

Freshwater fish parasite diversity in West Bengal – A review

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ABSTRACT

Aquaculture has the potential to meet the need of growing demand of fish in an affordable price. But in capture and in culture fisheries the fishes face diseases that interfere in the production of fish. The occurrence of disease causes the reduced production in aquaculture or reduce the marketable value of fish because of change of flesh quality, thus hampering the production. Freshwater fishes whether they are cultured or wild face different types of diseases in their skin, gills, fins, blood, and internal organs. The parasites that cause the diseases may be protozoans or metazoans. The main protozoan freshwater fish diseases are ichthyophthiriasis, trichodiniasis, costiosis, chilodonellosis. The most common metazoan parasitic diseases of freshwater fishes are dactylogyrosis, gyrodactylosis, argulosis, myxosporidiasis, ligulosis, ergasilosis, lernaesis, etc. The focus of this review is to screen the research studies that takes place on freshwater fish parasites of West Bengal. The review also aims to study the diversity of freshwater fish parasites in West Bengal, so that it will help the researcher to get an idea about the freshwater fish parasites and their mode of infection in the fishes. The research work that takes place in different regions of West Bengal. Some of them reveal new species of parasites in fishes. Protozoan, cnidarian, acanthocephalan, nematode, cestode, trematode, crustacean parasites are identified in freshwater fishes of West Bengal. Among the protozoans ciliates, flagellates are identified. Trichodinids are very common protozoan fish parasites in most districts. Parasites under genus *Myxobolus*, *Dactylogyrus*, *Gyrodactylus*, *Argulus*, *Lernea* are common among the metazoans.

Key words : Fish parasites, Diversity, Protozoan fish parasites, Metazoan fish parasites.

Introduction

Fishes are the important source of protein containing food. For that reason, day by day demand of fish production increases in West Bengal. With the increasing demand of fish food production concern about the fish diseases increases in the farmers and in the researchers. Fishes are the source of earning for many people and it helps in the economic devel-

opment of our country by acting as a source to earn foreign money. Parasitic infestation frequently occurs in fish that causes retarded growth rate, reduced production, consumer rejection, low reproduction and mass mortality in fish. There are many parasitic diseases of fishes in the world. Fish parasites cause commercial losses in both the aquaculture and fisheries industries and may have human health, as well as socioeconomic implications both in

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developing and developed countries. Many marine and freshwater fishes serve as a source of medically important parasitic zoonoses that include trematodiasis, cestodiasis, and nematodiasis. With date the importance of both captures and culture fisheries are increasing. In West Bengal scientific researches taking turn towards the study of fish parasitological investigation to learn proper knowledge about the fish parasites and to improve the fish health. Since 1937 to 2021 studies takes place on fish parasites from many districts of West Bengal. In Kolkata (Podder, 1937; Chakravarty, 1943), Nadia (Das and Halder, 1987; Saha and Halder, 1996; Asmat, 2001a,b; Asmat, 2002), Howrah (Dash *et al.*, 2008), Hooghly (Asmat, 2002; Banerjee *et al.*, 2017), North 24 Parganas (Mitra and Bandyopadhyay, 2005, 2006a,b, 2009; Purulia (Basu, 2009), Murshidabad (Mitra *et al.*, 2013b), South 24 Parganas (Das *et al.*, 2015, Ramudu *et al.*, 2016; Ramudu *et al.*, 2018; Vijaysundardeva *et al.*, 2018; Sanyal *et al.*, 2018) Burdwan (Ramudu *et al.*, 2016; Ramudu *et al.*, 2018; Vijaysundardeva *et al.*, 2018), Bankura (Banerjee *et al.*, 2016), Jalpaiguri (Banerjee, *et al.*, 2021). Application of innovative and fruitful technologies are required for the treatment of the parasitic diseases. This study is based on the information published in different research journals and focuses on the idea to make a brief account about the nature of fresh water fish parasites found in West Bengal. This review reveals that though research is done in many parts of West Bengal. However, some regions of West Bengal remain untouched. So, further study is required to know the complete knowledge of fish parasitic infections in West Bengal.

Research done in West Bengal

Protozoan fish parasites

Mukherjee and Halder in 1982 (Mukherjee and Halder, 1982) identified and described two genera *Trichodina* (*Trichodina nigra* Lom) and *Tripartiella* (*Tripartiella bulbosa*) from food fishes of West Bengal. The hosts fishes from where they identified the parasites are *Nandus nandus*, *Tilapia mossambica*, *Cirrhina mrigala*, *Labeo rohita*, *Labeo bata*, *Mystus bleekeri*, *Ambasis nama*. They also stated that these two parasites recorded first time from Indian fishes. Das and Halder in 1987 isolated and identified ciliates of the genus *Tripartiella* from *Catla catla*, *Labeo rohita*, *Gtenopharyngodon idella*, *Girrhinus mrigala* and *Gyrinus carpio* collected from Nadia district of West

Bengal. In their study they stated that tripartiella infects both cultured Indian and exotic carps. Saha and Halder (1996) identified a new ciliate parasite *Tripartiella bursiformis* in the gills of the freshwater fish *Xenentodon cancila* collected from Bethuadahari, Nadia, West Bengal. Basu and Halder (1998) studied the prevalence of protozoan parasites on pure and hybrid carps. Asmat (2001a) described a new species of trichodina, *Trichodina cancilae* sp. n. from the fish *Xenentodon cancila* from Kalyani of Nadia district and the parasitic infestation varies with seasons. Asmat (2001b) in his another work described a new population of trichodinid *Trichodina porocephalus* sp. n. from flathead Sleeper, *Ophiocara porocephalus*, collected from Hooghly river of West Bengal. In his study he noted intraspecific variation in the identified parasite based on the nature of denticle, and all the types are found in the same population of host species even in the same host with different conditions. Asmat (2002) identified two new trichodinian parasites namely *Trichodina chandae*, *Trichodina notopterusi* from *Chanda nama* and *Notopterus notopterus* of Nadia and Hooghly district of West Bengal. He provides the morphological description and morphological comparison of these two species in this paper. Mitra and Haldar (2004b) did a survey on trichodinid ectoparasites in freshwater fishes of Churni river. They reported *Trichodinella epizootica* first time in India from the gills of minor carp *Puntius gelius* and *Trichodina notopteridae* sp. n. from *Notopterus notopterus*. Mitra and Halder in 2004 (Mitra and Haldar 2004) found a new ectoparasite *Chilodonella hexasticha* in the gills of fish *Nandus nandus* during their investigations on parasites in fishes collected from river Churni and other water bodies. They found that *Chilodonella hexasticha* occurs mainly from September to December and disappears during Summer at temperature above 32°C. Mitra and Bandyopadhyay (2005) studied the freshwater fish parasites of Matla and Churni river. Their study revealed the occurrence of two previously described ciliophoran parasites *Trichodina japonica* from *Lates calcarifer* and *Trichodina mutabilis* from *Nandus nandus*, first time in India. Mitra and Halder (2005) studied the trichodinid ciliophorans of freshwater fishes from Churni river and nearest water bodies of West Bengal. During their survey they obtained two new species of parasites such as *Trichodina giurusis* p. n. from *Glossogobius giuris* and *Trichodina molae* sp. n. from

Amblypharyngodon mola. Mitra and Bandyopadhyay (2006b) did an investigation on the freshwater fish parasites from Churni River system of Nadia district and Ichamati river system of North 24 Parganas. They obtained two new species of fresh water fish parasites namely *Trichodina haldari* n. sp. from host fish *Glossogobius giuris* and *Paratrachodina bassonae* n. sp. from host fish *Mystus cavasius* during their survey. Mitra and Bandyopadhyay, (2006a) investigated about the trichodinid infestation in two exotic fishes *Oreochromis mossambicus*, *Oreochromis niloticus* from Churni river of West Bengal and a new species of ectoparasite (trichodinid) *Paratrachodina africana* was first recorded in *Oreochromis mossambicus*. Mitra and Bandyopadhyay, (2009) investigated Ichthyoparasitological surveys of freshwater fishes of the river Tista, Churni of West Bengal. They reported a new species *Dipartiella kazubski* sp. nov. in the gills of freshwater fishes *Batasio batasio* and *Wallago attu* they have studied. Previously this genus was considered as marine fish parasite but, in their study, they confirm the presence of this genus included in the freshwater forms as well. Basu et al. (2009) studied the prevalence of trichodinid fish parasites in pure and hybrid carps of jhalda, Purulia, West Bengal and compare the prevalence of that fish parasites. It has been revealed that infection rate is remarkably higher in hybrid carps. Mitra et al. (2012) studied the presence of *Trichodinid ciliophorans* (Ciliophora: Peritrichida) in the freshwater fishes of the river Churni in West Bengal, India. Their study revealed a new species which they designate as *Trichodina glossogobae* sp. nov. This species was found in the gills of *Glossogobius giuris* and they studied two another species *Tripartiella Bulbosa* and *T. copiosa* infecting the *labeobata* fish. Mitra et al., (2013b) studied the diversity of ectoparasite trichodinid ciliophorans from freshwater fishes collected from the Ganga River in Murshidabad district, West Bengal. During their study they identified two new species of the genus *Trichodina*. These are *T. silondiata* sp. nov. from the gills of freshwater fish *Silonia silondia* and *T. pangasi* sp. nov. from the gills of freshwater fish *Pangasius pangasius*. Mitra et al., (2013b) studied fish parasites trichodinid and *chilodonellid ciliophorans*, and did a comprehensive study among the parasites of fresh water and estuarine fishes of West Bengal. They studied the fishes from Vidyadhari River and Rupnarayan river. They isolated and identified *Trichodinella sunderbanensis*

sp. nov. and *Trichodina acuta* from an estuarine fish *Mystus gulio* from the Vidyadhari River; *Trichodina nandusi* sp. nov. from a freshwater fish, *Nandus nandus*, *Chilodonella hexasticha* from freshwater fishes *Labeo rohita* and *Cyprinus carpio* of the Rupnarayan river. Das (2015) studied the distribution of different parasites in freshwater exotic carps from south 24 Parganas district of West Bengal. Among the isolated and identified fish parasites most of them are the protozoan parasites viz. *Trichodina* sp., *Chilodonella* sp., *Zoothamnium* sp., *Vorticella* sp. from from host species *Hypophthalmichthys molitrix*, *Cyprinus carpio*, *Ctenopharyngodon Idella*. They noted that winter is the most vulnerable time for parasitic infection although some dominant infestation found noted during the summer. Ramudu et al. (2016) isolate and identified parasites from Indian major carp *Labeo rohita* collected from Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. Their study revealed that in cultivated fish ponds infection of fish parasites is a major problem in fish culture. The protozoan parasites that are isolated during their study were *Trichodina* sp., *Costia* sp., *Ichthyophtherius multifiliis*, development stages. They also found that with seasons infestation of parasites are greatly differed and in winter parasitic infestation increases than the other seasons. And they also noted that small sized fishes are more vulnerable to parasitic infection than the large fishes. Ramudu et al. (2018) studied parasite *Trichodina* sp in *Catla catla* fish collected from the Bheries of West Bengal. The fishes were collected from Bheries of Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. In their study they stated that parasitic prevalence differs with seasons. Vijaysundardeva et al. (2018) investigated parasites from Indian major carps in Garia, Bamanghata, of South 24 Parganas District, Ulluberia of Howrah District, Memari of Burdwan district of West Bengal. They isolated protozoan *Trichodina* sp., *Vorticella* sp. from the gills of *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*. And they found that adult fishes are more infected than the fingerlings. Sanyal et al. (2018) observed and identified *Trichodina* sp., *Gregarine* sp. from Indian major carps *Labeo rohita*, *Catla catla*, collected from different fish farms South 24 Parganas district of West Bengal.

Metazoan fish parasites

Cnidaria

Chakravarty (1943) studied the myxosporidian parasites from some common food fishes of West Bengal. Now myxosporidians are included under the phylum cnidaria (Fiala *et al.*, 2015). He examined *Amphipnous cuchia*, *Anabas testudineus*, *Catla catla*, *Cirrhina mrigala*, *Clarius bairachus*, *Heteropneustes fossilis*, *Hilsa ilisha*, *Labeo rohita*, *Lates calcarifer*, *Maerones gulio*, *Scatophagus argus* food fishes collected from Kolkata (local tanks, fish markets, large aquaria of laboratory) and he described many species of myxosporidians under the genera *Leptotheca*, *Ceraimyxa*, *Myxidium*, *Zschokkella*, *Chloromyxum*, *Thelohanellus* and *Myxobolus*. Basu *et al.* (2009) studied the prevalence of myxozoan fish parasites in pure and hybrid carps of jhalda, Purulia, West Bengal and compare the prevalence of that fish parasites. It has been revealed that infection rate is remarkably higher in hybrid carps. Mondal (2014) isolate *Thelohanellus caudatus* from *Labeo rohita*. Banerjee *et al.* (2016) studied the infestation of myxozoan parasite in fishes from Damodar river at Bankura district and identified 3 myxozoan genera *Myxobolus*, *Thelohanellus*, and *Henneguya* from fishes viz. *Puntius phutunio*, *Labeo bata*, *Salmostoma bacalia*, *Catla catla*, *Mystus vittatus*. During their study they found that the overall rate of infection was always higher during winter month. Ramudu *et al.* (2016) isolate and identify parasites from Indian major carp *Labeorohita* collected from Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. Their study revealed that in cultivated fish ponds infestation of fish parasites is a major problem in fish culture. The cnidarian parasites that are isolated during their study were *Myxobolus* sp., *Thelohanellus* sp. Ramudu and Dash (2016) studied the myxozoan parasites of Indian major carps *Labeo rohita* and *Cirrhinus mrigala* collected from Garia, West Bengal. They found *Myxobolus orissae*, *M. carnaticus* and *Thelohanellus caudatus* infecting the gills and fins of their hosts. Banerjee *et al.* (2016) studied the myxozoan parasites *Myxobolus Bütschli*, *Thelohanellus Kudo*, and *Henneguya Thélohan*, from fishes collected from Damodar river of Bankura district. They also noted that parasitic infection is higher during winter season than that of the other seasons in a year. Kaur *et al.* (2017) studied the species diversity of genus

Thelohanellus in freshwater fishes (major, minor and some other fishes) of India and stated that maximum number of species are recorded from West Bengal. They prepare a synopsis in which they describe the morphological identifying features of 52 *Thelohanellus* sp as well as they have given the records of molecular identifying features of 14 *Thelohanellus* sp. Vijaysundardeva *et al.* (2018) investigated parasites from Indian major carps viz. *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* in Garia, Bamanghata, of South 24 Parganas District, Ulluberia of Howrah District, Memari of Burdwan district of West Bengal. They isolated cnidarian *Myxobolus* sp. From the gills of fishes and highest infection by *Myxobolus* was found in rainy season. Sanyal *et al.* (2018) observed myxozoan parasite *Thelohallenus* sp, *Myxobolus* sp. from *Labeo rohita* and *Cirrhinus mrigala* respectively, the fishes were collected from different fish farms located in different areas of South 24 Parganas district of West Bengal. Banerjee *et al.* (2021) made a survey on fish parasites of riverine fishes from river Teesta and river Mahananda of Jalpaiguri district. In their survey they identified six myxozoan parasites as *Myxobolus shantipuri*, *Myxobolus koli*, *Thelohanellus qadrii*, *Thelohanellus* sp. I, *Henneguya* sp. I and *Henneguya* sp. II from fishes viz. *Rasbora daniconius*, *Amblypharyngodon mola*, *Puntius sophore*, *Channa punctatus*, *Chanda nama*, *Mystus vittatus* and the intensity of infection was fluctuated with season.

Helminth fish parasites

Cestodes

Banerjee *et al.* (2017) first reported one cestode parasite species *Bothriocephalus acheilognathi* under the family Bothriocephalidae from freshwater fish *Channa punctatus* and *Channa striatus* of Hooghly district, West Bengal. This parasite species is reported in its host species for the first time in West Bengal.

Acanthocephala

Podder (1937) investigated various fishes from Calcutta market for the parasitic infection and reported a new acanthocephalan parasite *Neoechinorhynchus topseyi*, from the intestine of *Polynemus heptadactylus* (Topsey or mango-fish). Sarkar (1953) recorded a new acanthocephalan *Pallisentis nandai* n.sp. from edible fresh-water fish *Nandus nandus*. Dash *et al.* (2015) identified parasites

from the exotic carps viz. *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix* and *Cyprinus carpio* fishes of South 24 Parganas district, West Bengal. In their study they have found that acanthocephalan parasites only in *Ctenopharyngodon idella* and are in highest number in summer season (March – April). Kundu *et al.* (2015) isolated and identified acanthocephalan parasite *Pallisentis allahabadii* from the abdominal cavity, liver and intestine of the fish *Channa punctatus* collected from fish farms of Nadia district. They observed parasitic infestation varies with seasons and it is affected by the water quality of the fish farm. Guchhait *et al.* (2017) studied the helminth parasites in *Mystus gulio* from South 24 Parganas, North 24 Parganas and East Midnapore districts of West Bengal. According to their study acanthocephalans are the most dominant helminths in *Mystus gulio* and are predominant during monsoon. *Pallisentis sp.*, *Raosentis podderi* and *Acathogyrus sp.* are the 3 acanthocephalan parasites that they found in the *Mystus gulio* and they observed that the fishes that have larger length are more infected than the groups that have smaller length. Banerjee *et al.* (2017) first reported two acanthocephalan parasite species *Pallisentis ophiocephali* under family Quadrogyridae and *Neoechinorhynchus sootai* under family Neoechinorhynchidae from freshwater fish *Channa punctatus* and *Channa striatus* of Hooghly district, West Bengal. This parasite species is reported in its host species for the first time in West Bengal.

Nematode

Dash *et al.* (2008) isolated and identified *Capillaria sp* (zoonotic) from Indian major carps *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* of Mohanpur, Kampa, Jagulia and Howrah. In their study they found that among the helminth parasites a very few have zoonotic potentiality and small size fishes are infected by nematode parasites only during rainy season. Das *et al.* (2015) studied the distribution of different parasite in freshwater exotic carps from south 24 Parganas district of West Bengal. They isolated and identified *Trichinella sp.* nematode parasite from *Hypophthalmichthys molitrix* and *Cyprinus carpio* fishes. In their study they observed that prevalence of parasitic infection is varies with seasons and parasitic infestation is higher during winter season. Kundu *et al.* (2015) studied the prevalence of helminth parasites in *Channa punctatus* from fish farms of Nadia district and isolated *Eustrongylides sp.*, a nematode

parasite from abdominal cavity, liver, intestine of the infected hosts. They observed that parasite infestation varies with seasons which they stated that this variation is due to the water quality change, presence of intermediate host, age of host etc. Ramudu *et al.* (2016) isolate and identify parasites from Indian major carp *Labeo rohita* collected from Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. Their study revealed that in cultivated fish ponds infection of fish parasites is a major problem in fish culture. They identified nematode parasites from the fishes. Guchhait *et al.* (2017) isolated and identified *Procamallanus sp.*, *Contraecaecum sp.* and *Eustrongylides sp* nematodes in *Heteropneustes fossilis* collected from South 24 Parganas, North 24 Parganas and East Midnapur district of West Bengal. In their study they found that fishes with a particular length were more susceptible to parasitic infection and the dominance of infection varies with seasons. Ramudu *et al.* (2018) identified nematodes in *Catla catla* fish collected from the Bheries of West Bengal. The fishes were collected from Bheries of Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. In their study they stated that parasitic prevalence differs with seasons.

Trematode

Ghosh *et al.* (1987) studied trematode dactylogyridin *Catla catla* from Hoogly. Das *et al.* (2008) identified *Heterophys sp.*, *Chlonorchis sp* zoonotic trematodes from Indian major carps. The fishes were collected from collected from several ponds, freshwater bheries and hatcheries, fish markets situated at Mohanpur, Kampa, Jagulia and Howrah. In their study they observed that zoonotic infection is rare for helminth parasites and the trematode infection is high during summer season in small size fishes. Kundu *et al.* (2015) isolated trematode parasite *Euclinostomum heterostomum* from the fish *Channa punctatus* of Nadia District during their study on the prevalence of helminth fish parasites. It is found during their study that the prevalence is varies with seasons and other factors such as water quality, age of host species etc. Ramudu *et al.* (2016) isolate and identify parasites from Indian major carp *Labeo rohita* collected from Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of

North 24 Parganas District, Memari of Burdwan District of West Bengal. Their study revealed that in cultivated fish ponds infection of fish parasites is a major problem in fish culture. The monogenean parasites that are isolated during their study were *Dactylogyrus* sp., *Gyrodactylus* sp. Ramudu *et al.* (2018) studied parasites *Dactylogyrus* sp., *Gyrodactylus* sp in *Catla catla* fish collected from the Bheries of West Bengal. The fishes were collected from Bheries of Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. In their study they stated that parasitic prevalence differs with seasons. G. Vijaysundardeva *et al.* (2018) investigated parasites from Indian major carps in Garia, Bamanghata, of South 24 Parganas District, Ulluberia of Howrah District, Memari of Burdwan district of West Bengal. They isolated monogenean trematode *Dactylogyrus* sp from the gills of *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* fishes and observed that adult fishes are

more susceptible to infection than the fingerlings.

Crustacea

Nandi and Das (1991) studied that juvenile fish mortality caused by argulosis in some fishes of Kakdwip, South 24 Parganas, West Bengal. Ramudu *et al.* (2016) isolate and identify parasites from Indian major carp *Labeo rohita* collected from Garia, Bantala, Bamanghata, Gangajua of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. Their study revealed that in cultivated fish ponds infection of fish parasites is a major problem in fish culture. The crustacean parasites that are isolated during their study were *Argulus* sp., *Lerneae* sp. Vijaysundardeva *et al.* (2018) investigated parasites from Indian major carps in Garia, Bamanghata, of South 24 Parganas District, Ulluberia of Howrah District, Memari of Burdwan district of West Bengal. They isolated crustacean parasites *Lerneae* sp.,

Table 1. List of some freshwater fish parasites recorded in different districts of West Bengal:

Districts of West Bengal	Fish parasites found
Kolkata	<i>Leptotheca</i> sp., <i>Ceratomyxa</i> sp., <i>Myxidium</i> sp., <i>Zschokkella</i> sp., <i>Chloromyxum</i> sp., <i>Thelohanellus</i> sp., <i>Myxobolus</i> sp., <i>Neoechinorhynchus topseyi</i>
Nadia	<i>Trichodina</i> (<i>Trichodina nigra</i> Lom) and <i>Tripartiella</i> (<i>Tripartiella bulbosa</i>), <i>Tripartiella bursiformis</i> , <i>Trichodina cancelae</i> sp. n., <i>Trichodina chandae</i> , <i>Trichodina notopterusi</i> , <i>Trichodinella epizootica</i> , <i>Trichodina notopteridae</i> sp. n., <i>Chilodonella hexasticha</i> , <i>Trichodina mutabilis</i> , <i>Trichodina giurusi</i> sp. n., <i>Trichodina molae</i> sp. n., <i>Trichodina haldarin</i> sp., <i>Dipartiella kazubski</i> sp. nov., <i>Trichodina glossogobae</i> sp. nov., <i>Tripartiella Bulbosa</i> and <i>T. copiosa</i> <i>Pallisentis allahabadii</i> , <i>Eustrongylides</i> sp., <i>Euclinostomum heterostomum</i>
Hoogly	<i>Trichodina porocephalusi</i> sp. n., <i>Trichodina chandae</i> , <i>Bothriocephalus acheilognathi</i> , <i>Pallisentis ophiocephali</i> , <i>Neoechinorhynchus ssootai</i> , <i>Dactylogyrus</i> sp
Howrah	<i>Trichodina</i> sp., <i>Vorticella</i> sp., <i>Myxobolus</i> sp., <i>Capillaria</i> sp., <i>Heterophys</i> sp., <i>Chlonorchis</i> sp., <i>Lerneae</i> sp., <i>Argulus</i> sp., <i>Ergasilus</i> sp.
North 24 Parganas	<i>Paratrichodina bassonae</i> n. sp., <i>Trichodina</i> sp., <i>Costia</i> sp., <i>Ichthyoptherius multifilus</i> <i>Myxobolus</i> sp., <i>Thelohanellus</i> sp., <i>Pallisentis</i> sp., <i>Raosentis podderi</i> and <i>Acathogyrus</i> sp., <i>Dactylogyrus</i> sp., <i>Gyrodactylus</i> sp., <i>Argulus</i> sp., <i>Lerneae</i> sp.
Jalpaiguri	<i>Dipartiella kazubski</i> sp. nov., <i>Myxobolus shantipuri</i> , <i>Myxobolus koli</i> , <i>Thelohanellus qadrii</i> , <i>Thelohanellus</i> sp., <i>Henneguya</i> sp.
Purulia	<i>Trichodina</i> sp. <i>Myxozoan</i>
Murshidabad	<i>T. silondiata</i> sp. nov., <i>T. pangasi</i> sp. nov.
South 24 Parganas	<i>Trichodina japonica</i> , <i>Trichodina</i> sp., <i>Chilodonella</i> sp., <i>Zoothamnium</i> sp., <i>Vorticella</i> sp., <i>Trichodina</i> sp., <i>Costiasp.</i> , <i>Ichthyoptherius multifilus</i> , <i>Gregarine</i> sp., <i>Thelohanellus caudatus</i> , <i>Myxobolus</i> sp., <i>Myxobolus orissae</i> , <i>M. carnaticus</i> , <i>Acanthocephala</i> sp, <i>Pallisentis</i> sp., <i>Raosentis podderi</i> , <i>Acathogyrus</i> sp. <i>Trichinella</i> sp., <i>Procamallanus</i> sp., <i>Contraecum</i> sp., <i>Eustrongylides</i> sp., <i>Dactylogyrus</i> sp., <i>Gyrodactylus</i> sp., <i>Argulus</i> sp., <i>Lerneae</i> sp., <i>Ergasilus</i> sp.
Burdwan	<i>Trichodina</i> sp., <i>Costia</i> sp., <i>Ichthyoptherius multifilus</i> , <i>Vorticella</i> sp., <i>Myxobolus</i> sp., <i>Thelohanellus</i> sp., <i>Dactylogyrus</i> sp., <i>Gyrodactylus</i> sp., <i>Argulus</i> sp., <i>Lerneae</i> sp., <i>Ergasilus</i> sp.
Bankura	<i>Myxobolus</i> sp., <i>Thelohanellus</i> sp., <i>Henneguya</i> sp.
Purba Medinipur	<i>Trichodinanandusi</i> sp. nov., <i>Chilodonella hexasticha</i> , <i>Pallisentis</i> sp., <i>Raosentis podderi</i> , <i>Acathogyrus</i> sp.

Argulus sp., *Ergasilus* sp from the gills of the *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* fishes and the presence of the parasites varies with seasons in their host species. Ramudu *et al.* (2018) identified *Argulus* sp., *Lerne* sp in *Catla catla* fish collected from the Bheries of West Bengal. The fishes were collected from Bheries of Garia, Bantala, Bamanghata, Gangajura of South 24 Parganas District, Naihati of North 24 Parganas District, Memari of Burdwan District of West Bengal. In their study they stated that parasitic prevalence differs with seasons and parasites. Sanyal *et al.* (2018) observed crustacean parasite *Argulus* sp. from Indian major carp diseased *Labeo rohita* of South 24 Parganas district of West Bengal. They noted that parasitic infestation depends on climatic change in the aquatic environment of the host fish.

Discussion

Although many studies done on the isolation and identification of fish parasites from different freshwater bodies of West Bengal some areas are remain untouched to study the parasitic diversity. The table 1 showing the districts covered for fish parasitological studies and the parasites identified. Among the identified parasites genus *Trichodina* are very common in protozoans and different species of this genus are identified. Protozoan, cnidarian, helminth, crustacean parasites are found to infect fishes although the prevalence varies with seasons.

Conclusion

This review has provided information about the research studies done on diversity of fish parasites, their isolation and identification carried out in different regions of West Bengal. Wide variety of parasites that infest the fishes have simple or complicated life cycle. Their diversity and abundance may vary with seasons. Some of them are zoonotic in nature. Proper control measures are lacking to treat the parasites. It may be suggested that more ichthyoparasitological investigation is required for gaining complete knowledge about fish parasite diversity from all areas of West Bengal. Because complete knowledge will be helpful to tackle the fish parasitism of any nature by applying preventive measure or by applying proper medication and that will be beneficial for healthy fish growth.

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