



Zootaxa 3854 (1): 001–104
www.mapress.com/zootaxa/

Copyright © 2014 Magnolia Press

Monograph

ISSN 1175-5326 (print edition)

ZOOTAXA

ISSN 1175-5334 (online edition)

<http://dx.doi.org/10.11646/zootaxa.3854.1.1>

<http://zoobank.org/urn:lsid:zoobank.org:pub:7F874BB5-91EB-41CC-A039-E98E7B53F47C>

ZOOTAXA

3854

Revision of the cricket genus *Cardiodactylus* (Orthoptera, Eneopterinae, Lebinthini): the species from both sides of the Wallace line, with description of 25 new species

TONY ROBILLARD^{1,4}, ANDREJ V. GOROCHOV², SIMON POULAIN¹ & YAYUK R. SUHARDJONO³

¹Muséum national d'Histoire naturelle, Institut de Systématique, Evolution, Biodiversité, ISYEB, UMR 7205 CNRS MNHN UPMC EPHE, CP 50 (Entomologie), 75231 Paris Cedex 05, France

²Zoological Institute, Russian Academy of Sciences, Universitatskaya Emb. 1, Saint Petersburg 199034, Russia

³Zoological Museum, Cibinong Science Center - LIPI, Jl. Raya, Jakarta- Bogor, Indonesia

⁴Corresponding author. E-mail: tony.robillard@mnhn.fr



Magnolia Press
Auckland, New Zealand

Accepted by D. Rentz: 19 Jun. 2014; published: 20 Aug. 2014

TONY ROBILLARD, ANDREJ V. GOROCHOV, SIMON POULAIN & YAYUK R. SUHARDJONO

Revision of the cricket genus *Cardiodactylus* (Orthoptera, Eneopterinae, Lebinthini): the species from both sides of the Wallace line, with description of 25 new species

(*Zootaxa* 3854)

104 pp.; 30 cm.

20 Aug. 2014

ISBN 978-1-77557-475-0 (paperback)

ISBN 978-1-77557-476-7 (Online edition)

FIRST PUBLISHED IN 2014 BY

Magnolia Press

P.O. Box 41-383

Auckland 1346

New Zealand

e-mail: zootaxa@mapress.com

<http://www.mapress.com/zootaxa/>

© 2014 Magnolia Press

All rights reserved.

No part of this publication may be reproduced, stored, transmitted or disseminated, in any form, or by any means, without prior written permission from the publisher, to whom all requests to reproduce copyright material should be directed in writing.

This authorization does not extend to any other kind of copying, by any means, in any form, and for any purpose other than private research use.

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

Table of contents

Abstract	3
Introduction	4
Material and methods	4
Systematic part	8
Subfamily Eneopterinae Saussure, 1874	8
Tribe Lebinthini Robillard, 2004	8
Genus <i>Cardiodactylus</i> Saussure, 1878	8
Classification	9
Species group <i>Novaeguineae</i> Otte, 2007a	9
Species group Efordi Otte, 2007a	9
List and distribution of <i>Cardiodactylus</i> species per island [country] in the region under study	10
List of species by alphabetic order	12
<i>Cardiodactylus borneoe</i> Robillard & Gorochov, n. sp.	12
<i>Cardiodactylus buru</i> Gorochov & Robillard, n. sp.	25
<i>Cardiodactylus celebae</i> Robillard, n. sp.	27
<i>Cardiodactylus contrarius</i> Gorochov, n. sp.	29
<i>Cardiodactylus doloduo</i> Gorochov, n. sp.	31
<i>Cardiodactylus empagatao</i> Otte, 2007a	33
<i>Cardiodactylus erniae</i> Robillard & Gorochov, n. sp.	33
<i>Cardiodactylus floresiensis</i> Robillard, n. sp.	36
<i>Cardiodactylus fruhstorferi</i> Gorochov & Robillard, n. sp.	40
<i>Cardiodactylus guttulus</i> (Matsumura, 1913)	42
<i>Cardiodactylus halmahera</i> Gorochov & Robillard, n. sp.	45
<i>Cardiodactylus jdoeria</i> Robillard, n. sp.	47
<i>Cardiodactylus kondoi</i> Otte, 2007a	49
<i>Cardiodactylus kotandora</i> Robillard, n. sp.	53
<i>Cardiodactylus lampongsi</i> Robillard & Gorochov, n. sp.	57
<i>Cardiodactylus loboae</i> Robillard, n. sp.	61
<i>Cardiodactylus lombrinjani</i> Robillard, n. sp.	63
<i>Cardiodactylus muiri</i> Otte, 2007a	68
<i>Cardiodactylus muria</i> Robillard, n. sp.	70
<i>Cardiodactylus obi</i> Gorochov & Robillard, n. sp.	75
<i>Cardiodactylus oeroe</i> Robillard, n. sp.	77
<i>Cardiodactylus palawan</i> Gorochov, n. sp.	80
<i>Cardiodactylus pelagus</i> Otte, 2007a	82
<i>Cardiodactylus reticulatus</i> Gorochov, n. sp.	84
<i>Cardiodactylus riga</i> Otte, 2007a	86
<i>Cardiodactylus rizali</i> Robillard, n. sp.	86
<i>Cardiodactylus sumba</i> Robillard, n. sp.	89
<i>Cardiodactylus talaudae</i> Robillard, n. sp.	93
<i>Cardiodactylus tangkoko</i> Gorochov, n. sp.	95
<i>Cardiodactylus tello</i> Robillard, n. sp.	97
<i>Cardiodactylus thailandia</i> Robillard, 2011	100
<i>Cardiodactylus variegatus</i> Gorochov & Robillard, n. sp.	100
Acknowledgements	102
References	102

Abstract

The genus *Cardiodactylus* is the most speciose and widely distributed genus of the cricket subfamily Eneopterinae and of the Lebinthini tribe. Along with diverse acoustic features, this genus is also characterized by a wide distribution area running from Japan to Southeast Asia, Northern Australia and in many archipelagos in the Western Pacific, with a high contrast in species distributions. In this paper we start revising *Cardiodactylus* by focusing on the western region of its wide distribution and the *Novaeguineae* species group. We describe 25 new species of *Cardiodactylus*, redescribe 3 species and bring new signalizations for 5 species. Whenever possible, information is provided about species distribution, male calling song and male and female genitalia, forewing venation and habitat.

Key words: Gryllidae, Eneopterinae, *Cardiodactylus*, revision, new species, Wallace line

dark brown spots on rest of these tibiae and on hind tarsi; abdomen with dark brown tergites having lighter spots and with small dark spots on cerci. Structure of body similar to that of female of *C. reticulatus*, dorsal tegminal field with 10 moderately convex longitudinal veins, genital plate intermediate between those of *C. reticulatus* and *C. borneoe* in shape of its apical part, and hind femur 1.3 times as long as ovipositor. Apex of ovipositor with both dorsal and ventral edges denticulate (Fig. 13S).

Female genitalia (Fig. 15I): Copulatory papilla diamond-shaped with wide baso-lateral sclerites; apex barely rounded and sclerotized, only slightly folded ventrally.

Male: Unknown.

Juvenile: Coloration pattern of head and legs close to that of adults; body light brown mottled with dark brown.

Measurements. Length in mm. Body 16.5; body with wings 21; pronotum 2.5; tegmina 12.5; hind femora 13.5; ovipositor 10.5.

Habitat and life history traits. Unknown.

Behavior. Unknown.

Acknowledgements

Field work in South Sulawesi (TR, YS, 2007) was organized by Louis Deharveng (MNHN), Anne Bedos (MNHN) and YS (MZB), with a grant from the PPF "État et structure phylogénétique de la biodiversité actuelle et fossile", MNHN (Philippe Janvier). The 2010 field work session in the Lesser Sunda Islands and Java (2010) was organized by TR (MNHN) and YS (MZB), funded by a grant from ATM "Biodiversité actuelle et fossile", MNHN (Stéphane Peigné & Philippe Janvier). The field work in Luzon, Philippines (2011) was organized by TR (MNHN) and Sheryl Yap (Museum Los Baños), funded by a grant from ATM "Biodiversité actuelle et fossile", MNHN (Stéphane Peigné & Philippe Janvier). We thank Claire Villemant (MNHN), Frédéric Legendre (MNHN), Pablo V. Quilao (Univ. of the Philippines), and Mark V. Yngente (Univ. of the Philippines) for helping collecting crickets. We also thank and Guy Lecorvec for preparation of the specimens, and Gilbert Hodebert (MNHN) for the habitus drawings of *C. oeroe*. We also thank: Judith Marshall and George Beccaloni (BMNH), for their help during the study of Eneopterinae crickets in the Natural History Museum, London, funded by the SYNTHESYS European program (GB-TAF-531); Rob de Vries and Caroline Pepermans (RMNH) for their help during the study in Leiden collections, funded by a grant from the PPF "État et structure phylogénétique de la biodiversité actuelle et fossile", MNHN (Philippe Janvier); Peter Schwendinger and John Hollier (MHNG) for their help during the study of Genève collections; and Oscar Effendi and Erni Ernawati (MZB, Indonesia) for their help during the study of Eneopterine crickets in Cibinong, Indonesia (MZB), and all the other persons helping us in the collection of crickets and in some other aspects. The high speed video recordings and SEM study of the stridulatory files in several species were permitted by a grant from the ATM "Formes possibles, formes réalisées", MNHN (Vincent Bels & Pierre-Henri Gouyon). The work of AG is supported by the Presidium of the Russian Academy of Sciences (Program "Biosphere Origin and Evolution of Geo-biological Systems").

References

- Chopard, L. (1967) *Pars 10. Fam Gryllidae: Subfam. Gryllinae*. Dr.W.Junk N.V., 's Gravenhage, 211 pp.
- Cowie, R.H. & Holland, B.S. (2008) Molecular biogeography and diversification of the endemic terrestrial fauna of the Hawaiian Islands. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 363, 3363–3376.
<http://dx.doi.org/10.1098/rstb.2008.0061>
- Desutter, L. (1987) Structure et évolution du complexe phallique des Gryllidea (Orthoptera) et classification des genres néotropicaux de Grylloidea. Ière partie. *Annales de la Société Entomologique de France (N.S.)*, 23, 213–239.
- Desutter-Grandcolas, L. (2003) Phylogeny and the evolution of acoustic communication in extant Ensifera (Insecta, Orthoptera). *Zoologica Scripta*, 32, 525–561.
<http://dx.doi.org/10.1046/j.1463-6409.2003.00142.x>
- Desutter-Grandcolas, L. (1998) Broad-frequency modulation in cricket (Orthoptera, Grylloidea) calling songs: two convergent cases and a functional hypothesis. *The Canadian Journal of Zoology*, 76, 2148–2163.
<http://dx.doi.org/10.1139/cjz-76-12-2148>

- Eades, D.C., Otte, D. & Naskrecki, P. (2008) Orthoptera Species File Online. Vers 2.0/3.4 [20/04/2008]. Available from: <http://Orthoptera.SpeciesFile.org> (accessed 4 July 2014)
- Eades, D.C., Otte, D., Cigliano, M.M. & Braun, H. (2013) Orthoptera Species File. Version 5.0/5.0. [26/05/2013]. Available from: <http://Orthoptera.SpeciesFile.org> (accessed 4 July 2014)
- Glor, R.E. (2010) Phylogenetic Insights on Adaptive Radiation. *Annual Review of Ecology, Evolution, and Systematics*, 41, 251–270.
<http://dx.doi.org/10.1146/annurev.ecolsys.39.110707.173447>
- Gorochov, A.V. (1986a) On system and morphological evolution of the cricket family Gryllidae (Orthoptera) with description of new taxa. Communication 1. *Zoologicheskij Zhurnal*, 65 (4), 516–527.
- Gorochov, A.V. (1986b) On system and morphological evolution of the cricket family Gryllidae (Orthoptera) with description of new taxa. Communication 2. *Zoologicheskij Zhurnal*, 65 (6), 851–858.
- Gorochov, A.V. (1995a) System and evolution of the suborder Ensifera (Orthoptera). Part 1. *Proceedings of the Zoological Institute of RAS*, 260, 1–224.
- Gorochov, A.V. (1995b) System and evolution of the suborder Ensifera (Orthoptera). Part 2. *Proceedings of the Zoological Institute of RAS*, 260, 1–213.
- Gorochov, A.V. (2002) Taxonomy of Podoscirtinae (Orthoptera: Gryllidae). Part 1: the male genitalia and Indo-Malayan Podoscirtini. *Zoosystematica Rossica*, 2001, 10 (2), 303–350.
- Hall, R. (2002) Cenozoic geological and plate tectonic evolution of SE Asia and the SW Pacific: computer-based reconstructions, model and animations. *Journal of Asian Earth Science*, 20, 353–431.
[http://dx.doi.org/10.1016/s1367-9120\(01\)00069-4](http://dx.doi.org/10.1016/s1367-9120(01)00069-4)
- Ichikawa, A. (1999) On the scientific name of "Madara-korogi" of the Ryukyu Islands. *Tettigonia*, 1, 105–106.
- Ichikawa, A., Kano, Y., Kawai, M., Tominago, O. & Murai, T. (2006) *Orthoptera of the Japanese archipelago in color*. Hokkaido University Press, Hokkaido, Japan, xxvi, 688 pp.
- Ito, G. & Ichikawa, A. (2003) Notes on Matsumura's type specimens of Orthoptera. *Insecta Matsumurana, New Series*, 60, 55–65.
- Losos, J.B., Ricklefs, R.E. & MacArthur, R.H. (2010) *The theory of island biogeography revisited*. Princeton University Press, Princeton, 496 pp.
- Ma, L. & Zhang, Y. (2010) New record of the cricket genus *Cardiodactylus* Saussure (Orthoptera, Grylloidea, Eneopterinae) from Hainan Island, China with description of a new species. *Transactions of the American Entomological Society*, 3 + 4, 299–302.
<http://dx.doi.org/10.3157/061.136.0313>
- Oshiro, Y., Sakai, T. & Oshiro, T. (1981) Studies on the singing insects in the Ryukyu Islands. Part 5. Life history of the spotted tree cricket, *Cardiodactylus novaeguineae* Haan (Orthoptera: Gryllidae) in Okinawa Island. *The Biological Magazine Okinawa*, 19, 25–32.
- Oshiro, Y. (1995) *Studies on the Gryllidae from the Ryukyu Islands*. Nakimushikai, Okinawa, 131 pp.
- Otte, D. (1994) *Orthoptera species file. 1. Crickets (Grylloidea)*. Orthopterists's Society and the ANSP, Philadelphia, Pennsylvania, 120 pp.
- Otte, D. (2007a) New species of *Cardiodactylus* from the western Pacific region (Gryllidae: Eneopterinae). *Proceedings of the Academy of Natural Sciences of Philadelphia*, 156, 341–400.
[http://dx.doi.org/10.1635/0097-3157\(2007\)156\[341:nsocft\]2.0.co;2](http://dx.doi.org/10.1635/0097-3157(2007)156[341:nsocft]2.0.co;2)
- Otte, D. (2007b) New cricket genera and species (Orthoptera: Grylloidea) from the Pacific Region deposited in the Bishop Museum, Honolulu. In: Evenhuis, N.L. & Bickel, D.J. (Eds.), *Fiji Arthropods IX*, 94, pp. 21–34.
- Ragge, D.R. (1955) *The wing venation of the Orthoptera Saltatoria*. British Museum (Natural History), London, 159 pp.
- Ragge, D.R. & Reynolds, W.J. (1998) *The songs of the grasshoppers and crickets of Western Europe*. Harley Books, Colchester, England, 612 pp.
- Randell, R.L. (1964) The male genitalia in Gryllinae (Orthoptera: Gryllidae) and a tribal revision. *Canadian Entomologist*, 96 (12), 1565–1607.
<http://dx.doi.org/10.4039/ent961565-12>
- Robillard, T. (2006) Phylogenetic systematics of *Pseudolebinthus*, a new genus of Eneopterinae crickets (Orthoptera, Grylloidea, Eneopteridae) from south-east Africa. *Systematic Entomology*, 31, 671–683.
<http://dx.doi.org/10.1111/j.1365-3113.2006.00347.x>
- Robillard, T. (2009) Eneopterinae crickets (Orthoptera, Grylloidea) from Vanuatu. *Zoosystema*, 31, 577–618.
<http://dx.doi.org/10.5252/z2009n3a11>
- Robillard, T. (2011) *Centuriarius* n. gen., a new genus of Eneopterinae crickets from Papua (Insecta, Orthoptera, Grylloidea). *Zoosystema*, 33, 49–60.
<http://dx.doi.org/10.5252/z2011n1a2>
- Robillard, T. (2014) Review and revision of the century-old types of *Cardiodactylus* crickets (Grylloidea, Eneopterinae, Lebinthini). *Zoosystema*, 36 (1), 101–125.
<http://dx.doi.org/10.5252/z2014n1a7>
- Robillard, T. & Desutter-Grandcolas, L. (2004a) Phylogeny and the modalities of acoustic diversification in extant Eneopterinae (Insecta, Orthoptera, Grylloidea, Eneopteridae). *Cladistics*, 20 (3), 271–293.

- <http://dx.doi.org/10.1111/j.1096-0031.2004.00025.x>
- Robillard, T. & Desutter-Grandcolas, L. (2004b) High-frequency calling in Eneopterinae crickets (Orthoptera, Grylloidea, Eneopteridae): an adaptive radiation revealed by phylogenetic analysis. *Biological Journal of the Linnean Society*, 83, 577–584.
<http://dx.doi.org/10.1111/j.1095-8312.2004.00417.x>
- Robillard, T. & Desutter-Grandcolas, L. (2004c) Evolution of acoustic communication in crickets: phylogeny of Eneopterinae reveals an adaptive radiation involving high-frequency calling (Orthoptera, Grylloidea, Eneopteridae). *Anais da Academia Brasileira de Ciências*, 76, 297–300.
<http://dx.doi.org/10.1590/s0001-37652004000200018>
- Robillard, T. & Desutter-Grandcolas, L. (2008) Clarification of the taxonomy of extant crickets of the subfamily Eneopterinae (Orthoptera: Grylloidea; Gryllidae). *Zootaxa*, 1789, 66–68.
- Robillard, T. & Desutter-Grandcolas, L. (2011a) Evolution of calling songs as multicomponent signals in crickets (Orthoptera: Grylloidea: Eneopterinae). *Behaviour*, 148 (5–6), 627–672.
<http://dx.doi.org/10.1163/000579511x572044>
- Robillard, T. & Desutter-Grandcolas, L. (2011) The complex stridulatory behavior of the cricket *Eneoptera guyanensis* Chopard (Orthoptera: Grylloidea: Eneopterinae) *Journal of Insect Physiology*, 57, 694–703.
<http://dx.doi.org/10.1016/j.jinsphys.2011.02.005>
- Robillard, T., Grandcolas, P. & Desutter-Grandcolas, L. (2007) A shift toward harmonics for high-frequency calling shown with phylogenetic study of frequency spectra in Eneopterinae crickets (Orthoptera, Grylloidea, Eneopteridae). *Canadian Journal of Zoology*, 85 (12), 1264–1275.
<http://dx.doi.org/10.1139/z07-106>
- Robillard, T. & Ichikawa, A. (2009) Redescription of two *Cardiodactylus* species (Orthoptera, Grylloidea, Eneopterinae): the supposedly well-known *C. novaeguineae* (Haan, 1842), and the semi-forgotten *C. guttulus* (Matsumura, 1913) from Japan. *Zoological Science*, 26, 878–891.
<http://dx.doi.org/10.2108/zsj.26.878>
- Robillard, T., Montealegre, Z.F., Desutter-Grandcolas, L., Grandcolas, P. & Robert, D. (2013) Mechanisms of high-frequency song generation in brachypterous crickets and the role of ghost frequencies. *Journal of Experimental Biology*, 216, 2001–2011.
<http://dx.doi.org/10.1242/jeb.083964>
- Robillard & Yap (2014)—submitted.
- Shiraki, T. (1930) Orthoptera of the Japanese Empire, Part I. (Gryllotalpidae and Gryllidae). *Insecta Matsumurana*, 4, 181–252.
- Specht, R. (2009). Avisoft-SASLab Pro: Sound Analysis and Synthesis Laboratory. Avisoft Bioacoustics, Berlin.
- Tan, M.K. & Robillard, T. (2014) A new species of *Cardiodactylus* (Orthoptera: Grylloidea: Eneopterinae) from Singapore. *Zootaxa*, 3764 (3), 364–376.
<http://dx.doi.org/10.11646/zootaxa.3764.3.6>
- Watari, Y., Takatsuki, S. & Miyashita, T. (2008) Effects of exotic mongoose (*Herpestes javanicus*) on the native fauna of Amami-Oshima Island, southern Japan, estimated by distribution patterns along the historical gradient of mongoose invasion. *Biological Invasions*, 10, 7–17.
<http://dx.doi.org/10.1007/s10530-007-9100-6>