7-3-2018

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Recommended Citation

Bowles, David E., and Gregory W. Courtney. "Advances in aquatic insect systematics and biodiversity in the Neotropics: introduction." (2018): 89-93.

AQUATIC INSECTS
2018, VOL. 39, NO. 2-3, 89–93
https://doi.org/10.1080/01650424.2018.1487566

Taylor & Francis
Taylor & Francis Group

Advances in aquatic insect systematics and biodiversity in the Neotropics: introduction

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ABSTRACT

The Neotropical Region or Neotropics, contains vast expanses of rain forest and river systems representing some of the most biologically diverse ecosystems on Earth, but much of its resident biota remains undescribed and undocumented, and some of it is at risk of extirpation and extinction. Anthropogenic disturbances, especially deforestation, urbanization, and climate change, threaten the integrity of the Neotropics and its biodiversity. In the Neotropics, freshwater habitats are particularly susceptible to environmental stressors and freshwater species throughout the Neotropics have experienced marked declines greater than those of other groups when compared to marine and terrestrial systems. Advances in taxonomic descriptions, preparation of keys, and faunal assessments will aid future studies as well as conservation efforts.

ARTICLE HISTORY
Received 21 March 2018
Accepted 22 May 2018
First published online
14 December 2018

KEYWORDS
Neotropical Region; systematics; biodiversity; conservation

The Neotropical Region, or Neotropics, occupies portions of Mexico, Central and South America, the Caribbean, and the extreme southern tip of Florida in the United States (Figure 1), and can be subdivided further into several sub-regions and other biologically distinct units (Morrone 2014). This region is known for its vast expanses of rain forest and river systems representing some of the most biologically diverse ecosystems on the Earth. As noted by Tundisi and Matsumura-Tundisi (2008), the Neotropics may contain the greatest number of plants and animals among all biogeographic regions. Anthropogenic disturbances, especially deforestation, urbanisation and climate change, threaten the integrity of the Neotropics and its biodiversity (Millenium Ecosystem Assessment 2005; Cayuela et al. 2012). For example, Kehoe et al. (2017) estimated that upwards of 30% of species richness and 31% of species abundance are at risk of loss in tropical areas due to intensification of agricultural stressors. This is problematic because most Neotropical biodiversity, especially invertebrates, remains undescribed and undocumented, and some of it is at risk of extirpation and extinction (Contrador, Kennedy, and Rozzi 2012).

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Published online 20 Dec 2018

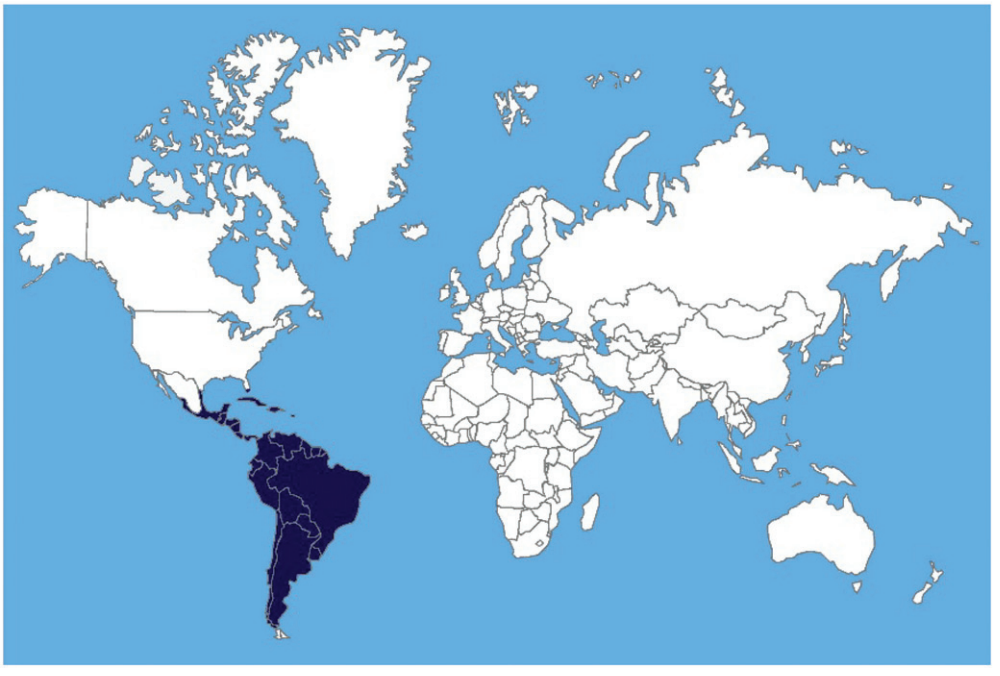

Figure 1. Map showing the location of the Neotropical Region indicated by the shaded area.

Cayuela et al. (2012) indicated that one of the main problems of conservation is the inadequate knowledge of descriptive taxonomy and the distribution of organisms, which is especially true for the Neotropics. Simple logic dictates that the more biodiversity is identified and described, the more likely conservation efforts aimed at protecting it will be successful. Indeed, the first step to effective conservation and development of sound management strategies is having an accurate inventory of the resource. Presently, there is a distinct risk that much of Neotropical biodiversity will be lost before it is described and inventoried. Furthermore, ecosystem services originating in the Neotropics are of immense economic and cultural value (Tundisi and Matsumura-Tundisi 2008; Williams and Williams 2017), and disruption or cessation of those services may yield substantial negative consequences.

Freshwater habitats are particularly susceptible to environmental stressors (Dijkstra, Monaghan, and Pauls 2014) and freshwater species throughout the Neotropics have experienced precipitous declines that are much greater when compared to marine and terrestrial systems (Millenium Ecosystem Assessment 2005). Neotropical aquatic insects have received far less attention than plants and vertebrates, particularly, from a conservation perspective (Contrador et al. 2012). Aquatic insects are a fundamental and important component of Neotropical biodiversity. They are critical to the proper structure and functioning of lentic and lotic ecosystems. Their importance and applicability for assessing environmental stress in those systems as ecological indicators is crucial (Barbour, Gerritsen, Snyder, and Stribling 1999).

The taxonomic, phylogenetic and distributional status of many Neotropical aquatic-insect groups is increasingly improving (e.g., Parfin and Gurney 1956; Penny 1981, 2002; Hogue and Bedoya-Ortiz 1989; Contreras-Ramos 1998, 2005; Flint, Holzenthal,

and Harris 1999; Costa 2000; Förster 2001; Heckman 2002, 2008; Domínguez, Molineri, Pescador, Hubbard, and Nieto 2006; Miller and Spangler 2008; de Souza Amorim 2009; Stark, Froehlich, and Zúñiga 2009; Vidotto-Magnoni and Carvalho 2009; Froehlich 2010; Garrison, von Ellenrieder, and Louton 2010; Megna and Epler 2012; Miller and Montano 2014; Short and García 2014; Liu, Hayashi, and Yang 2015; Short et al. 2015; Toledo and Michat 2015; Toussaint and Short 2016; Short, Cole, and Toussaint 2017). We do not attempt to list all published papers on individual aquatic insect taxa here because doing so would be impractical. Similarly, more ecological studies of aquatic insects are being published (e.g., Sites et al. 2003; Múrria et al. 2015; Ferreira et al. 2017; Gimenez 2017; Parreira de Castro et al. 2018) than we could possibly include here. However, the majority of the Neotropics remains unsurveyed.

This special issue contains nine papers that substantially advance our knowledge of Neotropical aquatic insects. The studies were conducted in Belize, Brazil, Chile, Colombia, Panama, Guyana and the West Indies. Included papers address creeping water bugs (Heteroptera: Naucoridae), lance lacewings (Neuroptera: Osmyliidae), alderflies, dobsonflies and fishflies (Megaloptera), caddisflies (Trichoptera), beetles (Coleoptera: Dryopidae, Hydraenidae) and true flies (Diptera: Blephariceridae, Tanyderidae). The keys, taxonomic descriptions and faunal assessments presented in these papers represent substantial advances in those areas and will aid future studies as well as conservation efforts. In addition to augmenting regional distributional data and producing first descriptions of larval forms, these papers describe one new genus and seven new species. Several more potentially undescribed species are also identified. The information on aquatic insects presented in this issue will better facilitate their use and practical application in water quality assessment, and ecosystem-level studies.

Disclosure statement

The views, statements, findings, conclusions, recommendations and data in this paper are solely those of the authors and do not necessarily reflect views and policies of the U.S. Department of Interior, National Park Service.

Acknowledgements

We thank Taylor & Francis and *Aquatic Insects* for giving us the opportunity to prepare this special issue. In particular, we thank Alison Paskins, Helena Shaverdo, Praise Ann Catubay, Sara Griffiths and William Padgett for their assistance and patience on this project.

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