RESEARCH PAPER

Eco-morphological diversity and distributional patterns of freshwater crabs (Barytelphusa) in the semi-arid Godavari River basin

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ABSTRACT

The present study was conducted to assess the diversity, distribution, and morphometric characteristics of freshwater crabs inhabiting the tributaries of the Godavari River system across Nanded, Hingoli, and Parbhani districts in Maharashtra. Extensive field surveys were carried out between June 2023 and June 2025 in various freshwater habitats, including rivers, tributaries, streams, lakes, farming areas and ponds. Some areas yet to be remain study and surveys. Specimens were collected manually and identified based on their external morphological features.

A total of two crab species belonging to the genus *Barytelphusa* were recorded such as *Barytelphusa guerini* and *Barytelphusa cunicularis*. Among them, *B. guerini* was the most widely distributed, occurring in several tributaries such as the Aasna, Manyad, and Kayadhu rivers, whereas *B. cunicularis* was restricted to deeper and stable water bodies. Distinct variations in body coloration, size, and chela structure were noted between species. Morphometric analysis showed clear sexual dimorphism, with males exhibiting larger carapace dimensions, heavier body weight, and more robust chelae, while females possessed broader abdomens adapted for egg carrying.

The findings highlight the Ecological richness of the Godavari-river basin and the adaptive diversity of its freshwater crab Fauna. Despite moderate anthropogenic pressure, these tributaries continue to support stable crab populations. The data generated in this study serve as a baseline for future ecological monitoring, biodiversity assessment, and conservation planning of freshwater ecosystems in the Marathwada region.

Keywords: Freshwater Crabs, River, Tributaries, *Barytelphusa,* Nanded and Hingoli Districts.

How to cite this article: Pawde UD, Barde RD. Eco-morphological diversity and distributional patterns of freshwater crabs (Barytelphusa) in the semi-arid Godavari River basin. Int J Drug Deliv Technol. 2026;16(12s): 153-161. DOI: 10.25258/ijddt.16.12s.16

INTRODUCTION

Freshwater ecosystems are among the most productive and ecologically significant habitats on Earth, providing essential services such as nutrient cycling, water purification, and habitat for a wide range of aquatic organisms (Dudgeon et al., 2006). Within these systems, freshwater crabs represent an important group of benthic macroinvertebrates that play a vital role in maintaining ecosystem balance. They contribute to detritus decomposition, sediment aeration, and serve as both predators and prey in aquatic food webs (Cumberlidge et al., 2009). Despite their ecological importance, freshwater crabs have often been overlooked in biodiversity assessments, particularly in the Indian subcontinent (Daniels, 2001).

Crabs are found in the aquatic ecosystem, both marine and fresh water. Fresh water crabs are the neglected component of the world's inland aquatic ecosystem. Of more than 6,700 known species of brachyuran crabs, over 1,300 are true fresh water crabs (Bandral et al,.2014).

India harbors a remarkable diversity of freshwater crabs, with several endemic genera found in specific regions. According to the latest taxonomic revisions, over 125 species of freshwater crabs have been recorded from India, distributed across various ecological zones, including the Western Ghats, central plateau, and peninsular rivers (Pati & Sharma, 2014). Maharashtra, due to its diverse hydrographic network and varying climatic conditions, supports a rich assemblage of freshwater fauna, yet the crab diversity in many of its interior districts remains poorly documented (Trivedi et al., 2018). Alteration in values of environmental

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parameters due to water pollution affects habitats of crab *Barytelphusa guerini* in the Godavaririver and its tributaries. (Ravi D. Barde et al.,2020)

The Marathwada region of Maharashtra comprising districts like Nanded and Parbhani lies within the Godavari River area and some tributaries, characterized by semi-arid conditions and a network of small tributaries and seasonal streams. Hingoli district consist of rivers like Penganga, Purna and Kayadhu. These freshwater bodies serve as crucial habitats for aquatic invertebrates, including crabs that are adapted to fluctuating hydrological conditions (Kumar et al., 2019). However, anthropogenic pressures such as agricultural runoff, sand mining, and habitat modification have increasing threatened to the freshwater ecosystems (Raghavan et al., 2014). Despite these environmental changes, very limited research has been carried out to document the diversity and distributional patterns of freshwater crabs in this part of Maharashtra.

Understanding the species diversity, distribution, and ecological preferences of freshwater crabs is essential for biodiversity conservation and water resource management. Such studies also provide baseline data that can inform ecological monitoring and regional conservation strategies (Guinot et al., 2008). Therefore, the present study aims to investigate the diversity and distribution of freshwater crabs in selected tributaries of Nanded, Hingoli, and Parbhani districts. By documenting species composition and habitat characteristics, this study seeks to fill existing knowledge gaps and contribute to the broader understanding of freshwater biodiversity in central India.

Recent studies emphasize that the biogeographical distribution of freshwater crabs is strongly influenced by hydrological patterns, soil composition, vegetation, and climatic conditions of the region (Yeo et al., 2008). In semi-arid landscapes such as Marathwada, where water availability fluctuates seasonally, crab populations exhibit remarkable ecological adaptations, including burrow construction and tolerance to desiccation (Pati & Thackeray, 2018). These behavioral and physiological traits allow them to survive temporary droughts and resume activity during monsoon-driven flows. However, such adaptive resilience has limits, as increasing human interference through pollution, deforestation, and damming of streams can fragment habitats and alter the natural distribution of species (Magalhães & Türkay, 2010). Therefore, understanding species-specific habitat preferences and spatial distribution patterns across tributaries is critical for assessing the ecological health of these freshwater systems. This regional survey not only documents local biodiversity but also contributes to broader conservation frameworks that aim to protect endemic freshwater taxa from habitat degradation and extinction.

Materials and Methods:

1. Study Area

The present study was conducted in selected tributaries of the Godavari River basin located in the districts of Nanded, Hingoli, and Parbhani in the Marathwada region of Maharashtra, India. Geographically, the region lies between 18°30′–20°00′ N latitude and 76°00′–78°15′ E longitude. The Godavari River, one of India's major peninsular rivers, originates from Trimbakeshwar in Nashik District and flows eastward across the Deccan Plateau, forming an extensive network of tributaries that sustain the aquatic biodiversity of this semi-arid region (Kale et al., 2016). The climate is tropical semi-arid, characterized by hot summers, moderate monsoons (June to September), and mild winters, with an average annual rainfall ranging between 750 and 900 mm (Deshmukh & Pathak, 2018). Sometimes the rainfall extends up to October due changing climatic conditions in Marathwada region like in 2025.

The study area includes major tributaries such as Asna, Manyad, Purna, and Kayadhu Rivers, along with minor streams and perennial ponds that provide suitable habitats for freshwater crabs. Water shade development programs completed by government of Maharashtra in specific areas helping in new habitats for freshwater Fauna. These freshwater systems are primarily surrounded by agricultural landscapes and rocky substrata, influencing both the water quality and habitat structure (Kumar et al., 2019). The selected sites were chosen to represent a range of ecological conditions, including slow-flowing streams, seasonal nallas, and human-impacted waterbodies.

2. Survey and Sampling Design

Systematic field surveys were conducted between June 2023 and February 2024, covering both monsoon and post-monsoon seasons to capture seasonal variation in crab diversity. Sampling was performed at 15 representative sites across the three districts — 5 each in Nanded, Hingoli, and Parbhani. Each site was georeferenced using a GPS camera , and environmental parameters such as temperature, pH, dissolved oxygen (DO), and conductivity were recorded using standard water testing kits (APHA, 2017).

Crabs were collected manually during daytime and early evening hours by turning stones, digging burrows, and scooping the riverbed substrate with hand nets (Pati & Sharma, 2014). The specimens were temporarily stored in plastic containers filled with site water to prevent desiccation and later preserved in 70% ethanol for

laboratory identification. In addition to live captures, local fishermen and residents were consulted to obtain information on species occurrence and behavior patterns (Cumberlidge et al., 2009).

3. Identification and Documentation

Collected specimens were identified to species level based on morphological characteristics such as carapace structure, cheliped morphology, and gonopod configuration, following standard taxonomic keys (Ng et al., 2008; Pati & Thackeray, 2018). Measurements such as carapace width (CW) and carapace length (CL) were taken using a digital Vernier caliper to the nearest 0.01 mm. Photographs of each species were captured using a GPS camera software in android mobile for documentation and comparative analysis.

Voucher specimens were deposited in the Department of Zoology, [N.E.S.Science College ,Nanded], to serve as reference material for future taxonomic verification and biodiversity studies. The diversity indices such as Shannon-Wiener index (H′) and Simpson's diversity index (D) were calculated to assess species richness and evenness among sites (Magurran, 2004).

4. Data Analysis

The occurrence and distribution data were compiled using Microsoft Excel and analyzed using Table representation. Correlation analyses between crabs and morphometric characters were studied to determine comparative analysis. The results were compared with earlier reports on Indian freshwater crabs to assess range extension or new records for the region (Trivedi et al., 2018; Pati & Sharma, 2014)

Results and Discussion

The present study recorded two species of freshwater crabs from different tributaries and freshwater bodies across Nanded, Hingoli, and Parbhani districts of Maharashtra. These species belong to the genus *Barytelphusa* and were identified as *Barytelphusa guerini* and *Barytelphusa cunicularis*. Both species were distributed within the Godavari River basin and its associated tributaries such as Aasna, Manyad, and Kayadhu rivers. Their occurrence in different habitats reflects the ecological richness of the freshwater systems in this semi-arid region.

Species Composition and Distribution

Among the two species, *Barytelphusa guerini* showed a wider distribution, being recorded from almost all surveyed tributaries in the Nanded,Hingoli and Parbhani districts of Maharashtra, India. It was found in the farming areas of villeges like Pangra shinde,Wadi B.K., Maralak etc, and Godavari river basin as well as tributaries like Aasna ,Manyad,Purna and Kayadhu. Nearby village streams, lakes etc. The frequent occurrence of this species suggests that it is well adapted to both perennial and seasonal water bodies. It was commonly observed along muddy riverbanks, under stones, and within self-dug burrows, indicating its strong adaptability to variable aquatic and terrestrial environments.

In contrast, *Barytelphusa cunicularis* was found in comparatively fewer localities such as the Kayadhu River, Manyad River (Barul Dam area), and Godavari River. Its restricted distribution suggests that it prefers more stable aquatic conditions with deeper pools and slow-flowing water. This difference in habitat preference highlights distinct Ecological roles played by the two species within the same river basin.

Morphological Characteristics

The two recorded species showed clear morphological differences. *Barytelphusa guerini* was comparatively smaller, with males measuring less than 8 cm and females below 6 cm in carapace width. The dorsal surface was faint yellow, the ventral side dark chocolate-colored, and the chelae tips appeared blackish red. *Barytelphusa cunicularis*, on the other hand, was larger, with males measuring below 12 cm and females around 11 cm in width. The dorsal side was bright yellow, ventral side shiny dark black, and chelae tips deep red. Such colour variations may be adaptive features related to the surrounding habitat substrate and water conditions. The darker ventral coloration and reddish chelae might help in camouflage and mating displays. The larger size and robust chelae of *B. cunicularis* may also reflect its dominance in stable habitats and competitive feeding behaviour.

Habitat Preferences and Ecological Observations

Both species were recorded in regions with muddy or sandy bottoms, moderate vegetation, and organic-rich sediments. They were mostly seen near agricultural fields or under shaded riverbanks. The crabs constructed burrows along the margins of streams and ponds, which serve as refuges during dry periods. These burrows also help in soil aeration and improve the physical structure of the riverbank ecosystem.

The abundance of *B. guerini* in smaller tributaries indicates its high tolerance to fluctuating water levels and human disturbances. The body size may also affects abundance. Meanwhile, the limited distribution of *B. cunicularis* suggests it may be more sensitive to habitat modification and pollution. The presence of both species, however, indicates that the freshwater ecosystems of the Godavari tributaries still maintain healthy environmental conditions in several areas.

Table 1. Morphological Features :

Sr. No.	Species	River System or Tributaries or Water Bodies	Status	Morphological Features				
				Body Colour				
				Male	Female	Dorsal Side	Ventral Side	Chelas (Claws)
1.	*Baryte-lphusa guerini*	**Tributaries Nanded Dist.**		< 8 cm	< 6cm	Faint Yellow colour	Dark chocklet colour	Blakish Red at Tip
		Wadi B.K.	+					
		Maralak	+					
		Aasna River	+					
		Godavari River	+					
		Manyad River	+					
		Tributaries Hingoli Dist. Pangra Shinde	+					
		Sirali	+					
		Kayadhu River (Kondhur, Nandapur region)	+					
2.	*Barytelphusa cunicularis*	Tributaries	-	<12	<11	Yellow coloured	Dark black shining	Dark Red at tips
		Kayadhu River	-					
		Godavari River	+					
		Manyad River (Barul Dam)	+					
		Aasna River	-					

Species : I *Barytelphusa guerini* (H.Milne Edwards,1853)

Taxonomic position of Crab :

Kingdom - Animalia
Phylum - Arhropoda
Subphylum - Crustacea
Class - Melacostraca
Order - Decapoda
Suborder - Pleocyemata
Infra order - Brachyura
Super Family - Gecarcinucoidea

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Family - Gecarcinucidae
Genus - *Barytelphusa*
Species - *guerini*

Figure 1 Female Crab

Figure 2 Female Crab

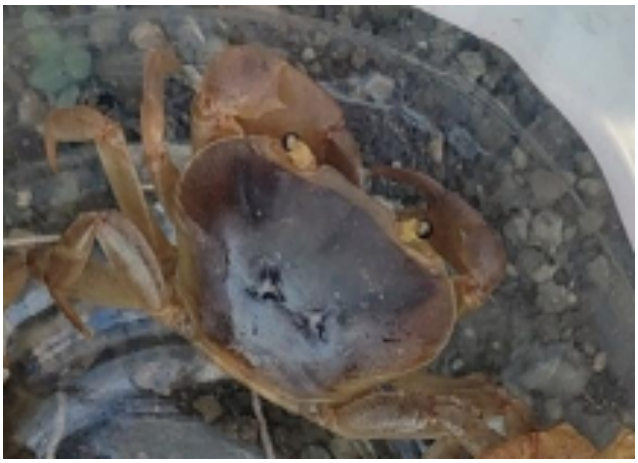

Figure 3: Male Crab

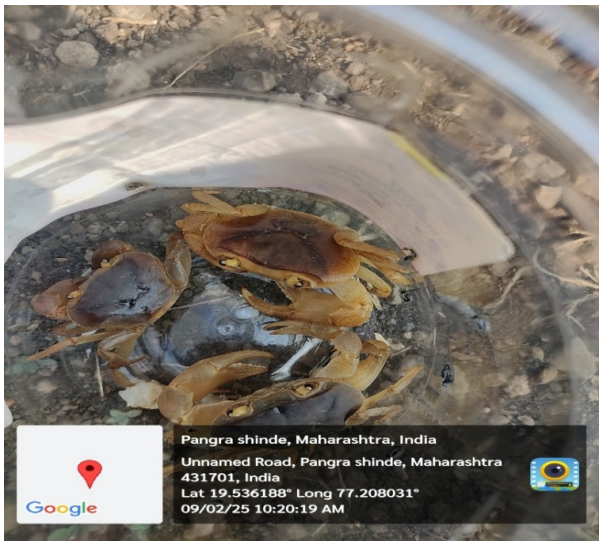

Figure 4: Collection of Sample species .

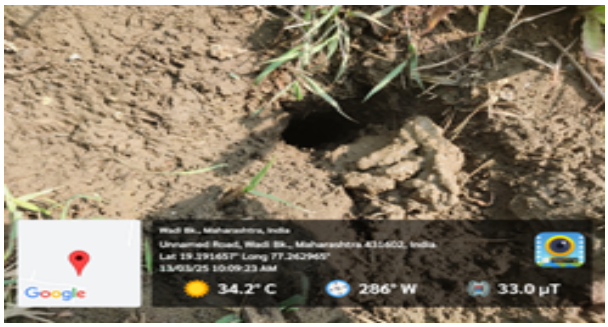

Figure 5: Crab Burrows

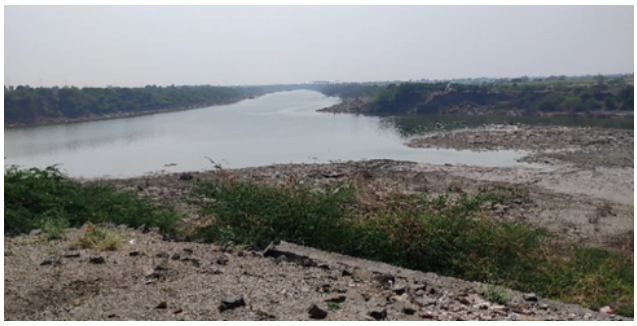

Figure 6: Godavari -Purna River Sangam

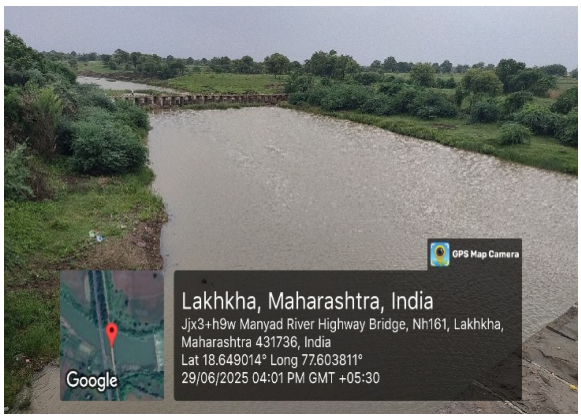

Figure 7: Manyad River tributary

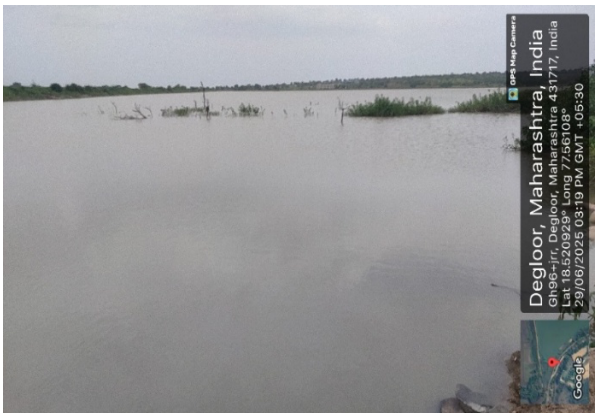

Figure 8 : Water Shade Development

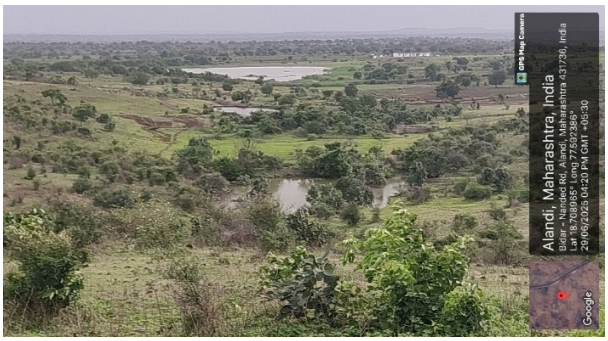

Figure 9: Water Shade Development

Table 2. *Barytelphusa guerini*

Sr.No.	Morphometric Analysis	Male (In cm)		Female (In cm)	
		Minimum	Maximum	Minimum	Maximum
1	Carapace Width	2.5	6.00	2.2	5.0
2	Carapace Length	1.8	4.9	1.5	4.0
3	Chela Depth	2.0	2.8	1.9	2.1
4	Chela length	2.0	5.0	1.9	4.6
5	Abdominal Width	2.5	3.5	2.9	4.4
6	Body Weight (In gm)	30.5	56.74	26.89	49.90

Morphometric Analysis (Discussion)

The morphometric measurements of the collected freshwater crab specimens revealed noticeable variation between males and females, indicating the presence of sexual dimorphism within the studied population. The carapace width of males ranged from 2.5 to 6.0 cm, while that of females ranged between 2.2 and 5.0 cm. This suggests that males generally possess broader carapaces compared to females. The broader and stronger carapace in males likely provides better protection and structural support during territorial defences and mating activities. Similarly, the carapace length of males varied from 1.8 to 4.9 cm, whereas in females it ranged between 1.5 and 4.0 cm. These dimensions indicate that males tend to attain slightly larger overall body sizes than females. Such differences in carapace proportions are often associated with ecological adaptations and reproductive strategies, where larger males dominate in breeding territories.

The measurements of the chela depth and chela length showed clear differences between the sexes. The chela depth ranged from 2.0 to 2.8 cm in males and 1.9 to 2.1 cm in females, while the chela length ranged from 2.0 to 5.0 cm in males and 1.9 to 4.6 cm in females. The comparatively longer and deeper chelae in males indicate stronger grasping ability and muscular development. This characteristic is typically associated with defence, competition, and courtship behaviour. In contrast, the relatively smaller chelae in females are thought to fewer agility and minimize energy expenditure during reproductive activities such as egg carrying. In terms of abdominal width, females exhibited slightly greater measurements (ranging from 2.9 to 4.4 cm) compared to males (2.5 to 3.5 cm). This difference reflects the biological adaptation of females for reproductive purposes. The broader abdomen provides space for egg attachment and protection of developing embryos. Such adaptations are commonly seen in freshwater crab species, where the abdomen plays an essential role in brood care. The body weight of males ranged between 30.5 and 56.74 grams, whereas females weighed between 26.89 and 49.90 grams. The higher average body weight in males corresponds to their overall larger body size and more muscular structure. In contrast, females generally have lower body mass but display a broader abdomen, balancing the body's morphology for reproductive efficiency. Overall, the morphometric analysis highlights distinct sexual dimorphism in size and body proportions between male and female freshwater crabs. Males tend to be larger, heavier, and more robust, while females possess broader abdomens adapted for carrying eggs. These variations not only reflect physiological and behavioural differences but also provide important taxonomic and ecological information for identifying species and understanding their reproductive strategies within the freshwater ecosystems of the Godavari basin.

Species : II

Taxonomic position of Crab :

Kingdom - Animalia
Phylum - Arthropoda
Subphylum - Crustacea
Class - Malacostreca
Order - Decapoda
Suborder - Pleocyemata
Infra order - Brachyura
Super Family - Gecarcinucoidea
Family - Gecarcinucidae
Genus - *Barytelphusa*
Species - *cunicularis*

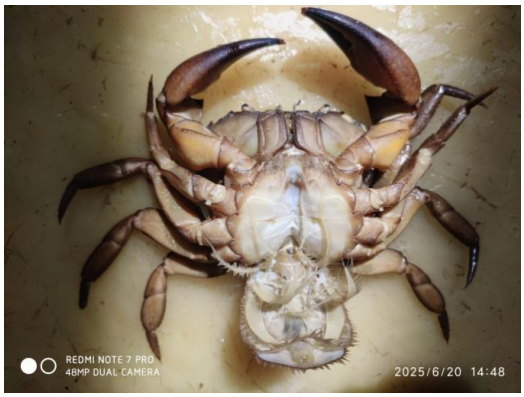

Figure :Female Crab

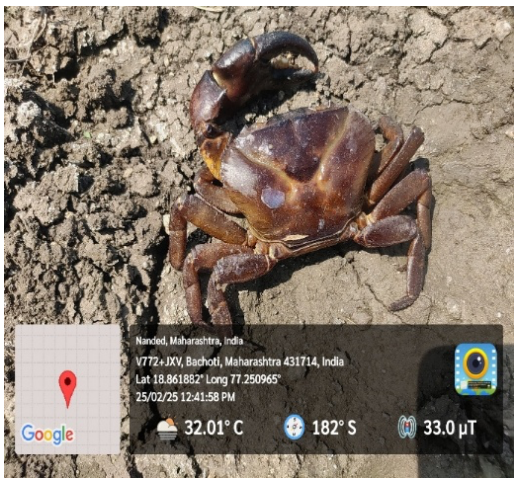

Figure: Male Crab

Table No.03 *Barytelphusa cunicularis*

Sr. no.	Morphometric Analysis	Male (In cm) Minimum	Male (In cm) Maximum	Female (In cm) Minimum	Female (In cm) Maximum
1	Carapace Width	5.0	8.9	5.8	8.5
2	Carapace Length	6.9	8.0	5.5	7.8
3	Chela Length	5.10	8.0	4.9	7.0
4	Chela Depth	2.9	5.0	2.5	4.0
5	Abdominal Width	4.1	5.6	3.6	5.6
6	Body Weight (gm)	120	198	100	147.9

Morphometric Analysis (Discussion):

The morphometric measurements of the collected freshwater crab specimens revealed noticeable variations between male and female individuals. The carapace width of males ranged from 5.0 to 8.9 cm, while in females it ranged from 5.8 to 8.5 cm. This indicates that males generally possess slightly broader carapaces, which may be associated with their territorial behaviour and need for greater physical protection. The carapace length showed a relatively narrow range of variation, with males measuring 6.9 to 8.0 cm and females 5.5 to 7.8 cm, suggesting overall size uniformity between sexes.

The measurements of chela length and chela depth exhibited more distinct sexual dimorphism. Males showed longer and deeper chelae, with lengths ranging from 5.10 to 8.0 cm and depths from 2.9 to 5.0 cm, compared to females with 4.9 to 7.0 cm and 2.5 to 4.0 cm, respectively. The larger and more robust chelae in males are likely related to their dominance behaviour, mating competition, and defence mechanisms. Females, on the other hand, exhibited proportionally smaller chelae, which may facilitate ease of movement and energy conservation during reproductive phases. The abdominal width also varied slightly between sexes, with males ranging from 4.1 to 5.6 cm and females from 3.6 to 5.6 cm. Females showed a relatively broader abdomen in some specimens, which is consistent with their reproductive role, as it provides space for egg carrying and protection. The body weight of males ranged between 120 and 198 grams, while females weighed between 100 and 147.9 grams. The higher body weight in males reflects their overall larger body structure and muscular development, particularly in the chelipeds and carapace regions. The morphometric data indicate clear

sexual dimorphism in both size and structural features. Males were generally larger, heavier, and more robust, whereas females exhibited compact body forms with wider abdomens. These differences are not only adaptive for reproductive and ecological roles but also help in distinguishing sexes during field identification. The variation observed across individuals may also be influenced by environmental conditions, habitat type, and availability of food resources within the tributaries of the Godavari basin.

Conclusion

The present investigation on the diversity and distribution of freshwater crabs in selected tributaries of the Godavari River system across Nanded, Hingoli, and Parbhani districts revealed the occurrence of two distinct species — *Barytelphusa guerini* and *Barytelphusa cunicularis*. These species were recorded from several freshwater habitats, including rivers, streams, ponds, and small reservoirs, indicating that the Godavari basin provides favorable ecological conditions for sustaining diverse crab populations. Among the two species, *Barytelphusa guerini* was found to be the most widely distributed and abundant, showing a higher degree of adaptability to various aquatic environments, whereas *Barytelphusa cunicularis* exhibited a more restricted distribution, preferring deeper and stable water bodies.

The study of morphological features such as body coloration and chela structure showed clear interspecific variations. *B. guerini* exhibited a faint yellow dorsal surface and dark chocolate ventral region with blackish-red chela tips, while *B. cunicularis* showed a bright yellow dorsal coloration with deep red-tipped chelae. These distinct color and structural patterns are useful diagnostic features for species identification in the field and may also have adaptive significance in different habitats.

The morphometric analysis revealed distinct sexual dimorphism between male and female individuals. Males were generally larger, heavier, and possessed more developed chelae, while females had broader abdomens suited for egg carrying. The recorded ranges of carapace width, chela length, and body weight confirmed that males dominate in physical size and robustness, whereas females exhibit structural adaptations related to reproduction. Such dimorphism reflects the ecological and reproductive roles played by each sex within their natural habitats.

In short, the findings highlight the ecological richness of the Godavari River, tributaries and their importance as habitats for freshwater crabs in the semi-arid Marathwada region of Maharashtra, India. Despite environmental fluctuations and Human interference, these water bodies continue to support viable crab populations. However, signs of habitat degradation due to agricultural runoff, sand mining, and pollution were observed at several sites, posing potential threats to local biodiversity. Hence, the present study provides valuable baseline data on species diversity, distributional range, and morphometric variation of freshwater crabs in this region. Such information will be useful for future taxonomic, ecological, and conservation-related research. Long-term monitoring and habitat protection strategies are essential to maintain the natural population of these ecologically significant crustaceans and to ensure the sustainability of freshwater ecosystems in the Godavari basin.

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