Prevalence and histopathologic study of *Lernaea* spp. (Maxillopoda: Lernaeidae) in *Cyprinus carpio* fish in Sistan and Baluchestan, Southeast Iran

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**Abstract.** *Lernaea* spp. are freshwater parasites that are a source of parasitic disease in fish. The main objective of this study was to determine the prevalence and pathology of Lernaeid parasites of *Cyprinus carpio* fish from Chahnimeh lakes in Sistan and Baluchestan, Southeast of Iran, from October 2014 to September 2015. For this purpose, 1000 *C. carpio* were randomly selected and examined. The fishes were classified based on weight and season. The overall prevalence of *Lernaea* spp. infestation in the fish was 10.7% (107/1000). In examined fishes, the highest infestation of the *Lernaea* spp. was 13.7% in weight group of 150-200 g, compared with other weight groups (P<0.05). The highest prevalence in spring (16.4%) and the lowest prevalence of Lernaeid infestation occurred in winter (4.8%) (P<0.001). The infestation rates in summer and autumn were 14% and 7.6%, respectively. Lesions caused by *Lernaea* spp. occurred in the epidermis, dermis, and muscles of the fish. On microscopic examination, ulcers in the epidermis and chronic inflammation in the dermis was evidently observed. Fibrous tissue formation, degeneration, and necrosis were also seen in the muscles. Considering the results of this study, Lernaeid infestation could be an economically serious disease in the fish industry. Hence an appropriate program to control, diagnosis and treatment of *Lernaea* infestation in this part of Iran is needed.

**Keywords:** *Lernaea* spp; *Cyprinus carpio*; Chahnimeh lakes; Prevalence; Histopathology.

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Introduction

Fish, in recent decades, is considered to be a food of excellent nutritional value, which provides high quality protein, vitamins and minerals to the diets of people worldwide (Kennedy, 1994). Similar to other animals, fish are susceptible to a wide range of parasites. *Lernaea* spp. are freshwater parasites that are a source of parasitic disease in fish (Mirzaei et al., 2014). The genus *Lernaea* or ‘anchor worms’, so called because of their anchor-like head which is used to attach under the skin of the fish, are common parasites of freshwater fish (Lester and Hayward, 2006). Lernaeid copepods are extremely harmful parasites not only due to their direct harm to the fish such as health problems, reduction in growth rate and abnormal metabolic activities, but also because of the aesthetic concerns for sale and the big loss to fish industry (Bhuiyan and Musa, 2008). *Lernaea* species are sheltered on various fish (over 100 fish species belonging to 25 different families) and feed on their blood and tissue. They cause a range of problems including redness and swelling at attachment site, irritation, inflammation, ulcers and scale damages. An intense parasitism could be the cause of mass mortalities and secondary bacterial or fungal infections (Woo, 1995; Raissy and Ansari, 2012; Mirzaei et al., 2014). The lifecycle of *Lernaea* species occurred in nine stages, including three free-living naupliar stages, five copepodid stages, and one adult. After mating on the fish host, the males die and females metamorphose and insert anterior anchor deeply into the host tissue and lay several hundred eggs (Nagasawa et al., 2007). The successful survival and development of Lernaeid copepods depend on the water temperature. *Lernaea* is a thermophilic organism and prefers a temperature range of 26–27°C for optimum development. Temperatures below 20°C have been reported to completely inhibit egg incubation and juvenile *Lernaea* cannot complete their growth cycle (Raissy and Ansari, 2012; Mirzaei et al., 2014). A review of literature reveals that studies on fish parasites in Iran were initiated by Bychowsky (1949), when he reported three *Dactylogyrus* species and one *Ancyrocephalus* on the gills of fishes in Karkheh River. Since then, over 300 species of endo- and ectoparasites have been recorded in Iranian freshwater fish (Raissy and Ansari, 2012). Although there have been a number of studies on the prevalence of parasites from fish in Iran, but in fact, there is a new gap in our information about the abundance of species, seasonal distribution and pathology of *Lernaea* in different parts of Iran. The purpose of the present study was to determine the prevalence and pathology of Lernaeid parasitic infestations in *Cyprinus carpio* from Chahnimeh lakes in Sistan and Baluchestan, Iran.

Materials and methods

**Field study area**

Chahnimeh lakes is a natural complex of aquatic ecosystems in the south of Sistan and Baluchestan Province in the southeast of Iran. Chahnimeh lakes are located in between 61°40´27" to 61°39´25" East longitudes and between 30°51´00" to 30°45´59" North latitude. Water stored in these lakes is used to supply a part of drinking water for the cities of Zabol and Zahedan and to provide irrigation water for agricultural lands.

**Sample size**

In this study, during a one-year period (October 2014 to September 2015), a total number of 1000 *C. carpio* were randomly purchased from local fishermen. Fish were transported to the laboratory, and each specimen was individually examined for the presence of *Lernaea* spp. Weights of the fish were recorded and then they were classified into three weight groups (150–200 g, 200–300 g and 300–400 g). Identification of the *C. carpio* was performed according to Coad (1980).

**Parasitological procedures**

External surfaces of the body including eyes, skin, fins, gills and mouth were carefully inspected for parasites. The collected parasites were preserved in 70% ethanol and identified at the genus level. For histopathological examination, tissue samples were fixed in 10% buffered formalin. Paraffin sections of 5 µm thickness were then stained with hematoxylin
and eosin and examined under an ordinary light microscope.

Statistical analysis

Chi-square test, using SPSS (version 20.0, SPSS, Inc., Chicago, IL, USA) software package was used to analyze the data. A P value of less than 0.05 was considered statistically significant.

Results

The results of this investigation revealed that from a total of 1000 *C. carpio*, 107 (10.7%) were found to be infested with *Lernaea* spp. Prevalence and the statistical significance level of *Lernaea* spp. infestation in different seasons and weight groups in *C. carpio* are presented in table 1.

Affected fish were ill in appearance and showed smaller sizes compared with healthy ones. Gross lesions included diffused swelling and hyperemic areas at attachment sites, scale loss and ulcers (figure 1). The histopathologic study showed a number of lesions in the epidermis, dermis, and muscles of the fish. Ulcers were observed in the epidermis where the parasite had attached. In the dermis, as a response to the presence of the parasite, an area of chronic inflammation containing lymphocytes, histiocytes, and eosinophils was seen. In addition, there were some cases in which the embedded parasites had induced fibrous tissue formation. In the skeletal muscle, degenerative to necrotic lesions were noticed, together with chronic granulomatous myositis (figure 2).

Table 1. Prevalence of *Lernaea* spp. infestation according to the seasonal and weight groups of examined *Cyprinus carpio* fish in Sistan and Baluchestan, Iran

<table>
<thead>
<tr>
<th>Fish species</th>
<th>Season</th>
<th>Number of fishes</th>
<th>Number of infested fishes</th>
<th>Prevalence (n/N) (%)</th>
<th>No. of infested fishes based on body weight range</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cyprinus carpio</em> (1000)</td>
<td>Spring</td>
<td>250</td>
<td>41</td>
<td>16.4</td>
<td>34 (6.2)</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>250</td>
<td>19</td>
<td>7.6</td>
<td>11 (2)</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>250</td>
<td>35</td>
<td>14</td>
<td>22 (4)</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>250</td>
<td>12</td>
<td>4.8</td>
<td>8 (1.4)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1000</td>
<td>107</td>
<td>10.7</td>
<td>75 (13.7)</td>
</tr>
</tbody>
</table>

Notes: n, fishes infested with *Lernaea* spp; N, total fishes examined.

Figure 1. Hyperemic and hemorrhagic points and scale loss can be seen in different body areas
Discussion

*Lernaea* spp. are a group of copepods parasites that infect both wild and cultured fish. Among the fish groups, *Cyprinus carpio* is the best-known host for *Lernaea* spp (Piasecki et al., 2004). In the present research, the overall prevalence of Lernaeid infestation was found to be 10.7%. There are several reports on the prevalence of Lernaeid infestation from fish in different parts of Iran and other countries. Prevalence rates of 69.4% and 53.3% have been reported in Chaharmahal – Bakhtyari and Sistan of Iran, respectively, and prevalence rates of 80% and 60% have been reported in Pakistan and Egypt (Tasawar et al., 2007; Shagar and El-Refaee, 2012; Raissy et al., 2013; Mirzaei et al., 2014). The difference in the prevalence of Lernaeid infestation may be due to different climate condition and parasite-host specificity (Tasawar et al., 2009).

In the current study, the intensity of infestation with *Lernaea* spp. occurred in weight group of 150-200 g was significantly greater than other weight groups (P<0.05). The results of our study are similar to those reported by Mirzaei et al. (2014) in Iran. They also found the greatest prevalence in the group of fish with the lowest body weight (Mirzaei et al., 2014). Moreover, results of some other studies revealed that fishes with lower body weight had a higher rate of parasitic infection (Bazari Moghaddam et al., 2009; Pennycuick, 2009; Takemoto et al., 2009). However, Kanwal et al. (2012) in Pakistan, reported that the fish group with higher body weight had the highest infestation rate by *Lernaea* spp. compared with ones with lower body weight. There are different perspectives on the effect of the weight of the fish on parasitic infestation rate. The variations recorded in the infestation rates with *Lernaea* spp. in different weight groups of fishes, could be due to the difference in scale structure of these fishes (Tasawar et al., 2009).
In this investigation, *Lernaea* spp. infection was more prevalent during spring months, whereas the minimum prevalence rate was observed in winter. This fact is not in accordance with the study conducted in Bangladesh (Bhuiyan and Musa, 2008), in which the maximum rate of *Lernaea* infestation occurred in winter. It is an established fact that climate condition and temperature influence the prevalence of *Lernaea* spp. in different seasons (Martins et al., 2002; Baker et al., 2008; Bhuiyan and Musa, 2008).

Histopathologic findings of this study included ulcers, chronic inflammation and the presence of scar tissue, degeneration and necrosis around the attachment sites of the parasite. These results are very similar to those of previous surveys (Roberts, 2012; El-Galil et al., 2012; Mirzaei, 2015).

**Conclusion**

From the results of this work, it is concluded that *Lernaea* spp. are widespread in *Cyprinus carpio* in the studied area. Therefore, knowledge of the prevalence of Lernaeid parasites will help to improve the control of *Lernaea* spp., minimize the economic losses to the fish industry and implement control programs for other fishes.

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**References**


