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Parasite Fauna in Common Carp (Cyprinus carpio L., 1758) from Fish Cage Culture System on Tikvesh Reservoir (N. Macedonia)

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Abstract. Over the years, fish cage culture system has become one of the economically viable methods of large-scale production of high-value food fishes. Although, cage farming has many economic advantages, diseases are one of the major limiting factors to the successful production. The aim of this study was to determine the presence of parasite fauna in common carp (Cyprinus carpio L. 1758) from fish cage farms on Tikvesh reservoir (N. Macedonia). A total of 206 specimens of common carp from this fish cage farms were examined for parasitological investigations. Infestation with parasite was determined in 121 specimens (58.74 %). In common carp from this reservoir, the presence of 5 parasite species was established: Trichodina sp., Dactylogyrus extensus, Euplozoon nipponicum, Bothriocephalus opsariichthydis and Ergasilus sieboldi. In confined conditions such as cages where the stocking density is very high and the resultant stress might act as conductive factor for pathogens to cause diseases. High stocking densities coupled with fluctuations in environmental conditions and/or stress can favor parasite proliferation leading to significant mortalities in net-cage-reared fishes.

Keywords: parasites, fish, common carp, cage culture system

Introduction

Growing global population, reduction of natural fish stocks, and the increasing demand are the major drivers for increasing fish production. Aquaculture remains the only option to meet these demands and globally, the share of aquaculture is projected to rise to 62% of the total fish production by 2030 [1]. However, considering the limitations of the traditional aquaculture systems due to environmental issues, carrying capacities etc., it has been recognized that cage culture has many advantages. Over the years, cage culture has become one of the economically viable methods of large-scale production of high-value food fishes. Although, cage fish farming has many economic advantages, like any other animal production system, diseases are one of the major limiting factors to the successful production. Increasing intensification and lack of adequate health management measures result in frequent occurrence of diseases. Since the basic cage culture practices are similar in all the regions, disease problems encountered will largely depend on the species being cultured, environmental conditions and management practices [2].

The aim of this study was to determine the presence of parasite fauna in common carp (Cyprinus carpio L. 1758) from fish cage culture system on Tikvesh reservoir (N. Macedonia). The Tikvesh reservoir is situated on the River Crna Reka, 12 kilometers on the southwest of Kavadarci town. It occupies territory of 14 km² and is 29 km long. The total gross area of the reservoir is 475
million m³ of water. The water from the Tikvesh reservoir is used for irrigation, production of electricity, as well as for fish production in cage systems. On average, the production of fish cage farms on Tikvesh reservoir ranges from 5-35 kg per 1 m³ volume of water, depending on the fish species and the technology of cultivation. On this reservoir, in total volume of 70,000 m³ of water, 2,400 tons of fish can be raised.

There are approximately 30 cage farms for carp breeding, with about 500 cages in the waters of Tikvesh reservoir. Cage farms are characterized by different number of cages, often with dimensions 5 m x 5 m x 3 m (with a total volume of 125 m³).

Fig.1. Tikvesh reservoir
Materials and methods

The fish were caught using net or by local anglers. The specimens were placed in plastic containers and transferred alive to the laboratory. During the dissection, the gill filaments, the eyes, the fins, the intestines and the skin were examined under the stereomicroscope. All parasites found in each individual fish were identified and enumerated. The parasite specimens were fixed in 70% alcohol to be observed under light microscope. During the study period, data on parasite species were categorized according to season. The environmental factors were not measured in this study. Total numbers of parasites were determined directly by numerical count. The number of fish examined, fish infected, prevalence and mean intensity (total and by seasons) are given in table 1.

Classical epidemiological variables (prevalence and mean intensity) were calculated according to [3].

The parasite specimens were identified using reference keys of [4] and [5]. During the examinations at Laboratory for fish diseases in Hydrobiological Institute in Ohrid (R. N. Macedonia), stereomicroscopes „Zeiss“- Stemi DV4 and „MBS 10“, as well as light microscope „Reichart“ were used.

Results and discussion

A total of 206 specimens of common carp from this fish cage culture system were examined for parasitological investigations. Infestation with parasite was determined in 121 specimens (58.74 %).

In common carp from this reservoir, the presence of 5 parasite species was established:

1. *Trichodina* sp. on fins in common carp in autumn;
2. *Dactylogyrus extensus* on gills in common carp in spring, summer, autumn and winter;
3. *Eudiplozoon nipponicum* on gills in common carp in spring;
4. *Bothriocephalus opsariichthydis* in intestines in common carp in autumn;
5. *Ergasilus sieboldi* on gills in common carp in spring.

Data on fish examined, fish infected, as well as the percent of infestation with parasites (total and by seasons) in common carp from Tikvesh reservoir are given in Table 1.

Table 1. Infestation with parasites in common carp (*Cyprinus carpio*) from fish cage culture system on Tikvesh reservoir (N. Macedonia)

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Number of examined fish</th>
<th>Number of infected fish</th>
<th>Percent of infestation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>55</td>
<td>35</td>
<td>63.64</td>
</tr>
<tr>
<td>Summer</td>
<td>51</td>
<td>21</td>
<td>41.17</td>
</tr>
<tr>
<td>Autumn</td>
<td>54</td>
<td>26</td>
<td>48.15</td>
</tr>
<tr>
<td>Winter</td>
<td>46</td>
<td>39</td>
<td>84.78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>206</td>
<td>121</td>
<td>58.74</td>
</tr>
</tbody>
</table>
Fig. 3. Trichodina sp. on fins in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)

Fig. 4. Eudiplozoon nipponicum (clamps) on gills in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)
Fig. 5. Eudiplozoon nipponicum (posterior part) on gills in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)

Fig. 6. Bothriocephalus opsariichthys in intestines in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)
Fig. 7. Ergasilus sieboldi (anterior part) on gills in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)

Fig. 8. Ergasilus sieboldi (hooks) on gills in common carp (Cyprinus carpio) from fish cage culture system on Tikvesh reservoir (original)

Except some protozoans, most of the economically important parasites infecting farmed fishes are ectoparasitic in nature, of which copepods are considered serious parasites causing mortalities. Ectoparasites feed on mucous, tissues, and blood/body fluids and the damage caused
by their attachment and feeding activities may pave way for secondary infections. Major pathology associated with some ectoparasitic infestation includes damage to the epithelial layer (skin and gills) resulting in hemorrhagic lesions on the skin and osmoregulatory dysfunction. They are also reported to act as vectors of some of the pathogenic viruses and bacteria besides making the fishes susceptible to secondary infection. Economic losses can be quantified in terms of direct mortalities, secondary infections, poor/reduced growth and expenses for treatment. Open cage farms facilitate easy transmission of parasites from wild to farmed fish and vice versa thereby causing unforeseen consequences in sympatric wild fishes.

In confined conditions such as cages where the stocking density is very high, the resultant stress might act as conductive factor for pathogens to cause diseases. High stocking densities coupled with fluctuations in environmental conditions and/or stress can favor parasite proliferation leading to significant mortalities in net-cage-reared fishes. As in other aquaculture systems, environmental factors such the temperature, salinity, dissolved oxygen, suspended particulate matters etc., are critical and any adverse changes in these parameters would make the fish susceptible to diseases. Similarly, crowding and handling stress and feed management also play a crucial role. However, as any other farming system, health management practices involving early detection of infection and prophylactic and therapeutic treatment are of paramount importance.

**Conclusions**

A total of 206 specimens of common carp from fish cage culture system on Tikvesh reservoir (N. Macedonia) were examined for parasitological investigations and infestation with parasite was determined in 121 specimens (58.74 %). In common carp from this reservoir, the presence of 5 parasite species was established: Trichodina sp., Dactylogyirus extensus, Eudiplozone nipponicum, Bothriocephalus opsarichthydis and Ergasilus sieboldi.

Many of the biosecurity measures which are employed in land based aquaculture systems will not have much relevance to cage farming, as the system is highly dynamic. However, a thorough understanding of pathogens, disease process, diagnosis, epidemiology and control measures are essential for better health management of farmed fishes in cages.

The treatment or control of parasitic diseases in fish can be achieved if the following parameters are addressed:

1. Identification of the parasite;
2. Obtaining knowledge about their life cycle;
3. Awareness of the environmental needs of the parasite, such as host specificity, optimum temperature, pH, nutrition and other metabolic needs;
4. Determining their geographical range;
5. Determining the effect of host immunological mechanisms on the parasite;
6. Learning the control and methods of diseases treatment caused by the relevant parasite.

**References**