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**HELICOMETRA FASCIATA (RUDOLPHI, 1819) COMPLEX
FROM NEW FISH HOST IN THE BLACK SEA,
THE BROADNOSED PIPEFISH
SYNGNATHUS TYPHLE LINNAEUS, 1758,
WITH NOTES ON BIOLOGY OF THIS TREMATODE SPECIES**

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This paper reports on the first record of *Helicometra fasciata* (Rudolphi, 1819) complex (Opaeoelidae) maritae from black-striped pipefish, *Syngnathus typhle* Linnaeus, 1758, in the Black Sea. Ten fish specimens caught near the Kerch Strait (north-eastern part of the Black Sea) in July 2007 were examined and one of them was found to be parasitized by a single *H. fasciata* complex ovigerous marita. Description and drawing of the trematode found are given. *S. typhle* and fish of the Syngnathidae family as a whole are believed to be accidental definitive hosts of *H. fasciata* complex. Cases of *Helicometra* spp. ovigerous maritae records in fresh waters are discussed. The expansion of *H. fasciata* complex definitive host range in the Black Sea (*S. typhle* is its 33d known fish host from here) reflects a complexity of food webs in the shelf zone of this sea.

Keywords: first record, Trematode, Opaeoelidae, Syngnathidae, Black Sea, food webs

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The Black Sea Syngnathidae are known as hosts of many helminth species with Trematoda as the most abundant class among them (Kornychuk et al., 2022). Nevertheless, studying the slides deposited in the Collection of Marine Parasites of the A.O. Kovalevsky Institute of Biology of the Southern Seas RAS (IBSS), <http://marineparasites.org>, we identified one more digenean which have not been previously mentioned from these fish hosts, namely *Helicometra fasciata* (Rudolphi, 1819) complex. According to Katokhin and Kornychuk (2020) and Sokolov et al. (2022), *H. fasciata* is actually a species complex consisting of at least two species in the Black Sea with a clear genetic differentiation. The present paper is devoted to morphological description of this find.

MATERIAL AND METHODS

The slide No 1404.Tr.39.v43 deposited in IBSS Collection of Marine Parasites was studied; according to our field journal entry, host specimens (broadnosed pipefish *Syngnathus typhle* Linnaeus, 1758) were sampled in the Black Sea (Kerch Strait near Naberezhnoe village, 45°08'20"N,

36°25'00"E) in July 2007 by hand nets at depths 0-1 m; identification of fishes to species was made using conventional keys (Svetovidov, 1964; Vasil'eva, 2007).

Fish hosts were dissection immediately after catching. For light microscopy, the digenean was stored in 70% ethanol and the whole mount was prepared as follows: stained with borax carmine, dehydrated in a graded ethanol series (70–100) and mounted in Canada balsam on a glass slide (Bykhovskaya-Pavlovskaya, 1985).

Trematoda species identification was taken using an Olympus CX-41 microscope with digital camera CAM-SC50 and CellSens Standard v. 1.18 software; all the measurements in the text are in micrometers.

RESULTS

The only gravid marita of *H. fasciata* species complex (Fig. 1) is fixed on the slide in a slightly curved position.

Body oval, 1234.4 x 598.7; body W:L ratio 2.06.

Tegument unarmed.

Oral sucker subterminal, 103.8 x 123.5. Ventral sucker 210.1 x 239.9. Sucker length ratio 1:2.02 and sucker width ratio 1:1.94.

Pharynx 53.3 x 68.2, prepharynx present, esophagus short.

Caeca blind, extend to posterior end of the body.

Forebody: 306.9 (25% of body length).

Testes tandem, contiguous, slightly indented. Anterior testis 108.9 x 132, posterior testis 132 x 158.4.

Posttesticular space: 238.1 (19% of body length).

Cirrus sac 188.3 x 51.4, its posteriormost extent slightly posterior to midlevel of ventral sucker, well developed, enclosing a seminal vesicle.

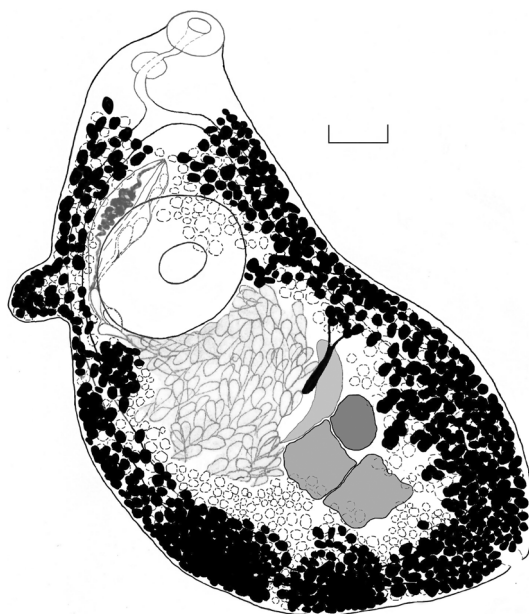


Figure 1. *Helicometra fasciata* (Rud., 1819) complex (Trematoda, Opcoelidae) marita from the Black Sea broadnosed pipefish *Syngnathus typhle* Linnaeus, 1758, ventral view. Scale bar – 100 μ .

Ovary 95.7 x 66, sinistro-submedian, at level of anterior testis, oval.

Genital pore median, between caeca bifurcation and anterior edge of ventral sucker. Anterior extremity to genital pore distance 267.3 (21.7% of body length).

Vitellaria follicular. Follicles of varying sizes, in lateral fields, dorsal, ventral and lateral to caeca, extending from level of caeca bifurcation to caeca ends, confluent dorsally in forebody and ventrally and dorsally in posttesticular space. The specimen studied has unusual vitellaria follicles grouped randomly into different-size globules.

Common vitelline reservoir slightly submedian, anterior to ovary.

Uterus coiled, preovarian. Metraterm along left edge of cirrus sac.

Eggs ($n = 15$) 53.45–59.67 (56.15) x 22.9–31.06 (25.82), with long unipolar filament.

The marita studied was found in the gut of one of eleven broadnosed pipefish specimens caught off Kerch Strait region (prevalence 10%, abundance 0.1). Taking into account total number of previously studied *S. typhle* from another parts of the Crimean Black Sea shelf ($n = 107$), the prevalence is 0.9%, abundance 0.009.

DISCUSSION

The trematode specimen we found matches morphologically with *H. fasciata* complex description, namely: a ventral sucker in the anterior part of the body, two tandem slightly indented testes, filamented eggs, a median genital pore near the caeca bifurcation, vitelline follicles in the lateral fields reaching far in the forebody (Blend, Dronen, 2014; Sokolov et al., 2022).

The body length of *H. fasciata* complex marita from broadnosed pipefish is in the previously established (Korniychuk, 2009a) limits of mature Black Sea representatives of this species complex (414–3795). Eggs sizes are in the frames (52–73 x 24–41) known for the Black Sea *H. fasciata* complex (Korniychuk, 2009a), too, and in the middle of appropriate limits (38–100 x 16–42) mentioned for *H. fasciata* complex by Blend, Dronen (2014). Strongly submedian position of ovary (“triangle” arrangement of gonads) sinistrally to anterior testis has also been previously identified in *H. fasciata* complex from Black Sea fishes, both in live and fixed worms (Korniychuk, 2009a).

There are only two cases of *Helicometra* spp. maritae records from Syngnathidae fish hosts have been known before (Blend, Dronen, 2014).

The first of them refers to Nora Sproston’s (1938) finding of “some” *Helicometra sinuata* (Rudolphi, 1819) (= *H. fasciata* s. lato) specimens from the only male of a short snouted seahorse, *Hippocampus hippocampus* (Linnaeus, 1758) (= *Hippocampus antiquorum* Leach, 1814) she studied, the fish was caught near French coast of the English Channel. To our knowledge, it was also a first report of opecoelid marita maritae from Syngnathidae fish hosts. One more finding of *Helicometra* Odhner, 1902 maritae from Syngnathidae was made by Alexandra Chaplina and Ljudmila Antsishkina (1961) who studied fish parasite fauna in small rivers (Berda, Obitochnaja, Lozovatka, Korsak, Big and Small Utljuk, Tashenak) flowing to the north part of the Sea of Azov and registered *Helicometra pulchella* (Rudolphi, 1819) (= *H. fasciata* s. lato) from the black-striped pipefish, *Syngnathus abaster*, without noting the exact locality of this find. The digeneans found were not described by the authors: there were no figures, measurements of the parasites as well as a remark on their maturity. The limits of infection cannot be obtained from the table in the text – very many”, as the authors stated; the prevalence at 50% seems exceptionally high comparing with data on another fish hosts in the region (Korniychuk, 2017) but the authors didn’t specify total number of the pipefish studied.

So, we believe Syngnathidae syngnathid fishes to be accidental definitive hosts of *H. fasciata* complex regardless of the true species affiliation of representatives of this digenean species complex.

The digeneans belonging to *Helicometra* are known mostly from fish hosts inhabiting marine and brackish waters (Blend, Dronen, 2014); there are also two records of *Helicometra* spp. in fresh waters, they are the above mentioned find of Chaplina and Antsishkina (1961) and a find of two ovigerous maritae in Kahovsky water reservoir on Dnieper river, from two fish hosts: the monkey goby, *Neogobius fluviatilis* (Gobiidae), and the pike perch, *Sander lucioperca* (Linnaeus, 1758) (= *Lucioperca lucioperca* (Linnaeus, 1758) (Koval' et al., 1975) and worth noting: judging by the drawing, the last find refers to *H. fasciata* s. lato. These two cases raise a question of possible ways of fish host infection.

The trochid gastropods *Steromphala adriatica* (R. A. Philippi, 1844) (= *Gibbula adriatica* (Philippi, 1844) acting as *H. fasciata* complex first intermediate hosts in the Black Sea (Machkevsky et al., 1997) are numerous along coasts of this sea at a depth of up to 50 m, on rocks and algae (Chukhchin, 1984). Concerning these mollusks in the Sea of Azov, *Steromphala* (= *Gibbula*) spp. are known there from the only place – near the Biryuchiy Island spit (north-western part of the sea) but are able to spread to the east along the northern coast of the Sea of Azov beyond the Belosaraiskaya Spit (bounding the Taganrog Bay from the north) (Anistratenko et al., 2011). The rivers studied by Chaplina and Antsishkina (1961) flows into the Sea of Azov just in this region. Nevertheless, *Helicometra* parthenogenetic generations have not been found yet as from *S. adriatica* inhabiting the Sea of Azov as from any other mollusks in the rivers flowing into the northern part of the Sea of Azov (Kudlay, 2011).

Metacercariae of *H. fasciata* complex were recorded from prawns *Palaemon elegans* Rathke, 1836 and *Palaemon adspersus* Rathke, 1836 inhabiting Crimean part of the Black Sea shelf zone (Mordvinova, 1979; Machkevsky et al., 1997; Korniychuk, 2008, 2009b; Tkachuk, Mordvinova, 1999) and from the same hosts in the Sea of Azov (Mordvinova, 1979).

Palaemon spp. prawn are the most common second intermediate hosts of *Helicometra* in different regions of the World Ocean; other than *Palaemonidae* hosts known to harbor *Helicometra* spp. metacercariae are prawns belonging to genera *Hippolyte* Leach, 1814 (Hippolytidae), *Alpheus* Fabricius, 1798 (Alpheidae), *Crangon* Fabricius, 1798 (Crangonidae) and *Gammarus* Fabricius, 1775 (Gammaridae) (Blend, Dronen, 2014). Of them *Crangon* spp. and *Gammarus* spp. are able to live in fresh waters but crustaceans from these genera are not recorded as hosts of *H. fasciata* complex metacercariae (Mordvinova, 1979).

The black-striped pipefish, *S. abaster*, inhabit relatively shallow waters around seaweed and sea grass in the Black Seas and are also known from brackish waters and can enter the rivers; they feed on small crustaceans, fish fry, and sometimes small adult fish (Svetovidov, 1964). So, in terms of routes of infection, these pipefish are able to ingest *Palaemon* spp. infected with *H. fasciata* complex metacercariae. Nevertheless, taking into account the above-mentioned data on *S. adriatica* areal in the Sea of Azov, we believe registration of *H. fasciata* complex trematode in fresh waters of North Azov region (Chaplina, Antsishkina, 1961) to be accidental and assuming infection of fish hosts, *S. abaster*, somewhere in the Sea of Azov and subsequent pipefish's migrations into the rivers. The same way we believe possible to explain the appropriate find by Koval' et al. (1975).

CONCLUSIONS

The previously summarized data on *H. fasciata* complex definitive host range in the Black Sea (Korniychuk, 2017) emphasized extremely wide host specificity of this trema-

todes at marita stage in the Black Sea (32 fish host species but excepting Syngnathidae) and on different importance of fish hosts. We also dissected more than 100 *S. typhle* specimens caught in the Crimean part of the Black Sea shelf (Kornychuk et al., 2022) but did not find *H. fasciata* complex – as well as other researchers. So, the role of these fish in maintaining *Helicometra maritae* hemipopulations we believe to be insignificant. Nevertheless, the expansion of *H. fasciata* complex definitive hosts range reflects grows of our understanding of food chains complexity in the Black Sea shelf zone.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This work does not contain any studies involving human and animal subjects.

CONFLICT OF INTEREST

The author of this work declares that he has no conflicts of interest.

REFERENCES

- Anistratenko V.V., Khaliman I.A., Anistratenko O.Yu. 2011. Mollusks of the Sea of Azov. Kiev, Naukova Dumka, 707 pp. [in Russian].
- Blend C.K., Dronen N.O. 2014. A review of the genus *Helicometra* Odhner, 1902 (Digenea: Opecoelidae: Plagioporinae) with a key to species including *Helicometra overstreeti* n. sp. from the cusk-eel *Luciobrotula corethromycter* Cohn, 1964 (Ophidiiformes: Ophidiidae) from the Gulf of Mexico. *Marine Biodiversity* 45(2): 183–270. DOI: 10.1007/s12526-014-0250-3
- Bykhovskaya-Pavlovskaya I.E. 1985. Parasitological investigation of fish. Leningrad, Nauka, 121 pp. [in Russian]. DOI: 10.21072/bykhovskaya-pavlovskaya-1985
- Chaplina O.M., Antsishkina L.M. 1961. Data on the fish parasites in small rivers of the northern Azov area. *Proceedings of Ukrainian Academy of Sciences* 2: 247–250 [in Ukrainian].
- Chukhchin V.D. 1984. Ecology of gastropods in the Black Sea. Kiev, Naukova dumka, 176 pp. [in Russian].
- Katokhin A.V., Kornychuk Yu.M. 2020. Genotyping of Black Sea trematodes of the family Opecoelidae by mitochondrial markers. *Marine Biological Journal* 5 (4): 15–27 [in Russian, with English Summary]. <https://doi.org/10.21072/mbj.2020.05.4.02>
- Kornychuk Y.M. 2008. Seasonal dynamics of abundance and qualitative composition of trematode, *Helicometra fasciata*, metacercaria hemipopulation in coastal biocenosis of Southwestern Crimea. *Ecology of the sea* 75: 9–15 [In Russian, with English Summary].
- Kornychuk Yu.M. 2009a. Additional description of hermaphroditic generation of trematodes Black Sea Fishes, *Helicometra fasciata* (Trematoda, Opecoelidae). *Vestnik zoologii, spec. iss.* 23: 63–68 [in Russian, with English Summary].
- Kornychuk Yu.M. 2009b. Fauna of shrimp parasites in the Black and Azov seas. *Ecology of the sea* 77: 44–48 [in Russian, with English Summary].
- Kornychuk Yu.M. 2017. Polyhostal helminthes: how to make a quantitative estimation of their final host significance. *Journal of General Biology* 78 (6): 3–15 [in Russian, with English Summary].
- Kornychuk Y., Polyakova T., Pronkina N. 2022. New data on pipefishes' and seahorse's endohelminths off Crimean coasts of the Black Sea. *Helminthologia* 59 (1): 74–82. <https://doi.org/10.2478/helm-2022-0006>
- Koval' V.P., Vagushenko A.M., Seregina L.J., Pashkevichute A.C. 1975. Parasite fauna of fishes of the Kahovsky Reservoir (in its upper part) on the fourteenth year of its existence. *Bulleting of Kiev State University, Biological Series* 17: 105–108 [in Russian].
- Kudlay O.S. 2011. Trematode fauna of Gastropoda from water bodies in region adjacent to the northern Azov Sea. PhD thesis. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine, Kyiv.
- Machkevsky V.K., Pronkina N.V., Gaevskaia A.V., Kornychuk J.M. 1997. Life cycle of *Helicometra fasciata* (Rud., 1819) (Trematoda: Opecoelidae) in the rock biocenosis from the Black Sea. *Ecology of the sea* (Kiev) 46: 58–62 [in Russian, with English Summary].

- Mordvinova T.N. 1979. Higher Crustacea as intermediate hosts of fish helminths. VII All-Union meeting on parasites and diseases of fish, Leningrad, Nauka, 74–75 [in Russian].
- Sokolov S.G., Shchenkov S.V., Khasanov F.K., Kornychuk Y.M., Gordeev I.I. 2022. Redescription and phylogenetic assessment of *Helicometra antarcticae* Holloway & Bier, 1968 (Trematoda, Opencelidae), with evidence of nonmonophyletic status of the genus *Helicometra* Odhner, 1902. *Zoosystema* 44 (15): 423–433. <https://doi.org/10.5252/zoosystema2022v44a15>. <http://zoosystema.com/44/15>
- Sproston N.G. 1938. Notes sur la faune parasitaire des poissons à Roscoff. Proceedings of Roscoff Biological Station 16: 33–58 [in French].
- Svetovidov A.N. 1964. Fish of the Black Sea. Moscow-Leningrad, Nauka, 552 pp. [in Russian]. 10.21072/Black_Sea_Fish
- Tkachuk L.P., Mordvinova T.N. 1999. On parasitic infection of the shrimp, *Palaemon elegans* from two coastal regions of the Black Sea. *Ecology of the sea (Kiev)* 49: 21–23 [in Russian, with English Summary].
- Vasil'eva E.D. 2007. Fish of the Black Sea. Key to marine, brackish-water, euryhaline, and anadromous species with color illustrations collected by S.V. Bogorodsky. VNIRO Publishing, 222 pp. [in Russian].

HELICOMETRA FASCIATA (RUDOLPHI, 1819) COMPLEX ИЗ НОВОГО ХОЗЯИНА
В ЧЁРНОМ МОРЕ, ДЛИННОРЫЛОЙ ИГЛЫ-РЫБЫ *SYNGNATHUS TYPHLE*
LINNAEUS, 1758, С ЗАМЕТКАМИ О БИОЛОГИИ ЭТОЙ ТРЕМАТОДЫ

Ю. М. Корнийчук

Ключевые слова: новый дефинитивный хозяин, Trematode, Opencelidae, Syngnathidae, Чёрное море, пищевые сети

РЕЗЮМЕ

Сообщается о первой находке мариты комплекса *Helicometra fasciata* (Rudolphi, 1819) (Opencelidae) у обитающей в Чёрном море длиннорылой иглы-рыбы (иглы-трубкорота) *Syngnathus typhle* Linnaeus, 1758: единственный зрелый (с яйцами) экземпляр этой трематоды был найден у одного из 10 экземпляров иглы-трубкорота, выловленных в северо-восточной части Чёрного моря (район Керченского пролива) в июле 2007 г. Приведены описание и рисунок этого паразита. *Syngnathus typhle* и рыб семейства Syngnathidae в целом мы относим к числу случайных дефинитивных хозяев комплекса *H. fasciata*. Обсуждаются находки зрелых марит *H. fasciata* complex у пресноводных рыб-хозяев в пресных водоемах. Полученные данные о расширении круга известных дефинитивных хозяев *H. fasciata* complex в Чёрном море (*S. typhle* – 33-й известный здесь её окончательный хозяин) отражают сложность пищевых сетей в его шельфовой зоне.