

Fish Nematode *Huffmanella* spp. (Enoplea: Trichinellida: Trichosomoididae)¹

Fauve Wilson and Jennifer L. Gillett-Kaufman²

The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

Huffmanella (Figure 1) is a genus of parasitic nematodes in the family Trichosomoididae.

Huffmanella species infest only one freshwater fish species and a small number of saltwater fishes. They commonly affect many tissues, in particular the swim bladder, gut mucosa, skin, and musculature (Carballo and Navone 2007).

Distribution

Approximately 20 species of *Huffmanella* have been found and described, most of which have been recovered in the egg stage (Justine and Iwaki 2014). *Huffmanella* spp. are found mostly in marine waters. One exception is *Huffmanella huffmanii*, which is found in the swimbladder of the freshwater species *Ambloplites rupestris*, *Micropterus salmoides*, and *Lepomis* spp. from an upper spring run in central Texas (Moravec 1987). Records of *Huffmanella* species have been from the south west Pacific Ocean near New Caledonia (Justine 2007), the Sea of Japan (Moravec et al.

1998), the Pacific coast of Mexico (Moravec and Fajer-Avila 2000), the Ligurian Sea in northern Italy (Moravec and Garibaldi 2000), the North Patagonian Gulfs in Argentina (Carballo and Navone 2007), the Pacific Ocean near Vancouver (Moravec et al. 2005), and the northwest Gulf of Mexico off the coast of Texas (Ruiz and Bullard 2013).

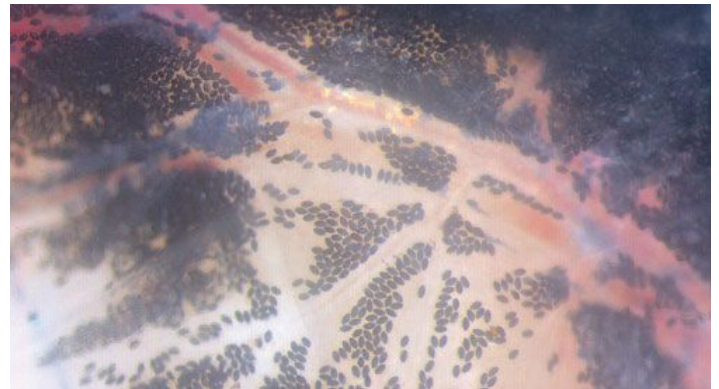


Figure 1. Egg stage of *Huffmanella huffmanii* (Host unknown).
Credits: David Huffman

Life Cycle and Biology

Eggs

Huffmanella eggs are small, measuring approximately 48 to 113 µm in length, and 20 to 54 µm in width (Justine 2011, Ruiz and Bullard 2013). They are typically oval or spindle shaped (Figure 3) (Zd'arská et al. 2001, Ruiz and Bullard 2013). While some eggs have a smooth surface (Ruiz and Bullard 2013), others have a layer of filamentous hairs

1. This document is EENY-744, one of a series of the Department of Entomology and Nematology, UF/IFAS Extension. Original publication date January 2020. Revised June 2024. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication. This document is also available on the Featured Creatures website at <http://entomology.ifas.ufl.edu/creatures>.
2. Fauve Wilson and Jennifer L. Gillett-Kaufman, Extension scientist, Department of Entomology and Nematology; UF/IFAS Extension, Gainesville, FL 32611.

(Justine 2011). Nematode eggs in this genus can vary in color. For example, young eggs of *Huffmanella plectropomi* are typically yellow and as the eggs age they become a darker brown, until becoming black (Justine 2011) as seen in Figure 2. Similarly, *Huffmanella markgracei* eggs range from clear to amber brown (Ruiz and Bullard 2013). The eggs often have layers, including a vitelline layer, chitinous layer, and lipid layer (Zd'árská et al. 2001). While in the egg stage, the larvae become fully developed and then emerge as adults (Moravec 1987). When *Huffmanella* is noticed, it is usually because the flesh that it infects has become apparent due to the darkening of tissue in or around the infected organ (Huffman, 2019).



Figure 2. Eggs of *Huffmanella huffmanii*, infesting the kidney of *Lepomis auratus*.
Credits: David Huffman

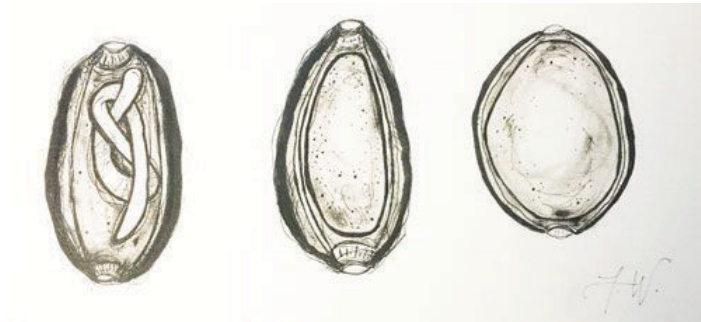


Figure 3. Three egg stages of a *Huffmanella* nematode. The far right egg is recently laid, and the eggs develop from right to left. The middle egg is unlarvated, but has a fully developed shell. The left egg has a fully larvated nematode ready to emerge.
Credits: Fauve Wilson

Adults

The genus *Huffmanella* is comprised of nematodes that have a worm-like shape in the adult stage. Both male and female *Huffmanella huffmanii* have a long and very narrow body shape, ranging from 4.69 mm to 7.51 mm (~1/8–1/3 in) as described by Moravec (1987). The width of *Huffmanella* bodies range from 0.024 mm to 0.030 mm (Moravec 1987). Of adults studied, they have a rather smooth body, sometimes with dense but fine striation on both ends of the worm shaped body (Huffman and Moravec 1988).

Little is known about *Huffmanella* life cycles. Only six species of *Huffmanella* are described as adults, and therefore most *Huffmanella* species are described only from the eggs. *Huffmanella* nematodes deposit their eggs in organs that are species-specific to each host (Worsham et al. 2015). No one has been able to successfully hatch *Huffmanella* eggs inside

of a host in a laboratory setting. Either digestion by another animal or natural decomposition of an infected host is necessary for the eggs to come into the environment.

The adult must lay eggs in its host, and those eggs must stay within the host long enough to transition to post infection. Eggs are released from their host after the host dies and releases the eggs through decomposition, or the host is consumed by another fish, that then defecates the eggs that were not digested indicating they have adequately developed protective shells (Figure 4, section B). The eggs then fall into sediment (Figure 4, section C). The developed eggs take different pathways until they are infective. The young eggs that are not fully developed cannot survive past this stage. Eggs without developed larvae that have fully developed shells can survive either in the environment or in the gastrointestinal tract of the new host. As shown in the diagram, the fully larval eggs are already infective to food that potential hosts may consume, as shown in section D of Figure 4 (Moravec 1987). The *Huffmanella* life cycle could be completed within 12 months but may take as long as 36 months (Moravec 1987).

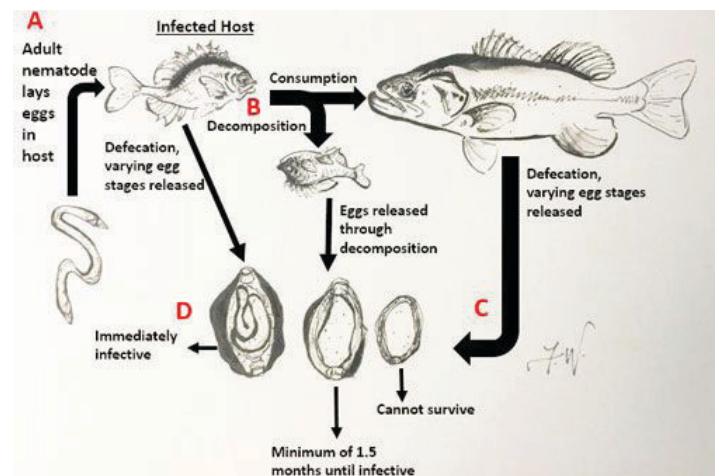


Figure 4. Steps in the life cycle of the species *Huffmanella huffmanii*, the only fresh water *Huffmanella* species known. This figure is based off of the first lab-based life cycle in the genus *Huffmanella*. Figure not to scale.
Credits: Fauve Wilson

Hosts

The genus *Huffmanella* infects many different tissues of some sharks and bony fishes. *Huffmanella* can affect many areas in fish and eel bodies, including the skin, oral cavity, gill openings, spinal column, bone, muscles, and swim bladder (Table 1) (Huffman and Moravec 1988; Moravec et al. 1998; Moravec and Fajer-Avila 2000; Moravec and Garibaldi 2000; Justine 2004; Justine 2005; Justine 2007; Justine 2011; Ruiz and Bullard 2013; Justine and Iwaki 2014).

Continuing Research

There is not much information on species in this genus. Most species of *Huffmanella* have only been described from the egg stage (as noted in Table 1). Aquatic species, particularly the marine species, are difficult to study. Finding the host aquatic species that are infected, collecting, and maintaining the host is difficult to do because maintaining and replicating aquatic environments is challenging.

Selected References

- Carballo M. C., and G. T. Navone. 2007. "A new *Huffmanella* species (Nematoda: Trichosomoididae) parasitizing atherinid fishes in North Patagonian Gulfs, Argentina." *Journal of Parasitology* 93: 377–382.
- Huffman D. G., and F. Moravec. 1988. "First description of adult *Huffmanella huffmanii* Moravec, 1987 (Nematoda: Trichosomoididae) from the swimbladder of centrarchid fishes of the upper San Marcos River, central Texas." *Folia Parasitologica* 35: 227–234.
- Huffman D. G. Personal communication, 26 July 2019.
- Justine J. 2004. "Three new species of *Huffmanella* Moravec, 1987 (Nematoda: Trichosomoididae) from the gills of marine fish off New Caledonia." *Systematic Parasitology* 59: 29–37.
- Justine J. 2005. "*Huffmanella lata* n. sp. (Nematoda: Trichosomoididae: Huffmanellinae) from the shark *Carcharhinus amblyrhynchos* (Elasmobranchii: Carcharhinidae) off New Caledonia." *Systematic Parasitology* 61: 181–184.
- Justine J. 2007. "*Huffmanella* spp. (Nematoda, Trichosomoididae) parasites in coral reef fishes off New Caledonia, with descriptions of *H. balista* n. sp. and *H. longa* n. sp. *Zootaxa* 1628: 23–41.
- Justine J. 2011. "*Huffmanella plectropomi* n. sp. (Nematoda: Trichosomoididae: Huffmanellinae) from the coral grouper *Plectropomus leopardus* (Lacépède) off New Caledonia." *Systematic Parasitology* 79: 139–143.
- Justine J., and T. Iwaki. 2014. "*Huffmanella hamo* sp. n. (Nematoda: Trichosomoididae: Huffmanellinae) from the dagger-tooth pike conger *Muraenesox cinereus* off Japan." *Folia Parasitologica* 61: 267–271.
- Moravec F., B. Koudela, K. Ogawa, and K. Nagasawa. 1998. "Two new *Huffmanella* species, *H. japonica* n. sp. and *H. shikokuensis* n. sp. (Nematoda: Trichosomoididae), from marine fishes in Japan." *The Journal of Parasitology* 84: 589–593.
- Moravec F., and E. Fajer-Avila. 2000. "*Huffmanella mexicana* n. sp. (Nematoda: Trichosomoididae) from the marine fishes *Sphoeroides annulatus* in Mexico." *Journal of Parasitology* 86: 1229–1231.
- Moravec F., and F. Garibaldi. 2000. "*Huffmanella paronai* sp. n. (Nematoda: Trichosomoididae), a new parasite from the skin of swordfish *Xiphias gladius* in the Ligurian Sea (Western Mediterranean)." *Folia Parasitologica* 47: 309–313.
- Moravec F. E., G. A. Conboy, and J. Speare. 2005. "A new trichosomoidid from the skin of *Sebastes* spp. (Pisces) from British Columbia, Canada." *Journal of Parasitology* 91: 411–414.
- Ruiz C. F., and S. A. Bullard. 2013. "*Huffmanella markgracei* sp. n. (Nematoda: Trichosomoididae) from buccal cavity of Atlantic sharpnose shark, *Rhizoprionodon terraenovae* (Carcharhiniformes: Carcharhinidae), in the northwestern Gulf of Mexico off Texas." *Folia Parasitologica* 60: 353–358.
- Zd'árská Z., D. G. Huffman, F. Moravec, and J. Nebesárová. 2001. "Egg shell ultrastructure of the fish nematode *Huffmanella huffmanii* (Trichosomoididae)." *Folia Parasitologica* 48: 231–234.

Table 1. Comprehensive recorded hosts of *Huffmanella* nematodes. The nematode species, host species, location of the host parasitized by the nematodes, and the life stage of the nematodes is included.

<i>Huffmanella</i>	Host	Location parasitized	Parasite life stage described
<i>Huffmanella markgracei</i>	<i>Rhizoprionodon Terraenovae</i> (Atlantic sharpnose shark)	Buccal cavity	Eggs
<i>Huffmanella huffmanii</i>	<i>Lepomis cyanellus</i> (green sunfish), <i>Lepomis macrochirus</i> (bluegill), and <i>Lepomis punctatus</i> (spotted sunfish)	Swimbladder	Eggs and Adults
<i>Huffmanella paronai</i>	<i>Xiphias gladius</i> (swordfish)	Skin	Eggs
<i>Huffmanella lata</i>	<i>Carcharhinus amblyrhynchos</i> (grey reef shark)	Gill opening	Eggs
<i>Huffmanella mexicana</i>	<i>Sphoeroides annulatus</i> (bullseye puffer fish)	Swimbladder	Eggs
<i>Huffmanella plectropomi</i>	<i>Plectropomus leopardus</i> (coral grouper)	Skin	Eggs
<i>Huffmanella ossicola</i>	<i>Bodianus loxozonus</i> , <i>Bodianus busellatus</i> , and <i>Bodianus perdition</i> (hogfishes)	Spinal cord	Eggs
<i>Huffmanella shikokuensis</i>	<i>Stephanolepis cirrifer</i> (thread-sail filefish)	Muscle	Eggs
<i>Huffmanella balista</i>	<i>Abalistes stellatus</i> (triggerfish)	Swimbladder	Eggs and Adults
<i>Huffmanella filamentosa</i>	<i>Gymnocranius grandoculis</i> (blue-lined large-eye bream)	Gill opening	Eggs
<i>Huffmanella branchialis</i>	<i>Nemipterus furcosus</i> (fork-tailed threadfin bream)	Gill opening	Eggs
<i>Huffmanella hamo</i>	<i>Muraenesox cinereus</i> (pike conger)	Muscle	Eggs
<i>Huffmanella japonica</i>	<i>Upeneus bensai</i> (Japanese goatfish)	Skin	Eggs
<i>Huffmanella longa</i>	<i>Gymnocranius grandoculis</i> (blue-lined large-eye bream)	Swimbladder	Eggs
<i>Huffmanella moravecii</i>	<i>Odontesthes smitti</i> , <i>Odontesthes nigricans</i> (silversides)	Fins and Gill Opening	Eggs and Adults
<i>Huffmanella carcharini</i>	<i>Carcharinus melanopterus</i> (blacktip reef shark)	Skin and Gill Mucosa	Eggs
<i>Huffmanella canadensis</i>	<i>Sebastes</i> spp. (rockfish)	Skin	Eggs and Adults