Zootaxa 3797 (1): 029–038
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3797.1.6
http://zoobank.org/urn:lsid:zoobank.org:pub:9A650252-080A-4A5B-875B-3689DE5EAEB1

Four new species of *Ciulfina* Giglio-Tos, 1915 (Mantodea: Liturgusidae, Liturgusinae) from the Northern Territory, Australia

GREGORY I. HOLWELL
School of Biological Sciences, The University of Auckland, Private Bag 92019, Auckland, 1142, New Zealand.
E-mail: g.holwell@auckland.ac.nz.

Abstract

The praying mantid genus Ciulfina Giglio-Tos includes many small, gracile tree-trunk dwelling species found throughout northern Australia. Four new species of Ciulfina: C. annecharlotteae, C. herbersteinae, C. ianrichardi, and C. terrymariceae are formally described on the basis of male genital morphology.

Key words: Mantodea, Liturgusidae, *Ciulfina*, praying mantis

Introduction

The genus *Ciulfina* Giglio-Tos 1915 (Mantodea: Liturgusidae) includes five described species from Australia: *Ciulfina biseriata* Westwood 1889, *Ciulfina liturgusa* Giglio-Tos 1915, *Ciulfina baldersoni* Holwell, Ginn & Herberstein 2007, *Ciulfina klassi* Holwell, Ginn & Herberstein 2007 and *Ciulfina rentzi* Holwell, Ginn & Herberstein 2007. External morphology is highly conservative in members of this genus. Whereas females are indistinguishable based on genitalia (Holwell *et al*. 2007), male genital structures are complex and highly species-specific. Balderson (1978*)* made extensive observation on genital variation within this genus and suggested that more than 17 species might exist. The historical taxonomic literature for *Ciulfina* is confusing and is discussed in detail in Holwell *et al.* (2007a). Of particular note is the uncertain taxonomic status of *C. liturgusa*, which still remains to be adequately described such as to allow distinction from other described species. The holotype of *C. liturgusa* currently lacks genitalia, and thus the only reliable suite of characters for species diagnosis is missing. The type locality is 'Cape York', a very large area. The species diagnosis for *C. liturgusa* uses only size and colouration, both of which are not reliable for species delimitation in this genus (Holwell *et al.* 2007a)

Members of *Ciulfina* occur throughout northern Australia, often at relatively high densities (Holwell *et al*. 2007a) and are frequently observed moving agilely on tree trunks in various habitats such as rainforest, woodlands, urban parks, roadside vegetation and mangroves (Hill *et al*. 2004; O'Hanlon & Holwell 2009, 2011). *Ciulfina* species are small (24-38 mm), cryptic predators that actively hunt a variety of arthropod prey, showing fidelity to particular trees (O'Hanlon 2011). Unlike many Mantodea, *Ciulfina* do not use airborne sex pheromones and do not exhibit sexual cannibalism. Instead, males visually inspect trees to find females (Holwell *et al.* 2007b) and mate frequently (Umbers *et al*. 2011). Females remove and consume male spermatophores following copulation (Holwell 2007). Males control the duration of copulation, which differs among species (Holwell 2008a). Variation in genital morphology influences both the duration of copulation and the amount of sperm transferred to females in *C. klassi*, suggesting that sexual selection acts in shaping male genitalia (Holwell *et al*. 2010).

Besides being complex and species-specific, male genitalia of some *Ciulfina* species are remarkable in exhibiting chiral dimorphism. The male genital complex of all Mantodea is asymmetric, with the 'normal' orientation (as described by Balderson 1978), exemplified by the caudal process of the left dorsal phallomere, being directed to the left. While other exceptions occur, such as *Haania doroshenkoi* (Anisyutkin & Gorochov, 2004), the most dramatic departure from this is found in *Ciulfina*, in which some populations exhibit a sinistral orientation (normal), whereas others exhibit dextral genitalia ('reversed' in Balderson 1978; defined as a genital

Accepted by J. Rivers & G.J. Svenson: 11 Mar. 2014; published:21 May 2014

References

Anisyutikin, L.N. & Gorochov, A.V. (2004) *Haania doroshenkoi*, a new species of mantises from Cambodia (Mantina: Mantidae: Thespinae) and a case of mirror symmetry in the structure of the male genitalia of mantises. *Russian Entomological Journal*, 13, 119–122.

Balderson, J. (1978) Reversal of the phallic complex in the genera *Ciulfina* Giglio-Tos and *Stenomantis* Saussure (Mantodea: Mantidae: Iridopteryginae). *Journal of the Australian Entomological Society*, 17, 235–239. http://dx.doi.org/10.1111/j.1440-6055.1978.tb00150.x

Ehrmann, R. (2002) *Mantodea: Gottesanbeterinnen der Welt*. Münster: Natur und Tier Verlag. 519.

Giglio-Tos, E. (1915) Mantidi esotici. generi e specie nuove. *Bulletin of the Society for Entomology Italy,* 46, 31–108.

Giglio-Tos, E. (1919) Saggio di una nuova classificazione dei Mantidi. *Bulletin of the Society for Entomology Italy,* 49, 50–87.

Hill, P.J.B., Holwell, G.I., Goth, A. & Herberstein, M.E. (2004) Preference for habitats with low structural complexity in the praying mantid *Ciulfina* sp. (Mantidae). *Acta Oecologica*, 26, 1–7. http://dx.doi.org/10.1016/j.actao.2004.02.002

Holwell, G.I. (2007) Spermatophore feeding and mating behaviour in praying mantids (Mantodea: Liturgusidae). *Journal of Zoology,* 271 (3), 255–260. http://dx.doi.org/10.1111/j.1469-7998.2006.00263.x

Holwell, G.I. (2008a) Male control of copulation duration in *Ciulfina* praying mantids (Mantodea: Liturgusidae). *Ethology, Ecology & Evolution,* 20, 61–70. http://dx.doi.org/10.1080/08927014.2008.9522544

Holwell, G.I. (2008b) Geographic variation in genital morphology in praying mantids (*Ciulfina*: Liturgusidae: Mantodea). *Journal of Zoology,* 276, 108–114. http://dx.doi.org/10.1111/j.1469-7998.2008.00475.x

Holwell, G.I., Ginn, S. & Herberstein, M.E. (2007a) Three new species of *Ciulfina* (Mantodea: Liturgusidae) from north-eastern Australia. *Zootaxa,* 1583, 23–35.

Holwell, G.I., Barry, K.L. & Herberstein, M.E. (2007b) Mate location, antennal morphology, and ecology in two praying mantids (Insecta: Mantodea). *Biological Journal of the Linnean Society,* 91, 307–313. http://dx.doi.org/10.1111/j.1095-8312.2007.00788.x

Holwell, G.I. & Herberstein, M.E. (2010) Genital dimorphism in praying mantids (Mantodea: *Ciulfina*). *Journal of Morphology,* 271, 1176–1184. http://dx.doi.org/10.1002/jmor.10861

Holwell, G.I., Winnick, C., Tregenza, T. & Herberstein, M.E. (2010) Genital morphology influences copulation duration and sperm transfer in a praying mantis *Ciulfina klassi* (Mantodea: Liturgusidae). *Behavioural Ecology & Sociobiology,* 64 (4), 617–625. http://dx.doi.org/10.1007/s00265-009-0879-2

Klass, K.D. (1997) The external male genitalia and the phylogeny of Blattaria and Mantodea. *Bonner Zoologische Monographien*, 42, 1–341.

O'Hanlon, J. (2011) Intraspecific interactions and their effect on habitat utilization by the praying mantid *Ciulfina biseriata* (Mantodea: Liturgusidae). *Journal of Ethology*, 29 (1), 47–54. http://dx.doi.org/10.1007/s10164-010-0220-6

O'Hanlon, J. & Holwell, G.I. (2009) Patterns of praying mantid population density following cyclone disturbance in far north Queensland, Australia. *Australian Journal of Zoology,* 57, 85–88. http://dx.doi.org/10.1071/zo09056

O'Hanlon, J. & Holwell, G.I. (2011) The effect of abrupt habitat edges on populations of the tree-running mantid *Ciulfina klassi* (Mantodea: Liturgusidae). *Insect Conservation and Diversity*, 4, 107–114.

Umbers, K., Holwell, G.I., Stow, A. & Herberstein, M.E. (2011) Molecular evidence for variation in polyandry among praying mantids (Mantodea: *Ciulfina*). *Journal of Zoology*, 284, 40–45. http://dx.doi.org/10.1111/j.1469-7998.2010.00779.x

Westwood, J.O. (1889) *Revisio Insectorum Familiae Mantidarum, speciebus novis aut minus cognitis descriptis et delineatis*. Gurney & Jackson, London, 55 pp.

Winnick, C., Holwell, G.I. & Herberstein M.E. (2009) Internal reproductive anatomy of the praying mantis *Ciulfina klassi* (Mantodea: Liturgusidae). *Arthropod Structure & Development,* 38, 60–69. http://dx.doi.org/10.1016/j.asd.2008.07.002