

Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*Aristichthys nobilis*) as Hosts of *Sinergasilus Polycolpus*, a New Copepod Species in the Ichthyoparasitofauna of Macedonia

Dijana Blažeković Dimovska
Faculty of biotechnical sciences, University "St. Kliment Ohridski"
7000 Bitola, Republic of Macedonia

Stojmir Stojanovski
Hidrobiological Institute, 6000 Ohrid, Republic of Macedonia

Abstract

Parasitic diseases represent negative factor, which in intensive fish farming can cause considerable damages in aquaculture. Parasites in the waters where they are present sometimes cause fish reduction, thereby directly affecting on fish stocks in the country. It is particularly important to recognize parasites and their vectors in fish in watercourses that supply water in fish breeding facilities, where beside parasitic infections, can lead to a significant reduction in fish production and even to mass fish deaths. The parasitological investigations were carried out from the period of autumn 2009 to summer 2012, by seasons, and a total of 47 specimens of silver carp (*Hypophthalmichthys molitrix*) and 53 specimens of bighead carp (*Aristichthys nobilis*) of different age groups obtained from two largest cyprinid fish farms near Bitola (Macedonia) were examined. Parasitic copepod *Sinergasilus polycolpus* was found on the gills in three - year old silver carp and bighead carp. The prevalence with *Sinergasilus polycolpus* in *Hypophthalmichthys molitrix* was 57,447 %, while the mean intensity was 10,148. The prevalence with *Sinergasilus polycolpus* in *Aristichthys nobilis* was 16,981 %, while the mean intensity was 20,000. Our findings of *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) are first recorded for Macedonia. At the same time, these two fish species represent new hosts for *Sinergasilus polycolpus* in Macedonia.

Keywords: *Hypophthalmichthys molitrix*, *Aristichthys nobilis*, *Sinergasilus polycolpus*

1. Introduction

Aquaculture represents more than 30% of total fish production for consumption (Delgado *et al.*, 2003). It is fastest growing sector of the world food economy. Van West (2006) noticed that it has increased on average by 11% per year, from which, the majority of global production comes from freshwater aquaculture (58%).

Parasitic diseases represent negative factor, which in intensive fish farming can cause considerable damages in aquaculture. Parasites in the waters where they are present sometimes cause fish reduction, thereby directly affecting on fish stocks in the country. It is particularly important to recognize parasites and their vectors in fish in watercourses that supply water in fish breeding facilities, where beside parasitic infections, can lead to a significant reduction in fish production and even to mass fish deaths.

Silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) are one of most important farm-cultured fish species inhabiting the two largest cyprinid fish farms near Bitola, Republic of Macedonia (Blažeković Dimovska, 2013). They are breeding in poly-culture together with the common carp (*Cyprinus carpio*), which is the most important fish grown in Macedonian fish farms. There are two largest cyprinid fish farms, Žabeni and Bukri, situated in the southeastern part of Pelagonia (Bitola, Macedonia), dating from 1960/61. Fish farm Žabeni occupies an area of 170 ha, while Bukri area of 55 ha. Land of the River Crna contributing fish farms to be very productive and rich in phyto and zoo plankton. Fertile soil and residual organic matter at the bottom of the farms for years allow development of lush aquatic vegetation, which in certain conditions can adversely affected on water quality and fish production. That's why these two herbivorous carps are used in aquaculture for phytoplankton blooms control. However, by introducing the fry of these fish species in our farms, by import from other countries, it was accidentally introduced the pathogenic parasitic copepod *Sinergasilus polycolpus*.

Sinergasilus polycolpus is pathogenic parasitic copepod that is specific and affected gills of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) and it is the most important specific parasite found on these fish species (Zhang *et al.*, 1999; Nie and Yao, 2000). Wang *et al.* (2002) considered that *Sinergasilus polycolpus* is one of the major pathogens of silver and bighead carp. Yulin (1996) in his investigations noticed prevalence with this copepod, higher than 50 % and huge mortality in these two fish species.

2. Materials and methods

Specimens of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) of different age groups were obtained from two largest cyprinid fish farms, Žabeni and Bukri, that are situated in the southeastern part of Pelagonia (Bitola, Republic of Macedonia). Fish farm Žabeni occupies an area of 170 ha, while Bukri area of 55 ha.

The parasitological investigations were carried out from the period of autumn 2009 to summer 2012, by seasons, and a total of 47 specimens of silver carp (*Hypophthalmichthys molitrix*) and 53 specimens of bighead carp (*Aristichthys nobilis*) were examined. Fish were caught by net and fish species were determined according key of Kottelat and Freyhof (2007).

Fish samples were examined by standard parasitological methods, by opening the operculum and looking for macroscopic changes of the gill filaments. The gills were dissected and the number of copepods on each fish was recorded. Some of the parasites were fixed in 70 % ethanol, while from the others, semi - permanent and permanent slides were prepared for further determination.

For material treatment and parasite determination, keys of Bauer (1985, 1987) were used.

Classical epidemiological variables (prevalence and mean intensity) were calculated according to Bush *et al.* (1997).

During the investigations, stereomicroscopes „Zeiss”- Stemi DV4 and „MBS 10”, as well as light microscope „Reichert” with magnifications of 40 - 100 X were used.

3. Results and discussion

Kingdom: ANIMALIA Linnaeus, 1758

Phylum: ARTHROPODA Latreille, 1829

Subphylum: CRUSTACEA Lamarck, 1801

Class: MAXILLOPODA Dahl, 1956

Subclass: COPEPODA Milne-Edwards, 1840

Order: POECILOSTOMATOIDA Thorell, 1859

Family: ERGASILIDAE von Nordmann, 1832

Genus: SINERGASILUS

Species: *SINERGASILUS POLYCOLPUS* Markewitsch, 1940

Sin: *Sinergasilus lieni* Yin, 1949

Hosts:

HYPOPHTHALMICHTHYS MOLITRIX,
ARISTICHTHYS NOBILIS

Localization: gills

Place: cyprinid fish farms in Macedonia

Season: summer and autumn

In our investigations, *Sinergasilus polycolpus* was found in 27 specimens of silver carp (*Hypophthalmichthys molitrix*) and 9 specimens of bighead carp (*Aristichthys nobilis*):

1. On the gills in three - year old silver carp (*Hypophthalmichthys molitrix*) from both cyprinid fish farms, Žabeni and Bukri, in summer and autumn;

2. On the gills in three - years old bighead carp (*Aristichthys nobilis*) only from cyprinid fish farm Žabeni, in summer and autumn.

Higher levels in prevalence and mean intensity were observed in autumn.

The prevalence with *Sinergasilus polycolpus* in *Hypophthalmichthys molitrix* was 57,447 %, while the mean intensity was 10,148.

The prevalence with *Sinergasilus polycolpus* in *Aristichthys nobilis* was 16,981 %, while the mean intensity was 20,000.

Our findings of *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) are first recorded for Macedonia. At the same time, *Hypophthalmichthys molitrix* and *Aristichthys nobilis* represent new hosts for *Sinergasilus polycolpus* in Macedonia.

Table 1. Prevalence and mean intensity with *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) from cyprinid fish farms in Macedonia

Fish species	Number of examined fish	Number of infected fish	Mean intensity	Prevalence (%)
<i>Hypophthalmichthys molitrix</i>	47	27	10,148	57,447
<i>Aristichthys nobilis</i>	53	9	20,00	16,981

The length of *Sinergasilus polycolpus* was 1,82 – 2,64 mm, while the width to 0,46 mm.

The gills of the infected fish specimens showed severe pathological changes. Our identification of this copepod signals the possible spread of the infectious disease sinergasilosis in fish farms in Macedonia.

4. Conclusion

In order to take certain preventive measures, it is necessary to know the composition of parasite fauna in economically most important fish species, their seasonal dynamics as well as prevalence and mean intensity of certain parasites in different age categories of fish in fish breeding facilities. These comprehensive researches on parasites, besides great practical importance, have theoretical interest. These investigations will help to explain the biology, ecology and phylogenetic development of parasites, as well as their hosts - fish.

Sinergasilus polycolpus has been detected in Macedonian waters for the first time. It is specific parasitic copepod for silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*), affecting the gills and cause severe pathological changes, but present in higher numbers can lead to breath difficulty and fish mortality. These fish are one of most important farm-cultured fish species inhabiting the two largest cyprinid fish farms near Bitola (Republic of Macedonia), used in aquaculture for phytoplankton blooms control. Pathogenic parasitic copepod *Sinergasilus polycolpus* is introduced in our fish farms by introducing fry of these fish species which origin is from China.

Silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) represent new hosts for *Sinergasilus polycolpus* in Republic of Macedonian water and it is first recorded in this paper. It is very important for further researches to examine factors which influence the population dynamics of *Sinergasilus polycolpus* in these two fish species from fish breeding facilities in Macedonia.

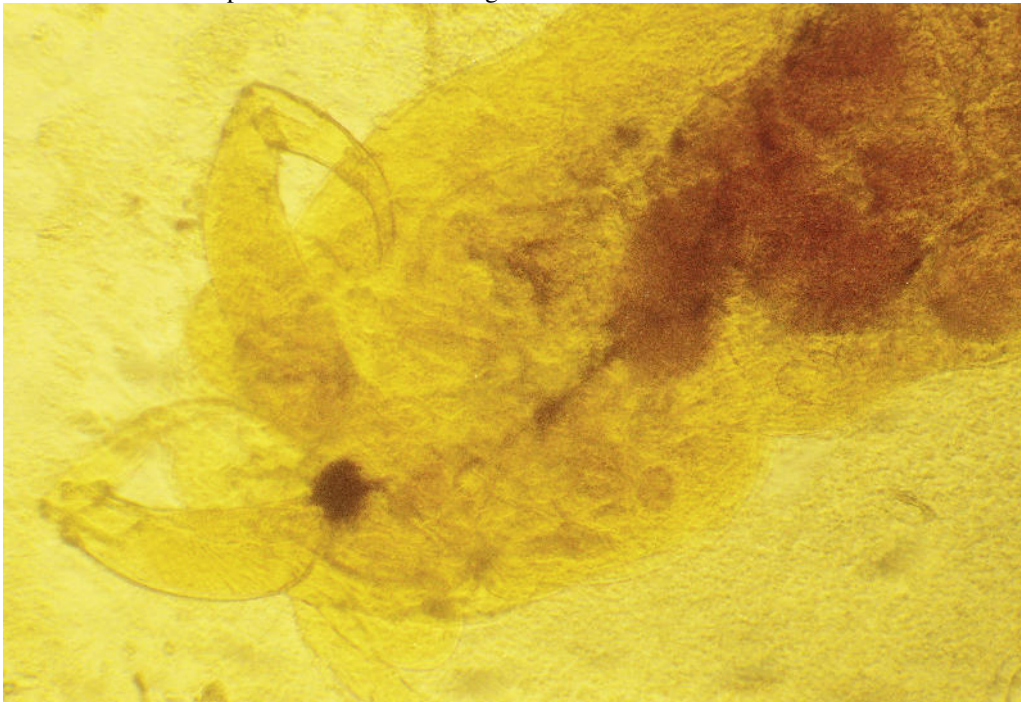


Figure 1. *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) (original)

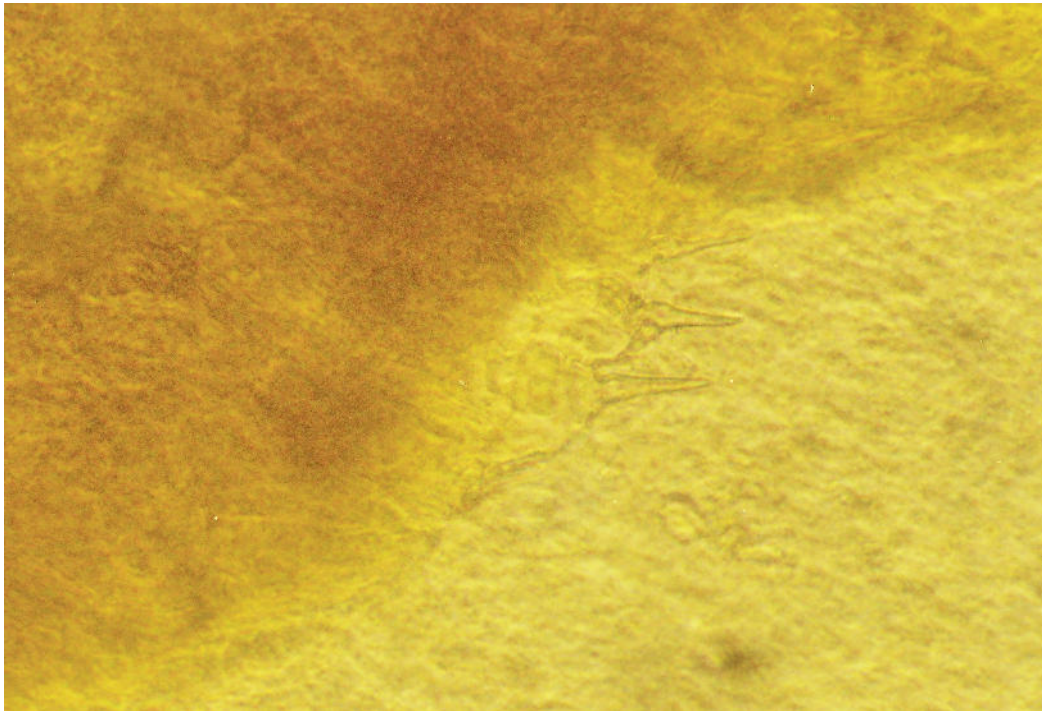


Figure 2. *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) (original)

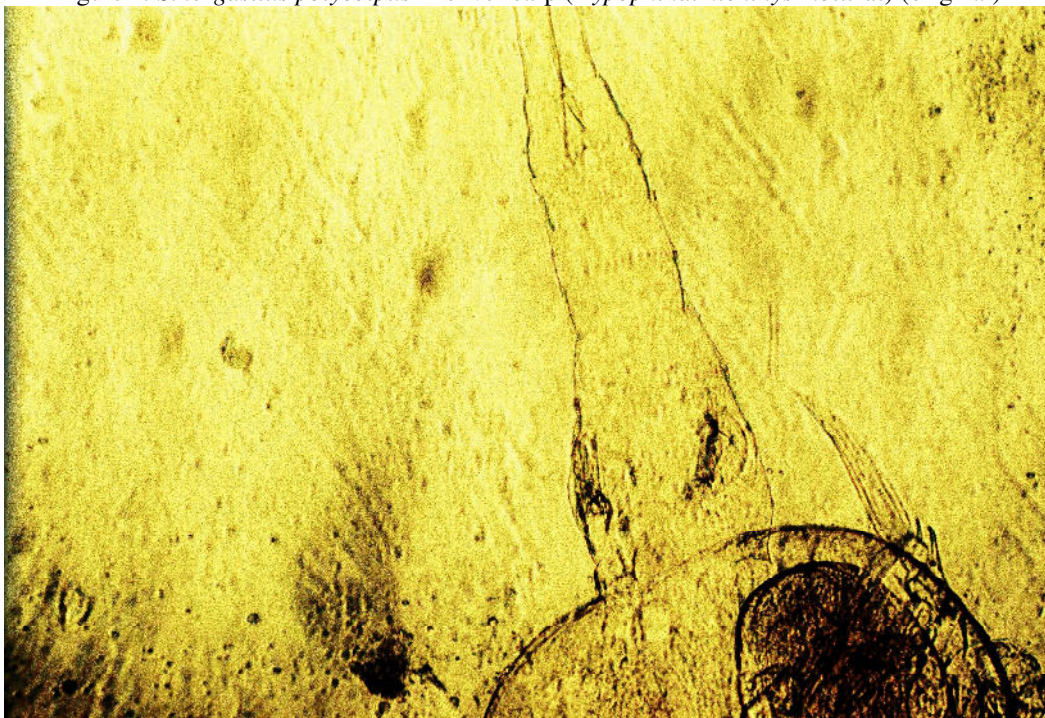


Figure 3. *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) (original)

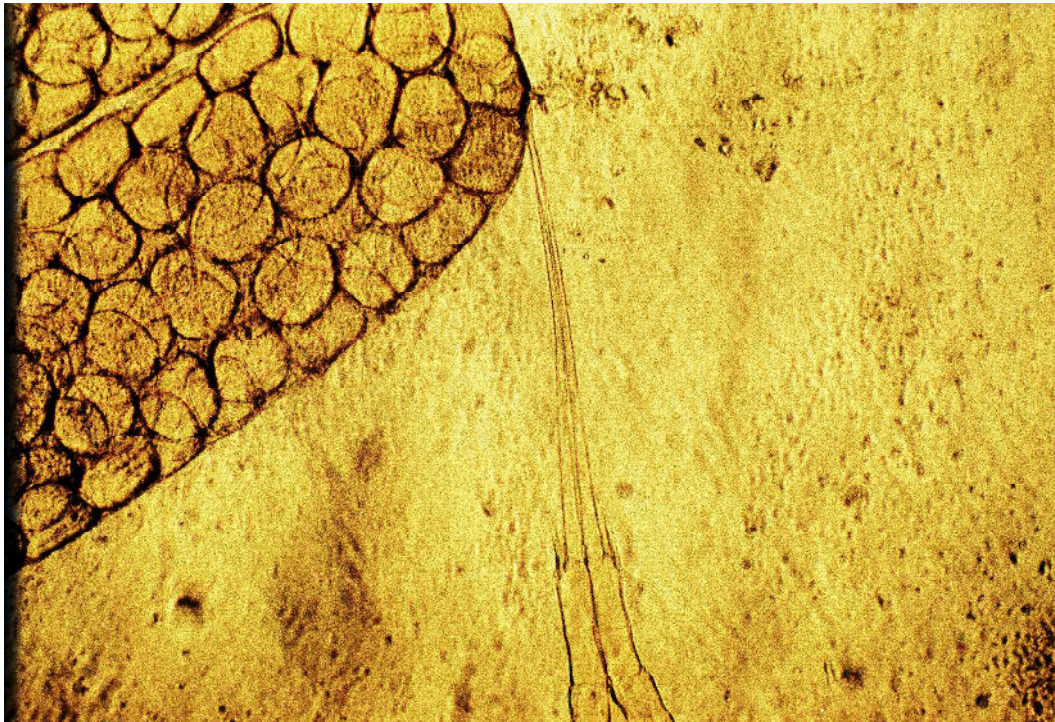


Figure 4. *Sinergasilus polycolpus* in silver carp (*Hypophthalmichthys molitrix*) (original)



Figure 5. *Sinergasilus polycolpus* in bighead carp (*Aristichthys nobilis*) – anterior part (original)

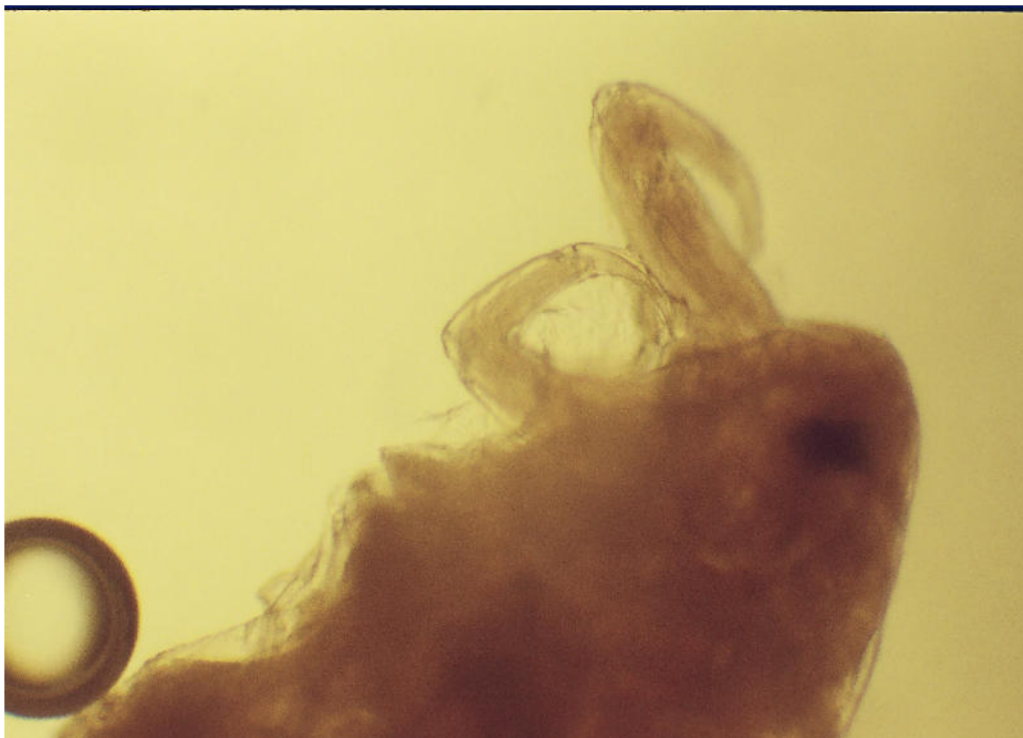


Figure 6. *Sinergasilus polycolpus* in bighead carp (*Aristichthys nobilis*) – anterior part (original)

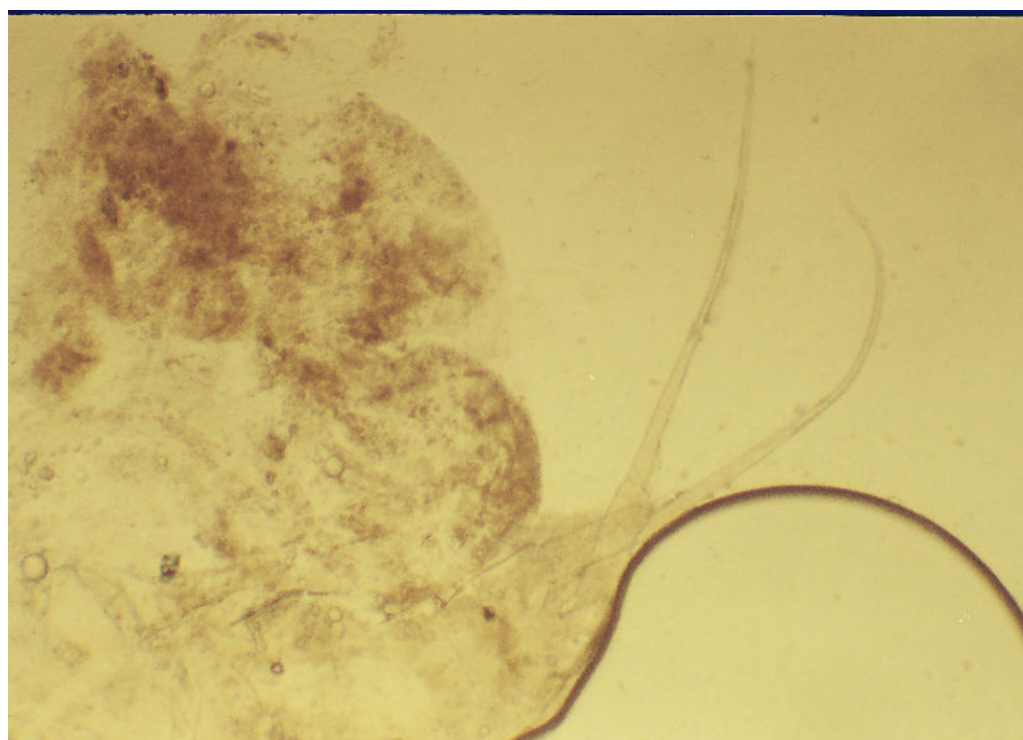


Figure 7. *Sinergasilus polycolpus* in bighead carp (*Aristichthys nobilis*) – posterior part (original)

References

- Bauer, O.N. (1985). *Opređelitelj parazitov presnovodnih ryb fauni SSSR. Tom II (Parazitičeskie mnogokletočnie. Pervaja čast).* Akademia Nauk SSSR. Izdateljstvo "Nauka", Leningrad.
- Bauer, O.N. (1987). *Opređelitelj parazitov presnovodnih ryb fauni SSSR. Tom III (Parazitičeskie mnogokletočnie. Vtoraja čast).* Akademia Nauk SSSR. Izdateljstvo "Nauka", Leningrad.
- Bush, A.O., Lafferty, K.D., Lotz, J.M. and Shostak, A.W. (1997). "Parasitology meets ecology on its own terms: Margolis et al. Revisited". *J. Parasitology.*, 83: 575- 583.

- Blažeković Dimovska D. (2013): “Parasite fauna and mycoses in cyprinid fish in the fish breeding facilities in the Republic of Macedonia”. PhD thesis. Faculty of biotechnical sciences, University “St. Kliment Ohridski”, Bitola, Macedonia.
- Delgado, C.L., Wada, N., Rosegrant, M.W., Meijer, S., Ahmed, M. (2003). Outlook for Fish to 2020: Meeting Global Demand. Report by the International Food Policy Research Institute.
- Kottelat M., Freyhof J. (2007). Handbook of European freshwater fish.
- Nie, P. and Yao, W. J. (2000). “Seasonal population dynamics of parasitic copepods, *Sinergasilus* spp. on farmed fish in China”, *Aquaculture*, Volume 187, Issues 3-4, pp. 239-245.
- Van West, P. (2006). “*Saprolegnia parasitica*, an oomycete pathogen with a fishy appetite: new challenges for an old problem”. *Mycologist* 20: 1–6.
- Wang, T. Gui, Li, X. Wen, Yao, J. Wei, Nie, P. (2002). “Mortalities induced by the copepod *Sinergasilus polycolpus* in farmed silver and bighead carp in a reservoir”, *Dis. Aquat. Org.*, Vol. 48, pp. 237–239.
- Yulin, J. (1996). “A review of traditional and innovative aquaculture health management in the People’s Republic of China”. *FAO Fish.Tech. Pap.* 360: pp. 88–103.
- Zhang, J., Qiu, Z., Ding, X. (1999). “Parasites and parasitic diseases of fishes”. Science Press, Beijing (in Chinese).