser posterad. Pronotal collar transversely carinate anteriorly, irregularly, shallowly punctured posteromedially. Pronotal tubercle sparsely, shallowly punctured, shiny. Pronotal sides coarsely, longitudinally wrinkled. Scutum and scutellum sparsely punctured, shiny, punctures generally more than 2 diameters apart, denser laterally. Omaular sulcus, acetabular sulcus, sternaulus, and scrobal sulcus coarsely pitted, complete. Omaular and acetabular sulcus accompanied by a carina anteriorly. Metanotum irregularly rugose. Metapleuron shiny, with a few coarse carinae in upper part, in some specimens with faint longitudinal carinulae in lower part. Metapostnotum with five longitudinal carinae, posteriorly delimited by lamellate carina. Propodeal sides with lamellate carina dorsally. Propodeal hindface irregularly, coarsely rugose; laterally delimited by irregular carina, which terminates posteriorly in a tooth-like projection. Tergum I densely punctatorugose laterally, in most specimens markedly larger and closer than lateral punctures on tergum II, which are delimited to a relatively small area. Lateral tergal punctation progressively sparser and shallower from tergum II to IV.

Body length 6.2–8.9 mm; forewing length 3.1–4.6 mm; length-width ratio of flagellomere I 4.8–5.1; ratio of lower to upper interocular width 1.1; ratio of distance between lateral ocellus to eye margin to midocellar diameter 0.9–1.1.

Male: Black. The following are orange-yellow: Mandible (tip and base narrowly black), apical margin of frontal platform, tibiae, tarsi, and antenna. Most specimens with white spot on pronotal tubercle. Forewing yellowish, hindwing almost hyaline.

Mandibular base, clypeus, lower face up to level of frontal platform, and mesosoma with dense, long, white setae, setal length twice midocellar diameter or more. Metapostnotum



Plates 5–6. *Dolichurus arabicus* nov. spec., female paratype, al-Ajban, UAE. 5: Lateral view; 6: Metasoma in dorsal view.



Plates 7–8. *Dolichurus arabicus* nov. spec., male paratype, Oman. 7: Lateral view; 8: Dorsal view.



Plates 9–10. *Dolichurus arabicus* nov. spec., male paratype, Oman. 9: Head from below; 10: Metasoma in dorsal view.

almost asetose, shiny. Metasoma covered with short, white setae, setal length markedly less than one midocellar diameter. Mandible broad, robust, with one large tooth on inner margin. Clypeus shallowly punctate, but sculpture largely obscured by dense white vestiture; with median carina, apically terminating in small, blunt tubercle. Median clypeal lobe broadly, deeply emarginate, emargination laterally terminating in blunt tubercle. Frontal platform as broad as long, irregularly, shallowly sculptured throughout; anterior and lateral margin markedly bulging and shiny. Scape with longitudinal, somewhat rounded carina ventrally. Length of flagellomeres I–III subequal, following flagellomeres becoming progressively shorter. Frons from base of frontal platform to level of midocellus irregularly rugose, rugulae more or less oriented to midocellus. Vertex irregularly punctate behind lateral ocelli, punctures not more than 1.0 diameters apart, punctures shallow posterad. Pronotal collar transversely carinate anteriorly, irregularly, shallowly punctured posteromedially. Pronotal tubercle sparsely, shallowly punctured, shiny. Pronotal sides coarsely, longitudinally carinate toward anterior and posterior margin, shiny medially. Scutum and scutellum coarsely punctured, punctures not more than one diameter apart, interspaces shiny. Omaular sulcus, acetabular sulcus, sternalus, and scrobal sulcus coarsely pitted, complete. Omaular and acetabular sulcus accompanied by a carina anteriorly. Metanotum irregularly rugose. Metapleuron longitudinally carinate in lower part, with a few coarse carinae in upper part. Metapostnotum with five longitudinal carinae, posteriorly delimited by a lamellate carina. Propodeal sides with irregular, lamellate carina dorsally. Propodeal hindface irregularly, coarsely rugose; laterally delimited by irregular carina, which terminates posteriorly in a tooth-like projection. Punctures on tergum I coarse, somewhat irregular, 1–2 diameters apart, generally denser so on tergum II. Tergum III evenly, densely punctate, less than one diameter apart. Sternum III with a strong, transverse carina subapically, sternal area behind carina markedly depressed, finely sculptured, without coarse punctures.

Body length 3.6–5.3 mm; forewing length 2.4–3.5 mm; length-width ratio of flagellomere I 2.6–2.8; ratio of lower to upper interocular width 0.9–1.0; ratio of distance between lateral ocellus to eye margin to midocellar diameter 1.6–1.8.

Distribution: *Dolichurus arabicus* nov. spec. is known from the UAE and Oman.

Derivation of name: The new species is named after its Arabian distribution. It is an adjective in the masculine gender.

***Trirogma caerulea* Westwood, 1841**

(Figs 11–12)

Trirogma caerulea Westwood, 1841: 152, ♂. Holotype or syntypes: ♂, northern India: no specific locality (depository?).

Specimen examined: Sharjah, 22–23.iv.2006, 1♂, light trap, leg. C. Gielis.

Diagnosis: Among all apoid wasps, *T. caerulea* has a unique character combination of a single complete, deeply grooved antennal platform and a metallic-blue overall colouration. The two Arabian species of *Ampulex* have also metallic colour, but each antennal base is covered by a separate overhanging lobe. *Dolichurus arabicus* has also a complete antennal platform, but it is not deeply grooved and the overall colour is black.

Comments: *Trirogma* was included in the key to Arabian sphecid genera by Guichard (1986), although no record of this genus from Arabia has been published yet. *Trirogma* currently includes seven described species from Iraq to Borneo, but *T. caerulea* is regarded as the most widely distributed species. However, *Trirogma* is in need of a taxonomic revision, and *T. caerulea* might in fact be a composite of two or more species.



Plates 11–12. *Trirogma caerulea* Westwood, Sharjah, UAE, male. 11: Lateral view; 12: Dorsal view.

The single specimen from the UAE has been collected in a dry light trap with chloroform as killing agent in the garden of a town house. This is unusual as *T. caerulea* does not show any morphological indication of a nocturnal mode of life (e.g. pale colouration). It cannot be excluded that the specimen was flying early on the day and has been collected incidentally in the light trap.

Distribution: Widespread in the Oriental region, as far west as Iraq (Abdul Rassoul, 1976) and Iran (Ebrahimi, 2008).

ACKNOWLEDGEMENTS

I thank Wojciech J. Pulawski (CAS) for the information on the two males of *Ampulex assimilis* in the collection of the California Academy of Sciences, which were originally in the personal collection of the late C.G. Roche. He also informed me about Michael Prentice' use of the term 'first intersubmarginal cell'. The multifocus photographs have been prepared by Juliette Brauer, Berlin. I am particularly indebted to Toni van Harten for constantly providing me with UAE specimens over the years. Financial support by the German Science Foundation (DFG) for a collecting trip to Oman is acknowledged (OH 81/4).

REFERENCES

- Abdul Rassoul, M.S. (1976): Checklist of Iraq Natural History Museum insects collection. University of Baghdad, Natural History Research Center, Publication No. 30: 1–41.
- Al-Ali, A.S. (1977). Phytophagous and entomophagous insects and mites of Iraq. University of Baghdad, Natural History Research Center, Publication No. 33: 1–143.
- Bohart, R.M. & A.S. Menke (1976): *Sphecid wasps of the World. A generic revision*. University of California Press, Berkeley, Los Angeles, London.
- Beaumont, J. de (1961): Sphecidae de l'Iraq (Hym.). *Opuscula Zoologica*, 56: 1–5.
- Ebrahimi, E. (2008): A contribution to the sphecid wasps of Iran (Hymenoptera: Sphecidae), including first record of six species. *Journal of Entomological Society of Iran*, 28: 93–97.
- Gadallah, N.S. & B.M. Assery (2004): A review of the Sphecidae (with the exception of Larrinae) of the Jeddah region (west of Saudi Arabia), with a checklist of the species known from Saudi Arabia. *Linzer Biologische Beiträge*, 36: 215–239.
- Guichard, K.M. (1980): A preliminary account of the sphecid wasps of Oman (Hymenoptera, Sphecidae). *Journal of Oman Studies, Special Report 2*: 223–232.
- Guichard, K.M. (1986): Hymenoptera: Fam. Sphecidae of Arabia. Key to the Arabian genera of hunting wasps. *Fauna of Saudi Arabia*, 8: 343–351.
- Guiglia, D. (1964): Missione 1962 del Prof. Giuseppe Scortecci nell'Arabia meridionale. Hymenoptera: Tiphidae, Vespidae, Eumenidae, Pompilidae, Sphecidae, Apidae. *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale in Milano*, 103: 305–310.
- Kohl, F.F. (1893): Ueber *Ampulex* Jur. (s.l.) und die damit enger verwandten Hymenopteren-Gattungen. *Annalen des naturhistorischen Hofmuseums in Wien*, 8: 455–516, 3 plates.
- Menke, A.S. & E. Yustiz (1983): *Ampulex compressa* (F.) in Venezuela. *Proceedings of the Entomological Society of Washington*, 85: 180.
- Morice, F.D. (1921): Annotated lists of Aculeate Hymenoptera (except Heterogyna) and Chrysidids recently collected in Mesopotamia and North-West Persia. *The Journal of the Bombay Natural History Society*, 27: 816–828.

- Ohl, M., K. Fritz & S. Neumann (2004): A new Afrotropical species of the wasp genus *Dolichurus* (Hymenoptera: Apoidea, Ampulicidae). *Journal of Hymenoptera Research*, 13: 262–268.
- Ohl, M. & P. Spahn (2010): A cladistic analysis of the cockroach wasps based on morphological data (Hymenoptera: Ampulicidae). *Cladistics*, 26: 49–61.
- Prentice, M.A. (1998): The comparative morphology and phylogeny of sphecid wasps. Unpublished doctoral Dissertation, University of California Berkeley, USA.
- Pulawski, W.J. (1964): Badania nad egipskimi Sphecidae (Hym.) – Etudes sur les Sphecidae (Hym.) d’Egypte. *Polskie Pismo Entomologiczne*, 34: 63–155.
- Veltmann, J. & W. Wilhelm (1991): Husbandry and display of the Jewel wasp, *Ampulex compressa*, and its potential value in destroying cockroaches. *International Zoo Yearbook*, 30: 118–126.

Author’s address:

Dr. Michael Ohl, Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Invalidenstr. 43, D-10115 Berlin, Germany; e-mail: michael.ohl@mfn-berlin.de