International Journal of Agriculture Innovations and Research
Volume 10, Issue 2, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 06/10/2021 | Accepted on: 28/10/2021 | Published: 15/11/2021

Contracaecum Microcephalum Rudolphi, 1809, A New Parasite of Fish in Armenia, As a Potential Risk for Human Health

Oleg Valery Shcherbakov[1,2*], Liana Hayk Grigoran[1], Anush Rafik Hakobyan[1] and Valery Volodya Grigoryan[1]

[1]National Agrarian University of Armenia, Department of Epidemiology and Parasitology, Yerevan, Republic of Armenia.

[2]Scientific Center of Zoology and Hydroecology, NAS RA, Laboratory of Parasitology, Yerevan, Republic of Armenia.

*Corresponding author email id: oleg1vet@gmail.com

***Abstract* – The goal of current work was research of prevalence of *Contracaecum microcephalum* in Armenia, and estimate risk for human health. Research was conducted at natural lakes, rivers, ponds, and fish farms from 4 regions of Armenia, as well as at the laboratory of the Department of Epidemiology and Parasitology, National Agrarian University of Armenia, and at the laboratory of General Parasitology, Scientific Center of Zoology and Hydroecology. Fish research has been conducted by classic method for ichthyoparasitological examination, using microscopic examination, and electronic ID key. *Contracaecum microcephalum* infection has been detected in Armenian schneiders (*Alburnoides bipunctatus armeniensis*) from river Hrazdan. Overall incidence of the fish *Contracaecum* infection is rather low (0.59%). Constant presence in Armenia during recent decades, natural focus formation, as well as capability of transition to other hosts and locality creates significant risk for human infection.**

***Keywords* – *Contracaecum Microcephalum, Alburnoides Bipunctatus Armeniensis*, Fish, Human Health, Risk.**

I. INTRODUCTION

Armenian fish fauna is rather poor, it has 47 species, 9 of that are endemics, and 19 representatives are introduced or invasive species [6]. Such pattern is mainly determined by mountain location of the country, and comparatively isolated status of hydrological system of the country, without access to World Ocean. Parasite fauna of fish in Armenia is also characterized by low diversity and number of species (59 parasite species). Significant part of the representatives of parasite fauna are introduced species that have entered with the introduced and acclimatized fish species - common carp, grass carp, Prussian carp, whitefish, and some other species. *Eudiplozoon nipponicum* Goto, 1891, *Dactylogyrus extensus* Mueller et Van Cleave, 1932, *Diplostomum rutili* Razmashkin, 1969, *Neascus cuticola* Nordmann, 1832, *Khawia sinensis* Hsu, 1935 and others can be taken as examples of invasive parasitic species [6]. New species of fish parasites are being described from time to time. Nevertheless, none of parasites described in fish of Armenia had been mentioned as potentially dangerous for humans.

Situation changed in 1963 when the first species that has zoonotic concern, namely *Contracaecum microcephalum* Rudolphi, 1809 (syn. *C. squalli* Rudolphi, 1819), was described in body cavity and mucous membranes of *Salmo ischchan* Kessler, 1877 and *Capoeta capoeta sevangi* De Filippi, 1865 in lake Sevan [14]. The next mention was in 2011 in the same tissues of *C. C. sevangi* at the same location [18]. No more references of fish *Contracaecum* infection in Armenia were found in special literature.

At the same time, the mentioned species is typical for numerous cyprinids all over the word [12].

The mentioned species was also registered in wetland bird species, namely in *Egretta garzetta* L., 1766 (little

egret), *Casmerodius albus* L., 1758 (syn. *Ardea alba* L., 1758), (great white egret), and *Ardea cinerea* L., 1758 (grey heron) [2; 13].

C. microcephalum Rudolphi, 1809 (Nematoda: Anisakiidae) is a common parasite of small intestines of piscivorous birds [5; 9; 11; 13].

Numerous cases of human *Contracaecum spp.* infection are described in the literature. Humans are facultative or aberrant definitive host for this roundworm, and adult, sexually mature helminthes are not detected in human organism [7; 10; 15-17].

Based on the above-mentioned, the goal of current work was research of prevalence and detection of causes for *Contracaecum microcephalum* infection in fish of Armenia.

II. Material and Methods

Research was conducted at natural lakes, rivers, and ponds, as well as in numerous fish farms in lake Sevan (Gegharkunik Region), as well as in Ararat, Armavir, and Kotayk Regions, in 2019-2021. All the farms have artificial ponds that are nourished by underground artesian water.

Research was conducted all year round.

Names and number of the examined fish species are demonstrated in Table 1.

Table 1. Examined fish species.

Common Name	Latin Name	Number of the Examined Fish
Silver trout	*Salvelinus agassizii* Garman, 1885	24
Rainbow trout	*Oncorhynchus mykiss* Walbaum, 1792	167
Californian golden trout	*Oncorhynchus mykiss aguabonita* Jordan, 1893	35
River trout	*Salmo trutta morpha fario* L., 1758	8
Sevan trout	*Salmo ischchan* Kessler, 1877	9
Whitefish	*Coregonus lavaretus* L., 1758	38
Common carp	*Cyprinus carpio* L., 1758	5
Prussian carp	*Carassius auratus gibelio* L., 1758	34
Armenian schneider	*Alburnoides bipunctatus armeniensis* Dadikyan, 1972	10
Sterlet	*Acipenser ruthenus* L., 1758	7

337 fish have been totally examined. Laboratory research was conducted at the laboratory of the Department of Epidemiology and Parasitology, National Agrarian University of Armenia, as well as at the laboratory of General Parasitology, Scientific Center of Zoology and Hydroecology, under National Academy of Sciences of the Republic of Armenia (NASRA). Fish research has been conducted by classic method for ichthyoparasitologi -cal examination [4]. Parasite identification was conducted by means of microscopic examination, using electronic ID key and ID manual [1].

III. Results and Discussion

Results of the fish examination are demonstrated in Table 2.

Table 2.Fish *contracaecum* infection incidence.

Fish Species	Number of the Examined Fish	Number of the Infected Fish	Incidence, %
Silver trout	24	0	0
Rainbow trout	167	0	0
Californian golden trout	35	0	0
River trout	8	0	0
Sevan trout	9	0	0
Whitefish	38	0	0
Common carp	5	0	0
Prussian carp	34	0	0
Armenian schneider	10	2	20
Sterlet	7	0	0
TOTAL	337	2	0,59

Infection by *Contracaecum microcephalum* larvae has been detected by us only in 2 Armenian schneiders (*Alburnoides bipunctatus armeniensis*) caught in river Hrazdan not far from its point of outflow from lake Sevan, Gegharkunik Region, in summer 2021. Both infected fish were adult females. Infection intensity was 2 larvae in one fish, and 1 larva in another. Larvae were spirally twisted, encapsulated, and located under the serous layer of intestinal wall (see Photos 1 and 2).

Contracaecum microcephalum larvae found by us, had a fusiform elongated shape, their size was equal to approximately 1.5 x 0.07 mm, greyish color, with notable rudiments of capital labiae. Larval tooth was long, and had a conic shape. Stoma had an apical position, and was comparatively short. Length of the gastric excrescence was approximately equal to the length of esophagus, and three times longer than intestinal excrescence, that is characteristic for *C. microcephalum*.

Overall incidence of the fish *Contracaecum* infection was equal to 0.59%, and it cannot be characterized as high. Nevertheless, constant presence of the mentioned pathogen in Armenia is obvious.

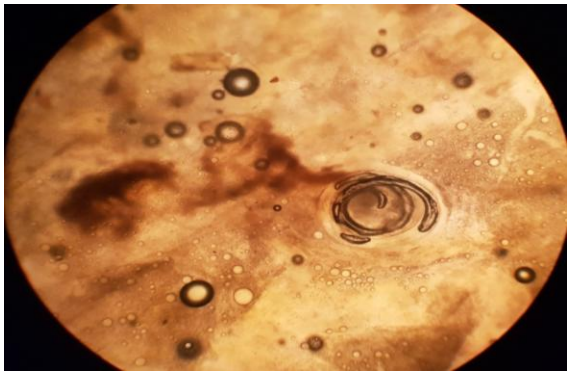

Photo 1. *Contracaecum microcephalum* spirally twisted larva in fish intestinal wall 64x.

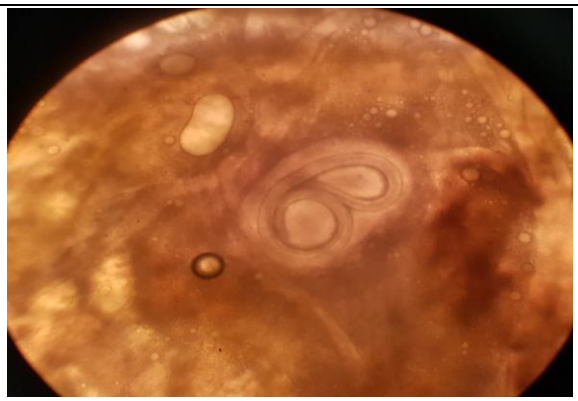

Photo 2. *Contracaecum microcephalum* encapsulated larva in fish intestinal wall 120x.

It is interesting to note that *C. microcephalum* has not been mentioned as a parasite of *Alburnoides bipunctatus armeniensis* before [3]. It was not detected in fish in Armenia outside of lake Sevan as well [8].

According to our research, expansion of *C. microcephalum* areal occurred; currently is found not only in Sevan, but also in river Hrazdan that flows out of the lake Sevan, while it was described in fish of lake Sevan only till 2011 [6; 14; 18].

Besides, eggs of *Contracaecum spp.* were found by us in feces of *Ardea cinerea* during routine examination of wetland birds caught from lake Sevan basin in spring 2021 (see Photo 3).

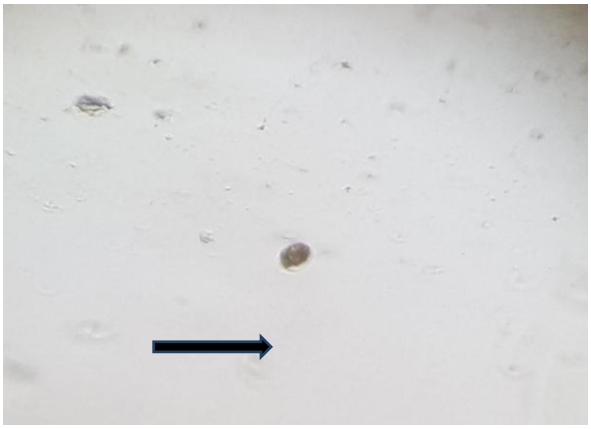

Photo 3. *Contracaecum spp*. egg (arrow) in feces of grey heron120x.

Therefore, active local focus of *Contracaecum* infection present in Armenia in wildlife, and humans can be easily involved in epidemic process consuming raw or poorly cooked fish.

Contracaecum microcephalum is an invasive parasite species that was not typical for local parasite fauna of Armenia. All previous mentions concerned lake Sevan only, and Sevan fish species only (namely, Sevan trout - *Salmo ischchan*, and Sevan scraper - *Capoeta capoeta sevangi*). Our discovery indicates the parasite transition to another locality, and another host. It also witnesses wide adaptive potential of the studied parasite, and capability to create new sources (i.e. fish species) for human infection.

IV. Conclusion

Contracaecum microcephalum infection has been detected in Armenian schneiders (*Alburnoides bipunctatus armeniensis*) from river Hrazdan. Overall incidence of the fish *Contracaecum* infection is rather low (0.59%).

Constant presence in Armenia during recent decades, natural focus formation, as well as capability of transition to other hosts and locality creates significant risk for human infection.

REFERENCES

[1] O.E. Bauer, *ID Manual on the Fish Parasites*. Vol. 3, Part 2: Parasitic Meazoa, Leningrad.: "Nauka", 1987, 583 p. (in Russian).
[2] L.V. Balyan, M.G. Ghasabyan, M.A. Nikoghosyan, R.A. Petrosyan, *Current state of waterbird fauna in the basin of lake Sevan and extent of their infestation,* in Proceedings of the International Conference "Biological Diversity and Conservation Problems of the Fauna-3", Armenia, Yerevan, 2017, September 27-29, pp. 38-46. (in Russian)
[3] N.E. Barseghyan, T.V. Vardanyan, *Biological characteristics of Alburnoides bipunctatus armeniensis (Osteichtyes, Cyprinidae), a new species for lake Sevan*, in Biological Journal of Armenia, 2011, vol. 63, pp. 87-89. (in Armenian)
[4] I.Ye. Bykhovskaya-Pavlovskaya, "*Fish Parasitological Examination"*, Leningrad: "Nauka", 1969, 108 p. (in Russian)
[5] F.B. Drago, V. Nunez, M.D. Diaz, *Checklist of the nematode parasites of wild birds of Argentina,* in Revue Suisse de Zoologie, vol. 127, pp. 43-61.
[6] *"Ecology of lake Sevan during the period of water level rise. The results of Russian-Armenian biological expedition for hydroecological survey of lake Sevan (Armenia) (2005–2009)",* Russian Federation, Makhachkala, 2011, 348 p. (in Russian)
[7] A.V. Gaevskaya, *Anisakid nematodes and diseases caused by them in animals and man*, Sevastopol: EKOSI- Gidrofizika, 2005, pp. 172-173. (in Russian)
[8] R.L. Hovhannisyan, M. Ya Rukhkyan, *On fauna of fish helminthes of river Metsamor,* in Biological Journal of Armenia, 2015, vol. 67, pp. 93-95. (in Russian)
[9] A.N. Al Khalaf, *Some helminthes of the Great Egret (Egretta alba) in Saudi Arabia,* in Beni-Suef Veterinary Medical Journal, 2007, vol. 17, pp. 6-10.
[10] D. Ljubojevic, V. Djordjevic, V. Radosavljevic et al., *Potential parasitic hazards for humans in fish meat*, in Procedia Food Science, 2015, vol. 5, pp. 172-175.
[11] Z.A. Mohammad, M.K. Hbaiel, *Isolate and identify of Contracaecum spp. nematodes from some aquatic bird species by using light microscope and scanning electron microscope,* in Journal of Education for Pure Science - University of Thi-Qar, 2019, vol. 9, pp. 180-192.
[12] K. Molnar, C. Szekely, F. Baska et al., *Differential survival of 3rd stage larvae of Contracaecum rudolphii type B infecting common bream (Abramis brama) and common carp (Cyprinus carpio),* in Parasitology Research, 2019, vol. 118, pp. 2811-2817.
[13] S.O. Movsesyan, E.A. Vlasov, M.A. Nikoghosian et al., *Nematodes of birds of Armenia,* in Annals of Parasitology, 2020, vol. 66, pp. 447-455
[14] T.A. Platonova, *Parasite fauna of Sevan fish,* in Parasitological Compendium, Leningrad, 1963, vol. 21, pp. 65-68. (in Russian)
[15] S. Shamsi, *Parasite loss or parasite gain? Story of Contracaecum nematodes in antipodean waters*, in Parasite Epidemiology and Control, 2019, vol. 3, e00087.
[16] S. Shamsi, A. Butcher, *First report of human anisakidosis in Australia*, in The Medical Journal of Australia, 2011, vol. 194, N 4, pp. 199-200. DOI:10.5694/j.1326-5377.2011.tb03772.x
[17] S. Shamsi, A. Turner, S. Wassens, *Description and genetic characterization of a new Contracaecum larval type (Nematoda: Anisakidae) from Australia*, in J. Helminthol., 2018, vol. 92, N 2, pp. 216-222. doi: 10.1017/S0022149X17000360.
[18] Ye. L. Voropaeva, O.O. Tolstenkov, R.L. Hovhannisyan, *Species diversity of parasites in lake Sevan (Armenia)*, in Russian Parasitological Journal, 2011, N 4, pp. 14-26. (in Russian)

AUTHOR'S PROFILE

First Author
Oleg Valery Shcherbakov, DVM, PhD., Senior researcher at the department of Epidemiology and Parasitology, National Agrarian University of Armenia. Senior researcher at the division of Molecular Parasitology, Laboratory of Parasitology, Scientific Center of Zoology and Hydroecology, National Academy of Sciences of Armenia. Field of Study: Veterinary parasitology, particularly fish parasites, sanitary helminthology, roundworm, protozoal and mite diseases of animals, ticks and tick-borne diseases of animals. Author of 73 scientific papers, 3 manuals, and 4 patents for invention. Member of Armenian Society of Parasitologists, and Armenian Small Animal Veterinary Association. Phone: +37455 386224.

Second Author
Liana Hayk Grigoryan, DVM, PhD, Associate Professor at the Department of Epidemiology and Parasitology, National Agrarian University of Armenia. Head of Scientific Center of Veterinary and Veterinary Sanitary Expertise, National Agrarian University of Armenia. Field of Study: Veterinary parasitology, particularly fish parasites, mite diseases of animals, ticks and tick-borne diseases of animals. Author of 54 scientific papers, 4 methodical manuals and 1 patent for invention. Member of Armenian Society of Parasitologists. Phone: +37493 835050. email id: lianagrigoryan7878@mail.ru

Third Author
Anush Rafik Hakobyan, DVM, PhD. Associate Professor at the Department of Epidemiology and Parasitology, National Agrarian University of Armenia. Senior Researcher at the Department of Epidemiology and Parasitology, National Agrarian University of Armenia. Field of Study: Veterinary, Epidemiology, Microbiology, Immunology, Fish Pathology, Veterinary Parasitology. Author of 58 scientific papers, 3 manuals, and 3 patents for invention. Member of Armenian Society of Parasitologists. Phone: +37493 441210. email id: ahakobian@yandex.ru

Fourth Author
Valery Volodya Grigoryan, DVM, PhD. Associate Professor at the Department of Epidemiology and Parasitology, National Agrarian University of Armenia. Senior Researcher at the Department of Epidemiology and Parasitology, National Agrarian University of Armenia. Field of Study: Veterinary parasitology, particularly fish parasites, mite diseases of animals, parasitic protozoa, ticks and tick-borne diseases of animals. Author of 63 scientific papers, 3 manuals and 6 patents for invention. Member of Armenian Society of Parasitologists. Phone: +37455 973753.
email id: grigoryanvgv@mail.ru