Veterinary Parasitology 210 (2015) 186–193

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Rapid infection and proliferation of dactylogyrid monogeneans on gills of spotted rose snapper (*Lutjanus guttatus*) after transfer to a sea-cage

Lilia C. Soler-Jiménez [a,b,1], Francisco N. Morales-Serna [b,c], Emma J. Fajer-Ávila [b,*]

[a] Posgrado en Ciencias del Mar y Limnología, Unidad Mazatlán, Universidad Nacional Autónoma de México
[b] Laboratorio de Parasitología, Centro de Investigación en Alimentación y Desarrollo, A.C., Unidad Mazatlán en Acuicultura y Manejo Ambiental, Mexico
[c] Cátedras-CONACyT, Mexico

ARTICLE INFO

Article history:
Received 13 January 2015
Received in revised form 26 March 2015
Accepted 2 April 2015

Keywords:
Fish parasite
Helminthes
Aquaculture
Lutjanidae
Marine water

ABSTRACT

Finfish mariculture is typically threatened by parasite and disease outbreaks. Therefore, it is important to identify parasite species of potential risk for this activity. Snappers are valuable food fish worldwide. In the Eastern Pacific, spotted rose snapper (*Lutjanus guttatus* [Steindachner, 1869]) is a firm candidate for sea-cage aquaculture. In the current study, the parasitism of caged *L. guttatus* by dactylogyrids was evaluated for the first time during a complete farming period. Twenty five thousand juvenile fish produced at the Research Center for Food and Development (CIAD, Mazatlan Unit) were reared in a sentinel sea-cage from February to November 2012 in Mazatlan Bay, Mexico. A fish sample ($n = 15$) was obtained every month. Dactylogyrids from the left second gill arch were identified and quantified. A total of 18,704 dactylogyrids distributed in three species, *Euryhaliotrema perezponcei* García-Vargas, Fajer-Ávila and Lamothe-Argumedo, 2008, *E. mehen* (Soler-Jiménez, García-Gasca and Fajer-Ávila, 2012), and *Haliotrematoides guttati* García-Vargas, Fajer-Ávila and Lamothe-Argumedo, 2008 (Monogenea: Dactylogyridae) was found, which were able to infect caged *L. guttatus* since the first month of the farming period. Prevalence of these parasite species was 100% all the time, except for initial low values for *E. mehen* and *H. guttati*. The mean intensity of infection of each dactylogyrid species varied significantly between sampling months. *Euryhaliotrema perezponcei* was the most abundant parasite, reaching the highest mean intensity in May, June and July (154.3, 296.9 and 176.6 parasites/host, respectively). No clear seasonality of infection was observed; however, the influence of the water temperature on the observed infection levels is discussed. There was no mortality, change on behavior or pathological signs. However, given the rapid infection and proliferation of dactylogyrids, particularly *E. perezponcei* on *L. guttaus* reared in a sentinel sea-cage, outbreak of these parasites could be expected when this fish species is cultured on a large scale.

* Corresponding author at: Centro de Investigación en Alimentación y Desarrollo, A.C. Unidad Mazatlán en Acuicultura y Manejo Ambiental, Av. Sábalo Cerritos s/n, Estero del Yugo, C.P. 82010, A.P. 711, Mazatlán, Sinaloa, Mexico. Tel.: +52 669 9898700; fax: +52 669 9898701.
E-mail addresses: efajer@ciad.mx, fajer73@gmail.com (E.J. Fajer-Ávila).
[1] Present address: Centro de Investigación y de Estudios Avanzados del IPN (CINVESTAV-IPN), Unidad Mérida, Mexico.

http://dx.doi.org/10.1016/j.vetpar.2015.04.005
0304-4017/

1. Introduction

Marine fish aquaculture keeps growing globally. Fish of the family Lutjanidae, commonly known as snappers, are abundant in tropical and subtropical marine waters worldwide. These are high-valued fish; but their demand may exceed its supply. Some studies about growth and reproduction of some snappers, such as *Lutjanus analis* (Cuvier, 1828), *Lutjanus campechanus* (Poey, 1860), *Lutjanus peru* (Nichols and Murphy, 1922) and *Lutjanus synagris* (Linnaeus, 1758) (see Masuda et al., 2003; Papanikos et al., 2003, 2008; Miller et al., 2005; Lima-Freitas et al., 2011; Gaitán-Espitia et al., 2013; Moguel-Hernández et al., 2015), have shown their potential for aquaculture in America. In the Eastern Pacific there is an increasing interest in spotted rose snapper (*Lutjanus guttatus* [Steindachner, 1869]) aquaculture since biotechnological studies have shown its suitability for commercial culture (Herrera-Ulloa et al., 2010; Ibarra-Castro and Alvarez-Lajonchère, 2011; Alvarez-Lajonchère et al., 2012). Particularly in Mexico, snapper wholesale prices are among the highest, promoting that wild juvenile snappers are captured and grown in sea-cages on a small scale in different areas of the Pacific coast. However, a pilot-scale marine finfish hatchery is being operated at the Research Center for Food and Development (CIAD) in Mazatlan, Mexico to ensure snapper's juvenile production, mainly *L. guttatus*, to grow in sea-cages (Álvarez-Lajonchère et al., 2007, 2012).

Development of fish aquaculture in sea-cages has been associated with an emergence of parasitic diseases (Nowak, 2007). Particularly, monogenean parasites have been recognised as a serious pathogen in maricultured fish (Whittington, 2005; Ogawa, 2014). These parasites are able to multiply rapidly in closed culture systems with high densities of fish due to its simple and direct life cycle (requires only a single host) (Rohde, 1993). Another important characteristic of these parasites is that they produce eggs with usually long filaments, which easily entangle on the nets of cages facilitating the infection process in caged fish (Ernst et al., 2002; Ogawa, 2002). Infection levels of monogeneans may be related to characteristics of the host, such as size (Lo et al., 1998; Morand et al., 2002), and parasite-specific factors, such as reproductive rates and survival (Tubbs et al., 2005); however, there are also strong influenced by environmental factors (Tinsley and Jackson, 2002). The temperature, for example, is considered as the main abiotic factor that regulates the dynamics of monogeneans, because it has a direct effect on reproductive rates and infectious processes of these parasites (Tinsley and Jackson, 2002; Ogawa, 2014). Additionally, the dissolved oxygen and salinity of the water are also recognised as important environmental factors limiting the distribution of many marine parasites (Rubio-Godoy and Tinsley, 2002; Raymond et al., 2006; Cavaleiro and Santos, 2009).

Monogeneans belonging to the family Dactylogyridae are common gill parasites from marine fish including lutjanids distributed throughout warm seas (Wu et al., 2006). Heavily affected fish by dactylogyrids may die due to asphyxia as a result of gill pathology and interference with the exchange of respiratory gases and ions (Stephens et al., 2003; Del Río-Zaragoza et al., 2010). To the best of our knowledge, there are not records about the occurrence of dactylogyrids on caged *L. guttatus*; however, during a recent survey, five dactylogyrid species (*Euryhaliotrema mehen* [Soler-Jiménez et al., 2012], *E. perezponcei* García-Vargas et al., 2008, *Haliotrematoides guttati* García-Vargas et al., 2008, *H. plectridium* Kritsky and Mendoza-Franco, 2009 and *H. spinatus* Kritsky and Mendoza-Franco, 2009) were found on wild *L. guttatus* (see Soler-Jiménez and Fajer-Ávila, 2012). Therefore, it is necessary to assess the presence and permanence time of dactylogyrids on caged *L. guttatus*. To achieve this goal, we conducted a survey to determine the prevalence and mean intensity of dactylogyrids on *L. guttatus* reared in a sentinel sea-cage, over a 9-month period in Mazatlan Bay, on the Pacific coast of Mexico.

2. Materials and methods

2.1. Sample collection and processing

Twenty five thousand snappers juveniles *L. guttatus* (average weight, 6.88 ± 2.04 g) were placed in a sentinel circular floating sea-cage (4 m in diameter and 3.7 m height) on February 25, 2012. These fish were produced in the pilot tropical marine finfish hatchery of the Research Center for Food and Development (CIAD, Mazatlan Unit). The sea-cage was anchored off the Isla de la Piedra (23°11′10.15″N; 106°24′47.95″W), in Mazatlan Bay, on the northwestern coast of Mexico. This bay is an open coastal ecosystem with approximately 17 km of coastline lacking of finfish farms. Before transfer into the sea-cage, 15 fish were sampled on the sowing day. Fish were then farmed over a 9-month period with a diet specific to snapper (protein 43% and 9% fat) formulated at CIAD Nutrition Lab (Hernández et al., 2013). From March to November, 15 fish were sampled monthly with a pure-seine net and transported alive to the laboratory for parasitological examination within 5 h of capture. Water temperature (Celsius), dissolved oxygen (milligrams per liters), and salinity (parts per thousand) of each sampling month were determined using an YSI meter (85-10FT). Fish were individually anesthetised with 0.5 ml L^{-1} of 2-phenoxyethanol (Sigma, St. Louis, MO, USA), measured (total length, TL) and weighed (wet weight). Fulton's condition factor (K) was calculated to assess the general condition of the fish using the following formula:

$$K = (100 \times W)/L^3,$$

where W is total body weight (grams) and L is standard length (centimeters).

The preference of dactylogyrids by the second gill arch of *L. guttatus* has previously been reported (Soler-Jiménez and Fajer-Ávila, 2012). In this study, therefore, the left second gill arch was isolated and carefully inspected in a Petri dish by using a stereomicroscope (Leica Microsystems, Wetzlar, Germany) with a total magnification of ×40. Dactylogyrid individuals were quantified and identified to species level. For this, each individual was isolated, placed on a slide with a drop of water, and covered with a cover slip for temporary observation at the compound microscope (Olympus BX-51). The species identification was based on