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# Histozoic myxosporeans infecting the stomach wall of elopiform fishes represent a novel lineage, the Gastromyxidae

Mark A. Freeman<sup>1,2\*</sup> and Árni Kristmundsson<sup>3</sup>

## Abstract

**Background:** Traditional studies on myxosporeans have used myxospore morphology as the main criterion for identification and taxonomic classification, and it remains important as the fundamental diagnostic feature used to confirm myxosporean infections in fish and other vertebrate taxa. However, its use as the primary feature in systematics has led to numerous genera becoming polyphyletic in subsequent molecular phylogenetic analyses. It is now known that other features, such as the site and type of infection, can offer a higher degree of congruence with molecular data, albeit with its own inconsistencies, than basic myxospore morphology can reliably provide.

**Methods:** Histozoic gastrointestinal myxosporeans from two elopiform fish from Malaysia, the Pacific tarpon *Megalops cyprinoides* and the ten pounder *Elops machnata* were identified and described using morphological, histological and molecular methodologies.

**Results:** The myxospore morphology of both species corresponds to the generally accepted *Myxidium* morphotype, but both had a single nucleus in the sporoplasm and lacked valvular striations. In phylogenetic analyses they were robustly grouped in a discrete clade basal to myxosporeans, with similar shaped myxospores, described from gill monogeneans, which are located at the base of the multivalvulid clade. New genera *Gastromyxum* and *Monomyxum* are erected to accommodate these myxosporean taxa from fish and gill monogeneans respectively. Each are placed in a new family, the Gastromyxidae with *Gastromyxum* as the type genus and Monomyxidae with *Monomyxum* as the type genus.

**Conclusions:** To improve modern systematics of the myxosporeans it is clear that a combination of biological, ecological, morphological and molecular data should be used in descriptive studies, and the naming and redistribution of taxa and genera is going to be necessary to achieve this. Here we demonstrate why some *Myxidium*-shaped myxospores should not be included in the family Myxidiidae, and create two new families to accommodate them based on their site of infection, host biology / ecology, DNA sequence data and morphological observations. Subsequent descriptive works need to follow a similar course if we are going to create a prevailing and workable systematic structure for the Myxosporia.

**Keywords:** *Gastromyxum*, Monomyxidae, *Monomyxum*, Elopiformes, Monogenea, Histozoic, Hyperparasite

\* Correspondence: mf33bitw@gmail.com

<sup>1</sup>Ross University School of Veterinary Medicine, Basseterre, St. Kitts, West Indies

<sup>2</sup>Institute of Ocean and Earth Sciences, University of Malaya, Kuala Lumpur, Malaysia

Full list of author information is available at the end of the article