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Research Article

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Lernaea Cyprinacea Linnaeus, 1758 (Cyclopoida: Lernaeidae) in Grass Carp (*Ctenopharyngodon idella*) from a Commercial Fish Farm in the Rearing Ponds of Shushtar, Khuzestan Province

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Abstract

Background and aim: *Lernaea cyprinacea* is an important ectoparasitic copepod, commonly known as an Anchor-worm. It is most likely native to Asia, including Iran, but has a wide global distribution including Europe, Africa, Australia, North and South America. It can infects more than 100 species of teleost fish and amphibians. This study was performrd in order to survey on the incidence of *Lernaea cyprinacea* on the grass carp (*Ctenopharyngodon idella*), in the rearing ponds of Shushtar, in Khuzestan province.
Materials and Methods: Two hundred seventy five fish were captured from four ponds by fishing net and transferred to laboratory of veterinary medicine, Kazerun Branch of Islamic Azad University by containers of formaldehyde 10%. After identifying the *Lernaea cyprinacea* by key identification, biometric operations were performed on fishes.
Results: The results showed that from 275 fish, 63 fish were infected to *Lernaea cyprinacea* which formed 23 % of the captured fish. The statistical results base on Pearson correlation showed that there was no significant relationship between total length or weight and number of lesions on the body ($p>0.05$).
Conclusion: *Lernaea cyprinacea* infected the population of grass carp in Shushtar region of Khuzestan province. Due to the biological and economic damages, it is necessary to take appropriate actions to eradicate the parasite.

Keywords: *Lernaea cyprinacea, Grass carp, Shushtar, Iran*

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Introduction

The Lernaeidae family comprises crustacean parasites with global distribution among freshwater and marine fish. Approximately 110 species of Lernaeids have been divided into 14 genera (Ho, 1998). The genus Lernaea belongs to phylumm of Arthropoda, Crustacean class, order of Copepoda and Lernaeidae family (Hoffman, 1967). The most common species of Lernaeids is *Lernara cyprinacea* that has been transmitted to ornamental fish in several countries such as North America, Europe, Asia, South Africa, and East Australia (Ho, 1998).The economic importance of Lernaea is increasing because of the epidemic caused by the parasite in most ornamental fish breeding centers in different parts of the world (Kır, 2007). The parasite affects its host's health, decreases growth rate, and causes abnormal metabolic activity. Accumulation of these parasites in some parts of the body makes painful points and has harmful outcomes for the functioning and survival of the host (Klinger & Floyd, 1998). The adult female *L. cyprinacea* attaches to the skin of some parts of fish, including the head, back, stomach, and tail-related areas. However, they frequently accumulate in the fin (Adams, 1984). Certain species of *L. cyprinacea* aggregate around the eyes and cause the destruction of the eye lens, thereby resulting in blindness. Gill infection causes the localized hyperplasia of the mucosal epithelial tissue and also the stiffening of the proliferous mucosal tissue that may seriously disturb breathing and provide the ground for bacterial and viral infections (Jalali & Barzegar, 2006). Lernaea is not limited to a specific host; however, it belongs to a wide range of various species of fish, including the families of angelfish, cyprinidae, salmon, and catfish (Robinson & Avenant-Oldewage, 1996). The host's size is effective in determining the structure of this parasite. Among fish, the frequency and severity of Lernaea infection increase with the age and size of hosts. Older fish provide larger space for the parasite as they grow; consequently, the infection increases (Des Clers, 1991). Different species of Lernaea genus are currently among the most important freshwater parasites in Iran and the world, and by the expansion of intensive fish farming, their importance has become more noticeable, especially in temperate and tropical regions. At high temperatures between 25-30 ºC, due to the shortening of the life cycle of the Lernaea, infection increases and can cause even death in fish (Hoffman, 1967; Mokhayer, 1983; Jazebizadeh, 1995). The male of these parasites have a free life and only the female have a parasitic life. Temperature is the most important factor on the life cycle and pathogenicity of these parasites, so their life cycle cannot be completed at a temperature lower than 15ºc. Forty species of this parasite have been identified and 32 species have been named. *L. cyprinacea* is the most important species of Lernaea genus and has a wide host of fishes, especially carp fish. Salmonidae is also infected with this parasite, although in salmon farms until 2013, this parasite was has not been observed, which is most likely related to the use of water with a temperature of 14 ºC or less, especially spring water for breeding, and the only reported case was related to the population of breeding trout in floating cages in Hamon lagoon. (Jalali, 1998). For the first time in Iran, this parasite was reported by Mokhayer (1983) from common carp (Mokhayer, 1983), then, infection with this parasite has been reported in different parts of the Iran (Jalali, 1998; Abdi, 1995; Alishahi & Peighan, 1999). Jalali (1987) observed this parasite in Bream, Grass carp, Crucian carp and Common carp (Jalali, 1987). Jazebizadeh (1983) reports heavy infection of *L. elegans* in Zarivar Lake in Kurdistan province (Jazebizadeh, 1983). In a rare report by Alishahi and Peighan (1999), 1462 parasites were isolated from silver carp (Alishahi & Peighan, 1999). Since many native and exotic cyprinids, collected from the Kor River Basin (Kor River and Dorudzan Reservoir), Southwest of Iran in 2010 and 2011 were infected to *Lernaea* sp. (Sayyadzadeh *et al.,* 2016). This study was performrd in order to survey on the incidence of *Lernaea cyprinacea* on the grass carp (*Ctenopharyngodon idella*), in the rearing ponds of Shushtar, in Khuzestan province.

Materials and Methods

Sampling was done from fish farms in Shushtar city. They were near the Garge branch of the Karun River. Sampling from three farms and in the four geographical directions of the pools performed using a hand net (Mashk) and using a random cluster method (10 samples from each farm) by the weight of fish was above 150 grams. It was tried to make the number of throwing nets equal in each of the ponds of the farm. After sampling, 10% formalin was used in 20 liter barrels to fix the fish, and the barrels were

closed well and transferred to the laboratory of the Faculty of Veterinary Medicine, Islamic Azad University, Kazerun branch .In the parasitology laboratory, at first, some of parasites were isolated from the surface of fishes for microscopic identification, which were identified with parasite keys (Hoffman, 1967). Then the fishes were weighed with a digital scale and the total length and the number of lesions created by the parasite on the fish body were counted and the data were recorded in a table. Data analyses were done using SPSS Package, version18 to determine mean abundance. Pearson's correlation coefficient test was used to determine relationship between total length and weight with the number of Lernaea parasite.

Results

The results of the infection of grass carp to lernaea showed that this fish is infected with *Lernaea cyprinaceae* parasite. Out of a total of 275 fish, 63 fish were infected to lernaea and 212 fish were not infected to it (22.9% of grass carp were infected and 77.1% were not infected).

Figure 1. Grass carp infected to *Lernaea cyprinacea***.**

In order to show whether there is a relationship between the length and weight of the fish and the parasitic lesions, at first the mean of total length, weight and the number of lesions were examined (Table 1).

Parameter	Fish(N)	Minimum	Maximum	Mean±(SD)
Total length	63	28	44	36.4±4.2
Weight	63	500	1020	1.4±0.73
Number of lesion	63	1	32	5.53±2.8

Table 1. Total Length, Weight and Number of lesions in infected grass carp *to Lernaea cyprinacea*. Statistical analysis based on Pearson's correlation coefficient test showed that there was no significant relationship between the total length of fish and the number of parasite's lesions (sig=0.667). Also, no significant relationship was found between weight and number of lesions (sig=0.916).

Discussion

Lernaeidae occupies a unique position owing to their extraordinary pathogenic effect and financial damages in fish farming. Specifically, the *L. cyprinacea* (Linnaeus, 1758) is the primary causative agent of lernaeaosis in Indian Major carps and Chinese carps and turns the saleable fisheries products nonsalable because it inflicts severe tegumentary lesions (Tavares-Dias & Martins, 2017). It is a highly adapted crustacean that penetrates the host's skin to form an extremely strong and damaging attachment. The adult females are usually attached to the surface of the such as observed in the present study (Gervasoni *et al*., 2018). The Lernaea species

are cosmopolitan parasites of several freshwater fish species reported from all the countries famous for fish culture. However, their classification and identification are controversial due to morphological intraspecific variability and interspecific similarities (Hua *et al.,* 2019). Lernaea has been reported in common carp from many parts of Iran (Jalali, 1998). There were many reports of this parasite in other regions of the world. Freshwater fishes of Iran are generally faced with lernaea all over the year, but severe infection of parasites along with losses can be seen only during the hot months of the year and this is because ecologically, the evolution of parasite life occurs at high temperatures. The spread of the disease in cold areas occurs only during the summer, but in hot areas, there is a possibility of dangerous epidemics throughout the year (Gutierrez-Galindo & Lacasa-Millan, 2005; Tasawar *et al.,* 2007). Bilal et al. showed the highest prevalence occurred from December to January (Bilal *et al.,* 2024). Besides, Iqbal et al. detected the highest incidence of the parasite till late winter (December to April) where the water temperature remained in the range of 13-23 ºC and low parasite incidence during the summer (Iqbal *et al.,* 2012). Ullah et al. reported heavy infestation during summer and low during winter (Ullah *et al*., 2018). In Iran, due to the fact that it is located in a temperate geographical latitude, the disease has been seen in a large part of it, especially in the south and the waters of the central plains, in spring, summer and autumn. Therefore, the most important factor that affects the life cycle of the parasite it is the temperature, so that their life cycle is not completed at temperatures below 15 ºC. Metanaoplius do not metamorphose at temperatures below 8 ºC, and it takes 100 days to complete the parasite cycle at 14-15 ºC. In hot areas, up to ten generations of progeny can be done during the year (Jalali, 1998). Some researchers like Abbas et al. and Moghadam et al. presented that small-sized fishes have shown higher parasitic infection rates (Abbas *et al.,* 2014; Moghadam *et al.,* 2009). Still, others believed the infection rate increases with increasing fish body weight and length. Mirzaei cited that anchor worms readily infected the small fish (Mirzaei, 2015). Bilal et al. showed that the prevalence of *Lernaea* was more significant in younger fishes but decreased with the increase of body weight (Bilal *et al.,* 2024).

The first report of parasite infection in Iran was done by Mokhayer in carp fish (Mokhayer, 1983). There were many other reports. Abdi in a study on the fishes of Mahabad dam lake isolated this parasite from *Capoeta capoeta* and grass carp (Abdi, 1995). Fadaei Fard et al. also reported this parasite from Capoeta *capoeta*. The disease enters the breeding centers of the country in a latent form during the stocking of water resources and causes a lot of spread and casualties (Fadaei Fard *et al.,* 2001). The most important report in this case is related to Jazebizadeh in Zarivar lake of Kurdistan province, the intensity of pollution in this lake was such that the caught fish were found unsellable (Jazebizadeh, 1983). *Lernaea* sp. was also collected and identified from nostrils, fins, gills, operculum, eye, lips and body of *Capoeta saadii*, *Capoeta aculeata*, *Alburnus mossulensis* (all native cyprinids), *Carassius auratus* and *Cyprinus carpio* (exotic cyprinids) collected from the Kor River Basin (Kor River and Dorudzan Reservoir), Southwest of Iran in 2010 and 2011 (Sayyadzadeh *et al.,* 2016). Although the most infections are seen in Khuzestan, due to having the right temperature all year round, there is a possibility of breeding parasites in it. Among these infections, report of Moghinemi can be mentioned (Moghinemi, 1995). In another study conducted by Alishahi and Peighan, a severe and rare infection with the *L. cyprinaceae* was reported in a carp, and 1462 parasites were counted in different parts of the fish's body (Alishahi & Peighan, 1999). In the present study, which was conducted on grass carp, out of 257 fish caught, 63 fish were infected with Lernaea, which is 22.9% of the total fish caught. In this research, there was no relationship between the number of parasites and the length and weight of the fish. Ananda Raja et al. proved that the emamectin benzoate (EMB) was 100% effective after 10th day of treatment against a crustacean parasite, *Lernaea* sp. in Asian Seabass juvenile (Ananda Raja *et al*., 2023). EMB treatment was not attributed to any fish mortalities and/or adverse reactions since the control group was also fed with EMB treated feed (Ananda Raja *et al*., 2020) which can be scientifically recommended with 100% efficacy and safety to use against lernaeosis in the aquaculture ponds.

Conclusion

In ntcurre study *L. cyprinacea* was record in a natural population of Grass carp (*C. idella*) from

Shustar, Khuzestan province. The parasitic prevalence was categorized as 23%. Generally, prevention and transmission control of these parasites is difficult and requires good management and efficient approaches. Control strategies should include training of traders and farmers in order to monitor the health condition of imported and weed fish.

Conflict of interest

There is no conflict of interest between the authors.

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بررسی آلودگی کپور علفخوار (*Ctenopharyngodon idella*) به انگل لرنه آ سپرینا سه آ (Linnaeus, 1758; Cyclopoida: Lernaeidae) در استخرهای پرورشی منطقه شوشتر استان خوزستان

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چکیده

زمینه و هدف: *Lernaea cyprinacea* یکی از انگل های خارجی کوپه پودی است که با نام انگل قلاب دار شناخته می شود. این انگل غالبا بومی آسیاست و در ایران نیز شیوع دارد اما دارای گسترش جهانی در اروپا، آفریقا، استرالیا، شمال و جنوب آمریکا می باشد. این انگل می تواند بیش از صد گونه ماهیان استخوانی و دوزیستان را آلوده نماید. این مطالعه به منظور بررسی میزان بروز انگل *Lernaea cyprinacea* در ماهی کپور علفخوار (*Ctenopharyngodon idella*)، در استخرهای پرورش شوشتر، استان خوزستان صورت گرفت.

مواد و روش ها: دویست و هفتاد و پنج قطعه ماهی از چهار استخر با تور ماهیگیری صید و بوسیله ظروف حاوی فرمالدئید ۱۰ درصد به آزمایشگاه دامپزشکی دانشگاه آزاد اسلامی واحد کازرون منتقل شدند. پس از شناسایی *Lernaea cyprinacea* با کلید شناسایی، عملیات بیومتری بر روی ماهیان انجام شد.

یافته ها: نتایج نشان داد که از ۲۷۵ ماهی، ۶۳ ماهی آلوده به *Lernaea cyprinacea* بودند که ۲۳ درصد از ماهیان صید شده را تشکیل داد. نتایج آماری نشان داد براساس همبستگی پیرسون، بین طول یا وزن کل و تعداد ضایعات روی بدن رابطه معنی داری وجود نداشت ($p>0.05$).

نتیجه‌گیری: *Lernaea cyprinacea* جمعیت ماهی کپور علف خوار منطقه شوشتر استان خوزستان را آلوده کرد. با توجه به آسیب های زیستی و اقتصادی، لازم است اقدامات مناسب برای ریشه کنی انگل انجام گیرد.

واژه‌های کلیدی: *لرنه آ، کپور علفخوار، شوشتر، ایران*

علیرضا گلچین منشادی، سید محمد رضا بلادی، محمد ترحمی. بررسی آلودگی کپور علفخوار (*Ctenopharyngodon idella*) به انگل لرنه آ سپرینا سه آ (Linnaeus, 1758; Cyclopoida: Lernaeidae) در استخرهای پرورشی منطقه شوشتر استان خوزستان. مجله طب دامپزشکی جایگزین. ۱۴۰۳؛ ۷(۲۰): ۱۱۶۱-۱۱۶۷.

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