

A checklist on aquatic beetles (Order: Coleoptera) of West Bengal

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Abstract

The most diverse group of animals in aquatic environment is freshwater insects. They contribute to processes including nutrient cycling, primary production, decomposition, and the transport of materials within the ecosystem, all of which play significant roles in ecosystem dynamics. This study offers a thorough analysis of the variety of water beetles in West Bengal, India. Present communication reports 138 distinctive species spread over 8 families belonging to order Coleoptera from the state of West Bengal.

Key words: Aquatic beetles, Coleoptera, Checklist, West Bengal

1. Introduction

Terrestrial beetles have been extensively studied in zoogeography, while aquatic beetles have not received the same level of attention. Beetles are incredibly diverse, comprising approximately 386,500 species across 29,500 genera and 176 families within four suborders (Archostemata, Myxophaga, Adephaga, and Polyphaga), making them the most species-rich animal group on Earth and accounting for 40% of the world's total animal diversity (Slipinski et al., 2011). Remarkably, it's estimated that a significant portion, roughly 70-95%, of beetle species remains undiscovered (Grove and Stork, 2000).

Aquatic beetles are a diverse group of beetles that live in and adapt to various aquatic habitats, including rivers, springs, lakes, ditches, puddles, seepages, rainwater, and groundwater. These freshwater beetles belong to the order Coleoptera, a name originating from Greek words describing their distinctive forewings (elytra) that shield their membranous hind wings.

True aquatic beetles are those whose adult forms spend most of their time submerged in water, although their larvae and pupae can be aquatic or terrestrial (Jäch, 1998). They are categorized into six groups based on their relationship with aquatic environments: true, false, phytophilous, parasitic, facultative, and shore beetles (Jäch, 1998). These beetles exhibit remarkable adaptations to aquatic life, including specialized leg structures with swimming hairs, divided eyes, plastron structures for air retention, large claws, and a streamlined body shape.

India boasts an exceptionally diverse beetle fauna, comprising approximately 17,431 species, which represents about 4.66% of the world's known beetle species. (Ramakrishna and Alfred, 2007) These beetles are classified into 113 families across three suborders: Adephaga, Myxophaga, and Polyphaga (Ramakrishna and Alfred, 2007). Notably, seventeen of these families are considered truly aquatic, including Hydrophilidae, Scirtidae, Gyrinidae, Hydraenidae, Elmidae, Psephenidae, Noteridae, Haliplidae, Dryopidae, Georissidae, Helophoridae, Hydroscaphidae, Hydrochidae, Epimetopidae, Spercheidae, and Sphaeriusidae.

Based on the review done by Chandra et al. (2017) India's aquatic beetle fauna comprises a rich diversity of 776 species, distributed among 137 genera and 17 families within three suborders. These suborders include Polyphaga with 371 species, Adephaga with 353 species, and Myxophaga with 7 species.

Among these families, Dytiscidae stands out with the highest number of species at 256, followed by Hydrophilidae (212 species), Scirtidae (75 species), Gyrinidae (73 species), Hydraenidae (45 species), Elmidae, and Psephenidae (24 species each), while Noteridae features 16 species, and Haliplidae and Dryopidae each have 10 species. Georissidae and Helophoridae both have 7 species, Hydroscaphidae and Hydrochidae each have 5 species, Epimetopidae includes 4 species, Spercheidae has 3 species, and Sphaeriusidae has 2 species. Additionally, seven genera were identified as monotypic, consisting of Rhantaticus (Dytiscidae), Laorina, Macronychoides, Paramacronychus (Elmidae), Monstrosostea (Dryopidae), Ophthalmocyclus, Morastus, and Pseudocercyon (Hydrophilidae) (Chandra et al., 2017)

The primary aim of this review is to analyze the research trends related to aquatic beetles and their species diversity within West Bengal. West Bengal's unique geographical features range from the Himalayan mountains in the north to the Sundarban mangroves in the south, offering a wide spectrum of landscapes and a complex network of 29 river basins. The region

experiences a tropical monsoon climate with varying rainfall patterns, making it distinct from other state ecologically (Ganguly and Satpati, 2019).

2. Earlier Works

In West Bengal, there are a total of 29 publications based on aquatic beetle till date. Out of which, 28 are firmly on Taxonomy and the rest on Ecology. The taxonomic contributors like De and Sengupta (1993), Nandi et al. (1993), Nandi et al. (1999; 2001; 2005; 2007), Biswas et al. (1995a;b), Biswas and Mukhopadhyay (1995c), Pahari et al. (1997; 1999), Khan and Ghosh (2001), Nandi et al. (2001), Nandi et al. (2004), Kundu et al. (2008), Jana et al. (2009), Ghosh et al. (2011), Sanyal et al. (2012), Das et al. (2014), Das et al. (2014), Roy et al. (2014), Ghosh and Mitra (2014), Ghosh et al. (2015a,b), Das et al. (2016), Ghosh and Das (2016), Maity et al. (2016), Mitra (2017) enriched the aquatic beetle faunal diversity in West Bengal. The single Ecological publication had been made by Aditya and Saha (2006).

Biswas et al. (1995a), conducted extensive research on aquatic beetles of the Dytiscidae family in West Bengal, documenting their taxonomic characteristics and identifying 6 species. These species were later taxonomically revised and reclassified under the Noteridae family as *Neohydrocoptussubvittulus* Motschulsky, 1859, *Canthydrus flavus* Motschulsky, 1855, *Canthydruslaetabilis* Walker, 1858, *Canthydrusluctosus* Aube, 1838, *Canthydrusmorsbachi* Regimbart, 1880 (which was subsequently renamed *Canthydrus angularis* Sharp, 1882), and *Canthydrusritsemai* Regimbart, 1880. Additionally, Biswas et al. (1995b) explored the Gyrinidae and Haliplidae families, discovering 4 Haliplidae species and a total of 20 Gyrinidae species across West Bengal. Furthermore, Biswas and Mukhopadhyay (1995) collaborated on research concerning the Hydrophilidae family, cataloging 39 species from West Bengal. Sanyal et al. (2012) later reorganized and recorded some previously known aquatic beetle species in West Bengal.

This comprehensive review not only focuses on understanding the species diversity of aquatic beetles but also places special emphasis on examining their presence in protected areas, wetlands, and Ramsar sites within the state. Furthermore, it identifies the gap areas where research on aquatic beetles in West Bengal requires further exploration. Consequently, this review serves not only as a valuable bibliographical resource but also establishes an introductory dataset for future research endeavors.

3. Result

This study reports 138 species of aquatic beetles belonging to 8 families under the order Coleoptera from West Bengal (**Table 1**). The major contributors are (Aditya et al., 2006), (Aditya and Saha, 2006), (Barman and Gupta, 2015), (Biswas et al., 1995a), (Campos et al., 2004), (Das et al., 2014), (Das et al., 2014), (Fischer et al., 2000), (Ghosh et al., 2015).

Table 1: List of aquatic beetle species from West Bengal.

Sl No.	Species
Family Dytiscidae	
1.	<i>Agabus amoenussinuaticollis</i> Regimbart, 1899
2.	<i>Agabus guttatusguttatus</i> (Paykull, 1798)
3.	<i>Clypeodytes bufo</i> (Sharp, 1890)
4.	<i>Copelatus indicus</i> Sharp, 1882
5.	<i>Cybisterconfusus</i> Sharp, 1882
6.	<i>Cybisterconvexus</i> Sharp, 1882
7.	<i>Cybisterdehaani</i> Aube, 1838
8.	<i>Cybisterguerini</i> Aube, 1838
9.	<i>Cybisterjavanus</i> Aube, 1838
10.	<i>Cybisterlimbatus</i> (Fabricius, 1775)
11.	<i>Cybisterposticus</i> Aube, 1838
12.	<i>Cybisterrugulosus</i> (Redtenbacher, 1844)
13.	<i>Cybistersugillatus</i> Erichson, 1834
14.	<i>Cybistertripunctatus lateralis</i> (Fabricius, 1798)
15.	<i>Cybisterventralis</i> Sharp, 1882
16.	<i>Eretes griseus</i> (Fabricius, 1781)
17.	<i>Hydaticus bengalensis</i> Regimbart, 1899
18.	<i>Hydaticusfabriciifabricii</i> (W.S. Macleay, 1825)
19.	<i>Hydaticusluczonicus</i> Aube, 1838
20.	<i>Hydaticusponticus</i> Sharp, 1882
21.	<i>Hydaticusricinus</i> Wewalka, 1979
22.	<i>Hydaticussatoisatoi</i> Wewalka, 1975
23.	<i>Hydroglyphusflammulatus</i> (Sharp, 1882)
24.	<i>Hydroglyphusinconstans</i> (Regimbart, 1892)
25.	<i>Hydroglyphusgeminus</i> (Fabricius, 1792)
26.	<i>Hydroglyphusorientalis</i> (Clark, 1863)
27.	<i>Hydroglyphuspendjabensis</i> (Guignot, 1954)
28.	<i>Hydroglyphusregimbarti</i> (Gschwendtner, 1936)
29.	<i>Hydroglyphussignatellus</i> (Klug, 1834)
30.	<i>Hydrovatusacuminatus</i> Motschulsky, 1859
31.	<i>Hydrovatusbonvouloiri</i> Sharp, 1882
32.	<i>Hydrovatuscastaneus</i> Motschulsky, 1855
33.	<i>Hydrovatusconfertus</i> Sharp, 1882

34.	<i>Hydrovatuspicipennis</i> Motschulsky, 1859
35.	<i>Hydrovatusrufescens</i> Motschulsky, 1859
36.	<i>Hydrovatusseminarius</i> Motschulsky, 1859
37.	<i>Hydrovatus sinister</i> Sharp, 1890
38.	<i>Hydrovatussubrotundatus</i> Motschulsky, 1859
39.	<i>Hyphoporus aper</i> Sharp, 1882
40.	<i>Hyphoporus bengalensis</i> Severin, 1890
41.	<i>Hyphydrusrenardi</i> Severin, 1890
42.	<i>Laccophilusanticatusanticatus</i> Sharp, 1890
43.	<i>Laccophilus chinensis</i> Boheman, 1858
44.	<i>Laccophilus elegans</i> Sharp, 1882
45.	<i>Laccophilusellipticus</i> Regimbart, 1899
46.	<i>Laccophilusflexuosus</i> Aube, 1838
47.	<i>Laccophilusinefficiens</i> (Walker, 1859)
48.	<i>Laccophiluskempikempi</i> Gschwendtner, 1936
49.	<i>Laccophilusparvulusparvulus</i> Aube, 1838
50.	<i>Laccophilussharpi</i> Regimbart, 1889
51.	<i>Laccophilusuniformis</i> Motschulsky, 1859
52.	<i>Lacconectusfulvescens</i> Motschulsky, 1855
53.	<i>Lacconectusritsemae</i> Régimbart, 1883
54.	<i>Leiodytes indicus</i> (Régimbart, 1892)
55.	<i>Leiodytesorissaensis</i> (Vazirani, 1969)
56.	<i>Methles indicus</i> Régimbart, 1899
57.	<i>Peschetiusquadricostatus</i> (Aube, 1838)
58.	<i>Platambuskempi</i> (Vazirani, 1970)
59.	<i>Platynecteskashmiranus</i> <i>kashmiranus</i> J. Balfour-Browne, 1944
60.	<i>Rhantus ovalis</i> Gschwendtner, 1936
61.	<i>Rhantussikkimensis</i> Régimbart, 1899
62.	<i>Rhantustaprobanicus</i> Sharp, 1890
63.	<i>Rhantaticus congestus</i> (Klug, 1832)
64.	<i>Sandracottusmixtus</i> (Blanchard, 1843)
65.	<i>Uvarusquadrilineatus</i> (Zimmermann, 1923)
Family Gyrinidae	
66.	<i>Dineutus indicus</i> Aube, 1838
67.	<i>Dineutus spinosus</i> (Fabricius, 1781)
68.	<i>Dineutus unidentatus</i> (Aube, 1838)
69.	<i>Orectochilusandamanicus</i> Regimbart, 1884
70.	<i>Orectochiluscardoni</i> Regimbart, 1892
71.	<i>Orectochiluscribratellusmetallescens</i> Regimbart, 1907
72.	<i>Orectochilus cuneatus</i> Regimbart, 1892
73.	<i>Orectochiluscylindricus</i> Regimbart, 1892
74.	<i>Orectochilusdesgodinsidesgodinsi</i> Regimbart, 1886
75.	<i>Orectochilusdiscifer</i> (Walker, 1859)
76.	<i>Orectochilusfiguratus</i> Regimbart, 1892
77.	<i>Orectochilusfletcheri</i> Ochs, 1925
78.	<i>Orectochilus gangeticus</i> Wiedmann, 1821
79.	<i>Orectochilushaemorrhous</i> Regimbart, 1891
80.	<i>Orectochilushorni</i> Ochs, 1933

81.	<i>Orectochilusmetallicus</i> Regimbart, 1884
82.	<i>Orectochilus murinus</i> Regimbart, 1891
83.	<i>Orectochilusoblongiusculus</i> Regimbart, 1886
84.	<i>Orectochilusproductus</i> Regimbart,1884
85.	<i>Orectochilusribeiroi</i> Vazirani,1958
86.	<i>Orectochilussimilis</i> Ochs,1929
Family Haliplidae	
87.	<i>Haliplusarrowi</i> Guignot, 1936
88.	<i>Haliplusaugustifrons</i> Regimbart, 1892
89.	<i>Halipluspruthi</i> Vazirani,1966
90.	<i>Halipluspulchellus indicus</i> Regimbart, 1899
Family Hydraenidae	
91.	<i>Hydraenatenjikuana</i> Sato, 1979
92.	<i>Hydraenawittmeri</i> Sato, 1979
Family Hydrochidae	
93.	<i>Hydrochusbinodosus</i> Motschulsky,1860
Family Hydrophilidae	
94.	<i>Amphiops mirabilis</i> Sharp, 1890
95.	<i>Amphiopspedestris</i> Sharp,1890
96.	<i>Amphiops simplex</i> Sharp, 1890
97.	<i>Berosusfairmairei</i> Zaitsev, 1908
98.	<i>Berosus indicus</i> Motschulsky,1861
99.	<i>Berosuspulchellus</i> Macleay,1825
100.	<i>Cercyondilutum</i> Regimbart, 1903
101.	<i>Cercyonpseudodilutum</i> Sato,1979
102.	<i>Cercyonvicinalis</i> Walker,1859
103.	<i>Coelostomasubditum</i> d'Orchymont, 1936
104.	<i>Crenetisorientalis</i> Sato,
105.	<i>Dactylosternumhydrophiloides</i> (MacLeay, 1825)
106.	<i>Enochrusesuriens</i> (Walker,1858)
107.	<i>Enochrusrubrocinctus</i> Regimbart, 1903
108.	<i>Globarialeachi</i> Hope, 1838
109.	<i>Helocharesanchoralis</i> Sharp,1890
110.	<i>Helocharescrenatus</i> (Regimbart, 1903)
111.	<i>Helochareslentus</i> Sharp,1890
112.	<i>Helocharespallens</i> (MacLeay,1825)
113.	<i>Hydrophilusbilineatuscashmirensis</i> Kollar & L. Redtenbacher, 1844
114.	<i>Hydrophilus indicus</i> (Bedel, 1891)
115.	<i>Hydrophilusolivaceus</i> Fabricius, 1781
116.	<i>Hydrophilusrufocinctus</i> (Bedel, 1891)
117.	<i>Hydrophilus senegalensis</i> (Percheron, 1835)
118.	<i>Laccobiusrotundus</i> Regimbart, 1903
119.	<i>Laccobiussimulans</i> d'Orchymont, 1923
120.	<i>Pachysternumcardonid</i> 'Orchymont, 1926
121.	<i>Pachysternumnigrovittatum</i> Motschulsky, 1863
122.	<i>Pachysternumstevensid</i> 'Orchymont,1926
123.	<i>Paracymsevanescens</i> Sharp,1890

124.	<i>Regimbertia attenuata</i> (Fabricius,1801)
125.	<i>Sphaeridium cameronid</i> d'Orchymont,1936
126.	<i>Sphaeridium dimidiatum</i> Gory, 1834
127.	<i>Sphaeridium quinque maculatum</i> Fabricius, 1798
128.	<i>Sphaeridium seriatum</i> d'Orchymont, 1913
129.	<i>Sphaeridium severinid</i> 'Orchymont, 1919
130.	<i>Sternolophus rufipes</i> (Fabricius,1792)
Family Noteridae	
131.	<i>Canthyrus angularis</i> Sharp,1882
132.	<i>Canthyrus flavus</i> Motschulsky,1855
133.	<i>Canthyrus laetabilis</i> (Walker,1858)
134.	<i>Canthyrus luctuosus</i> (Aube,1838)
135.	<i>Canthyrus ritsemai</i> (Regimbart, 1880)
136.	<i>Neohydrocoptus bivittulus</i> (Motschulsky,1859)
137.	<i>Neohydrocoptus bivittis</i> Motschulsky, 1859
Family Spercheidae	
138.	<i>Spercheus gibbus</i> Champion,1919

The Dytiscidae family emerged as the most diverse, containing 65 distinct species, followed by the Hydrophilidae family with 37 species. The Gyrinidae family was also notable, contributing 21 species to the overall diversity. Other families represented in the study include Noteridae (7 species), Haliplidae (4 species), Hydraenidae (2 species), Hydrochidae (1 species), and Sperchidae (1 species).

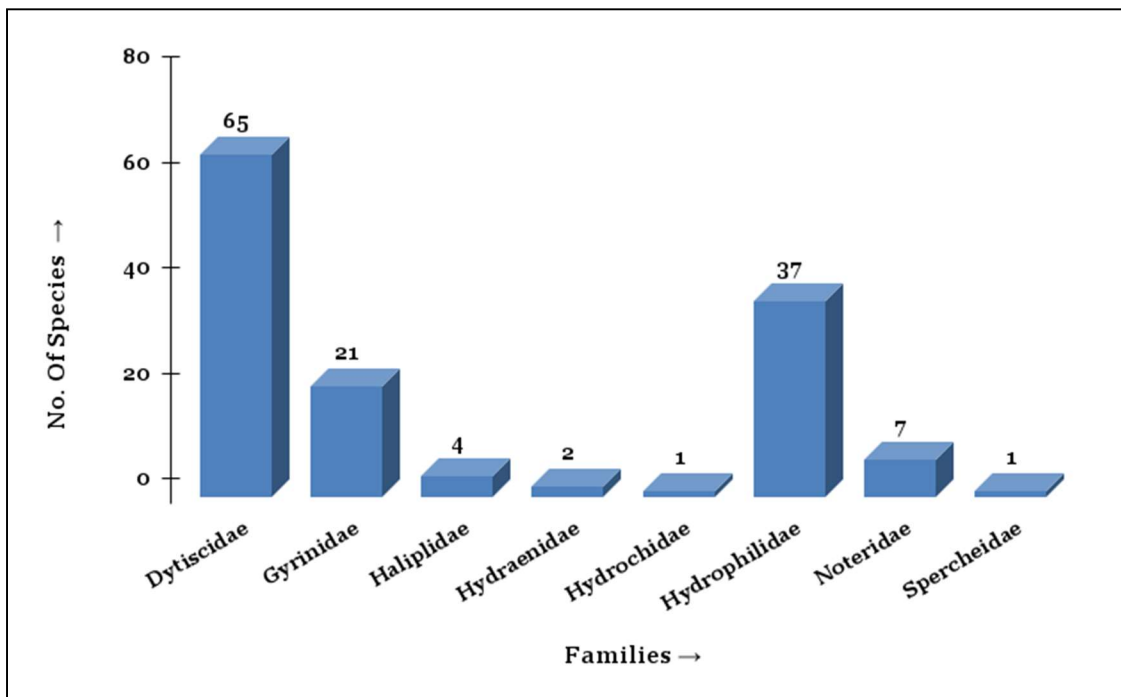


Fig. 1. Distribution of aquatic beetle species in West Bengal (Family-wise)

These findings underscore the rich and varied aquatic beetle fauna present in West Bengal and provide a foundation for further investigations into their ecological roles, conservation status, and distribution within the region. Fig. 1 illustrates the distribution of these species across the identified families, visually representing the dominance of Dytiscidae and Hydrophilidae in West Bengal's aquatic ecosystems. The discovery of such diverse aquatic beetle populations in the state highlights the importance of continued research and conservation efforts in West Bengal, particularly in protected areas, wetlands, and Ramsar sites, where these species play vital ecological roles and contribute to the overall biodiversity of the region.

4. Discussion

The results of this study shed light on the remarkable diversity of aquatic beetles in West Bengal, India, providing valuable insights into the composition and distribution of these species within the region. The dominance of the Dytiscidae and Hydrophilidae families, with 65 and 37 species, respectively, underscores their significance in West Bengal's aquatic ecosystems. Furthermore, the noteworthy presence of the Gyrinidae family, contributing 21 species, adds to the richness of the aquatic beetle fauna in the state. The diversity of aquatic beetles is indicative of the ecological complexity of the aquatic environments in West Bengal, encompassing a wide range of habitats such as ponds, rivers, lakes, and wetlands. Each of these beetle families has likely adapted to specific ecological niches and plays unique roles in these aquatic ecosystems. Understanding these roles is crucial for comprehending the functioning and dynamics of these habitats.

These findings provide a genuine foundation for future research endeavours, both in terms of taxonomy and ecology. Taxonomically, further investigations may lead to the discovery of additional species, including potentially endemic or rare taxa, contributing to a more comprehensive understanding of West Bengal's aquatic beetle diversity. Additionally, molecular techniques can be employed to refine species identification and unravel cryptic diversity within these families.

From an ecological perspective, the presence of such diverse aquatic beetles in West Bengal emphasizes the importance of these insects as key components of freshwater ecosystems. These beetles are involved in various ecological processes, including nutrient cycling, predation, and decomposition, which can have cascading effects on the health and stability of aquatic ecosystems (Ribera, 2000). Thus, future research should delve into the ecological

roles of these beetles, investigating their interactions with other aquatic organisms and their responses to environmental changes.

Conservation implications also arise from these findings. The documentation of aquatic beetle diversity in West Bengal can inform conservation efforts, particularly in protected areas, wetlands, and Ramsar sites. These areas serve as critical habitats for many aquatic species, and understanding the presence and distribution of aquatic beetles can contribute to more effective management and conservation strategies to protect not only these insects but also the broader aquatic biodiversity of the region.

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