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Occurrence and diversity of protozoan ectoparasites in the giant freshwater Prawn *Macrobrachium rosenbergii* (De Man, 1879) from Manar Dam, Nanded, Maharashtra, India

Mane Sahebrao Dhondiba*, Neetarani Ramesh Jaiswal
Department of Zoology, Yeshwant Mahavidyalaya, Nanded, Maharashtra, India
Corresponding Author: Mane Sahebrao Dhondiba
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Abstract
The present study investigated the occurrence, diversity, and anatomical distribution of protozoan ectoparasites in the giant freshwater prawn, *Macrobrachium rosenbergii* (De Man, 1879), collected from Manar Dam, Warwant, Nanded District, Maharashtra, India, between March 2025 and October 2026. A total of 123 prawn specimens (65 males and 58 females) were examined microscopically. Overall, 20 specimens (16.26%) were infected, comprising 9 males (13.85%) and 11 females (18.97%). Four genera of ciliate protozoan ectoparasites were identified: *Zoothamnium*, *Chilodonella*, *Vorticella*, and *Epistylis*. Across all infected hosts, 115 protozoan occurrences were recorded (61 in males and 54 in females). *Zoothamnium* sp. was the most prevalent genus (37 occurrences; 32.17%), followed by *Chilodonella* sp. (33; 28.70%), *Vorticella* sp. (23; 20.00%), and *Epistylis* sp. (22; 19.13%). Ectoparasites were distributed across the carapace, general exoskeleton, body surface, gills, gill filaments, and appendages, with gill-associated colonization being particularly prominent. These findings provide baseline parasitological data on *M. rosenbergii* in the Manar Dam ecosystem, supporting future health monitoring and sustainable inland fisheries management.

Keywords: *Macrobrachium rosenbergii*, protozoan ectoparasites, *Zoothamnium*, *Chilodonella*, *Vorticella*, *Epistylis*, prevalence, Manar Dam

Introduction
The giant freshwater prawn, *Macrobrachium rosenbergii* (De Man, 1879) [1] (Crustacea: Decapoda: Palaemonidae), is one of the most commercially valuable freshwater crustaceans in tropical and subtropical regions (De Man, 1879) [1]. Owing to its rapid growth, high nutritional value, and adaptability to varied freshwater habitats, *M. rosenbergii* plays a vital role in inland capture fisheries and aquaculture production.

The health and productivity of freshwater prawns are closely regulated by abiotic water parameters and biotic interactions, particularly parasitic infections. Protozoan ectoparasites—especially peritrich and cyrtophorid ciliates such as *Zoothamnium*, *Epistylis*, *Vorticella*, and *Chilodonella*—frequently colonize the external surfaces, appendages, and gill filaments of aquatic crustaceans (Lom & Dyková, 1992; Noga, 2010) [2, 3]. Because prawn gills are essential for respiration and osmoregulation, heavy ectoparasitic colonization can impair gas exchange and compromise host vigour under environmental stress (Woo & Buchmann, 2012) [4].

Manar Dam, located at Warwant in the Nanded region of Maharashtra, India, is a major freshwater reservoir supporting local fisheries and crustacean biodiversity. Despite its ecological and economic importance, baseline data on the protozoan ectoparasite fauna of *M. rosenbergii* in this reservoir remain scarce. Therefore, the present study was undertaken to (i) determine the prevalence of protozoan ectoparasites in male and female *M. rosenbergii* from Manar Dam, (ii) identify the major protozoan genera present, and (iii) document their anatomical distribution across the carapace, exoskeleton, body surface, appendages, and gills.

Materials and Methods
1. Study Area and Sample Collection
The study was conducted at Manar Dam (18.842333° N, 77.323728° E), located at Warwant, Nanded District, Maharashtra, India, from March 2025 to October 2026. A total of 123 specimens of *Macrobrachium rosenbergii* (65 males and 58 females) were collected with the assistance of local fishermen and transported live to the Department of Zoology, Yeshwant Mahavidyalaya, Nanded. Sexes were differentiated based on external morphological characteristics, including the presence of the appendix masculina on the second pleopod in males.



2. Microscopic Examination and Identification
Each prawn was examined systematically for protozoan ectoparasites across the carapace, general exoskeleton, body surface, appendages, and excised gill filaments. Wet mounts were prepared from gill tissues and surface scrapings and observed under a compound light microscope. Protozoan ectoparasites were identified to the genus level based on

diagnostic morphological features—such as colonial or solitary habit, stalk contractility, ciliation pattern, and macronuclear shape—following standard taxonomic keys (Lom & Dyková, 1992; Noga, 2010) [2, 3].

3. Data Recording and Analysis

Parasite occurrences were recorded separately for male and female hosts according to protozoan genus and anatomical attachment site. Prevalence (%) was calculated as the percentage of infected prawns relative to the total number of prawns examined. Relative representation (%) of each genus was calculated as the percentage of occurrences of that genus relative to the total protozoan occurrences recorded.

Results

1. Overall and Sex-Wise Prevalence

Out of 123 examined specimens of *M. rosenbergii*, 20 prawns were infected with protozoan ectoparasites, yielding an overall prevalence of 16.26% (**Table 1**). Female prawns exhibited a higher infection prevalence (18.97%; 11/58) compared to male prawns (13.85%; 9/65).

Table 1: Sex-wise occurrence and prevalence of protozoan ectoparasitic infection in *Macrobrachium rosenbergii* from Manar Dam.

Parameters	Male	Female	Total
Examined prawns (n)	65	58	123
Infected prawns (n)	9	11	20
Uninfected prawns (n)	56	47	103
Prevalence (%)	13.85	18.97	16.41

2. Diversity and Relative Representation of Protozoan Genera

Four genera of protozoan ectoparasites were recorded: *Zoothamnium* sp., *Chilodonella* sp., *Vorticella* sp., and *Epistylis* sp. A total of 115 protozoan occurrences were documented, with 61 recorded in male prawns and 54 in female prawns (**Table 2**). *Zoothamnium* sp. was the dominant genus (37 occurrences; 32.17%), followed by *Chilodonella* sp. (33; 28.70%), *Vorticella* sp. (23; 20.00%), and *Epistylis* sp. (22; 19.13%).

Table 2: Genus-wise distribution and relative representation of protozoan ectoparasites in male and female *M. rosenbergii*.

Protozoan Genus	Male	Female	Total	Relative Representation (%)
Zoothamnium sp.	18	19	37	32.17
Chilodonella sp.	16	17	33	28.70
Vorticella sp.	14	9	23	20.00
Epistylis sp.	13	9	22	19.13
Total	61	54	115	100.00

3. Anatomical Distribution of Protozoan Genera

The anatomical distribution varied among the four recorded genera (Tables 3–6). *Zoothamnium* sp. was recorded predominantly on the carapace (21 occurrences) compared to the gills (16 occurrences) (Table 3). *Epistylis* sp. was most abundant on the general exoskeleton (11), followed by appendages (7) and gills/gill filaments (4) (Table 4). *Chilodonella* sp. showed nearly equal distribution between the appendages (17) and gills (16), with slightly higher counts on male appendages and female gills (Table 5). *Vorticella* sp. was recorded primarily on the gills (15) compared to the general body surface (8) (Table 6).

Table 3: Anatomical distribution of *Zoothamnium* sp. in *M. rosenbergii*.

Anatomical Region	Male	Female	Total
Carapace	10	11	21
Gills	8	8	16
Total	18	19	37

Table 4: Anatomical distribution of *Epistylis* sp. in *M. rosenbergii*.

Anatomical Region	Male	Female	Total
Exoskeleton	7	4	11
Appendages	3	4	7
Gills / gill filaments	3	1	4
Total	13	9	22

Table 5: Anatomical distribution of *Chilodonella* sp. in *M. rosenbergii*.

Anatomical Region	Male	Female	Total
Appendages	9	8	17
Gills	7	9	16
Total	**16**	**17**	**33**

Table 6: Anatomical distribution of *Vorticella* sp. in *M. rosenbergii*.

Anatomical Region	Male	Female	Total
Body surface	5	3	8
Gills	9	6	15
Total	14	9	23

Discussion

The present investigation provides the first baseline documentation of protozoan ectoparasites associated with *Macrobrachium rosenbergii* in Manar Dam, Maharashtra. The overall infection prevalence of 16.26% indicates a moderate level of ectoparasitic colonization in the wild reservoir population. Female prawns showed a higher prevalence (18.97%) than males (13.85%), which may reflect sex-related differences in moulting frequency, reproductive physiology, or microhabitat use, though further statistical and seasonal analyses are needed to confirm these drivers.

Among the four recorded genera, the colonial peritrich ciliate *Zoothamnium* sp. was the most abundant (32.17%), followed by *Chilodonella* sp. (28.70%), *Vorticella* sp. (20.00%), and *Epistylis* sp. (19.13%). Peritrich ciliates (*Zoothamnium*, *Epistylis*, and *Vorticella*) are common epibionts on freshwater crustaceans, utilizing the host's chitinous exoskeleton and gills as stable substrates for filter-feeding (Lom & Dyková, 1992) [2]. In contrast, *Chilodonella* is a mobile cyrtophorid ciliate capable of grazing on epithelial surfaces, making its presence on the gills and appendages particularly relevant to host health (Noga, 2010) [3].

A notable finding of this study is the high frequency of gill-associated occurrences across all four genera, particularly *Vorticella* sp. (65.2% on gills) and *Chilodonella* sp. (48.5% on gills). Because prawn gills are delicate, vascularized structures responsible for respiration and osmoregulation, dense epibiotic or parasitic colonization can obstruct water flow across gill lamellae and impair respiratory efficiency (Woo & Buchmann, 2012) [4]. Interestingly, while infection

prevalence was higher in females, total parasite occurrences were slightly higher in males (61 vs. 54), underscoring the distinction between host infection rate and parasite burden.

Certain limitations of this study should be noted. Identifications were performed at the genus level based on light microscopy; molecular characterization (e.g., 18S rRNA sequencing) is recommended for species-level confirmation. Additionally, physicochemical water parameters (temperature, dissolved oxygen, pH, and organic load) and histopathological effects on gill tissues were not assessed. Integrating these parameters with seasonal monitoring in future studies will clarify the ecological drivers and pathological impacts of ectoparasitism in Manar Dam.

Conclusion

This study establishes baseline data on the occurrence, diversity, and anatomical distribution of protozoan ectoparasites in *Macrobrachium rosenbergii* from Manar Dam, Maharashtra. Four genera—*Zoothamnium*, *Chilodonella*, *Vorticella*, and *Epistylis*—were identified, with an overall prevalence of 16.26%. Gills and external cuticular surfaces served as the primary attachment sites. Future research incorporating molecular identification, seasonal dynamics, water quality analysis, and histopathology is recommended to support sustainable fishery management in the region.

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