

Internal morphological studies of crab burrows with special reference to *Barytelphusa cunicularis*

Sharda N Padghane^{1*}, Dilip H Dudhmal², Rupali S Babare³

¹ Department of Zoology, MSP Arts, Science & KPT Commerce College, Manora, Washim, Maharashtra, India

² Department of Zoology, MVP Samaj's ACS College, Dindori, Nashik, Maharashtra, India

³ Department of Zoology, Late Nitin College, Pathri, Parbhani, Maharashtra, India

Abstract

Burrows may be of different shape and size, simple or complex, having many branches or a single opening depending upon the animal. Various techniques have been used by biologists to determine the morphological patterns and other environmental effects on the burrow architecture. Burrows are simple tunnels, descending downwards either straight or slightly slanted, with or without branches. The burrow exhibits L, S, or Y like shapes. The relationship between Area of burrow opening (Sq. cm) and crab carapace width (mm) and burrow depth at Asna River were ($r = 0.268$ and $r = 0.160$) and at Lendi river it was ($r = 0.046$ and $r = 0.160$).

Keywords: Burrow, frequency, width, depth, cunicularis, river

Introduction

Organisms usually do not live in isolation. They interact with other organisms, inhabit a particular environment. Habitat is the place where organisms live and interact with their changing environments. The structure and architecture of burrows play a significant role and provide morphological support in the life of an organism [1, 8]. The activities of burrow construction promote the remobilization of sediment grain and nutrient cycling, thus changing the physical and chemical features of the local environments. It may be of different shape, size, simple or complex, may have single or multiple opening. By comparing the morphology, architecture and different patterns of burrows, it may be possible to suggest ecological differences between concern or associated species and their interaction with the surrounding environment. Burrow morphology depends on physical characteristics of the soil [2]. There is a difference between juvenile and adult crabs. Juveniles produce shallow J-shaped burrows, which incline vertically into the substratum. Larger crabs have Y-shaped and spiral burrows [3]. The study of crab burrows becomes important as the crab collectors use various methods to collect crabs [9]. To better understand the morphology and characteristics of burrows, we study the habitat of the crab *Barytelphusa cunicularis* with its burrow dimensions, found in Godavari River and its tributaries (Asna River and Lendi River) of Nanded, Maharashtra state.

Materials and Methods

1. Field study

Barytelphusa cunicularis excavates burrow at the shore of river when water level is high in rainy seasons. This study was conducted for measuring crab burrow openings with the help of measuring tape and calculated burrow dimensions. The empty, abandoned burrows were filled with thin slurry of Plaster of Paris. The mixture was poured through the mouth of the burrow openings and was allowed to harden for 2–3 h, depending upon environmental conditions. Burrow characterization was done using the following formula by [4].

$$\text{Area} = \pi \times a \times b/4$$

Where, a = length of burrow opening.

b = width of burrow opening.

π (Pie) = 3.14

2. Burrow casting

This study was conducted in February and March 2018. The burrows were selected randomly upstream and downstream side at Asna River, tributaries of Godavari River Nanded. To know the burrow structure of *Barytelphusa cunicularis*, a semisolid mixture (slurry) of Plaster of Paris (POP) was poured into burrows until the burrow was filled. Casting work was conducted only if there was a relatively high burrow density/frequency. The solidified burrow casts were (approximately after 2 h) dug out and brought to the laboratory for further measurement.



Fig a): Single opening of burrow



Fig b): Double opening of burrow



Fig c): Quadruplet burrow opening



Fig d): Burrow-opening measurement



Fig e): Burrow opening measurement



Fig f): Burrow-opening measurement

Fig 1 (a-f): A field study for characterization of burrows of *Barytelphusa cucicularis* In Godavari River and its tributaries in Nanded



Fig a): Poring of POP in burrows



Fig b): Active crab



Fig c): POP cast structure of burrow



Fig d): POP structure a burrow



Fig e): Measurement of burrow depth



Fig f): POP cast structure of burrow

Fig 2 (a- f): Casting of burrow in *Barytelphusa cunicularis* on field at Asna and Lendi River (Godavari basin) using Plaster of Paris slurry (POP)

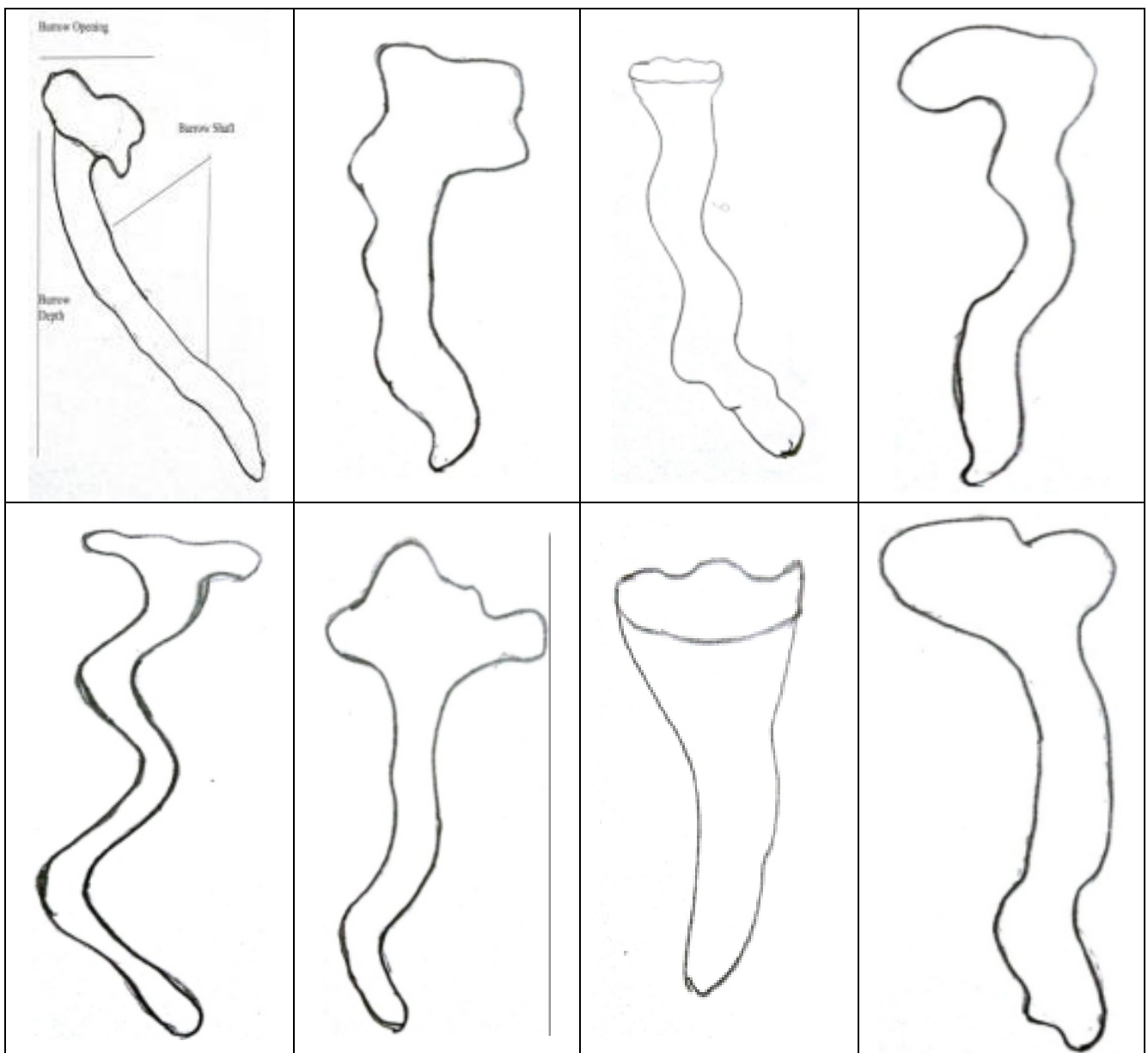


Fig 3: Schematic diagrams of dried excavated burrows after poring Plaster of Paris

Results

1. Burrow morphology and characteristics

Barytelphusa cunicularis excavate burrows of different shapes and size. Burrows pattern was simple tunnel and

descending downward in any direction until reaches to the water level in wet area. It also excavates under big stone or rocks. Various shapes of burrows have been reported, such as unbranched, spiral, strait, gently curved, flask shape, etc.

2. Data analysis

The relationship between Area of burrow opening (Sq. cm) and crab carapace width (mm) and burrow depth at Asna River were ($r = 0.268$ and $r = 0.160$) and at Lendi river it was ($r = 0.046$ and $r = 0.160$).

One-way ANOVA showed that when comparing six burrow characteristics at three levels (Surface area opening, carapace width and burrow depth), there was a significant difference between them ($P = 0.0032$) at Asna river. It was not shown any significant difference at Lendi River (6.0288)

Table 1: Comparative account of burrow characteristics (BC) and carapace width of *B. cunicularis* at Asna River during 2017-2018

Cast Number	Burrow opening (Cm)		Surface area of opening (cm ²)	Carapace width of crabs (mm)	Burrow depth (Cm)
	Major	Minor			
BC 1	5.1	4.5	18.01	60.18	27
BC 2	6.0	5.1	24.02	65.32	35
BC 3	4.5	3.7	13.07	61.16	30
BC 4	5.5	4.1	17.70	42.52	40
BC 5	5.2	4.9	20.00	58.48	76
BC 6	3.9	2.6	7.95	28.83	13.5

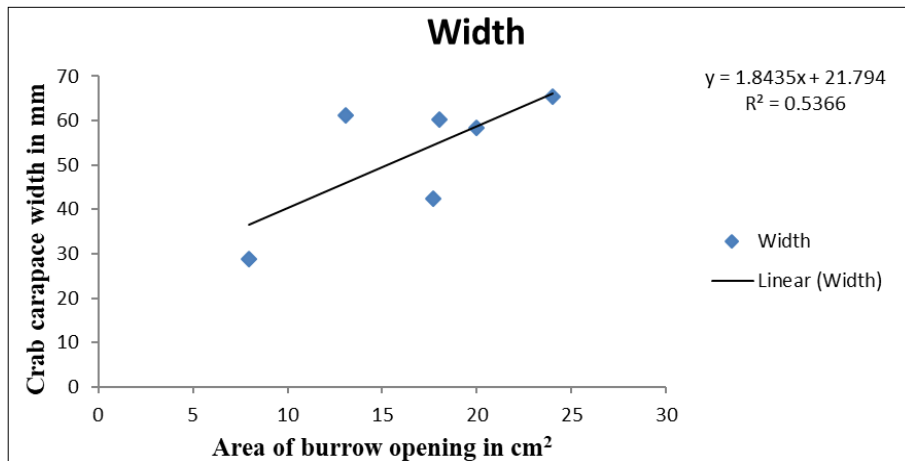


Fig 4: Relationship between Area of burrow opening (cm²) and crab carapace width (Mm) at Asna River

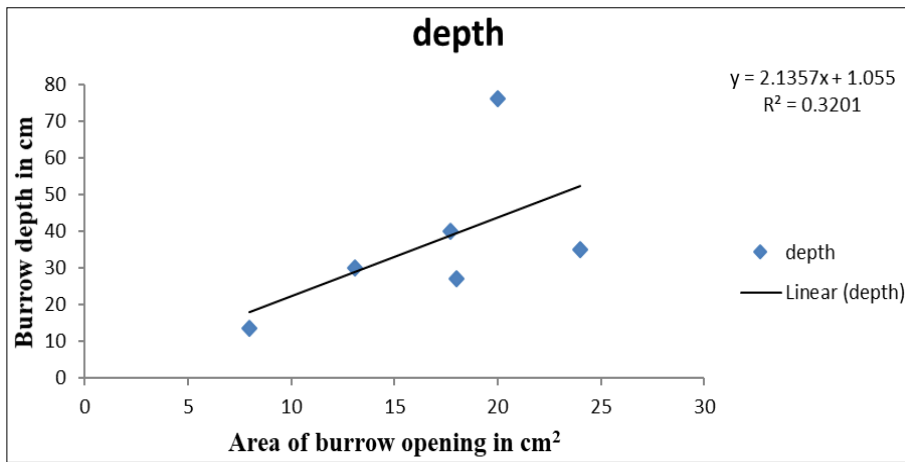


Fig 5: Relationship between Area of burrow opening (cm²) and Burrow depth (cm) at Asna River

Table 2: One-way ANOVA for the mean of Burrow characteristics (Surface area, crab carapace width and burrow depth) of *Barytelphusa cunicularis*

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3897.0783	2	1948.539	8.632866	0.0032	3.68232
Within Groups	3385.6759	15	225.7117			
Total	7282.7542	17				

P < 0.05

Table 3: Comparative account of burrow characteristics and carapace width of *B. cunicularis* at Lendi River during 2017-2018

Cast Number	Burrow opening (Cm)		Surface area of opening (cm ²)	Carapace width of crabs (mm)	Burrow depth (Cm)
	Major	Minor			
BC 1	5.1	4.9	19.61	58.1	8.5
BC 2	4.6	3.8	13.72	48.4	6.3

BC 3	4.7	3.9	14.38	45.6	11.2
BC 4	3.7	3.6	10.45	53.3	21.3
BC 5	5.8	4.6	20.94	55.4	9.9
BC 6	5.2	4.8	19.59	46.5	11.2

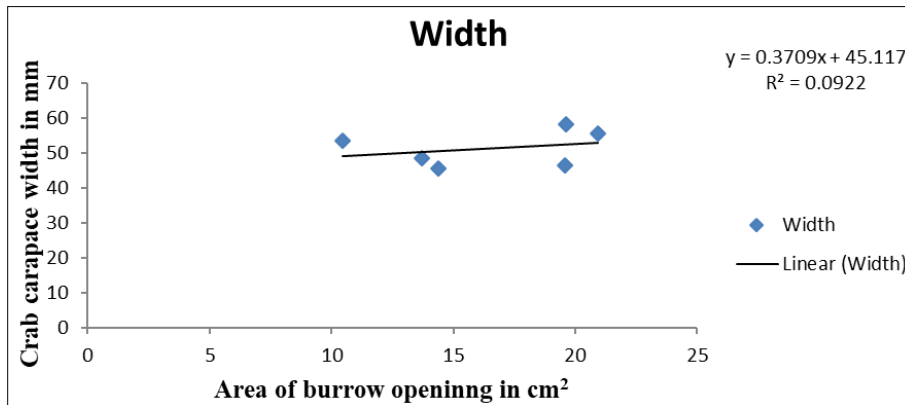


Fig 6: Relationship between Area of burrow opening (cm²) and crab carapace width (mm) at Lendi River

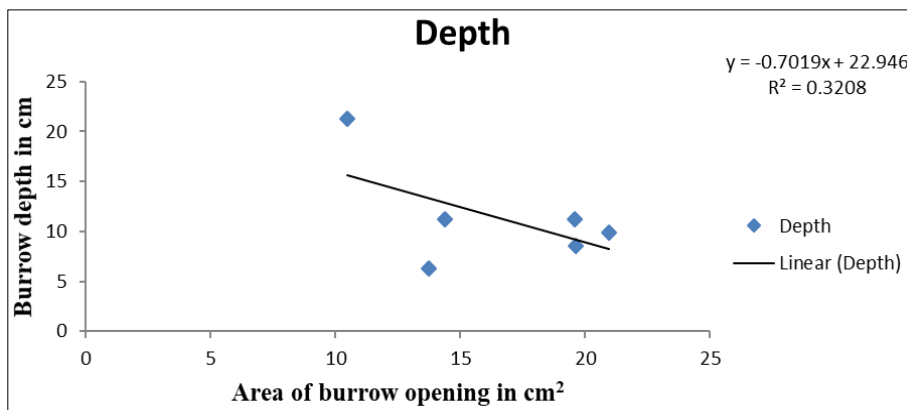


Fig 7: Relationship between Area of burrow opening (cm²) and Burrow depth (cm) at Lendi River

Table 4: One-way ANOVA for the mean of Burrow characteristics (Surface area, crab carapace width and burrow depth) of *Barytelphusa cunicularis*

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5639.379233	2	2819.69	119.6638	6.02883E-10	3.682320344
Within Groups	353.4514167	15	23.56343			
Total	5992.83065	17				

P > 0.05

Discussion

Burrow morphology of brachyuran crab *Ocypode ceratophthalmus* was studied at two sites located at the Saurashtra [5]. In the present investigations, total 55 burrow casts were obtained and 8 types of burrows shape were recorded. The crab carapace width showed significant correlation with burrow-opening diameter, burrow volume and burrow total length. Present Study also showed a significant relationship between areas, carapace width and burrow depth at Asna river (Tributaris of Godavari River) study site but not at Lendi River.

Burrow architecture of the ghost crab, *Ocypode ceratophthalmus* was studied [6], total 67 burrows were analyzed out of 131 burrows were excavated in their studies. compared with the young and juvenile crab burrows result of this study provides evidence that the J and U-shaped burrows could be precursors of Y-shaped burrows in the excavation process. [7], studied the engineering impact of burrowing crabs on distribution of organic matter. In their

investigations, burrowing activities of these crabs and passive deposition of materials in their burrows have a significant impact on the organic matter and nutrient distributions in subtropical mangrove sediments.

Tunnels can be of various shapes and sizes, basic or complex, having numerous branches or a solitary opening depending upon the idea of the creatures [8]. In this examination the tunnels of *B. cunicularis* were found to have ellipsoidal openings at both rivers. Straightforward, at times spread either straight or somewhat inclined plummeting downwards many times burrows were spiral in shape.

Conclusion

This study provides one of the first descriptions of the morphology and ecology of burrows of freshwater crab *Barytelphusa cunicularis* in Nanded region of Maharashtra. The result shows significant variation in the burrow morphology. The complex morphology of these burrows

suggests that they are created, maintained the burrows. Crab burrow acts as an indicator crab population abundance and represent the interconnectivity of the burrow systems.

List of Abbreviations:

BC= Burrow Cast
Mm= Millimeter
Cm= centimeter
POP= Plaster of Paris

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