



## Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Preface

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During the past 20 decades, many taxonomic and ecological studies were undertaken on different taxa of a fascinating, biologically diverse group of insects, the aculeate wasps, in different areas of the Arabian Peninsula. These wasps comprise all Aculeata, except for the ants (Formicidae) and bees (Anthophila) which are specialized monophyletic groups that have attracted more focused attention across the world. The Arabian studies have been published in the form of scattered articles in various journals, newsletters, book chapters, etc., many being rather obscure and difficult to trace. Recently, the number of such studies has increased as a result of targeted collecting projects. The results of most of these have now been published, making this an opportune time to collect all the available information into a single volume that makes it more accessible to researchers interested in this group of insects. In the process, this provides us an opportunity to estimate the diversity and distributions of aculeate wasps in the Arabian countries. This is also important for the development of the Arabian national collections, especially in aggregating taxonomic changes with their subsequent synonymous forms and pointing out the very many gaps in sampling, so indicating where additional work is needed.

The present project attempts to include all citations of aculeate wasps recorded from the Arabian Peninsula, whether fully identified or not, by involving specialists for each group, some of whom have also taken the opportunity to make new taxonomic or nomenclatural proposals. It begins with an overview dealing with this group of wasps, the biogeography and suggested zoogeographical borders of the Arabian Peninsula, then surveying the wasp diversity in the studied area; a brief biogeographical analysis is also presented, based on reviewing the exact locality data for each wasp species (Gadallah & Brothers 2020a). This is followed by a compilation of 16 papers, each of which discusses and lists all species and subspecies of a particular family recorded from the Arabian Peninsula, their distributions, and the citations for such records. Although it is not geographically located on the Arabian Peninsula, we include the Socotra Archipelago, as it is politically a part of Yemen. The localities cited in some older records are vague (or even uncertain as to relevance), such as ones stating “Arabian Peninsula” or even merely “Arabia”, but these are nevertheless included in the lists; mentions of “Trucial Coast” or similar statements are treated as referring to Oman and the United Arab Emirates. In order to minimize repetition and avoid excessive expansion of the reference lists, the original citations in which the names of the taxa were established have not been provided; such references can generally be ascertained from relevant catalogues or taxonomic publications.

Four papers cover the apooid wasps: Ampulicidae (Gadallah 2020a), Crabronidae (Gadallah 2020b), Heterogynaidae (Gadallah 2020c) and Sphecidae *s.s.* (Gadallah 2020d). Five papers deal with the chrysidoid wasps: Bethyloidea (Gadallah *et al.* 2020a), Chrysididae (Rosa *et al.* 2020), Dryinidae (Olm 2020a), Embolemidae (Olm 2020b) and Sclerogibbidae (Olm 2020c). The vespoid wasps are covered in seven papers: Bradynobaenidae (Gadallah & Brothers 2020b), Mutillidae (Gadallah *et al.* 2020b), Pompilidae (Gadallah *et al.* 2020c), Sapygidae (Gadallah & Brothers 2020c), Scoliidae (Gadallah & Brothers 2020d), Tiphiidae (Gadallah & Brothers 2020e), Vespidae (Carpenter & Gadallah 2020). New taxonomic and/or nomenclatural proposals include three new synonymies in Chrysididae, a new name in Scoliidae, and a new combination in Vespidae. It was found that 1096 species of aculeate wasps have been recorded from the Arabian Peninsula (excluding the unidentified ones), from 251 genera in 16 families and three superfamilies (Apoidea (Spheciformes), Chrysidoidae, and Vespoidea). Most of them have Afro-tropical affinities (46%), followed by the Palearctic species (37%), then the Indo-Malayan (17%). About 29% of

the species have been recorded only from the Arabian Peninsula, and are apparently endemic. Since many regions of the Arabian Peninsula have not been sampled or have only been surveyed for brief periods, these lists are certainly incomplete, even more so for some groups of wasps and countries than others. In particular, Saudi Arabia, one of the largest countries, has largely been ignored for many groups of wasps (Gadallah & Brothers 2020a).

We are very grateful to all of the specialists who authored or co-authored the component papers, often at some personal sacrifice; without their contributions this project would not have been possible. We also wish to acknowledge the assistance of Wojciech Pulawski who read most of the Apoidea (Spheciformes) sections; his comments and suggestions were of great help. We are also grateful to Raymond Wahis for updating the names of some spider-wasp (Pompilidae) species. Sincere gratitude is extended to Mario Boni-Bartalucci for providing us with some papers, and for his invaluable discussion of some issues involving tiphiids. Val McAteer, Librarian of the Royal Entomological Society, was extremely helpful in providing copies of the relevant pages of an obscure book, as was Brigitte Howarth for different books. Many thanks go to Ahmed Soliman for providing us with some articles, and Yusuf Edmardash and Sally Yusuf for their help on some technical issues during the preparation of the cover plate. In addition, the comments and suggestions from the array of reviewers involved, especially Arkady Lelej and Juriya Okayasu, were valuable and helped considerably to improve the quality of the papers.

We thank those who provided the photographs comprising the cover plate, as follows: *Heterogyna* and *Ampulex* (from Soliman *et al.* 2017), *Bembecinus* and *Sceliphron* (from Gadallah *et al.* 2013), *Chrysis* (original photo of live specimen by Huw Roberts), *Trachepyrus* (original photo of live specimen by Felipe Fraga), *Vespa* (original photo of live specimens by Donat Agosti), *Rasnitsynitilla* (original photo by Valery Loktionov), *Stilbum* (original photo by Huw Roberts). *Tachypompilus* (from Schmid-Egger 2017), *Echthrodolphax* (from Olmi 1998).

## References

- Carpenter, J.M. & Gadallah, N.S. (2020) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Vespidae. *Zootaxa*, 4754 (1), 183–191.  
<https://doi.org/10.11646/zootaxa.4754.1.20>
- Gadallah, N.S. (2020a) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Apoidea (Spheciformes), Ampulicidae. *Zootaxa*, 4754 (1), 9–17.  
<https://doi.org/10.11646/zootaxa.4754.1.5>
- Gadallah, N.S. (2020b) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Apoidea (Spheciformes), Crabronidae. *Zootaxa*, 4754 (1), 18–20.  
<https://doi.org/10.11646/zootaxa.4754.1.6>
- Gadallah, N.S. (2020c) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Apoidea (Spheciformes), Heterogynidae. *Zootaxa*, 4754 (1), 21–74.  
<https://doi.org/10.11646/zootaxa.4754.1.7>
- Gadallah, N.S. (2020d) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Apoidea (Spheciformes), Sphecidae. *Zootaxa*, 4754 (1), 75–77.  
<https://doi.org/10.11646/zootaxa.4754.1.8>
- Gadallah, N.S., Al Dhafer, H.M., Aldryhim, Y.N., Fadl, H. & El Gharbawy, A.A. (2013) The digger wasps of Saudi Arabia: New records and distribution, with a checklist of species (Hym.: Ampulicidae, Crabronidae and Sphecidae). *North-western Journal of Zoology*, 9 (2), 345–364.
- Gadallah, N.S., Azevedo, C.O. & Brothers, D.J. (2020a) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Chrysoidea, Bethyloidea. *Zootaxa*, 4754 (1), 78–91.  
<https://doi.org/10.11646/zootaxa.4754.1.8>
- Gadallah, N.S. & Brothers, D.J. (2020a) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Overview. *Zootaxa*, 4754 (1), 6–8.  
<https://doi.org/10.11646/zootaxa.4754.1.4>
- Gadallah, N.S. & Brothers, D.J. (2020b) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Bradynobaenidae. *Zootaxa*, 4754 (1), 132–134.  
<https://doi.org/10.11646/zootaxa.4754.1.14>
- Gadallah, N.S. & Brothers, D.J. (2020c) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Sapygidae. *Zootaxa*, 4754 (1), 154–174.  
<https://doi.org/10.11646/zootaxa.4754.1.17>
- Gadallah, N.S. & Brothers, D.J. (2020d) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Scolidae. *Zootaxa*, 4754 (1), 175–176.  
<https://doi.org/10.11646/zootaxa.4754.1.18>

- Gadallah, N.S. & Brothers, D.J. (2020e) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Tiphiidae. *Zootaxa*, 4754 (1), 177–182.  
<https://doi.org/10.11646/zootaxa.4754.1.19>
- Gadallah, N.S., Lelej, A.S. & Brothers, D.J. (2020b) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Mutillidae. *Zootaxa*, 4754 (1), 135–141.  
<https://doi.org/10.11646/zootaxa.4754.1.15>
- Gadallah, N.S., Schmid-Egger, C. & Brothers, D.J. (2020c) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Vespoidea, Pompilidae. *Zootaxa*, 4754 (1), 142–153.  
<https://doi.org/10.11646/zootaxa.4754.1.16>
- Olmi, M. (1998) A contribution to the knowledge of the Dryinidae (Hymenoptera, Chrysidoidea). *Lambillionea*, 98, 49–59.
- Olmi, M. (2020a) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Chrysidoidea, Dryinidae. *Zootaxa*, 4754 (1), 102–122.  
<https://doi.org/10.11646/zootaxa.4754.1.11>
- Olmi, M. (2020b) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Chrysidoidea, Embolemidae. *Zootaxa*, 4754 (1), 123–129.  
<https://doi.org/10.11646/zootaxa.4754.1.12>
- Olmi, M. (2020c) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Chrysidoidea, Sclerogibbidae. *Zootaxa*, 4754 (1), 130–131.  
<https://doi.org/10.11646/zootaxa.4754.1.13>
- Rosa, P., Gadallah, N.S. & Brothers, D.J. (2020) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Chrysidoidea, Chrysididae. *Zootaxa*, 4754 (1), 92–101.  
<https://doi.org/10.11646/zootaxa.4754.1.10>
- Schmid-Egger, C. (2017) Order Hymenoptera, family Pompilidae. *Arthropod Fauna of the United Arab Emirates*, 6, 350–416.
- Soliman, A.M., Gadallah, N.S., Ohl, M. & Al Dhafer, H.M. (2017) Revision of the digger wasps of the Ampulicidae and Heterogynidae (Hymenoptera) of Saudi Arabia, with the description of a new species of the enigmatic genus *Heterogyna* Nagy. *Journal of Natural History*, 51 (33–34), 2057–2085.  
<https://doi.org/10.1080/00222933.2017.1355492>