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SHORT COMMUNICATION

PARASITES FROM THE RED LIONFISH, *PTEROIS VOLITANS*, FROM THE GULF OF MEXICO

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INTRODUCTION

Invasion of lionfish from the Indo—Pacific Ocean into the western Atlantic Ocean has recently become the subject for ecological investigation directed at exploring concepts pertaining to host—parasite ecology (Sikkel et al. 2014, Sellers et al. 2015). The potential impact that host—parasite interactions may have on the relative success of lionfish in their new habitat is of particular interest. The value of data analyzed in such ecological investigations is dependent on accurate identification of parasite species, which in turn is dependent on the ability to verify parasite identification with vouchered museum specimens and sequence data. Studies identifying parasites of invasive lionfish in the western Atlantic Ocean that are supported by museum vouchered specimens or published sequence data are limited to 4 reports (Ruiz—Carus et al. 2006, Bullard et al. 2011, Ramos—Ascherl et al. 2015, Claxton et al. 2017), so there is a need to improve the current state of knowledge of parasites of invasive lionfish. This study reports and vouchers some parasites from invasive Red Lionfish from the northern Gulf of Mexico.

MATERIALS AND METHODS

Red Lionfish (*Pterois volitans* [Linnaeus, 1758]) were collected from the Gulf of Mexico between 29 March 2013 and 13 October 2014 (see Table 1). Fish were collected and identified following methods described in Fogg et al. (2013, 2014). Forty—nine fish from a separate life history study of Red Lionfish were opportunistically examined for external parasites (skin, fins, mouth and gills). Twenty—four of the 49 fish were placed on ice after initial external examination and further examined for internal parasites (from the heart and digestive tract) between 12 and 24 h after capture.

Leeches were cold—shocked or recently dead and therefore not relaxed prior to preservation in 70% ethanol. Arthropods were preserved in 70% ethanol. Digeneans and a nematode were removed, fixed using hot water, and preserved in 70% ethanol. Digeneans were stained using aqueous Meyer's hematoxylin, dehydrated through an alcohol series, cleared in methyl salicylate, and mounted in Damar gum.

TABLE 1. *Collections of Red Lionfish,* Pterois volitans, *examined for parasites.*

Collection date	Latitude	Longitude	Bottom habitat	Depth (m)	Number of fish examined	
					External only (n=25)	Internal and external (n=24)
3/29/2013	30.31	-86.60	Artificial	26	1	
6/12/2013	26.68	-83.73	Natural	74	1	
6/13/2013	25.84	-83.61	Natural	70	1	
6/13/2013	25.98	-83.70	Natural	86	1	
6/14/2013	24.65	-83.43	Natural	61	1	
6/15/2013	25.53	-83.18	Natural	59	1	
6/22/2013	28.34	-91.18	Artificial	30	1	
7/1/2013	30.32	-86.58	Natural	26	1	
9/21/2013	27.26	-83.01	Natural	26	1	
10/1/2013	29.69	-87.40	Natural	32	1	
10/13/2013	30.19	-86.43	Natural	30	1	
12/3/2013	29.97	-87.21	Artificial	34	3	
2/25/2014	30.15	-86.94	Natural	35		6
3/21/2014	30.18	-86.86	Natural	36	1	5
4/12/2014	27.45	-83.27	Artificial	34		5
4/22/2014	30.04	-87.56	Artificial	32	1	8
4/26/2014	29.59	-88.05	Artificial	44	1	
5/2/2014	30.08	-87.20	Artificial	27	1	
6/10/2014	30.11	-87.25	Artificial	34	3	
6/10/2014	28.71	-84.49	Natural	41	1	
6/18/2014	27.13	-83.31	Natural	42	1	
9/7/2014	29.61	-88.10	Artificial	40	1	
10/13/2014	30.13	-86.04	Natural	28	1	

The nematode was cleared and mounted in warm glycerin jelly for microscopic examination. Arthropods and leeches were directly examined in ethanol and temporarily cleared and examined using lactic acid. Identification of leeches was based on Ingram (1957) and Meyer (1965). Identification of arthropods was based on Richardson (1905), Wilson (1911, 1917), Brusca (1981), Kensley and Schotte (1989), and Williams and Bunkley—Williams (1996).

Two ecological parameters, prevalence and mean intensity of infection (with standard deviation), were calculated for each species of parasite when appropriate. Parasite prevalence is the percentage of fish examined that are infected with a particular parasite species; mean intensity is the mean number of a particular parasite species per individual infected host (Bush et al. 1997). Ecological data were pooled for the entire study area due to the small number of fish examined. Reef habitat type was noted as natural or artificial for each captured fish and its associated parasites. Representative voucher specimens of each species of parasite are deposited in the United States National Museum in the Smithsonian Institution, Washington, D.C., and in the Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi (Table 2).

Results and Discussion

We collected 9 species of parasites during the study. Four of the 9 taxa are reported from the Red Lionfish for the first time (Table 2).

Annelida

A single species of marine leech, *Trachelobdella lubrica* (Grube, 1840) Ingram, 1957, infested the mouth or inner operculum of 10 of 49 fish (Prevalence = 20.4%, Mean intensity = 1.2 ± 0.63). The leech occurred at both natural and artificial reefs. *Trachelobdella lubrica* is known to occur in clear, high—salinity habitats, and infests a wide variety of teleosts over much of the warm Atlantic Ocean, Mediterranean Sea, and Red Sea (Sawyer, 1986). Meyer (1965) redescribed the species based on material from an unidentified serranid fish from western Africa, providing the best available taxonomic description for the species. Williams et al. (1994) reported *T. lubrica* from fishes from the orders Elopiformes, Myctophormes and Perciformes in the Caribbean Sea, and Saglam et al. (2003) and Sanver—Celik and Aydin (2006) reported *T. lubrica* from the Black Scorpionfish, *Scorpaena porcus* Linnaeus, 1758, and the Red Scorpionfish, *Scorpaena scrofa* Linnaeus, 1758, in the Dardanelles of the Aegean Sea. *Trachelobdella lubrica* was reported from lionfish from near Jacksonville, Florida (see Ruiz—Carus et al. 2006, Bullard et al. 2011), and Puerto Rico (Ramos—Ascherl et al. 2015). *Trachelobdella lubrica* is known to infest *P. volitans* in the Red Sea (see Paperna, 1976); consequently, *T. lubrica* is the only known parasite that invasive lionfish share with fish from their native range.

Arthropoda

Three isopod species and 2 copepod species were collected. In all cases, infested fish had a single arthropod parasite. The isopods *Rocinela signata* Schiödte and Meinert, 1879 and *Nerocila acuminata* Schiödte and Meinert, 1881 each infested 4 of 49 fish examined (Prevalences = 8.2%). *Rocinela signata* occurred only on natural reefs (near Sarasota and Pensacola, Florida) while *N. acuminata* occurred

TABLE 2. *Parasites of the Red Lionfish,* Pterois volitans, *from the northern Gulf of Mexico. The location of the parasite on the host and museum accession numbers for representative vouchers are indicted. *Represents a new host record for the parasite. USNM—United States National Museum, Smithsonian Institute, Washington, D.C.; GCRLM—Gulf Coast Research Laboratory Museum, Ocean Springs, MS.*

Parasite Phylum / Class/Subclass / Order / Family / Species	Site on/in host	Museum accession #
Annelida		
Clitellata/Hirudinea		
Rhynchobdellida		
Piscicolidae		
Trachelobdella lubrica	Gill chamber, operculum	USNM 1420607-1420614
Arthropoda		
Malacostraca/Eumalacostraca		
Isopoda		
Aegidae		
Rocinela signata	Mouth, gills, pectoral fin	GCRLM 06577-80
Corallanidae		
*Alcirona krebsii**	External surface, gills	GCRLM 06581-2
Cymothoidae		
*Nerocila acuminata**	Fins, external surface	GCRLM 06573-6
Maxillipoda/Copepoda		
Siphonostomatoida		
Caligidae		
*Caligus lobodes**	External surface	USNM 1420615
Pennellidae		
*Lernaeenicus cf. polyceraus**	Tongue, operculum, mandible muscles	USNM 1420616-7, GCRLM 06583
Nematoda		
Chromadorea/Chromadoria		
Rhabditida		
Raphidascarididae		
Raphidascaris sp.	Intestine	Not deposited
Platyhelminthes		
Trematoda/Digenea		
Plagiorchiida		
Didymozoidae		
Unidentified adult	Inner operculum	USNM 1420618
Hemiuridae		
Lecithochirium floridense	Stomach	GCRLM 06569-72

on a natural reef (near Sarasota, Florida) and artificial reefs (near Mississippi and Alabama). Both of these isopod species are known to be generalist parasites of various fishes in the Gulf of Mexico (Kensley and Schotte 1989). A third isopod species, *Alcirona krebsii* Hansen, 1890, infested the gills of a fish and the external surface of another, both at natural reef sites (near Destin, Florida and near Sarasota, Florida; Prevalence = 4.0%). *Alcirona krebsii* is typically a free—living associate of sponges and corals and is not normally a parasite on fishes; however, Richardson (1905) reported that 2 individuals infested a "Hamlet Grouper" in the Atlantic. The infestation we observed on the Red Lionfish may or may not represent an accidental association. Similarly, Poole (2011) reported that another corallanid isopod specimen belonging in *Excorallana* Stebbing, 1904 infested the gills of *P. volitans* from the Caribbean Sea but members of that genus are also free—living and not normally parasites on fish. Of the 3 isopod species collected, only *R. signata* had been previously reported to infest *P. volitans* in Puerto Rico (Ramos—Ascherl et al. 2015) and Panama (Sellers et al. 2015).

A single adult specimen of the copepod *Caligus lobodes* (Wilson, 1911) Kabata, 1979 infested the skin of a fish from a natural reef near Sarasota, Florida. This copepod was originally described from an infestation from the head of the Great Barracuda, *Sphyraena barracuda* Walbaum, 1792, from the Dry Tortugas, Florida. *Caligus lobodes* is well—known from Great Barracuda in the Caribbean Sea and Gulf of Mexico (see Williams and Bunkley—Williams 1996), and was also reported from *Sphyraena* sp. from the Indian Ocean (Lewis et al. 1969). This represents the first global report of *C. lobodes* from a Red Lionfish. Five specimens of the copepod *Lernaeenicus* cf. *polyceraus* Wilson, 1917 were found embedded in the tongue or musculature associated with the dentary on 5 fish (Prevalence = 10.2%) collected from both natural and artificial reefs (Figure 1). The specimens conform closely to the description of *L. polyceraus* by Wilson (1917), but certain elements of the cephalothorax of each specimen were damaged or removed during collection. Observation of number and size of all swimming legs, which represent key generic features for *Lernaeenicus* Le Sueur, 1824, was not possible, rendering the identification of this species reasonable but tentative. *Lernaeenicus polyceraus* is infrequently reported but known to occur on a variety of fishes in the western Atlantic Ocean. Wilson (1917) described the species on the basis of the holotype from the Atlantic Tomcod, *Microgadus tomcod* (Walbaum, 1792) at Woods Hole, Massachusetts and two paratypes from Red Goatfish (as *Upeneus maculatus*, a junior subjective synonym of the Spotted Goatfish, *Pseudupeneus maculatus* (Bloch, 1793), (see page 992 of Eschmeyer 1998, Eschmeyer and Fong 2016) at Beaufort, North Carolina. Pearse (1947) reported *L. polyceraus* from the Bay Anchovy, *Anchoa mitchilli* (Valenciennes, 1848), the American Eel, *Anguilla rostrata* (Le Sueur, 1817)

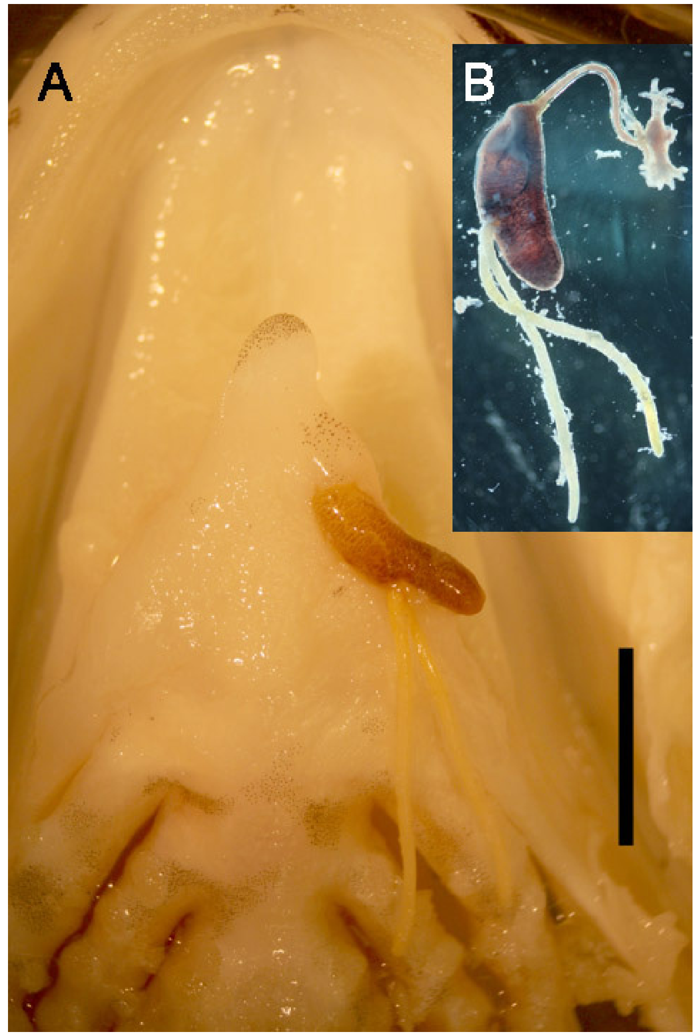

FIGURE 1. Lernaeenicus cf. polyceraus *from the Red Lionfish,* Pterois volitans*, from the northern Gulf of Mexico near Destin, Florida. A. Adult female specimen anchored on the ventral side of tongue. B. Specimen removed from tongue revealing anchored anterior end. Scale bar = 5 mm.*

and the Naked Goby, *Gobiosoma bosc* (Lacepède, 1800), all from Beaufort, North Carolina. Skinner (1978) reported *L. polyceraus* from the Vermilion Snapper, *Rhomboplites aurorubens* (Cuvier, 1829), from near Panama City, Florida. This represents the first global report of *L. polyceraus* from a Red Lionfish.

Nematoda

A single mature female specimen of *Raphidascaris* sp. infected the intestine of 1 fish from a natural reef near Destin, Florida; however, after preliminary identification the specimen was lost. Observed features consistent with *Raphidascaris* Railliet and Henry, 1915 according to Hartwich (1974) were: spines absent on cuticular rings, and an appendix emanated from a ventriculus. The position of the excretory pore was not noted. Ramos—Ascherl et al. (2015) reported adult *Raphidascaris* sp. from the stomach of *P. volitans* in the vicinity of Puerto Rico.

Platyhelminthes

Two species of Platyhelminthes, both adult digeneans, were collected. One was represented by a single specimen belonging in the Didymozoidae Monticelli, 1888 that was embedded beneath the epidermis of the inner opercle of a fish from a natural reef near Sarasota, Florida. The anterior extremity was not intact preventing further identification. Neotorticaecum—type didymozoid metacercaria were reported from the stomach of *P. volitans* in Puerto Rico (see Ramos—Ascherl et al. 2015), but it is not clear if the adult reported herein is conspecific with the larval stage from Puerto Rico. The other digenean species, *Lecithochirium floridense* (Manter, 1934) Crowcroft, 1946, was the most common parasite encountered during the present study. *Lecithochirium floridense* infected the stomachs of 13 of 24 fish (Prevalence = 54.2%, Mean intensity = 7.7 ± 5.92), from both natural and artificial reefs. *Lecithochirium floridense* is a common generalist stomach parasite of teleosts in the western Atlantic Ocean, where it is known to infect perhaps as many as 60 species of pelagic and reef—oriented fishes, including the Red Lionfish (Bullard et al. 2011). Based on high prevalence of *L. floridense* reported in this and recent studies of invasive lionfish parasites, *L. floridense* represents the most successful parasite colonizer of Red Lionfish in the western Atlantic Ocean (Bullard et al. 2011; Ramos—Ascherl et al. 2015; Sellers et al. 2015; Claxton et al. 2017). The present study confirms what common sense would predict: only generalist parasites are found in invasive Red Lionfish in the Gulf of Mexico and no exotic parasites have been detected thus far.

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