

**A revised and updated checklist of the parasites of eels (spp.)
(Anguilliformes: Anguillidae) in Japan (1915-2017)**

Kazuya NAGASAWA¹⁾ and Hirotaka KATAHIRA²⁾

¹⁾*Graduate School of Biosphere Science, Hiroshima University,
1-4-4 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8528, Japan*

²⁾*Faculty of Bioresources, Mie University,
1577 Kurima machiya-cho, Tsu, Mie 514-8507, Japan*

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REVIEW

A revised and updated checklist of the parasites of eels (spp.) (Anguilliformes: Anguillidae) in Japan (1915-2017)

Kazuya NAGASAWA^{1)*} and Hiroataka KATAHIRA²⁾

¹⁾ Graduate School of Biosphere Science, Hiroshima University,
1-4-4 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8528, Japan

²⁾ Faculty of Bioresources, Mie University,
1577 Kurima machiya-cho, Tsu, Mie 514-8507, Japan

Abstract Information on the protistan and metazoan parasites of four species of eels (the Japanese eel *Anguilla japonica*, the giant mottled eel *Anguilla marmorata*, the European eel *Anguilla anguilla*, and the short-finned eel *Anguilla australis*) in Japan is summarized in the Parasite-Host and Host-Parasite lists, based on the literature published for 103 years between 1915 and 2017. This is a revised and updated version of the checklist published in 2007. *Anguilla japonica* and *A. marmorata* are native to Japan, whereas *A. anguilla* and *A. australis* are introduced species from Europe and Australia, respectively. The parasites, including 54 nominal species and those not identified to species level, are listed by higher taxa as follows: Sarcomastigophora (no. of nominal species: 0), Ciliophora (6), Microspora (1), Myxozoa (6), Trematoda (12), Monogenea (8), Cestoda (3), Nematoda (7), Acanthocephala (6), Hirudinida (3), Bivalvia (1), and Copepoda (1). For each parasite species listed, the following information is given: its currently recognized scientific name, any original combination, synonym(s), or other previous identification used for the parasite from Japanese eels; habitat (freshwater, brackish, or marine); site(s) of infection within or on the host; known geographical distribution in Japanese waters; and the published source of each locality record. Of the 54 nominal species of parasites listed, 50 are from *A. japonica*, six from *A. marmorata*, nine from *A. anguilla*, and one from *A. australis*. Five species, viz., *Gyrodactylus anguillae*, *Gyrodactylus nipponensis*, *Pseudodactylogyrus mundayi* (Monogenea), *Bothriocephalus claviceps* (Cestoda), and *Raphidascaris acus* (Nematoda), have been regarded as introduced parasites from other countries, and the remaining 49 nominal species are indigenous parasites of Japan. Nine nominal species of marine and/or brackish-water origin, viz., *Lecithochrium musculus*, *Proctotrematoides pisodontophidis*, *Tubulovesicula anguillae* (Trematoda), *Gyrodactylus nipponensis*, *Pseudodactylogyrus kamegarii* (Monogenea), *Nybelinia angullicola* (Cestoda), *Cucullanus filiformis*, *Heliconema anguillae* (Nematoda), and *Limnotrachelobdella okae* (Hirudinida), have been reported from *A. japonica*. Individuals of *A. japonica* known as “ sea eels ” and “ estuarine eels ” inhabiting coastal marine and riverine brackish waters are considered to serve as hosts for those marine and/or brackish-water parasites.

Key words: *Anguilla anguilla*, *Anguilla australis*, *Anguilla japonica*, *Anguilla marmorata*, bibliography, checklist, eels, parasites

INTRODUCTION

In 2007, *A checklist of the parasites of eels (Anguilla spp.) (Anguilliformes: Anguillidae) in Japan (1915-2007)* was published based on the literature published for 93 years between 1915 and 2007 (Nagasawa *et al.*, 2007). This checklist contained the information on both protistan and metazoan parasites reported from three species of freshwater eels (the Japanese eel *Anguilla japonica* Temminck and Schlegel; the giant mottled eel *Anguilla marmorata* Quoy and Gaimard; and the European eel *Anguilla anguilla* (Linnaeus)) in Japan, and 44 nominal species of parasites were listed by higher taxa as follows: Ciliophora (6), Microspora (1), Myxozoa (6), Trematoda (7), Monogenea (7), Cestoda (3), Nematoda (7), Acanthocephala (4), Hirudinida (2), and Copepoda (1). It also contained the information on unidentified species of Sarcomastigophora, Ciliophora, Microspora, Myxozoa, Trematoda, Monogenea, Cestoda, and Nematoda.

The checklist is revised and updated herein based on three sources of the literature: 1) the papers cited in the 2007 version; 2) those overlooked in the 2007 version (Nagao, 1956; Isobe, 1956, 1962; Irie, 1958; Egusa, 1958; Furukawa and Kobayashi, 1966; Ito, 1968; Horiuchi *et al.*, 1988; Nagasawa, 1991; Rahhou *et al.*, 2005; Shimazu and Araki, 2006; Shimazu, 2007); and 3) those published between the years 2008 and 2017 (Shimazu, 2008; Wielgross *et al.*, 2008; Fang *et al.*, 2008; Tanaka *et al.*, 2009;

A new scientific name is adopted herein for each of the following species because their scientific name has currently been changed: *Pseudophyllodistomum macrobrachicola* (Yamaguti, 1934) (Trematoda), *Anguillicola crassus* Kuwahara, Niimi and Itagaki, 1974 (Nematoda), and *Heliconema anguillae* Yamaguti, 1935 (Nematoda). These species were reported as *Phyllodistomum anguillae*, *Anguillicoloides crassus*, and *Heliconema longissimum*, respectively, in the 2007 version. Moreover, *Genarchopsis goppo* Ozaki, 1925 (Trematoda) listed in the 2007 version has been re-identified and separated by Shimazu (2015) into three species, itself, *Genarchopsis gigi* Yamaguti, 1939, and *Genarchopsis chubuensis* Shimazu, 2015, the latter two species of which are listed herein.

Like in Nagasawa *et al.* (2007), the information on the parasites reported from Japanese *Anguilla* spp. is assembled as Parasite-Host and Host-Parasite lists. In the **PARASITE-HOST LIST**, the parasites are arranged by higher taxa in the following order: Sarcomastigophora, Ciliophora, Microspora, Myxozoa, Trematoda, Monogenea, Cestoda, Nematoda, Acanthocephala, Hirudinida, Bivalvia, and Copepoda. Within each higher taxa, 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 *Anguilla* 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

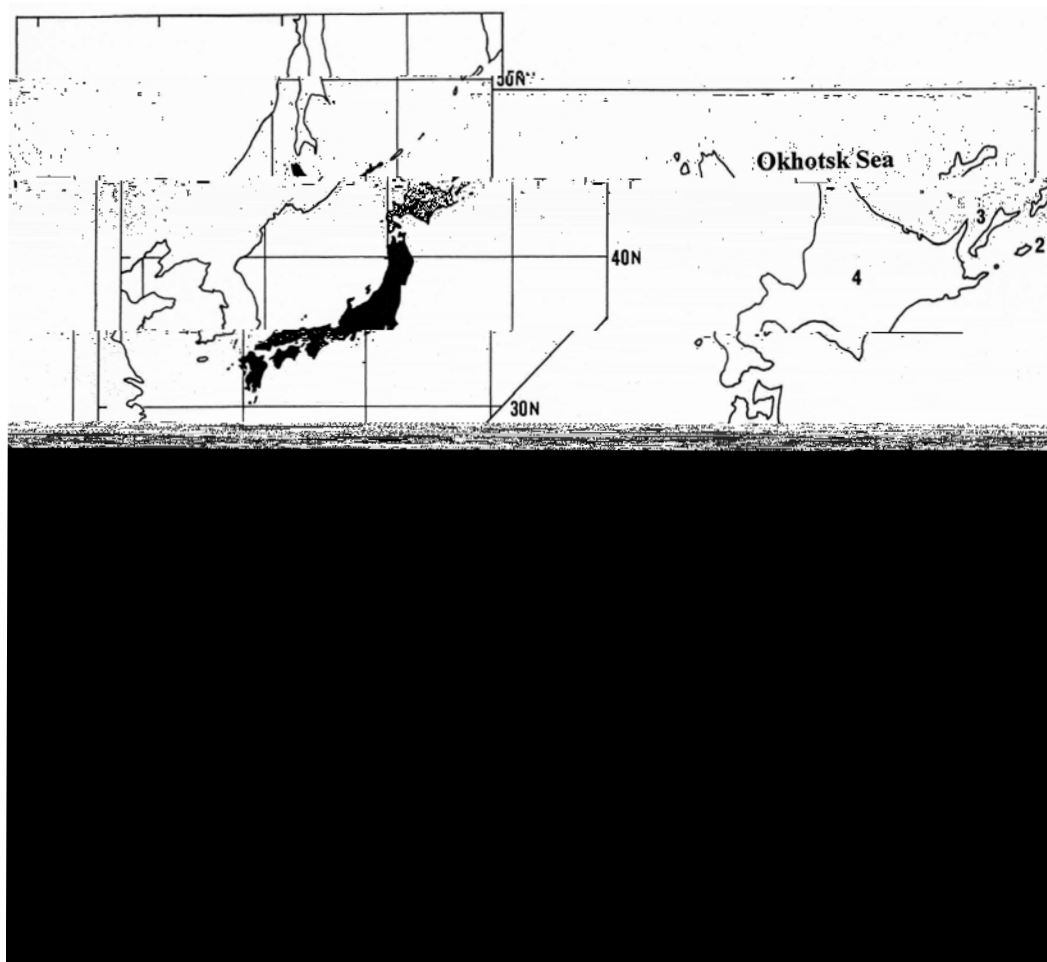


Fig. 1. Map of Japan showing the prefectural boundaries. The following prefectural names are arranged in alphabetical order: Aichi-24; Akita-7; Aomori-5; Chiba-15; Ehime-41; Etorofu Island-1; Fukui-26; Fukuoka-43; Fukushima-10; Gifu-23; Gunma-14; Hiroshima-37; Hokkaido-4; Hyogo-33; Ibaraki-12; Ishikawa-25; Iwate-6; Kagawa-39; Kagoshima-49; Kanagawa-18; Kochi-42; Kumamoto-47; Kunashiri Island-3; Kyoto-29; Mie-28; Miyagi-8; Miyazaki-48; Nagano-20; Nagasaki-45; Nara-30; Niigata-11; Oita-46; Okayama-35; Okinawa-50; Osaka-31; Saga-44; Saitama-16; Shiga-27; Shikotan Island-2; Shimane-36; Shizuoka-21; Tochigi-13; Tokushima-40; Tokyo-17; Tottori-34; Toyama-22; Wakayama-32; Yamagata-9; Yamaguchi-38; and Yamanashi-19.

PARASITE-HOST LIST

SARCOMASTIGOPHORA

sp.

(FW)

Hosts: *Anguilla anguilla*

Anguilla japonica

Sites of infection: skin, fns

Distribution: unknown

Record: Niwa 1979 (-)

sp.

(FW)

Includes: *Costia* sp. (erroneously as “*Chostia*”) of Niwa, 1979Hosts: *Anguilla anguilla**Anguilla japonica*

Sites of infection: skin, fns

Distribution: unknown

Record: Niwa 1979 (–)

sp.

(FW)

Host: *Anguilla japonica*

Site of infection: blood

Distribution: Shizuoka

Records: 1. Hoshina and Sano 1957 (Yoshida); 2. Egusa 1967 (Yoshida)

CILIOPHORA

sp.

(FW)

Host: *Anguilla japonica*

Sites of infection: gills, skin

Distribution: unknown

Record: Egusa 1978 (–)

sp.

(FW)

Includes: *Glossatella* sp. of Nishio *et al.*, 1970; Egusa, 1970; Hatai and Egusa, 1973; Niwa, 1979Hosts: *Anguilla anguilla* (3, 5)*Anguilla japonica* (1, 2, 4)

Site of infection: gills

Distribution: Shizuoka

Records: 1. Nishio *et al.* 1970 (Yoshida); 2. Egusa 1970 (Yoshida); 3. Hatai and Egusa 1973 (Yaizu, Yoshida); 4. Egusa 1978 (–); 5. Niwa 1979 (–)

(Buetschli, 1889) Jankowski, 1973

(FW)

Previous identification: *Trichophrya piscium* of Egusa, 1978Includes: *Trichophrya* sp. of Egusa and Ahmed, 1970; Nishio *et al.*, 1970; Egusa, 1970, 1971; Niwa, 1979Hosts: *Anguilla anguilla* (1, 2, 4, 5, 6)*Anguilla japonica* (1, 3, 4, 6)

Site of infection: gills

Distribution: Shizuoka

Records: 1. Egusa and Ahmed 1970 (Yaizu); 2. Nishio *et al.* 1970 (Yoshida); 3. Egusa 1970 (Yoshida); 4. Egusa 1971 (–); 5. Egusa 1978 (–); 6. Niwa 1979 (–)Remarks: Matsui (1972: 577-578, fgs. 27.44, 27.45) reported, in addition to *Capriniata piscium* (as *Trichophrya* sp.), two species of ciliates, “*Sayphidia* or *Sayphydia* sp.” and “*Sudonia* sp.” were

found on the gills of *A. japonica*. His identification of the latter two species, however, is definitely not correct.

Linnaeus, 1758 (FW)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Tokushima

Record: Naruto Station, Fish. Exp. St. Tokushima Pref. 1966 (–)

sp. (FW)

Hosts: *Anguilla anguilla* (2)

Anguilla japonica (1, 2)

Sites of infection: gills, skin

Distribution: unknown

Records: 1. Egusa 1978 (–); 2. Niwa 1979 (–)

Ichthyophthirius multifiliis Fouquet, 1876 (FW)

Hosts: *Anguilla anguilla* (1, 3, 4, 5, 6, 7, 8, 9)

Anguilla japonica (1, 2, 6, 7, 8, 9)

Sites of infection: skin, fins, gills, buccal cavity

Distribution: Shizuoka

Records 1. Egusa *et al.* 1970 (Yaizu); 2. Nishio *et al.* 1970 (Yoshida); 3. Egusa 1971 (–); 4. Oka 1973a (near Lake Hamana); 5. Oka 1973b (–); 6. Egusa 1978 (–); 7. Egusa 1979 (–); 8. Niwa 1979 (–); 9. Egusa 1983 (–)

Lom, 1961 (FW)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Mie

Record: Imai *et al.* 1991 (Tsu)

Haider, 1964 (FW)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Mie

Record: Imai *et al.* 1991 (Tsu)

Remarks: This trichodinid was reported from the gills of *A. japonica* cultured in freshwater ponds in central Japan (Imai *et al.*, 1991). However, it was later found on marine fishes (the bastard halibut *Paralichthys olivaceus* and the stone flounder *Kareius bicoloratus*) in China (Xu *et al.*, 2001), suggesting that *T. jadratica* is a euryhaline species.

Imai, Miyazaki and Nomura, 1991 (FW)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Mie

Record: Imai *et al.* 1991 (Tsu)

Remarks: This trichodinid was described from the gills of *A. japonica* cultured in freshwater ponds in central Japan (Imai *et al.*, 1991). However, it also occurs on marine fishes (the Japanese seabass *Lateolabrax japonicus* and the red seabream *Pagrus major* [as *Chrysophrys major*]) and a brackish-water fish (the barramundi *Lates calcarifer*) in China and India, respectively (Xu *et al.*, 1999, 2001; Mitra and Bandyopadhyay, 2005), indicating that *T. japonica* is a euryhaline species, like *T. jadranica* (see above).

sp.

(FW)

Hosts: *Anguilla anguilla* (3, 6, 7, 8)

Anguilla japonica (1, 2, 3, 4, 5, 6, 8)

Sites of infection: gills

Distribution: Shizuoka

Records: 1. Egusa 1967 (Yoshida); 2. Egusa 1968 (Yoshida); 3. Nishio *et al.* 1970 (Yoshida); 4. Egusa 1970 (Yoshida); 5. Egusa *et al.* 1971 (Yoshida); 6. Egusa 1971 (-); 7. Hatai and Egusa 1973 (Yaizu, Yoshida); 8. Niwa 1979 (-)

MICROSPORA

(Hoshina, 1951) Lom, Dyková, Körting and Klinger, 1989

(FW)

Original combination: *Pleistophora anguillarum* Hoshima, 1951

Previous identification: *Pleistophora anguillarum* of Hoshina, 1972; Awakura, 1974; Hashimoto and Takinami, 1976; Hashimoto *et al.*, 1976; Niwa, 1979

Pleistophora anguillarum of Kano and Fukui, 1982; Kano *et al.*, 1982; Buchmann *et al.*, 1992

Includes: *Pleistophora* sp. of Niwa, 1979

Hosts: *Anguilla anguilla* (6)

Anguilla japonica (1, 2, 3, 4, 5, 6, 7, 8, 9)

Site of infection: musculature

Distribution: Hokkaido, Kanagawa, Shizuoka, Aichi, Kagoshima

Records: 1. Hoshina 1951a (Kanagawa: near Odawara; Shizuoka: Yoshida); 2. Hoshima 1972 (Kanagawa:-; Shizuoka:-; Aichi:-); 3. Awakura 1974 (Hokkaido: Shikabe); 4. Hashimoto and Takinami 1976 (Shizuoka: Hamanko Branch of Shizuoka Pref. Fish. Exp. St.); 5. Hashimoto *et al.* 1976 (Shizuoka: Hamanko Branch of Shizuoka Pref. Fish. Exp. St.); 6. Niwa 1979 (Shizuoka:-; Aichi:-; Kagoshima:-); 7. Kano and Fukui 1982 (-); 8. Kano *et al.* 1982 (-); 9. Buchmann *et al.* 1992 (Shizuoka:-)

Remarks: The present species was transferred from the genus *Pleistophora* to *Hetrosporis* by Lom *et al.* (1989). Although Awakura (1974) found this parasite in Hokkaido, the infected fish had been transported from Shizuoka, central Honshu (see Fig. 1). The species is known to infect *A. japonica* in Taiwan (T'sui and Wang, 1988; T'sui *et al.*, 1988; Tsai *et al.*, 2002) and Korea (Suh and Chun, 1988; Joh *et al.*, 2007) as well. Hoshima (1972) reported the presence of this parasite in young *A. japonica* imported from Taiwan to Japan.

Unidentified Microspora (FW)
 Host: *Anguilla japonica*
 Site of infection: gills
 Distribution: Shizuoka
 Record: Egusa 1967 (Yoshida)

MYXOZOA

Cépède, 1906 (FW)
 Synonyms: *Myxidium anguillae* Ishii, 1915; *Myxidium enchelypterygii* Hoshina, 1952
 Previous identification: *Myxidium anguillae* of Ishii, 1915
Myxidium enchelypterygii of Hoshina, 1952
 Includes: *Myxidium* sp. of Ishii, 1916b; Iwata, 1972
 Hosts: *Anguilla anguilla* (5)
Anguilla japonica (1, 2, 3, 4, 6)
 Sites of infection: skin, fins, gills
 Distribution: Tokyo, Shizuoka, Miyazaki
 Records 1. Ishii 1915a (Shizuoka: Numazu); 2. Ishii 1916b (Tokyo:–); 3. Hoshina 1952 (Shizuoka: Yoshida Fish-Cultural Laboratory); 4. Iwata 1972 (Miyazaki: Hosoda River); 5. Hine 1980 (–); 6. Oka and Egusa 1983 (Shizuoka: Hamamatsu)
 Remarks: Although Hoshina (1952) reported that the spores of *Myxidium enchelypterygii* were clearly differentiated from those of *M. anguillae* by their size and shape, Hine (1980) regarded both taxa as identical, which was supported by Oka and Egusa (1983). Hine (1980: table 1) listed a record of *M. giardi* from the gall bladder and musculature of the American eel *Anguilla rostrata* from Japan, but this record is not included herein because no references were found to support it.

Fujita, 1929 (FW)
 Synonym: *Myxidium fusiforme* Fujita, 1927
 Host: *Anguilla japonica*
 Site of infection: kidney
 Distribution: Shiga
 Record: Fujita 1927 (Lake Biwa)
 Remarks: This parasite had been originally described by Fujita (1927) as *M. fusiforme*, but it was later renamed as *Myxidium lentiforme* by Fujita (1929: 249-250) because the former had been preoccupied.

Fujita, 1929 (FW)
 Host: *Anguilla japonica*
 Site of infection: skin
 Distribution: Kanagawa, Shizuoka, Aichi
 Records: 1. Fujita 1929 (Shizuoka: near Lake Hamana; Aichi: Toyohashi); 2. Hoshina 1952 (Kanagawa: Odawara); 3. Egusa 1978 (–); 4. Hine 1980 (–)

Fujita, 1927 (FW)

Host: *Anguilla japonica*

Site of infection: kidney

Distribution: Shiga

Record: Fujita 1927 (Lake Biwa)

sp. (FW)

Hosts: *Anguilla anguilla* (3, 4, 6)

Anguilla japonica (1, 2, 5, 6)

Sites of infection: gills, kidney, liver

Distribution: Shizuoka

Records: 1. Egusa 1967 (Yoshida); 2. Egusa 1970 (Yoshida); 3. Oka 1973a (near Lake Hamana); 4. Oka 1973b (-); 5. Ushiyama and Misaki 1977 (suburb of Hamamatsu); 6. Niwa 1979 (-)

Remarks: There is no information on the morphology and identification of this parasite. Niwa (1979) reported that its spores are more commonly found in the kidney of *A. anguilla* than *A. japonica*.

(Ishii, 1915) Landsberg and Lom, 1991 (FW)

Original combination: *Lentospora dermatobia* Ishii, 1915

Previous identification: *Myxosoma (Lentospora) dermatobia* of Hoshina, 1952

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Tochigi, Shizuoka

Records: 1. Ishii 1915b (Shizuoka: Numazu); 2. Hoshina 1952 (Tochigi: Lake Chuzenji)

Remarks: The present species originally described as *Lentospora dermatobia* by Ishii (1915b) was transferred to the genus *Myxobolus* by Landsberg and Lom (1991).

(Fujita, 1929) Eiras, Molnár and Lu, 2005 (FW)

Synonym: *Lentospora anguillae* Fujita, 1929

Previous identification: *Lentospora anguillae* of Fujita, 1929

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Ibaraki

Record: Fujita 1929 (Lake Hinuma)

Remarks: The present species originally described as *Lentospora anguillae* by Fujita (1929) was renamed as *Myxobolus anguilli* by Landsberg and Lom (1991). However, because of the preoccupation of the latter name, Eiras *et al.* (2005) proposed a new name, *Myxobolus fujitai*, for *M. anguilli*.

Unidentified Myxozoa (FW)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Shizuoka, Gifu

Records: 1. Nishio *et al.* 1970 (Shizuoka: Yoshida); 2. Nishio *et al.* 1971 (Shizuoka: Yoshida); 3.

Anonymous 2002 (Gifu: a tributary of the Kiso River)

TREMATODA

(Ariake, 1922) Shimazu, 1979 (FW)

Synonym: *Azygia anguillae* Ozaki, 1924

Previous identification: *Azygia anguillae* of Ozaki, 1924; Yamaguti, 1934a; Iwashita *et al.*, 2003; Shimazu, 2007

Includes: *Azygia gotoi*-like trematodes of Shimazu, 1979

Host: *Anguilla japonica*

Sites of infection: stomach, esophagus

Distribution: Aomori, Ibaraki, Chiba, Tokyo, Nagano, Shiga

Records: 1. Ozaki 1924 (Tokyo:-); 2. Yamaguti 1934a (Ibaraki: Lake Kasumiga-ura [as " Kasumiga-ura"]); 3. Shimazu 1979 (Aomori: Lake Hira-numa; Nagano: Lake Kizaki, Lake Suwa; Shiga: Lake Biwa); 4. Iwashita *et al.* 2003 (Chiba: mouth of the Tone River); 5. Shimazu 2007 (Nagano: Lake Kizaki, Lake Suwa); 6. Shimazu *et al.* 2011 (Shiga: Lake Biwa, Uso River); 7. Shimazu 2014b (Aomori: Hiranuma; Ibaraki: Lake Kasumigaura; Chiba: Tone River; Tokyo: vicinity of Tokyo; Nagano: Lake Nakatsuna and Lake Kizaki; Shiga: Lake Biwa basin)

Remarks: The taxonomy and life history of this trematode was reported in details by Shimazu (1979). Although *A. anguillae* was proposed by Shimazu (2007) as the scientific name of the species, *A. gotoi* has been currently adopted (see Shimazu *et al.*, 2011). Information on the species is available from Shimazu (1999a, 2003).

sp. (M)

Host: *Anguilla japonica*

Site of infection: digestive tract

Distribution: Chiba

Record: Iwashita *et al.* 2003 (mouth of the Minato River)

Remarks: This species has been suggested to be a marine parasite (Iwashita *et al.*, 2003).

(Nishigori, 1924) Price, 1932 (metacercaria) (FW)

Host: *Anguilla japonica*

Habitat: gills

Distribution: Kagoshima

Records: 1. Yanohara and Kagei 1983 (Tanegashima Island); 2. Kagei and Yanohara 1995 (Tanegashima Island)

Ozaki, 1926 (FW)

Host: *Anguilla japonica*

Habitat: intestine

Distribution: Shiga

Records: 1. Shimazu *et al.* 2011 (Uso River); 2. Shimazu 2016b (Uso River)

Yamaguti, 1938 (FW)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Ibaraki

Records: 1. Yamaguti 1938 (Tsuchiura [as Tutiura]); 2. Shimazu 1995 (Tsuchiura); 3. Shimazu 2015 (Tsuchiura)

Shimazu, 2015 (FW)

Previous identification: *Genarchopsis goppo* of Shimazu, 1995Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Nagano

Records: 1. Shimazu 1995 (Lake Suwa); 2. Shimazu 2015 (Lake Suwa)

Yamaguti, 1939 (FW)

Previous identification: *Genarchopsis goppo* of Shimazu, 1995; Shimazu *et al.*, 2011Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Shiga

Records: 1. Shimazu 1995 (Omatsu); 2. Shimazu *et al.* 2011 (Omatsu); 3. Shimazu 2015 (Omatsu)**Hemiuridae** gen. sp. (FW?)Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Tokyo

Record: Ozaki 1924 (–)

Remarks: When *Azygia gotoi* (as *A. anguillae*) was described, Ozaki (1924: 426) reported that another trematode belonging to the family Hemiuridae occurred in the stomach of *A. japonica*. No description of this trematode is yet available.

(Kobayashi, 1915) Shimazu, Cribb, Miller, Urabe, Ha, Binnh and Shed'ko, 2014 (FW)

Synonym: *Isoparorchis hypselobagri* (Billet, 1898)Previous identification: *Isoparorchis hypselobagri* of Nagasawa *et al.*, 2013Host: *Anguilla japonica*

Sites of infection: stomach wall tissue, mesentery, outer surface of airbaldder wall

Distribution: Shimane, Ehime

Record: Nagasawa *et al.* 2013 (Shimane: Lake Shinji, Lake Nakaumi; Ehime: Sozu River)Remarks: Information on this species (as *I. hypselobagri*) is available in Nagasawa *et al.* (2013).

sp. (M)

Host: *Anguilla japonica*

Site of infection: intestine (digestive tract)

Distribution: Aomori, Chiba

Records: 1. Iwashita *et al.* 2003 (Chiba: mouth of the Tone River); 2. Shimazu 2005 (Aomori: Lake Ogawara)

Remarks: This species has been suggested to be a marine parasite (Iwashita *et al.*, 2003).

(Looss, 1907) Nasir and Diaz, 1971 (M)

Synonym: *Sterrhurus musculus* Looss, 1907

Previous identification: *Sterrhurus musculus* of Yamaguti, 1934a

Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Mie, unspecified prefecture facing the Seto Inland Sea

Record: Yamaguti 1934a (Mie: Ise Bay; unspecified prefecture: Seto Inland Sea [as Inland Sea])

Remarks: The identification of this trematode by Yamaguti (1934a) needs confirmation (Gibson and Bray, 1986: 83-90).

spp. (metacercaria) (FW)

Host: *Anguilla japonica*

Site of infection: fins

Distribution: Shizuoka

Records: 1. Ito and Mochizuki 1968 (Tenryu River); 2. Ito 1968 (Tenryu River)

(Yamaguti, 1936) Szidat, 1943 (FW)

Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Shiga

Records: 1. Shimazu *et al.* 2011 (Omatsu); 2. Shimazu 2016a (Omatsu)

Yamaguti, 1938 (M)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Chiba

Record: Hoshina 1951b (Urayasu)

(Yamaguti, 1934) Cribb, 1987 (FW)

Previous identification: *Phyllodistomum anguillae* of Shimazu, 2005, 2007, 2008

Host: *Anguilla japonica*

Sites of infection: urinary bladder, intestine

Distribution: Aomori, Nagano, Ibaraki, Shiga, Tokushima

Records: 1. Shimazu 2005 (Aomori: Lake Ogawara; Ibaraki: Tsuchiura); 2. Shimazu 2007 (Nagano: Lake Suwa); 3. Shimazu 2008 (Tokushima: Kaifu River); 4. Shimazu *et al.* 2011 (Shiga: Momose); 5. Shimazu 2014a (Aomori: Lake Ogawara; Nagano: Lake Suwa; Ibaraki: Tsuchiura; Shiga: Lake Biwa basin; Tokushima: Kaifu River)

Yamaguti, 1934 (M)

Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Miyagi

Record: Yamaguti 1934a (Matsushima Bay [as Matusima Bay])

sp. (M)

Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Chiba

Record: Iwashita *et al.* 2003 (mouth of the Minato River)

Remarks: This species has been suggested to be a marine parasite (Iwashita *et al.*, 2003).

MONOGENEA

Ergens, 1960 (FW)

Host: *Anguilla anguilla*

Sites of infection: skin, gills

Distribution: Shizuoka

Record: Ogawa and Egusa 1980 (Maisaka)

Remarks: This species was introduced into Japan with *A. anguilla* from France (Ogawa and Egusa, 1980). Hayward *et al.* (2001) showed the current worldwide distribution of the species. Ogawa and Egusa (1978) redescribed it based on the specimens from England.

Ogawa and Hioki, 1986 (FW)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Shizuoka

Record: Ogawa and Hikoki 1986 (Yoshida)

Ogawa and Hioki, 1986 (FW)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Shizuoka

Record: Ogawa and Hikoki 1986 (Yoshida)

Ogawa and Egusa, 1978 (B)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Chiba, Shizuoka, Tokushima, Miyazaki

Records: 1. Ogawa and Egusa 1978 (Shizuoka:-; Tokushima:-); 2. Ogawa and Egusa 1980 (Chiba:-; Shizuoka:-; Tokushima:-; Miyazaki:-); 3. Hayward *et al.* 2001 (Chiba: Minato River; Shizuoka: Lake Hamana)

Remarks: This monogenean appears to have been introduced into Japan on eels imported from elsewhere in the Indo-western Pacific region, perhaps originating in Southeast Asia (Hayward *et al.*, 2001: 422). This species prefers brackish waters (Hayward *et al.*, 2001: 422).

sp.

(FW)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Shizuoka

Record: Ushiyama and Misaki 1977 (suburb of Hamamatsu)

Remarks: There is no information on the morphology and taxonomy of this gyrodactylid. Identification needs to be confirmed in comparison with the above four species of *Gyrodactylus* reported from eels in Japan.

(Yin and Sproston, 1948) Gusev, 1965

(FW)

Synonym: *Pseudodactylogyrus microrchis* Ogawa and Egusa, 1976

Previous identification: *Pseudodactylogyrus microrchis* of Ogawa and Egusa, 1976; Imada and Muroga, 1977, 1978, 1979

Hosts: *Anguilla anguilla* (1, 2, 3, 4, 5, 7, 9, 10, 11)

Anguilla japonica (5, 6, 11, 12, 14)

Anguilla marmorata (13)

Anguilla sp. (8)

Site of infection: gills

Distribution: Chiba, Shizuoka, Aichi, Hiroshima, Tokushima, Ehime, Kagoshima

Records: 1. Ogawa and Egusa 1976 (Chiba:–; Shizuoka:–); 2. Imada and Muroga 1977 (Hiroshima: Hiroshima University); 3. Imada and Muroga 1978 (Hiroshima: Hiroshima University); 4. Imada and Muroga 1979 (Hiroshima: Hiroshima University); 5. Ogawa *et al.* 1985a (Chiba:–; Aichi:–; Tokushima:–); 6. Horiuchi *et al.* 1988 (Shizuoka: eel pond); 7. Iwashita *et al.* 2002 (Shizuoka: Maisaka); 8. Hayward 2004 (Aichi:–; Kagoshima: Yaku Island); 9. Yoshikawa 2005 (Shizuoka: Hamanako Branch of Shizuoka Pref. Fish. Exp. St.); 10. Umeda *et al.* 2006 (Kagoshima: Ibusuki Branch of Kagoshima Pref. Fish. Center); 11. Fang *et al.* 2008 (experimental infection); 12. Katahira *et al.* 2012 (Ehime: Renjoji River, Sozu River); 13. Katahira and Nagasawa 2014 (Ehime: Renjoji River); 14. Ogawa *et al.* 2015 (Shizuoka: Yoshida)

Remarks: Ogawa *et al.* (1985a) synonymized *P. microrchis* as a junior synonym of *P. anguillae*.

(Kikuchi, 1929) Gusev, 1965

(FW)

Original combination: *Dactylogyrus bini* Kikuchi, 1929

Previous identification: *Dactylogyrus bini* of Kikuchi, 1929

Hosts: *Anguilla anguilla* (2, 4, 6)

Anguilla japonica (1, 5, 6, 7, 9)

Anguilla marmorata (8)

Anguilla sp. (3)

Site of infection: gills

Distribution: Chiba, Shizuoka, Aichi, Ehime, Kagoshima

Records: 1. Kikuchi 1929 (-); 2. Ogawa and Egusa 1976 (Chiba:-; Shizuoka:-); 3. Hayward 2004 (Aichi:-; Kagoshima: Yaku Island); 4. Umeda *et al.* 2006 (Kagoshima: Ibusuki Branch of Kagoshima Pref. Fish. Center); 5. Sato and Tanaka 2007 (Shizuoka: near Lake Hamana); 6. Fang *et al.* 2008 (experimental infection); 7. Katahira *et al.* 2012 (Ehime: Renjoji River, Sozu River); 8. Katahira and Nagasawa 2014 (Ehime: Renj ji River); 9. Ogawa *et al.* 2015 (Shizuoka: Yoshida)

Iwashita, Hirata and Ogawa, 2002 (B)

Host: *Anguilla japonica*

Site of infection: gills

Distribution: Chiba, Ehime

Records: 1. Iwashita *et al.* 2002 (Chiba: Minato River); 2. Katahira *et al.* 2012 (Ehime: Misho Cove, Renjoji River, Sozu River); 3. Ogawa *et al.* 2015 (Chiba: Minato River)

Remarks: This species was found on *A. japonica* collected in brackish waters (Iwashita *et al.*, 2002; Katahira *et al.*, 2012).

Ogawa, Iwashita, Hayward and Kurashima, 2015 (FW)

Host: *Anguilla australis*

Site of infection: gills

Distribution: Shizuoka

Record: Ogawa *et al.* 2015 (Shizuoka: Hamamatsu)

Remarks: This species was recovered from *A. australis* which had been caught in Tasmania and then shipped alive to Japan (Ogawa *et al.*, 2015).

spp. (FW)

Includes: *Dactylogyrus* sp. of Kikuchi, 1929; Egusa and Ahmed, 1970; Egusa, 1970, 1971; Oka, 1973a; Hatai and Egusa, 1973; Ushiyama and Misaki, 1977 (as "*Dactylogirus*")

Pseudodactylogyrus bini or *P. anguillae* of Tanaka and Sato, 2007; Sato and Tanaka, 2007

Pseudodactylogyrus bini and *P. anguillae* of Tanaka *et al.*, 2009

Pseudodactylogyrus sp. of Niwa, 1979

"*Pseudodactylogyrus* sp. ang. 4" of Hayward, 2004

Hosts: *Anguilla anguilla* (2, 4, 5, 6, 8, 10)

Anguilla japonica (1, 3, 7, 11, 12, 13)

Anguilla sp. (9)

Site of infection: gills

Distribution: Shizuoka, Kagoshima

Records: 1. Kikuchi 1929a (-); 2. Egusa and Ahmed 1970 (Shizuoka: Yaizu); 3. Egusa 1970 (Shizuoka: Yoshida); 4. Egusa 1971 (-); 5. Oka 1973a (Shizuoka: near Lake Hamana); 6. Hatai and Egusa 1973 (Shizuoka: Yaizu, Yoshida); 7. Ushiyama and Misaki 1977 (Shizuoka: suburb of Hamamatsu); 8. Niwa 1979 (-); 9. Hayward 2004 (Kagoshima: Yaku Island); 10. Yoshikawa *et al.* 2006 (Shizuoka: Hamana Branch of Shizuoka Pref. Fish. Exp. St.); 11. Tanaka and Sato 2007 (Shizuoka: near Lake Hamana); 12. Sato and Tanaka 2007 (Shizuoka: near Lake Hanama); 13. Tanaka *et al.* 2009 (Shizuoka: Hamanako Branch of Shizuoka Pref. Fish. Exp. St.)

Unidentified Monogenea (FW)

Includes: *Gyrodactylus* sp. or *Dactylogyrus* sp. of Nishio *et al.*, 1970

“ monogenetic trematodes ” of Shimazu, 1979

Hosts: *Anguilla anguilla* (1)

Anguilla japonica (1, 2)

Site of infection: gills

Distribution: Nagano, Shizuoka

Records: 1. Nishio *et al.* 1970 (Shizuoka: Yoshida); 2. Shimazu 1979 (Nagano: Lake Kizaki)

CESTODA

(Goeze, 1782) Rudolphi, 1810 (FW)

Host: *Anguilla japonica* (?)

Site of infection: intestine

Distribution: Shiga

Record: Scholz *et al.* 2004 (Shiga: Lake Biwa)

Remarks: Identification of the eel from Lake Biwa examined by Scholz *et al.* (2004) was uncertain: these authors tentatively identified the fish as *A. japonica* but it may be identified as *A. anguilla*. If the eel was actually the latter species, the cestode may have been introduced into the lake via imported fish from overseas (Scholz *et al.*, 2004).

Yamaguti, 1934 (FW)

Previous identification: *Bothriocephalus claviceps* of Luo *et al.*, 2002

Hosts: *Anguilla japonica* (1, 2, 4)

Anguilla marmorata (3, 4)

Site of infection: intestine

Distribution: Ibaraki, Nagano, Gifu, Shiga, Kagoshima

Records: 1. Yamaguti 1934b (Ibaraki: Lake Kasumiga-ura [as “ Kasumiga-ura”]); 2. Anonymous 2002 (Gifu: a tributary of the Kiso River); 3. Luo *et al.* 2002 (Kagoshima: Yaku Island [as Yako Island]); 4. Scholz *et al.* 2004 (Ibaraki: Kasumiga-ura; Nagano: Lake Suwa; Shiga: Lake Biwa; Kagoshima: Yaku Island)

Remarks: The cestode reported as “ *Bothriocephalus claviceps* ” by Luo *et al.* (2002) was re-identified as *B. japonicus* by Scholz *et al.* (2004). In the 2007 version of this checklist (Nagasawa *et al.*, 2007: 103), “ *Bothriocephalus claviceps* ” reported by Luo *et al.* (2002) was listed as the species, but it was wrong (Nagasawa, 2015: 98-99). Information on this cestode is available from Shimazu (1997) and Scholz *et al.* (2004). The scientific name was misspelled “ *japonicum* ” in Anonymous (2002).

sp. (FW)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Nagano

Record: Shimazu 1979 (Lake Kizaki)

Remarks: There is no morphological and taxonomic information on this cestode (Shimazu, 1979: 230, footnote).

Yamaguti, 1952 (larva) (M)

Previous identification: *Nybelinia* sp. of Yamaguti, 1934

Host: *Anguilla japonica*

Site of infection: encysted in submucosa of intestine

Distribution: Mie

Records: 1. Yamaguti 1934b (Kuki); 2. Yamaguti 1952 (Kuki)

Unidentified Cestoda (FW)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Shizuoka

Record: Ushiyama and Misaki 1977 (suburb of Hamamatsu)

Remarks: There is no information on the morphology and identification of this cestode. It was frequently found from June to September in cultured *A. japonica* (Ushiyama and Misaki, 1977).

NEMATODA

Kuwahara, Niimi and Itagaki, 1974 (FW)

Previous identification: *Anguillicola globiceps* of Egusa *et al.*, 1969

Anguillicola crassa of Hirose *et al.*, 1976; Egusa, 1979; Niwa, 1979

Anguillicola (Anguillicoloides) crassus of Moravec and Taraschewski, 1988

Includes: *Anguillicola japonica* of Matsui, 1972

Anguillicola sp. of Egusa and Ahmed, 1970; Ushiyama and Misaki, 1977

“ swimbladder nematode ” of Egusa, 1970

Hosts: *Anguilla anguilla* (1, 2, 5, 6, 9, 10, 11)

Anguilla japonica (1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21)

Site of infection: swimbladder

Distribution: Chiba, Tokyo, Shizuoka, Gifu, Aichi, Mie, Wakayama, Okayama, Tokushima, Oita, Miyazaki, Okinawa

Records: 1. Egusa *et al.* 1969 (Shizuoka: Yoshida); 2. Egusa and Ahmed 1970 (Shizuoka: Yaizu); 3. Egusa 1970 (Shizuoka: Yoshida); 4. Matsui 1972 (-); 5. Kuwahara *et al.* 1974 (Shizuoka: near Hamamatsu); 6. Hirose

et al. 2008 (Aichi: Mikawa Bay; Yamaguchi: Fushino); 21. Laetsch *et al.* 2012 (Wakayama: "natural water system")

Remarks: The biology of this nematode was reviewed by Nagasawa *et al.* (1994) and Moravec (2006). Information on the species is also available from Shimazu (1998). A brief note on the nematode is also published by Salati (1987). Although Matsui (1972: 571) stated infection of "*Anguillicola japonica*" in the "gall bladder" of *Anguilla japonica*, the worm is identifiable as *A. crassus*, based on a picture (fig. 27.36) shown by him (see Nagasawa *et al.*, 1994: 128). The records (Inui *et al.*, 1998, 1999) were based on the species from *A. japonica* imported from Taiwan to Japan. Information on the life cycle of the nematode in Japan is available in Hirose *et al.* (1976) and Moravec *et al.* (2005). The distribution of the species in Japan is shown by Lefevre *et al.* (2012).

Yamaguti, 1935 (FW)

Hosts: *Anguilla japonica* (1, 2, 3, 4, 5, 7, 8)

Anguilla sp. (*A. japonica* ?)(6)

Site of infection: swimbladder

Distribution: Aomori, Nagano, Chiba, Shizuoka, Aichi, Wakayama, Okayama

Records: 1. Yamaguti 1935b (Shizuoka: Lake Hamana); 2. Suyehiro 1957 (Okayama:–); 3. Egusa 1978 (Shizuoka:–; Aichi:–); 4. Egusa 1979 (–); 5. Shimazu 1979 (Aomori: Lake Hira-numa, Nagano: Lake Kizaki); 6. Moravec and Taraschewski 1988 (–); 7. Hirose *et al.* 1998 (Chiba: Tone River); 8. Laetsch *et al.* 2012 (Wakayama: "natural water system")

Remarks: The biology of this nematode was reviewed by Nagasawa *et al.* (1994) and Shimazu (1998). A brief review on *Anguillicola* is available in Salati (1987). Although Egusa *et al.* (1969) reported *A. globiceps* from Japanese eels cultured in Shizuoka, Hirose *et al.* (1976: 27, footnote) reported that Egusa *et al.*'s worms were not *A. globiceps* but *A. crassus*. The latter authors also mentioned that the morphology of the worms collected at an eel farm in Mishima, Shizuoka was similar to that of *A. globiceps*. The distribution of the species in Japan is shown by Lefevre *et al.* (2012).

Cucullanus filiformis Yamaguti, 1935 (M)

Host: *Anguilla japonica*

Site of infection: intestine

Distribution: Mie

Record: Yamaguti 1941 (Hamajima)

Remarks: This nematode was originally reported from the conger eel *Conger myriaster* in Japan (Yamaguti, 1935b).

Owen, 1836 (larva) (FW)

Host: *Anguilla japonica*

Sites of infection: musculature, viscera

Distribution: Kagawa, Fukuoka, Kumamoto

Records: 1. Nagao 1956 (Fukuoka: Mizuma); 2. Isobe 1956 (Kumamoto: Yoshima, Tensui); 3. Kikuchi 1956 (experimental infection); 4. Irie 1958 (Kagawa:–); 5. Isobe 1962 (Kumamoto: Kikuchi River); 6. Miyazaki 1963 (unspecified prefecture in Kyushu:–); 7. Miyazaki 1966 (unspecified prefecture in Kyushu:–)

Yamaguti, 1935

(B)

Previous identification: *Heliconema longissimum* of Katahira *et al.*, 2011

Host: *Anguilla japonica*

Site of infection: stomach

Distribution: Ehime, Saga, Kagoshima

Records: 1. Yamaguti 1935b (-); 2. Matsui 1972 (-); 3. Katahira *et al.* 2011 (Ehime: Mishi Cove,

Unidentified Nematoda (?)
 Host: *Anguilla japonica*
 Site of infection: caecum
 Distribution: unknown
 Record: Shimazu and Araki 2006 (–)

ACANTHOCEPHALA

Van Cleave, 1925 (FW)
 Hosts: *Anguilla japonica* (1, 2, 3)
Anguilla marmorata (4)
 Site of infection: intestine
 Distribution: Tokyo, Aichi, Ehime
 Records: 1. Van Cleave 1925 (Tokyo: fish market); 2. Yamaguti 1935a (various localities in Japan); 3. Fukui and Morisita 1936 (Aichi:–); 4. Katahira and Nagasawa 2014 (Ehime: Renji River)
 Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

Katahira and Nagasawa, 2014 (FW)
 Host: *Anguilla marmorata*
 Site of infection: intestine
 Distribution: Ehime
 Record: Katahira and Nagasawa 2014 (Renji River)

Yamaguti, 1935 (FW)
 Host: *Anguilla japonica*
 Site of infection: [intestine]
 Distribution: Shiga
 Record: Amin *et al.* 2007 (Lake Biwa)
 Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

(Harada, 1935) Fukui and Morisita, 1937 (immature worm) (M)
 Host: *Anguilla japonica*
 Site of infection: [intestine]
 Distribution: Aichi
 Record: Fukui and Morisita 1937 (–)
 Remarks: Information on this species is available in Fukui and Morisita (1938). While Petrochenko (1956) considered this species as a junior synonym of *Longicollum pagrosomi*–)

Distribution: Shiga

Record: Amin *et al.* 2007 (Lake Biwa)

Remarks: Information on this acanthocephalan is available from Shimazu (1999b).

(Van Cleave, 1925) Witenberg, 1932 (cystacanth) (FW)

Host: *Anguilla marmorata*

Site of infection: encapsulated in mesentery

Distribution: Ehime, Kagoshima

Records: 1. Katahira and Nagasawa 2014 (Ehime: Renj ji River); 2. Nagasawa and Kan 2017 (Kagoshima: Okinoerabu-jima Island)

HIRUDINIDA

(Oka, 1910) (FW)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Aichi, Kagoshima

Record: Ogawa *et al.* 1985b (Aichi: Isshiki; Kagoshima:–)

Remarks: While Soós (1967) regarded *Glossiphonia smaragdina* as a junior synonym of *Batrachobdella paludosa*, Ogawa *et al.* (1985b) did not follow it.

(O. F. Müller, 1774) Vedjovsky, 1884 (FW and B)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Aichi

Record: Nagasawa and Miyakawa 2006 (river near Akabane Port)

Remarks: Although this species usually occurs in fresh waters (Burreson, 2006), Nagasawa and Miyakawa (2006) found the specimens on elvers from brackish waters.

(Moore, 1924) Epshtein, 1968 (B)

Host: *Anguilla japonica*

Site of infection: skin

Distribution: Oita

Record: Nagasawa and Utsumi 2015 (lower reaches of the Katsura River)

BIVALVIA

(Martens, 1861) (glochidium) (FW)

Host: *Anguilla japonica*

Sites of infection: gills, fns

Distribution: Shiga

Record: Furukawa and Kobayashi 1966 (experimental infection)

COPEPODA

Linnaeus, 1758

(FW)

Original combination: *Lernaea (Lernaeocera) elegans* Leigh-Sharpe, 1925Previous identification: *Lernaea elegans* of Matsui and Kumada, 1928; Nakai and Kokai, 1931Includes: *Lernaea* sp. of Egusa, 1958; Niwa, 1979Hosts: *Anguilla anguilla* (11)*Anguilla japonica* (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

Sites of infection: buccal cavity, nostril, orbit, fins

Distribution: Chiba, Shizuoka, Aichi, Mie, Okayama, Hyogo, Shimane, Miyazaki

Records: 1. Leigh-Sharpe 1925 (Aichi: Kitajima near Toyohashi); 2. Matsui and Kumada 1928 (Shizuoka: on the coast of Lake Hamana; Aichi: near Toyohashi, Hekikai County); 3. Nakai and Kokai 1931 (Chiba:-); 4. Yamaguti 1939 (Shizuoka [as "Sizuoka"]:-); 5. Kasahara 1957 (-); 6. Egusa 1958 (-: Fisheries Laboratory of the University of Tokyo, and adjacent fish ponds); 7. Kasahara 1958 (Shizuoka:-; Aichi: Toyohashi; Mie:-); 8. Kasahara 1959 (-); 9. Kasahara 1962 (Shizuoka:-; Aichi:-; Mie:-; Okayama:-; Hyogo:-; Shimane:-; Miyazaki:-); 10. Tsutsumi 1978 (-); 11. Niwa 1979 (-)

Remarks: Information on this copepod as a parasite of *A. japonica* is available from Matsui (1972).**HOST-PARASITE LIST**

Temminck and Schlegel, 1847

Japanese eel, "nihon-unagi"

Sarcomastigophora

Cryptobia sp. (-)*Ichthyobodo* sp. (-)*Trypanosoma* sp. (Shizuoka)

Ciliophora

Ambiphrya sp. (-)*Apiosoma* sp. (Shizuoka)*Capriniata piscium* (Shizuoka)*Carchesium polypinum* (Tokushima)*Chilodonella* sp. (-)*Ichthyophthirius multifiliis* (Shizuoka)*Trichodina acuta* (Mie)*Trichodina jadratica* (Mie)*Trichodina japonica* (Mie)*Trichodina* sp. (Shizuoka)

Microspora

Heterosporis anguillarum (Hokkaido, Kanagawa, Shizuoka, Aichi, Kagoshima)

Unidentified Microspora (Shizuoka)

Myxozoa

Myxidium giardi (Tokyo, Shizuoka, Miyazaki)*Myxidium lentiforme* (Shiga)

Myxidium matsuii (Kanagawa, Shizuoka, Aichi)

Myxidium uchiyamae (Shiga)

Myxidium sp. (Shizuoka)

Myxobolus dermatobius (Tochigi, Shizuoka)

Myxobolus fujitai (Ibaraki)

Unidenti fed Myxozoa (Shizuoka, Gifu)

Trematoda

Azygia gotoi (Aomori, Ibaraki, Tokyo, Nagano, Shiga)

Bucephalus sp. (Chiba)

Centrocestus formosanus (Kagoshima)

Coitocaecum plagiorchis (Shiga)

Genarchopsis anguillae (Ibaraki)

Genarchopsis chubunsis (Nagano)

Genarchopsis gigi (Shiga)

Hemiuridae gen. sp. (Tokyo)

Isoparorchis eurytremus (Shimane, Ehime)

Lasiotocus sp. (Aomori)

Lecithochrium musculus (Mie, unspeci fed prefecture facing the Seto Inland Sea)

Metagonimus spp. (Shizuoka)

Palaeorchis diplorchis (Shiga)

Proctotrematoides pisodontophidis (Chiba)

Pseudophyllodistomum macrobrachicola (Aomori, Nagano, Ibaraki, Shiga, Tokushima)

Tubulovesicula anguillae (Miyagi)

Tubulovesicula sp. (Chiba)

Monogenea

Gyrodactylus egusai (Shizuoka)

Gyrodactylus joi (Shizuoka)

Gyrodactylus nipponensis (Chiba, Shizuoka, Tokushima, Miyazaki)

Gyrodactylus sp. (Shizuoka)

Pseudodactylogyrus anguillae (Chiba, Shizuoka, Aichi, Tokushima, Ehime)

Pseudodactylogyrus bini (Shizuoka, Ehime)

Pseudodactylogyrus kamegaii (Chiba, Ehime)

Pseudodactylogyrus spp. (Shizuoka)

Unidenti fed Monogenea (Shizuoka, Nagano)

Cestoda

Bothriocephalus claviceps (Shiga)

Bothriocephalus japonicus (Ibaraki, Nagano, Gifu, Shiga)

Bothriocephalus sp. (Nagano)

Nybelinia anguillicola (Mie)

Unidenti fed Cestoda (Shizuoka)

Nematoda

Anguillicola crassus (Chiba, Shizuoka, Gifu, Aichi, Mie, Wakayama, Okayama, Tokushima, Oita, Miyazaki, Okinawa)

Anguillicola globiceps (Aomori, Nagano, Chiba, Shizuoka, Aichi, Wakayama, Okayama)

Cucullanus filiformis (Mie)

Gnathostoma spinigerum (Kagawa, Fukuoka, Kumamoto)

Heliconema anguillae (Ehime, Saga, Kagoshima)

Heliconema sp. (Okayama)

Philometroides anguillae (Tokyo, Aichi)

Raphidascaris acus (Shiga)

Unidentified Nematoda (–)

Acanthocephala

Acanthocephalus gotoi (various localities including Tokyo, Aichi, and Ehime)

Echinorhynchus cotti (Shiga)

Longicollum alemniscus (Aichi)

PseudorhadL524 8e3813egmegaiensidas cotti

Quoy and Gaimard, 1824

Giant mottled eel, “ -unagi ”

Monogenea

Pseudodactylogyus anguillae (Ehime)*Pseudodactylogyus bini* (Ehime)

Cestoda

Bothriocephalus japonicus (Kagoshima)

Acanthocephala

Acanthocephalus gotoi (Ehime)*Acanthocephalus longiacanthus* (Ehime)*Southwellina hispida* (Ehime, Kagoshima)

Remarks: Only six species of parasites have been reported from *Anguilla marmorata* in Japan. This is caused by the past insufficient investigation in Japan into the parasites of *Anguilla marmorata*, on which only two papers are available (Luo *et al.*, 2002; Katahira and Nagasawa, 2014). As *Anguilla marmorata* is commonly found in the subtropical region of Japan, it is desirable to clarify the parasite fauna of the species from the region.

Acanthocephalus longiacanthus was described from *Anguilla marmorata* and has been reported only from this eel species (Katahira and Nagasawa, 2014), but, like other echinorhynchid acanthocephalans, *A. longiacanthus* does not appear to be host-specific. If this is true, no parasites which are specific to *Anguilla marmorata* have been reported from Japan to date because *Southwellina hispida* utilizes a variety of freshwater fishes as its paratenic hosts and the remaining four species of parasites also can infect *Anguilla japonica*.

(Linnaeus, 1758)

European eel, “ y roppa-unagi ”

Sarcomastigophora

Cryptobia sp. (–)*Ichthyobodo* sp. (–)

Ciliophora

Apiosoma sp. (Shizuoka)*Capriniata piscium* (Shizuoka)*Chilodonella* sp. (–)*Ichthyophthirius multifiliis* (Shizuoka)*Trichodina* sp. (Shizuoka)

Microspora

Heterosporis anguillarum (Shizuoka, Aichi, Kagoshima)

Myxozoa

Myxidium giardi (–)*Myxidium* sp. (Shizuoka)

Monogenea

Gyrodactylus anguillae (Shizuoka)*Pseudodactylogyus anguillae* (Chiba, Shizuoka, Aichi, Hiroshima, Kagoshima)*Pseudodactylogyus bini* (Chiba, Shizuoka, Kagoshima)*Pseudodactylogyus* spp. (Shizuoka)

Unidentified Monogenea (Shizuoka)

Nematoda

Anguillicola crassus (Shizuoka)

Copepoda

Lernaea cyprinacea (–)

Remarks: Due to a shortage of *Anguilla japonica* eelers for pond culture in Japan, numerous eelers of *Anguilla anguilla* were imported from several European countries (mainly France) to Japan during the late 1960s and 1970s (Egusa, 1979; Tanaka, 1979). Currently, the eel import of the species from Europe has been very strictly regulated because it has been registered as a critically endangered species. The nine nominal species of parasites* listed herein were all reported from cultured or experimentally reared *Anguilla anguilla* between the years 1969 and 2008 (Egusa *et al.*, 1969; Fang *et al.*, 2008). There is no recent work on the parasites of *Anguilla anguilla* in Japan. Although some individuals of the species have been reported from Japanese rivers and lakes (Zhang *et al.*, 1999; Okamura *et al.*, 2001), nothing is known about the parasites of those fish.

Richardson, 1841

Short-finned eel

Monogenea

Pseudodactylogyrus mundayi (Shizuoka)

Remarks: As a pathway to import non-native eels alive to Japan, small-lot commercial tradings from Oceania currently exist (see Ogawa *et al.*, 2015). Further attentions are needed to monitor introductions of non-indigenous parasites, accompanied with such international eel transportations, into Japan.

sp.

Monogenea

Pseudodactylogyrus anguillae (Aichi, Kagoshima)*Pseudodactylogyrus bini* (Aichi, Kagoshima)*Pseudodactylogyrus* sp. (Kagoshima)

Nematoda

Anguillicola globiceps (–)

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* The number of parasite species reported from *Anguilla anguilla* in Japan was erroneously reported as 10 in Nagasawa *et al.* (2007: 91).

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日本産ウナギ類の寄生虫目録：追補改定版（1915-2017年）

長澤和也¹⁾・片平浩孝²⁾¹⁾ 広島大学大学院生物圏科学研究科 〒739-8528 東広島市鏡山1-4-4²⁾ 三重大学生物資源科学研究科 〒514-8507 津市栗真町屋町1577

要 旨 1915-2017年の103年間に出版された文献に基づき、日本産ウナギ属魚類3種（ニホンウナギ *Anguilla japonica*、オオウナギ *Anguilla marmorata*、ヨーロッパウナギ *Anguilla anguilla*）と日本に輸入された *Anguilla australis* の寄生虫に関する情報を2つのリスト（寄生虫 - 宿主リスト、宿主 - 寄生虫リスト）に整理して目録を作成した。宿主のニホンウナギとオオウナギは在来種であり、ヨーロッパウナギはシラスウナギとして輸入され養殖された個体、*Anguilla australis* はオーストラリアから輸入された個体である。本目録は2007年に出版した同名目録の追補改定版である。本目録には、54名義種の寄生虫（繊毛虫類6種、微孢子虫類1種、ミクソゾア類6種、吸虫類12種、単生類8種、条虫類3種、線虫類7種、鉤頭虫類6種、ヒル類3種、二枚貝類1種、カイアシ類1種）に加えて、学名がまだ決定していない寄生虫の情報が含まれる。寄生虫 - 宿主リストでは、各寄生虫は高位分類群ごとに配列され、最新の学名、シノニム、寄生部位、地理的分布および報告者の情報が示されている。上記54名義種のうち、ニホンウナギから50種、オオウナギから6種、ヨーロッパウナギから9種、*Anguilla australis* から1種の寄生虫が報告されていた。単生類の *Gyrodactylus anguillae*、*Gyrodactylus nipponensis* および *Pseudodactylogyrus mundayi*、条虫類の *Bothriocephalus claviceps*、線虫類の *Raphidascaris acus* は海外から持ち込まれたと推察されており、残りの49名義種が日本にもともと分布するものである。ニホンウナギから報告された寄生虫のうち、9名義種（*Lecithochrium musculus*、*Proctotrematoides pisodontophidis*、*Tubulovesicula anguillae* [吸虫類] *Gyrodactylus nipponensis*、*Pseudodactylogyrus kamegaiti* [単生類] *Nybelinia angullicola* [条虫類] *Cucullanus filiformis*、*Heliconema anguillae* [線虫類] *Limnotrachelobdella okae* [ヒル類]) は海産または汽水産であり、海ウナギや河口ウナギとして知られる個体がそれら寄生虫の宿主になっていると考えられる。

キーワード：オオウナギ，寄生虫，ニホンウナギ，目録，ヨーロッパウナギ，*Anguilla australis*

