ZooNotes 199: 1-3 (2022)
www.zoonotes.bio.uni-plovdiv.bg
ISSN 1313-9916

Common carp (*Cyprinus carpio* Linnaeus, 1785): a species equally important for aquaculture and aquatic toxicology

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Abstract. Our main goal in this short review is to present the pros of using common carp (*Cyprinus caprio* Linnaeus, 1785) for the purposes in both, aquaculture and aquatic toxicology.

Key-words: common carp, aquaculture, pollution.

Introduction

According to Kumar *et al.* (2022) aquaculture production in the Central and Eastern Europe (CEE) was 396 thousand MT in 2018, of which 342 thousand MT (86%) was originated from freshwater rearing systems (FAO, 2020). Furthermore, the vast majority (80%) of freshwater fish farming is based on low production-intensity pond culture, which consists of technologies of polyculture of different Cyprinid species, with common carp, being the dominant farmed organism, accounting for 75–80% of pond farming (FAO, 2016). Common carp, as explained by Shahi *et al.* (2022), contributes to 3.4% of the global fish production and is overall cultured in more than 100 countries. According to Nakajima *et al.* (2019) the cultivation of common carp can be traced back to 8000 years ago and today it is the most commonly grown freshwater fish in China. In addition, it is among the top five of the most cultivated freshwater fish species, along with grass carp (*Ctenopharyngodon idella* Valenciennes, 1844), silver carp (*Hypophthalmichthys molitrix* Valenciennes, 1844)) and Nile tilapia (*Oreochromis niloticus* Linnaeus 1758), because of its wide distribution and easy availability, high economic value, and growth traits (Saucedo-Vence *et al.*, 2017; Chen *et al.*, 2019). Common carp is also the most commonly reared fish in aquaculture in Bulgaria, along with brown trout (*Salmo trutta fario* Linnaeus, 1758) and rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792).

Discussion

We agree with da Silva Montes *et al.* (2020) who explain that successful monitoring and risk-assessment programs begin with the choice of bioindicator species. Common carp also serves as an excellent test organism in ecotoxicological studies because it is relatively resilient to water pollution, which is essential for the selection of bioindicators in laboratory and field experiments (Yancheva *et al.*, 2019). It is a bentho-pelagic fish found, both in brackish waters and freshwater rivers (Ghelichpour *et al.*, 2013) and due to its omnivorous, sediment-dwelling behaviour, this species tends to accumulate more pollutants than pelagic fish (Alam *et al.*, 2002). Furthermore, we support the opinion of Pirsaheb *et al.* (2019) the dominance of common carp in the aquatic systems and the fact that it has a better capacity for resistance against pollutants rather than other laboratory fish, such as zebra fish (*Danio rerio* F. Hamilton, 1822) and Japanese medaka (*Oryzias latipes* Temminck & Schlegel 1846) are common reasons for choosing this exact species in ecotoxicological tests. In this regards,

Received: 22.02.2022, Accepted: 22.02.2022, Published: 23.02.2022
Университетско издателство "Паисий Хилендарски"
Plovdiv University Press "Paisii Hilendarski"

the efficacy of common carp as a sentinel species has been proven previously, involving laboratory experiments, field studies, and biomonitoring programs, including our studies (Stoyanova *et al.*, 2020; Georgieva *et al.*, 2021). They confirm the successful application of common carp in aquatic toxicology in regards of analysing a number of biomarkers, such as enzymatic, histological and physiological alterations, along with classical chemical analyses.

Since, aquaculture has been growing 6% per year and now has become a major food industry in the world market, as well as an extremely important source of protein in the human diet (FAO, 2020), we believe that the levels of priority organic contaminants (heavy metals and toxic elements, pesticides, organic pollutants) in common carp meat should be monitored regularly. This is undoubtedly important for human health risk assessment. On the other hand, we think that these studies go hand in hand with aquatic toxicology. In addition, we consider that aquatic toxicology should use bioindicator species, which are also economically important, not just species that are convenient for handling, easily reproduced, etc. In this way, business and science will unite, so that soceity will fully benefit from the knowledge obtained.

Conclusions

We strongly recommend the use of common carp in aquatic toxicology and we also consider that other Cyprinid species should be promoted for the purposes of aquaculture and aquatic toxicology.

Acknowledgements. Project FP 21 BF 008 - "*Ex situ* assessment of xenobiotic-contaminated aquatic ecosystems by applying multi-biomarkers in selected bioindicator species", which is funded by the Scientific Fund at Plovdiv University, Bulgaria is very much appreciated.

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