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Checklist of helminth parasites of Goodeinae (Osteichthyes: Cyprinodontiformes: Goodeidae), an endemic subfamily of freshwater fishes from Mexico

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Abstract

From August 2008 to July 2010, 1,471 fish belonging to the subfamily Goodeinae (representing 28 species) were collected from 47 localities across central Mexico and analyzed for helminth parasites. In addition, a database with all available published accounts of the helminth parasite fauna of goodeines was assembled. Based on both sources of information, a checklist containing all the records was compiled as a necessary first step to address future questions in the areas of ecology, evolutionary biology and biogeography of this host-parasite association. The checklist is presented in two tables, a parasite-host list and a host-parasite list. The checklist contains 51 nominal species, from 34 genera and 26 families of helminth parasites. It includes 8 species of adult digeneans, 9 metacercarie, 6 monogeneans, 3 adult cestodes, 9 metacestodes, 1 adult acanthocephalan, 1 cystacanth, 6 adult nematodes and 8 larval nematodes. Based on the amount of information contained in the checklist, we pose that goodeines, a subfamily of viviparous freshwater fishes endemic to central Mexico, might be regarded as the first group of wildlife vertebrate for which a complete inventory of their helminth parasite fauna has been completed.

Key words: taxonomy, Digenea, Monogenea, Cestoda, Nematoda, Acanthocephala, Mexico

Introduction

Freshwater fish helminth parasites are undoubtedly the best-known group among vertebrate parasites in Mexico (Pérez-Ponce de León & Choudhury 2010). The large number of published papers contributing to the inventory of the helminth parasite fauna of fish hosts, allowed Luque & Poulin (2007) to suggest that Mexico stands out as a hotspot of parasite diversity in freshwater fishes. The helminth parasite fauna of goodeines, a group of viviparous Cypronodontiform fishes, has been intensively studied in Mexico for the last three decades (Pérez-Ponce de León & Choudhury 2010; Garrido-Olvera *et al*. 2011). The entire subfamily Goodeinae is endemic to central and northern parts of Mexico (Domínguez-Domínguez *et al*. 2010). The inventory work of the helminth parasite fauna of this fish subfamily began with Lamothe-Argumedo (1970), who described the digenean *Margotrema bravoae* from the intestine of *Girardinichthys multiradiatus* in the Lerma River. However, it was not until the last 25 years that a series of studies was designed to survey the helminth fauna of this fish group. More than 50 studies have been published regarding some aspects of the helminth parasite fauna of goodeines, including descriptions of new species, local or regional inventories establishing new host and locality records, analyses of parasite community

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both, *Crenichthys* Gilbert, which consists of two species, and *Empetrichthys* Miller, with four species, are endemic to Nevada, U.S., where small populations are found in isolated warm springs (Froese & Pauly 2013). This information is necessary to better understand the historical biogeography and evolutionary history of the helminth parasite fauna of this Nearctic freshwater fish group. Currently, interpretations are made regarding the phylogenetic and biogeographic relationships of goodeines with other members of the freshwater fish fauna in Mexico (see Pérez-Ponce de León and Choudhury, 2005; Pérez-Ponce de León *et al*. 2007; Martínez-Aquino *et al*. 2013). Also, helminth parasites of vertebrates have been used to track the evolutionary history of their hosts (Zietara & Lumme 2002; Nieberding *et al*. 2008; Laetsch *et al*. 2012). Therefore, information about parasites of Empetrichthyinae will represent the keystone to assess further questions about the evolutionary history of the host-parasite association in central and northern Mexico.

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