REVIEW

A synopsis of the parasites from cyprinid fishes of the genus *Tribolodon* in Japan: A 2016 update and supplement

Kazuya Nagasawa¹* and Hirotaka Katahira¹,²)

¹) Graduate School of Biosphere Science, Hiroshima University, 1-4-4 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8528, Japan
²) Present address: National Research Center for Protozoan Diseases, Obihiro University of Agriculture & Veterinary Medicine, Nishi-2-13 Inada-cho, Obihiro, Hokkaido 080-8555, Japan

Abstract The synopsis of the parasites from cyprinids of the genus *Tribolodon* in Japan was published in 2013 based on the literature published for 106 years between 1908 and 2013 (Nagasawa and Katahira, 2013). This synopsis contained the information on both protistan and metazoan parasites reported from the four species of *Tribolodon* (*T. hakonensis*, *T. sachalinensis*, *T. brandtii*, and *T. nakamuraii*), and 44 nominal species of parasites were listed by higher taxon as follows: Ciliophora (2 species), Myxozoa (1), Trematoda (18), Monogenea (1), Cestoda (3), Nematoda (9), Acanthocephala (3), Hirudinida (1), Mollusca (1), Copepoda (6), and Isopoda (1). Those nominal species and parasites not identified to species level are listed in Host-Parasite List: 48, eight, four, and three nominal species were from *T. hakonensis*, *T. sachalinensis*, *T. brandtii maruta*, and *T. brandtii brandtii*, respectively, and one unidentified species was from *T. nakamuraii*. 

Key words: parasites, synopsis, *Tribolodon brandtii brandtii*, *Tribolodon brandtii maruta*, *Tribolodon hakonensis*, *Tribolodon nakamuraii*, *Tribolodon sachalinensis*

INTRODUCTION

The synopsis of the parasites from cyprinid fishes of the genus *Tribolodon* in Japan was published in 2013 based on the literature published for 106 years between 1908 and 2013 (Nagasawa and Katahira, 2013). This synopsis contained the information on both protistan and metazoan parasites reported from the four species of *Tribolodon* (*T. hakonensis*, *T. sachalinensis*, *T. brandtii*, and *T. nakamuraii*) in Japan, and 44 nominal species of parasites were listed by higher taxon as follows: Ciliophora (2 species), Myxozoa (1), Trematoda (18), Cestoda (3), Nematoda (9), Acanthocephala (3), Hirudinida (1), Mollusca (1), Copepoda (6), and Isopoda (1). The synopsis also contained the information on unidentified species of Monogenea and Branchiura.

The synopsis is updated here based on the papers published between 2014 and 2015 (Skern-Mauritzen et al., 2014; Shimazu, 2014; Shimazu et al., 2015) and those overlooked in the 2013 version (Shiraki, 1974; Sicard et al., 2003; Amin et al., 2007; Shimazu, 2007, 2013; Nakano and Itoh, 2011). In this updated version, the following six species of metazoan parasites are newly added:

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1. *Azygia rhinogobii* Shimazu, 2007 (Trematoda) from *T. hakonensis* (Shimazu, 2007, 2014);
2. *Sanguinicola ugui* Shimazu, 2007 (Trematoda) from *T. hakonensis* (Shimazu, 2007, 2013);
3. *Paradiplozoon skrjabini* Akhmerov, 1974 (Monogenea) from *T. hakonensis*, *T. sachalinensis*, and *T. brandtii brandtii* (Sicard et al., 2003; Shimazu et al., 2015);
4. *Contracaecum osculatum* (Rudolphi, 1802) (Nematoda) from *T. hakonensis* (Shiraki, 1974);
5. *Hysterothylacium* sp. (Nematoda) from *T. hakonensis* (Shiraki, 1974); and

Shimazu et al. (2015) examined some institutional specimens of the monogenean listed as *Diplozoon* sp. in the previous version and identified them as *P. skrjabini*. However, no other specimens of *Diplozoon* sp. have yet been examined for identification. Thus, the information on *Diplozoon* sp. still remains here after slightly revised. For the three species, viz., *Asymphylodora innominata* (Faust, 1924) (Trematoda), *Anisakis simplex* (Rudolphi, 1809) (Nematoda), and *Limnotrachelobdella okae* (Moore, 1924) (Hirudinida), Shimazu’s (2007), Shiraki’s (1974), and Nakano and Itoh’s (2011) papers are newly cited in this version, respectively, and the information on these three parasites is revised here. Moreover, a new scientific name is adopted here for each of the following species listed before because their scientific name has currently been changed: *Isoparorchis hypselobagri* (Billet, 1898) (Trematoda), *Bothriocephalus aehelognathi* Yamaguti, 1934 (Cestoda), *Hysterothylacium aduncum* (Rudolphi, 1802) (Nematoda), *Pseudocapillaria tomentosa* (Dujardin, 1843) (Nematoda), and *Lepeophtheirus salmonis* (Kroyer, 1837) (Copepoda).

Like in Nagasawa and Katahira (2013), the information on the above mentioned parasites is assembled as Parasite–Host and Host–Parasite lists. In the Parasite–Host List, parasites are arranged by higher taxon in the following order: Trematoda, Monogenea, Cestoda, Nematoda, Acanthocephala, and Hirudinida. Within each higher taxon, genera and species are listed alphabetically. For each species of parasite, the following information is provided:

1) The current scientific name, including author(s) and date(s), followed by any original combination, recognized synonym(s), or other identifications(s) that have been used in establishing records from *Tribolodon* spp. in Japan.
2) The habitat in which the parasite was acquired and normally completes its life cycle is given as FW for fresh waters, B for brackish waters, and M for marine waters.
3) The Site(s) of infection of the parasite in or on its host. If the site was not given in the original record, the likely site was determined from other records and is enclosed in square brackets.
4) The Distribution of the parasite is indicated by prefecture (boundaries shown in Fig. 1), in geographical order from northeast to southwest.
5) The Record(s). The authors responsible for the records are listed in chronological order. If a parasite has been reported more than once, the references are numbered, but not when there has been only one record of the parasite. Each reference is followed by the locality or localities given in two parts, first the prefecture and then the detailed collection locality or localities from which the parasite was reported. If no locality record was given, the geographical locality is shown by a dash (—). When all records are from the same prefecture, only the detailed collection locality or localities are listed.
6) Under Remarks, explanatory comments are given on systematics, nomenclature, useful references, and notes on specific items such as tentative parasite identifications in the original reports.
7) The References section includes works directly cited in the Parasite-Host List. If only a Japanese
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In the HOST–PARASITE LIST, hosts are listed alphabetically. The scientific, English, and Japanese names of Tribolodon spp. follow Hosoya (2015), in which, in addition to *T. hakonensis*, *T. nakamuraii*, and *T. sachalinensis*, two subspecies of *T. brandtii* (*T. brandtii brandtii* and *T. brandtii maruta*) are listed based on Sakai and Amano (2014). Based on the previous and present versions of the synopsis, all the parasites reported from Tribolodon spp. are listed in alphabetical order in each higher taxon, and after the name of each parasite, its geographical distribution in Japan is given in parenthesis. Information on the parasites not listed here are found in Nagasawa and Katahira (2013).
PARASITE–HOST LIST

Trematoda

Asymphylodora innominata (Faust, 1924) (FW)

Previous identification: *Asymphylodora macrostoma* of Yamaguti (1934), Shimazu (1992), Nakamura *et al.* (2000), Shimazu and Urabe (2005), and Shimazu (2007)

Site of infection: intestine

Host: *Tribolodon hakonensis*

Distribution: Saitama, Nagano, Toyama, Fukui, Shiga, Nara, Hiroshima


Remarks: Although *Asymphylodora macrostoma* had been used as the scientific name of this trematode in Japan, Shimazu *et al.* (2011) used *A. innominata* for the species.

Azygia rhinogobii Shimazu, 2007 (FW)

Site of infection: intestine

Host: *Tribolodon hakonensis*

Distribution: Nagano

Records: Shimazu 2007 (Lake Suwa); Shimazu 2014 (Lake Suwa)

Remarks: *Tribolodon hakonensis* has been considered as an accidental host because this fish preys on a true final host (small gobiids) (Shimazu, 2007).

Isoparorchis eurytremum (Kobayashi, 1915) (FW)

Previous identification: *Leptolecithum eurytremum* of Kobayashi (1915, 1921)

Site of infection: body cavity

Host: *Tribolodon hakonensis*

Distribution: Ibaraki


Remarks: Only immature worms of this trematode occurs in *T. hakonensis* (Kobayashi, 1915, 1921; Yamaguti, 1934). Although Kobayashi (1915, 1921) gave no detailed localities of the species, its adults were collected at various sites in Okayama Prefecture, Sawara in Chiba Prefecture, Lake Kasumigaura (as Kasumiga-ura) in Chiba Prefecture, and Lake Biwa in Shiga Prefecture. Although the species was listed as *I. hypselobagri* (Billet, 1898) in the previous version of the synopsis (Nagasawa and Katahira, 2013), it has currently been treated as *I. eurytremum* based on a revisional work on the genus *Isoparorchis* (Shimazu *et al.*, 2014). Nagasawa *et al.* (2013) reviewed the biology of the species (as *I. hypselobagri*) infecting Japanese freshwater fishes based on the literature published between 1915 and 2013.

Sanguinicola ugui Shimazu, 2007 (FW)
Sites of infection: blood vessels chiefly of the gills and rarely of the liver, kidneys, and heart.
Host: *Tribolodon hakonensis*
Distribution: Nagano
Records: Shimazu 2007 (Hiroi River, Lake Suwa, Tenryu River); Shimazu 2013 (Hiroi River, Lake Suwa, Tenryu River, Sai River)

**MONOGENEA**

*Diplozoon* sp. (FW)
Site of infection: gills
Hosts: *Tribolodon hakonensis* (1–5, 7–8)
        *Tribolodon sachalinensis* (5)
        *Tribolodon nakamura* (6)
Distribution: Hokkaido, Saitama, Niigata, Gifu, Nara
Remarks: Currently, Nagasawa (2016) has suggested that the monogenean reported as *Diplozoon* sp. is most probably as *Paradiplozoon skrjabini* Akhmerov, 1974 (see below).

*Paradiplozoon skrjabini* Akhmerov, 1974 (FW)
Previous identification: *Diplozoon* sp. of Nagasawa et al. (1989) and Ogawa (1994); *Paradiplozoon* sp. of Sicard et al. (2003)
Hosts: *Tribolodon hakonensis* (1–4)
        *Tribolodon sachalinensis* (2, 4)
        *Tribolodon brandii brandii* (2, 4)
Distribution: Hokkaido, Nagano, Hiroshima
Remarks: Some specimens reported as *Diplozoon* sp. by Ogawa (1994) were identified as *P. skrjabini* by Shimazu et al. (2015). The latter authors also state that *Paradiplozoon* sp. reported by Sicard et al. (2003) is identical as *P. skrjabini*.

**CESTODA**

*Schantzocotyle acheilognathi* (Yamaguti, 1934) (FW)
Previous identification: *Coelobothrium oitense* of Kugi and Matsuo (1990)
Site of infection: intestine
Host: *Tribolodon hakonensis*
Distribution: Oita
Record: Kugi and Matsuo 1990 (Chikugo River)
Remarks: Coelobothrium oitense was regarded as a junior synonym of Bothriocephalus acheilognathi

**NEMATODA**

*Anisakis simplex* (Rudolphi, 1809) (larva) (M)
Previous identification: *Anisakis* larva (I) of Shiraki (1974) and *Anisakis* sp. type I Miyamoto and Kutsumi (1980)
Sites of infection: musculature, mesentery
Host: *Tribolodon hakonensis*
Distribution: Hokkaido, Iwate, Akita, Niigata

*Contracaecum osculatum* (Rudolphi, 1802) (larva) (M)
Previous identification: *Contracaecum*–type larva (A) of Shiraki (1974)
Site of infection: body cavity
Host: *Tribolodon hakonensis*
Distribution: Akita
Record: Shiraki 1974 (Yoneshiro River)
Remarks: Shiraki (1974) suggests that this nematode is identical as *Contracaecum osculatum* (Rudolphi, 1802). The biology of this species in Japan was reviewed by Nagasawa (2012).

*Hysterothylicium gadi aduncum* (Rudolphi, 1802) (larva) (FW)
Previous identification: *Hysterothylicium aduncum* of Moravec et al. (1985)
Site of infection: intestine
Host: *Tribolodon sachiensis*
Distribution: Hokkaido
Record: Moravec et al. 1985 (Lake Toro)
Remarks: *Hysterothylicium gadi aduncum* reported by Moravec et al. (1985) has currently been treated as *H. gadi aduncum* (Moravec, 2013).

*Hysterothylicium* sp. (larva) (M)
Previous identification: *Thynascaris* sp. of Moravec et al. (1985)
Site of infection: [intestine]
Host: *Tribolodon hakonensis*
Distribution: Akita, Niigata
Record: Shiraki 1974 (Akita: Yoneshiro River, Omono River; Niigata: Agano River)

*Pseudocapillaria (Pseudocapillaria) tomentosa* (Dujardin, 1843) (FW)
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Previous identification: *Capillaria ugui* of Yamaguti (1941) and *Pseudocapillaria tomentosa* of Moravec and Nagasawa (1989), Moravec *et al.* (1998), and Nakamura *et al.* (2000)

Site of infection: intestine

Host: *Tribolodon hakonensis*

Distribution: Tokyo, Shizuoka, Fukui, Nara


Remarks: The current scientific name of this species follows Moravec (2013).

**Acanthocephala**

*Pseudoradinorhynchus samegaiensis* Nakajima and Egusa, 1975 (FW)

Site of infection: intestine

Host: *Tribolodon hakonensis*

Distribution: Shiga

Record: Amin *et al.* 2007 (Lake Biwa and rivers flowing into the lake)

**Copepoda**

*Lepeophtheirus salmonis oncorhynchi* Skern-Mauritzen, Torrissen and Glover, 2014 (M)

Previous identification: *Lepeophtheirus salmonis* of Nagasawa *et al.* (1994)

Site of infection: body surface

Host: *Tribolodon hakonensis*

Distribution: Hokkaido

Record: Nagasawa *et al.* 1994 (Furuu River)

Remarks: Skern-Mauritzen *et al.* (2014) have separated *L. salmonis* into two subspecies, *L. salmonis salmonis* (from the Atlantic Ocean) and *L. salmonis oncorhynchi* (from the Pacific Ocean).

**Hirudinida**

*Limnotrachelobdella okae* (Moore, 1924) (B or M)

Sites of infection: body surface, fins

Hosts: *Tribolodon hakonensis* (2)

*Tribolodon brandtii brandtii* (1)

Distribution: Niigata, Tokyo


**HOST–PARASITE LIST**

*Tribolodon brandtii brandtii* (Dybowski, 1872) Jusan dace, ”jusan-ugui” (Japanese name)

Trematoda

*Metagonimus yokogawai* (Hokkaido)

Monogenea

*Dactylogyrus* sp. (Hokkaido)
Paradiplozoon skrjabini (Hokkaido)
Diplozoon sp. (Hokkaido)
Nematoda
Rhabdochona sp. (Niigata)
Hirudinida
Limnotrachelobdella okae (Niigata)

Tribolodon brandtii maruta Sakai and Amano, 2015 Maruta dace, “maruta” (Japanese name)
Trematoda
Allocreadium japonicum (Tokyo)
Clonorchis sinensis (Miyagi)
Exorchis oviformis (Miyagi)
Metagonimus sp. (Miyagi)
Pseudexorchis major (Tokyo)

Tribolodon hakonensis (Günther, 1877) Japanese dace, “ugui” (Japanese name)
Ciliophora
Chilodonella piscicola (Hokkaido)
Trichodina fujitai (Yamagata, Osaka)
Trichodinidae gen. sp. (Yamagata, Gifu)
Ciliophora gen. sp. (Nara)
Myxozoa
Chloromyxum richardsonii (Hokkaido)
Myxozoa gen. sp. (Gifu, Nara)
Trematoda
Allocreadium japonicum (Tokyo)
Allocreadium tosai (Hokkaido)
Allocreadium tribolodontis (Iwate)
Asymphylodora innominata (Saitama, Nagano, Toyama, Fukui, Shiga, Nara, Hiroshima)
Azygia rhinogobii (Nagano)
Centrocestus armatus (Shizuoka, Gifu, Oita)
Clinostomum complanatum (Tottori)
Clonorchis sinensis (Miyagi, Toyama, Nagano, Shiga)
Echinochasmus milvi (—)
Exorchis oviformis (Niigata, Tokyo)
Holostephanus nipponicus (Yamagata)
Isoparorchis eurytremum (Ibaraki)
Metagonimus katsuradai (Oita)
Metagonimus miyatai (Hokkaido, Hiroshima)
Metagonimus takahashii (Niigata, Toyama, Ishikawa, Okayama, Hiroshima, Yamaguchi, Oita)
Metagonimus yokogawai (Hokkaido, Aomori, Akita, Miyagi, Yamagata, Niigata, Gunma, Kanagawa, Shizuoka, Toyama, Ishikawa, Mie, Shimane, Hiroshima, Yamaguchi, Tokushima, Oita, Miyazaki, Kumamoto)
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Metagonimus spp. (Hokkaido, Yamagata, Shizuoka, Gifu, Hiroshima)
Neoplagiopterus elongatus (Shiga)
Pseudoxorhizis major (Tokyo, Shizuoka, Gifu, Oita)
Pseudozoogonoides ugui (Hokkaido, Iwate)
Sanguinicola ugui (Nagano)
Digenea gen. spp. (Hokkaido, Akita, Toyama, Nara)

Monogenea

Dactylogyrus sp. (Hokkaido)
Diplodoon sp. (Hokkaido, Saitama, Gifu, Nara)
Gyrodactylus sp. (Hokkaido)
Paradiplozoon skrjabini (Hokkaido, Tokyo, Nagano, Hiroshima)
Monopisthocotylea gen. sp. (Gifu)

Cestoda

Caryophyllaeides ergensi (Hokkaido, Aomori, Shizuoka, Nagano)
Caryophyllidea fam. gen. sp. (Hokkaido)
Caryophyllidae gen. sp. (Iwate)
Ligula interrupta (Hokkaido, Tochigi, Gunma, Kanagawa, Yamanashi)
Schyzocotyle acheilognathi (Oita)

Nematoda

Anisakis simplex (Hokkaido, Iwate, Akita, Niigata)
Camallanus cotti —
Contracaecum sp. (Akita)
Gnathostoma nipponicum (Aomori)
Hysterothylacium gadi aduncum (Hokkaido)
Hysterothylacium sp. (Akita, Niigata)
Pseudocapillaria (Pseudocapillaria) tomentosa (Tokyo, Shizuoka, Fukui, Nara)
Raphidascaris gigi (Shiga)
Rhabdochona coronacauda (Nara)
Rhabdochona denunata honshuensis (Nara)
Rhabdochona zacconis (Hokkaido, Aomori, Iwate, Tokyo, Nagano, Shizuoka, Shiga, Nara)
Nematoda gen. sp. (Hokkaido)

Acanthocephala

Acanthocephalus opsariichthydis (Nagano)
Acanthocephalus sp. (Iwate)
Pseudorhadinorhynchus leuciscus (Hokkaido, Iwate)
Pseudorhadinorhynchus samegaiensis (Shiga)
Acanthocephala gen. sp. (Gifu)

Hirudinida

Limnotrachelobdella okae (Tokyo)

Mollusca

Pronodularia japanensis (Chiba)

Branchiura

Argulus sp. (Nara)
Copepoda

*Caligus orientalis* (Hokkaido)
*Caligus punctatus* (Aomori, Miyagi)
*Ergasilus hypomesi* (Hokkaido)
*Lepeoptheirus salmonis oncorhynchi* (Hokkaido)
*Lernaea cyprinacea* (Hokkaido)
*Neoergasilus japonicus* (Hokkaido)

Isopoda

*Nerocila japonica* (Shimane)

*Tribolodon nakamuraii* Doi and Shinzawa, 2000 Long lowerjaw dace, "ukekuchi-ugui" (Japanese name)

Monogenea

*Diplozoon* sp. (Niigata)

*Tribolodon sachalinensis* (Nikolskii, 1889) Ainu dace, “ezo-ugui” (Japanese name)

Trematoda

*Allocreadium tosai* (Hokkaido)
*Allocreadium tribolodontis* (Hokkaido)
*Metagonimus miyatai* (Hokkaido)
*Metagonimus takahashii* (Hokkaido)
*Metagonimus yokogawai* (Hokkaido)

Digenea gen. spp. (Hokkaido)

Monogenea

*Dactylogyrus* sp. (Hokkaido)
*Diplozoon* sp. (Hokkaido)
*Paradiplozoon skrjabini* (Hokkaido)

Cestoda

*Caryophyllaeides ergensi* (Hokkaido)
*Ligula interrupta* (Hokkaido)

Nematoda

Camallanidae gen. sp. (Hokkaido)
Rhabdoconidae gen. sp. (Hokkaido)
Nematoda gen. sp. (Hokkaido)

*Tribolodon sp.*

Trematoda

*Metagonimus yokogawai* (Hokkaido, Yamagata, Niigata, Toyama)

Nematoda

Nematoda gen. sp. (Hokkaido)
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日本産ウグイ属魚類の寄生虫目録：補足（2016年）

長澤和也1)・片平浩孝1,2)

1) 広島大学大学院生物圈科学研究科，〒739-8528 広島県東広島市鏡山1-4-4
2) 現住所：帯広畜産大学原虫病研究センター，〒080-8555 北海道帯広市福田町西2線13番地

要 旨 1908年以降に出版された文献に基づき、2013年に日本産ウグイ属魚類4種（ウグイ Tribolodon hakonensis，エゾウグイ T. sachalinensis，マルタ T. brandtii，ウケクチウグイ T. nakamura）の寄生虫に関する情報を整理した目録を出版した。今回、その後に出版された情報と2013年の目録に収録されなくなった情報を加えて、この目録を補足した。宿主に関して、従来のマルタは2015年に2亜種（マルタ T. brandtii maruta, ユウサンウグイ T. brandtii brandtii）に分けられたので、各亜種における寄生虫の情報を整理した。本目録では、新たに追加した6種の寄生虫（吸虫類2種，単生類1種，線虫類2種，鉤頭虫類1種）を含む15種の寄生虫に関する情報を寄生虫－宿主リストに整理して示した。今回の作業により、1908～2015年の108年間にわが国のウグイ属魚類からは48名義種の寄生虫（繊毛虫類2種，ミクソゾア類1種，吸虫類20種，単生類1種，線虫類3種，鉤頭動物3種，ヒル類1種，カイアシ類6種，フラジムシ類1種）が報告されていたことが分かった。種まで同定された寄生虫の種数を魚種別に示すと、ウグイから48種，エゾウグイから8種，マルタから4種，ユウサンウグイから3種で、ウグイから最も多く寄生虫が報告されていった。ウケクチウグイからは1未同定種のみが記録されていた。

キーワード：ウグイ，ウケクチウグイ，エゾウグイ，寄生虫，ユウサンウグイ，マルタ，目録