

Metazoan Ectoparasites of Edible Freshwater Fishes of Vizianagaram District, Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration between all authors. Author MG got this minor research project and she designed the study, collected the host samples from sampling sites, carried out dissections, collected the parasites and managed the literature searches. Authors APV and VC helped in processing the parasites and preparing the first and final draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Ectoparasites like copepods and monogeneans of fishes cause serious damage in the aquaculture industry. Five species of freshwater fishes collected from different freshwater bodies of Vizianagaram district of Andhra Pradesh were analysed for ectoparasitic infection. This communication recorded five species of ectoparasites, out of which three were monogenean species and two copepod species. They were recovered from gill filaments and skin of fishes. The parasites recovered include *Dactylogyrus catalius*, *Bychowskyella wallagonia*, *Thaparocleidus tengra*, *Ergasilus malnadensis* and *Argulus siamensis*. Among the fish hosts examined in present study, *Catla catla* and *Labeo rohita* were found to be most common hosts for ectoparasites. All five parasitic species reported were redescriptions and they were described briefly. Out of five species recovered in the present study, four species (*B. wallagonia*, *T. tengra*, *E. malnadensis* and *A. siamensis*) are new locality records. Keeping in view the importance of these ectoparasites, the present study was designed to investigate the status of their ectoparasite communities (prevalence, mean intensity and nature of recovered species) in freshwater fishes of this district.

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Keywords: Monogeneans; copepods; Vizianagaram; *Dactylogyrus catalius*; *Bychowskyella wallagonia*; *Thaparocleidus tenra*; *Ergasilus malnadensis*; *Argulus siamensis*.

1. INTRODUCTION

Freshwater fishes are important food resources [1,2]. Intensive culture practices of food fishes are now being pursued on an increasing scale in the country. The success of implementation of various fishery development programmes depends to a certain extent on extensive research on parasites of freshwater fishes, because the improvement of yield can mainly be achieved from healthy stock. Most of the freshwater food fishes of India harbour parasites [3]. Monogeneans are ectoparasites of fish with a direct life cycle and most of them are parasites of fishes with relatively high host specificity [4]. They cause extensive damage to the gills and skin due to their attachment with equipped haptor armature and their feeding on mucus and other host tissues. Heavy infections are of a frequent occurrence in fish hatcheries, natural ponds, aquaria where crowding effect is prevalent often resulting in mass mortalities of fishes, major infection being of various Dactylogyrids. Copepods occupy an important place as destructive ectoparasites of fishes [4]. Large numbers of lice have been found on the skin, gills and in the oral cavity of fish which resulted in pale gills, destruction of oral mucosa, skin abrasions, severe haemorrhaging and ulcerative lesions at the site of attachment [5]. Such lesions could extend into the muscle of fish [6]. Infected fish may also show increased mucus production. Ectoparasites not only harm the fish directly but also impact the fish growth and induce host mortalities [7]. They have been receiving considerable scientific attention due to serious damage to fishery resources by them [8]. On attachment to gill and skin, the ectoparasites cause localized hyperplasia, upset osmoregulation and may ultimately kill the host [7,9]. Ectoparasites also provide a pathway for the secondary pathogens such as viruses, bacteria and fungi [10]. As this is the first survey of the ectoparasite fauna of freshwater fishes of Vizianagaram District, short redescription of the parasites are presented.

2. MATERIALS AND METHODS

A total of 675 freshwater fish were procured from rivers, streams, irrigation canals, ponds and from the local fish market of Vizianagaram district, Andhra Pradesh. Fish were brought to the laboratory for comprehensive examination of

various possible organs like eyes, buccal cavity, skin and gills for the ectoparasites like monogeneans and parasitic copepods. These ectoparasites were generally found attached to the gill filaments and skin. Gills were removed carefully, placed in a saline solution, then teased and contents were washed and observed under a binocular microscope. Monogenetic trematodes were collected with utmost care because they have a firm attachment by the opisthaptor.

The monogenean parasites were collected with the help of small pipettes under binocular microscope and the single parasite was kept in the centre of glass slide in a small drop of water. The hard parts of the parasite such as copulatory organs and haptor armature are studied temporarily by placing a cover slip gently on to the parasite with glycerine added underneath and all the four corners sealed with nail enamel. Permanent slides can also be prepared for big parasites by fixing them in Malmberg's fixative (ammonium-picrate-glycerine) with the four corners sealed [11]. Copepod parasites recovered were fixed in 10% formalin. For identification, one copepod from each species was kept in cavity block with a few drops of lactic acid for 12-24 hours for clearing. Mouth parts and appendages of these parasites were dissected to draw diagrams with the aid of camera lucida for identification [12]. Parasites recovered were identified using standard keys [11-13]. Records pertaining to the number of host examined, infected, number of parasites found and the places of collection were maintained. Data collected were analysed for various ecological parameters like prevalence, abundance and mean intensity [14]. The latest criteria of Bush et al. [15] was employed and prevalence of infection was used as an index to identify groups of parasites as core species, secondary species and satellite species. Core species are those with prevalence of infection greater than 66% and satellite are those with less than 33% and all species between these ranges are considered as secondary species.

3. RESULTS

Monogenean Parasites

1. *Dactylogyrus catalius* (Thapar, 1948) Monaco & Mozielle, 1955 (Fig. 1).

Syn: *Paradactylogyrus catlalius* Thapar, 1948

Hosts (Prevalence of infection %): *Catla catla* (16%) and *Labeo rohita* (5.7%).

Infected organs: Gill filaments and Skin.

Place of collection: Dharmapuri tank, Vizianagaram.

Measurements: Body 2.6-2.72 × 0.45-0.50; Head organs 7 pairs; Pharynx 0.17-0.19 × 0.18-0.20; haptor 0.19-0.21 × 0.24-0.28; anchors 0.058-0.062; Transverse bar 0.055-0.063; marginal hooklets 14; Onchium 0.066-0.07; testis 0.62-0.68 × 0.29-0.32; ovary 0.22-0.25 × 0.14-0.17 and vagina 0.16-0.18.

2. ***Thaparocleidus tengra* (Tripathi, 1959)** Lim, 1996 (Fig. 2).

Hosts (Prevalence of infection %): *Mystus vittatus* (12%) and *Sperata seenghala* (2.9%).

Infected organs: Gill filament.

Place of collection: Andra reservoir, Vizianagaram.

Measurements: Body 0.24-0.30 × 0.02-0.04; pharynx 0.01-0.02 × 0.01-0.03; dorsal anchors 0.03-0.05; middle dorsal bar 0.01-0.02 × 0.01-0.013; small anchors 0.02-0.04; lateral bars 0.01-0.03; testis 0.05-0.07 × 0.02-0.04 and ovary 0.02-0.025 × 0.01-0.015.

3. ***Bychowskyella wallagonia* (Jain, 1959)** Gussev, 1961 (Fig. 3).

Hosts (Prevalence of infection %): *Wallago attu* (8.3%).

Infected organs: Gill filaments.

Place of collection: Nelivada cheruvu, Vizianagaram.

Measurements: Body 0.54-0.59 × 0.08-0.10; pharynx 0.03-0.04 in diameter; Haptor 0.05-0.07 × 0.11-0.14; dorsal anchors 0.033-0.034 × 0.003; connective bar 0.03-0.04 × 0.003; ventral anchors 0.017-0.020 × 0.007-0.008; ventral connecting bar 0.02-0.025 × 0.002-0.003; testis 0.10-0.12 × 0.04-0.06 and ovary 0.05-0.07 × 0.03-0.06.

Copepod Parasites

4. ***Ergasilus malnadensis*** Venkateshappa, Seenappa & Manohar, 1998 (Fig. 4).

Hosts (Prevalence of infection %): *Wallago attu* (5.0%).

Infected organs: Gill filaments and Skin.

Place of collection: Tatipudi reservoir, Vizianagaram.

Measurements: Cephalothorax 0.97-1.03 × 0.341-0.36; Cephalon 0.45-0.47 × 0.33-0.34; thorax 0.17-0.18 × 0.13; genital segment 0.06 × 0.09; Egg sacs 0.52-0.54; Eggs 0.05 × 0.05; abdomen 0.04-0.05 × 0.07; anal lamina 0.03-0.04.

5. ***Argulus siamensis*** Wilson, 1926 (Fig. 5).

Hosts (Prevalence of infection %): *Labeo rohita* (11.4%).

Infected organs: Gill filaments.

Place of collection: Dharmapuri tank, Vizianagaram.

Measurements: Body 4.0-4.59; carapace 2.4-2.60 × 2.2-2.47 and abdomen 1.12-1.28 × 0.99-1.015.

Three species of monogeneans and two species of copepods were recovered from 5 species of freshwater fishes. The parasites recovered, their hosts, number of host examined and infected, number of parasites recovered, site of infection, prevalence, mean intensity of infection and nature of species are summarised in Table 1.

All monogeneans recovered during the present study belongs to sub family: Dactylogyrinae. The highest prevalence of infection was shown by *Dactylogyrus catalius* (16%) in *Catla catla* and the lowest by *Thaparocleidus tengra* (2.9%) in *Sperata seenghala*. *D. catalius* also had a low prevalence (5.7%) in the host *Labeo rohita*. All monogeneans recovered are satellite species. The prevalence of infection of all recovered species of monogeneans was comparatively low. Ramasamy et al. [16] reported that monogeneans generally occur in low numbers within their natural hosts.

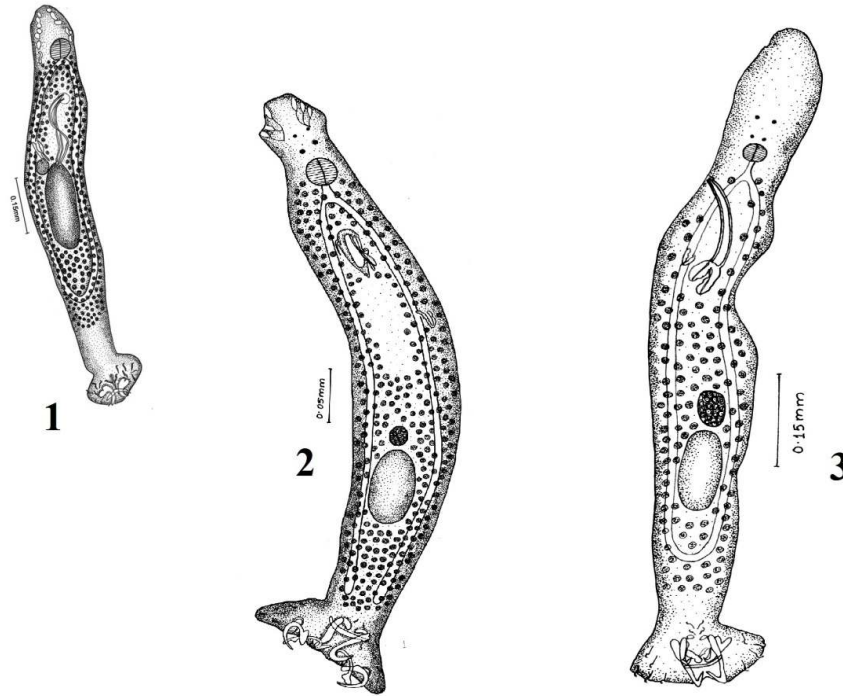


Fig. 1. *Dactylogyrus catalius* (Thapar, 1948) Monaco & Mozielle, 1955
Fig. 2. *Thaparocleidus tengra* (Tripathi, 1959) Lim, 1996
Fig. 3. *Bychowskyella wallagonia* (Jain, 1959) Gussev, 1961

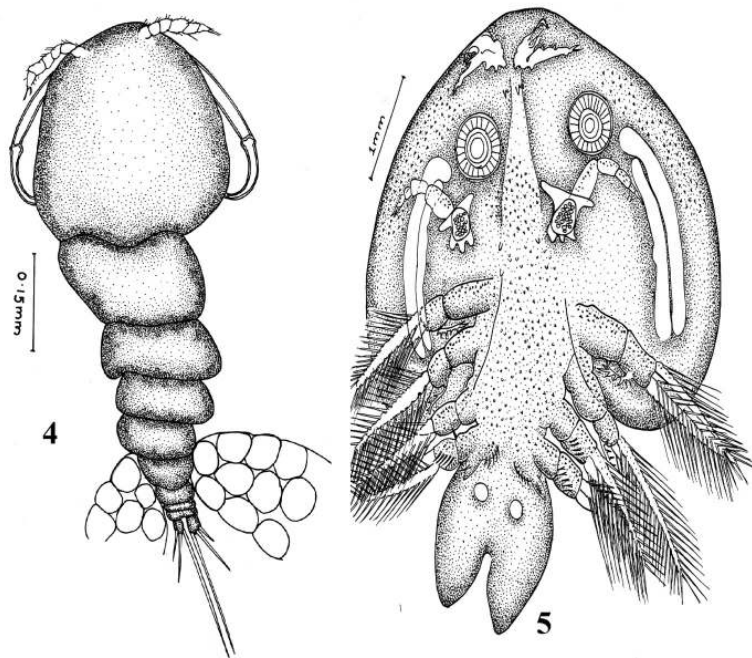


Fig. 4. *Ergasilus malnadensis* Venkateshappa, Seenappa & Manohar, 1998
Fig. 5. *Argulus siamensis* Wilson, 1926

Table 1. Ectoparasites recovered, their number, hosts, total number of fishes examined and infected, site of infection, prevalence of infection, mean intensity and nature of species

Ectoparasites	Host	Fish examined	Fish infected	No. of parasites	Site of infection	P (%)	MI	Nature of sp's
Monogenea								
1. <i>Dactylogyrus catalius</i> (Thapar, 1948) Monaco & Mozielle, 1955	<i>Catla catla</i> (Hamilton)	150	24	32	Gill filaments	16	1.3	Satellite
	<i>Labeo rohita</i> (Hamilton)	140	08	18	Gill filaments & Skin	5.7	2.3	Satellite
2. <i>Thaparocleidus tengra</i> (Tripathi, 1959) Lim, 1996	<i>Mystus vittatus</i> (Bloch)	125	15	22	Gill filaments	12	1.5	Satellite
	<i>Sperata seenghala</i> (Sykes)	140	04	15	Gill filaments	2.9	3.8	Satellite
3. <i>Bychowkyella wallagonia</i> (Jain,1959) Gussev, 1961	<i>Wallago attu</i> (Schneider)	120	10	18	Gill filaments	8.3	1.8	Satellite
Copepoda								
4. <i>Ergasilus malnadensis</i> Venkateshappa, Seenappa & Manohar, 1998	<i>Wallago attu</i> (Schneider)	120	06	12	Gill filaments & Skin	5.0	2.0	Satellite
5. <i>Argulus siamensis</i> Wilson, 1914	<i>Labeo rohita</i> (Hamilton)	140	16	20	Gill filaments	11.4	1.3	Satellite

Out of the two copepod parasites recovered from this area, the highest prevalence of infection was shown by *Argulus siamensis* (11.4%) recovered from the host fish *Labeo rohita*. The other parasite *Ergasilus malnadensis* showed comparatively less prevalence of infection (5%) than *Argulus* species. These two copepod parasites are recovered from gill filaments and skin of *Wallago attu* and *Labeo rohita*. Both *E. malnadensis* and *A. siamensis* are satellite species having prevalence less than 33%.

The highest mean intensity of monogenean parasites was recorded in *Sperata seenghala* (3.8) and the lowest in *Labeo rohita* and *Catla catla* (1.3). Mean intensity of copepod parasites registered the maximum in *Wallago attu* (2.0), followed by *Labeo rohita* (1.3).

4. DISCUSSION

In the present study, *Catla catla*, *Labeo rohita* and *Wallago attu* belonging to families Cyprinidae and Siluridae are found to be most preferred host fishes for ectoparasites, infested by 2 monogeneans and 2 copepod species. However, *Mystus vittatus* and *Sperata seenghala* belonging to family: Bagridae are infected by a monogenean, *Thaparocleidus tengra*. The present study agrees with previous reports [17,18,19] that marine fishes harbour more diverse and rich parasite fauna than freshwater fishes.

Thapar [20] first erected the genus *Paradactylogyrus* from the gill filaments of *Catla catla*. There is a lot of disagreement on the validity and synonymy of the genus. Monaco & Mozielle [21], Tripathi [22] and Gussev [23] synonymized this genus with *Dactylogyrus* Diesing, 1850. However, Yamaguti [12], Agarwal [24], Singh and Rastogi [25] and Agrawal et al. [26] disagreed with the synonymy extended by Tripathi [22] and retained the genus as valid. There are only four reports of this genus namely, *P. catalius* Thapar, 1948, *P. bati* Tripathi, 1959, *P. thapari* Agrawal, 1980 and *P. indicus* Singh and Rastogi, 2000. But Pandey et al. [27] synonymized the latter three species as synonyms of *P. catalius*. Later, Sujana and Shameem [28] agreed with Gussev [23] and synonymized this as *Dactylogyrus* Diesing, 1850. However, during the present study, after a careful analysis it was felt that synonymy of *Paradactylogyrus* with *Dactylogyrus* is prudent. So, we agree with Sujana and Shameem [28] and the present parasites come closer to *D. catalius* in the number of head organs,

direction of dorsal transverse bar extremities, shape of onchium, testes position. Hence, the present parasites are considered as *Dactylogyrus catalius* (Thapar, 1948) Monaco & Mozielle, 1955.

The genus *Bychowskyella* was first erected by Akhmerov [29] in freshwater siluriform fishes. Jain [30] described this species earlier as *Sprostonia wallagonia* and *Neosprostonia wallagonia*. However, Gussev [31] synonymized these parasites with *Bychowskyella wallagonia*. The present parasite resembles *B. wallagonia* in all morphological characters. Hence, they are considered as *Bychowskyella wallagonia* (Jain, 1959) Gussev, 1961.

The genus *Thaparocleidus* was first proposed by Jain [32] with *T. wallagonius* as its type-species from *Wallago attu*. Lim [33] included about 79 species under the genus *Thaparocleidus*. Tripathi [22] earlier described this species under a different genus *Neomurraytrema* as *N. tengra* from the freshwater fish, *Mystus gulio*. Gussev [23,34] included this species under the genus *Silurodiscooides* and named it as *S. tengra*. Later, Dubey et al. [35] named the same species as *Parancylodiscooides tengra* under the genus *Parancylodiscooides*. But Lim [33] synonymized all the three genera, *Neomurraytrema*, *Silurodiscooides* and *Parancylodiscooides* with the genus *Thaparocleidus* and reassigned the species as *T. tengra*. The present parasites come closer to *T. tengra* in all characters and are considered as *Thaparocleidus tengra* (Tripathi, 1959) Lim, 1996.

Nordmann [36] erected the genus *Ergasilus* with *E. sieboldi* as its type-species. Ergasilids are much diversified comprising of 110 species of which 21 are reported from India. There are reports on Ergasilids by many scientists [37-42]. *E. malnadensis* was reported by Venkateshappa et al. [42] from the gills of *Wallago attu*. Present parasites resemble *E. malnadensis* in most of the characters and hence are considered as *Ergasilus malnadensis* Venkateshappa, Seenappa & Manohar, 1998.

Müller [43] proposed the genus *Argulus* with *A. foliaceus* as its type-species. There are a number of reports from various parts of the world [44-47]. It is a commonly occurring parasite and is regarded as "enemy of fishes" as it is generally known to parasitize both marine and freshwater fishes [45]. Present parasites resemble *A. siamensis* in all characters and are considered as *Argulus siamensis* Wilson, 1926.

Table 2. New locality records of the ectoparasites recovered

S. no.	Parasite	Host	Locality
1.	<i>Bychowskyella wallagonia</i> (Jain,1959) Gussev, 1961	<i>Wallago attu</i> (Schneider)	Nelivada cheruvu, Vizianagaram
2.	<i>Thaparocleidus tengra</i> (Tripathi, 1959) Lim, 1996	<i>Mystus vittatus</i> (Bloch)	Andra reservoir, Vizianagaram
3.	<i>Ergasilus malnadensis</i> Venkateshappa, Seenappa & Manohar, 1998	<i>Wallago attu</i> (Schneider)	Tatipudi reservoir, Vizianagaram
4.	<i>Argulus siamensis</i> Wilson, 1914	<i>Labeo rohita</i> (Hamilton)	Dharmapuri tank, Vizianagaram

Family: Dactylogyridae was the most dominant family among the freshwater fishes of Vizianagaram, represented by three species, *Dactylogyrus catalius*, *Bychowskyella wallagonia* and *Thaparocleidus tengra*. Chiary et al. [48] worked on the abundance, diversity and successful establishment of the family Dactylogyridae of Monogenea class on their respective host. Among all monogeneans, *B. wallagonia* is most host specific, whereas *D. catalius* and *T. tengra* showed narrow host specificity and more of host family specificity as per previous reports [49,50]. These two parasites are specific to Cyprinidae and Bagridae families of host fishes. Monogeneans are among the most host-specific of parasites in general and may be the most host-specific of all fish parasites [51]. Out of five species recovered in the present study, four species are new locality records (Table 2) observed for the first time in Vizianagaram district of Andhra Pradesh. Reports of *D. catalius* already observed in Cyprinidae fishes of this locality [28]. One possible hypothesis is that anthropogenic factors affect both hosts and parasites adversely. Parasites may act as bioindicators of anthropogenic pollution and ecological state of water body [52-54]. So, awareness programmes should be conducted to farmers on the impact of chemical fertilizers in aquatic ecosystem and educate them to use biofertilizers [55].

5. CONCLUSION

The study of ectoparasites of freshwater fishes was first conducted in Vizianagaram district of Andhra Pradesh. Eventhough no new species were encountered but four new locality records were reported. In the present study, three dactylogyrid species of monogeneans, *Dactylogyrus catalius*, *Bychowskyella wallagonia* and *Thaparocleidus tengra* were attained. There were very few reports on monogeneans of Vizianagaram district of Andhra Pradesh [28]. *B. wallagonia* and *T. tengra* appeared to be new

locality records. Ergasilids and Argulids are the widespread family of parasitic copepod crustaceans infecting a variety of freshwater and marine fishes. Both *E. malnadensis* and *A. siamensis* are commonly occurring parasites in the freshwater fishes and are reported from new locality during the present survey.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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