

MINIMALIST REVISION AND DESCRIPTION OF 403 NEW SPECIES IN 11 SUBFAMILIES OF COSTA RICAN BRACONID PARASITOID WASPS, INCLUDING HOST RECORDS FOR 219 SPECIES

BY
MICHAEL J. SHARKEY, DANIEL H. JANZEN, WINNIE HALLWACHS, ERIC G. CHAPMAN,
M. ALEX SMITH, TANYA DAPKEY, ALLISON BROWN, SUJEEVAN RATNASINGHAM,
SURESH NAIK, RAMYA MANJUNATH, KATE PEREZ, MEGAN MILTON, PAUL HEBERT,
SCOTT R. SHAW, REBECCA N. KITTEL, M. ALMA SOLIS, MARK A. METZ,
PAUL Z. GOLDSTEIN, JOHN W. BROWN, DONALD L.J. QUICKE,
C. VAN ACHTERBERG, BRIAN V. BROWN, JOHN M. BURNS



ZooKeys 1013 ♦ 2021
Special Issue

<http://zookeys.pensoft.net>

ZooKeys 1013 ♦ 2021

MINIMALIST REVISION AND DESCRIPTION OF 403 NEW SPECIES IN 11 SUBFAMILIES OF COSTA
RICAN BRACONID PARASITOID WASPS, INCLUDING HOST RECORDS FOR 219 SPECIES
Michael J. Sharkey, Daniel H. Janzen, Winnie Hallwachs, Eric G. Chapman, M. Alex Smith, Tanya Dapkey, Allison Brown,
Sujeevan Ratnasingham, Suresh Naik, Ramya Manjunath, Kate Perez, Megan Milton, Paul Hebert, Scott R. Shaw, Rebecca N. Kittel,
M. Alma Solis, Mark A. Metz, Paul Z. Goldstein, John W. Brown, Donald L.J. Quicke, C. van Achterberg, Brian V. Brown, John M. Burns

Keys are given for the New World genera of the following braconid subfamilies: Agathidinae, Braconinae, Cheloninae, Homolobinae, Hormiinae, Ichneutinae, Macrocentrinae, Orgilinae, Proteropinae, Rhysipolinae, and Rogadinae. All of these except for some members of Ichneutinae and Proteropinae attack caterpillars. 416 Costa Rican species of these subfamilies are described or redescribed. Most of the species have been reared and all but 13 are new to science. A consensus sequence of the COI barcodes possessed by each species is employed to diagnose the species, and this approach is justified in the introduction. Most descriptions consist of a lateral or dorsal image of the holotype, a diagnostic COI consensus barcode, the Barcode Index Number (BIN) code with a link to the Barcode of Life Database (BOLD), and the holotype specimen information required by the International Code of Zoological Nomenclature. Three new genera, *Michener* (Proteropinae), *Bioalfa* (Rogadinae), and *Hermosomastax* (Rogadinae) are described and a number of new synonyms and combinations are suggested. Gregarious parasitoidism is recorded for the first time for three braconid subfamilies, Cheloninae (*Chelonus*, 3 species), Hormiinae (*Exasticolus*), and Orgilinae (*Orgilus*).

<http://zookeys.pensoft.net>

For those who want their work rapidly known to the World !

Editor-in-Chief

Terry Erwin
Smithsonian Institution
PO Box 37012, MRC 187, Rm. CE-723
Washington, DC 20013-7012
U.S.A.
E-mail: erwint@si.edu

Managing Editor

Lyubomir Penev
Institute of Biodiversity and Ecosystem Research
Bulgarian Academy of Sciences
Yurii Gagarin Street 2
1113 Sofia, Bulgaria
E-mail: info@pensoft.net

Editorial Board: <http://zookeys.pensoft.net/board>

Focus and Scope

ZooKeys is a peer-reviewed, open-access, rapidly disseminated journal launched to accelerate research and free information exchange in taxonomy, phylogeny, biogeography and evolution of animals. **ZooKeys** aims to apply the latest trends and methodologies in publishing and preservation of digital materials to meet the highest possible standards of the cybertaxonomy era. **ZooKeys** will publish papers in systematic zoology containing taxonomic/faunistic data on any taxon of any geological age from any part of the world with no limit to manuscript size.

ZooKeys will consider for publishing works on the following topics:

- new descriptions of taxa, if they are accomplished with proper diagnoses, keys and/or revision of at least at species group level
- taxonomic revisions of extant (or "recent") and fossil animal groups
- checklists and catalogues
- phylogenetic and evolutionary analyses
- papers in descriptive and/or historical biogeography
- methodology papers
- data mining and literature surveys
- monographs, conspecti, atlases
- collections of papers, Festschrift volumes, conference proceedings

Papers containing identification keys will be accepted with priority. Extensive manuscripts consisting mostly of keys will be considered for publishing as well.

ISBN numbers will be assigned to large monographic papers (i.e., major revisions of taxa), monographs, collections of papers, Festschrift volumes, atlases, checklists, conspecti.

All content is Open Access distributed under the terms of the *Creative Commons Attribution License*, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. Authors are thus encouraged to post the pdf files of published papers on their homepages or elsewhere to expedite distribution.

Editorial Office

Pensoft Publishers
Prof. Georgi Zlatarski 12, 1700 Sofia, Bulgaria. Tel. +359-2-8704281, Fax +359-2-8704282
E-mail: zookeys@pensoft.net

AUTHOR GUIDELINES

Authors are kindly requested to submit their manuscript *only* through the online submission module at <http://zookeys.pensoft.net/>. In case of difficulties with the submission procedure, please contact zookeys@pensoft.net. Full text of author guidelines is available at: <http://zookeys.pensoft.net/about#AuthorGuidelines>

EXCERPTS FROM THE GUIDELINES

BODY TEXT. All papers must be in English, checked by a native English-speaking colleague (if author(s) is/are not native English speaker(s)). Write with precision, clarity, and economy: use the active voice and first person whenever appropriate.

WEB (HTML) LINKS. Authors may include links to other Internet resources in their article. This is especially encouraged in the reference section. When inserting a reference to a web-page, please include the **http://** portion of the address.

CITATIONS WITHIN THE TEXT. Before submitting the manuscript, check each citation in the text against the **References** to ensure that they match exactly. Delete citations from the list if they are not actually cited in the text of the article. Citations in the text should be formatted as follows: (Smith 1990) or (Smith et al. 1998; Brock and Gunderson 2001; Felt 2006).

REFERENCES. It is crucial to properly format the references, because all references will be linked electronically as much as possible to the papers they cite. For all references, list all authors. You can include a **DOI** number for the full-text article as an alternative to or in addition to traditional volume and page numbers. Please use the following style for the reference list:

Published Papers: Polaszek A, Alonso-Zarazaga M, Bouchet P, Brothers DJ, Evenhuis NL, Krell FT, Lyal CHC, Minelli A, Pyle RL, Robinson N, Thompson FC, van Tol J (2005) ZooBank: the open-access register for zoological taxonomy: Technical Discussion Paper. *Bulletin of Zoological Nomenclature* 62: 210-220.

Accepted Papers: Same as above, but "In press" appears instead the page numbers.

Electronic Journal Articles: Mallet J, Willmott K (2002) Taxonomy: renaissance or Tower of Babel? *Trends in Ecology and Evolution* 18 (2): 57-59. doi: 10.1016/S0169-5347(02)00061-7.

Paper within conference proceedings: Orr AG (2006) Odonata in Bornean tropical rain forest formations: Diversity, endemism and applications for conservation management. In Cordero Rivera A (Ed) *Forest and Dragonflies. Fourth WDA International Symposium of Odonatology*, Pontevedra (Spain), July 2005. Pensoft Publishers, Sofia-Moscow, 51-78.

Book chapters: Mayr E (2000) The biological species concept. In: Wheeler QD, Meier R (Eds) *Species Concepts and Phylogenetic Theory: A Debate*. Columbia University Press, New York, 17-29.

Books: Goix N, Klimaszewski J (2007) *Catalogue of Aleocharine Rove Beetles of Canada and Alaska*. Pensoft Publishers, Sofia-Moscow, 166 pp.

Book with institutional author: International Commission on Zoological Nomenclature (1999) *International code of zoological nomenclature. Fourth Edition*. London: The International Trust for Zoological Nomenclature.

PhD thesis: Dalebout ML (2002) *Species identity, genetic diversity and molecular systematic relationships among the Ziphiidae (beaked whales)*. PhD thesis, Auckland, New Zealand: University of Auckland.

Link/URL: BBC News: Island leopard deemed new species. <http://news.bbc.co.uk/> [accessed 3.VI.2008]

CITATIONS OF PUBLIC RESOURCE DATABASES: It is highly recommended all appropriate datasets, images, and information to be deposited in public resources. Please provide the relevant accession numbers (and version numbers, if appropriate). Accession numbers should be provided in parentheses after the entity on first use. Examples of such databases include,

but are not limited to:

- Zoobank (www.zoobank.org),
- Morphbank (www.morphbank.net),
- Genbank (www.ncbi.nlm.nih.gov/Genbank),
- BarCode (www.barcodinglife.org)

Providing accession numbers allows linking to and from established databases and integrates your article with a broader collection of scientific information. Please list all accession numbers directly **after the References**.

INTERNATIONAL CODE FOR ZOOLOGICAL NOMENCLATURE. **ZooKeys** will publish papers only strictly following the rules of the 4th edition of the *International Code of Zoological Nomenclature*. Each first mentioning of an animal species name within the text must be provided with author(s)' name(s). Year of publication of animal species is recommended to be given in taxonomic revisions with providing full referencing of original description in the list of references.

OPEN ACCESS FEES. Publication fees in open access journals ensure a barrier-free distribution of your paper at no charge for the readers and include costs involved in processing, formatting, publishing, indexing and archiving your paper.

The journal charges Open Access Publication Fee (see Article Processing Charges: <http://zookeys.pensoft.net/about#ArticleProcessingCharges>). Publication fees for larger papers will be discounted and can be negotiated with the Managing Editor.

Open Access Publication Fees are usually covered by institutional funds and grants. Discounts/waivers can be requested by private and retired zoologists, scientists from low- and middle-level income countries, post-graduate students, especially in case of exceptionally good manuscripts.

Discounts will be offered also to scientists who actively participate in the reviewing and editing process.

PRINTED VERSION. Offprints and printed issues of the journal can be purchased additionally (see journal's website). For standing orders/subscriptions please contact the Managing Editor.