**First Report of *Glauconome chinensis* (Gray, 1828) from West Bengal-Odisha coast, India**


## Abstract

The intertidal marine bivalve *Glauconome chinenensis* (Chinese glauconome), Gray 1828 is a burrowing benthic fauna inhabiting in soft muddy to sandy sediments of Western pacific mangrove areas. The specimen is characterised by long siphon (inhalant and exhalent) for feeding and a prominent foot for locomotion. They are mostly gonochoric, few are sometimes protandric hermaphrodites. According to Gray's description their embryonic development starts through free swimming trochophore larvae and succeeded by the veliger. *Glauconome chinenensis* has been rediscovered for the first time from the intertidal coastal mangrove areas of Talsari, confluence of Subarnarekha estuary of West Bengal-Odisha coast, India. Quadrates having areas of $1m^2$ were placed randomly on study sites and the studied specimens were unearthed, counted their size, biomas, population density and distribution pattern. Physico-chemical parameters were also evaluated. For anatomical study tissues were fixed in 4% formalin solution and processed through alcoholic grades. Body length, siphon, gill, mantle, foot, adductor muscles, digestive gland and gonads were examined. The studied specimens were stayed in 10-40cm depth from sediment surface and showed clumped distribution pattern. The mean length, width and biomass of the specimen were 39.2(mm) ±0.393, 14.5(mm) ±0.351and 3.89(gm) ±0.382 respectively. The report on the occurrence of such intertidal bivalve adds relevant data for the good assessment of food chain and food web of marine coastal mangrove ecosystem. The present study also aims to gather knowledge of valuable ecological services of *Glauconome chinensis* and to maintain the biological integrity of West Bengal-Odisha coastal region with Bay of Bengal.



**Keywords:** Intertidal, Bivalve, *Glauconome chinenensis*, mangrove.


## 1. Introduction

Mangrove-coastal-estuarine ecosystem is a unique, fragile and dynamic ecosystem of the world. Mangrove ecosystem is the highly productive natural ecosystem in the intertidal zone of coastal region. Mangrove forests, due to their high productivity, create an appropriate habitat in ecosystems [1]. Different faunal species, including arthropods, molluscs, fish, amphibians, birds prefer mangroves for spawning, nursery and feeding grounds. Mangrove limnology has been changing day-by-day because of human encroachment, deforestation, and environmental hazards, along with its varied resources as well as floral and faunal community, including bivalves [2]. Bivalves, the second-largest invertebrates with soft tissue, inhabit diverse habitats in marine environments **[3]**. They play an important role in nutrient cycling and productivity in coastal regions, including mangrove areas [4]. In 1828, G.E Gray recorded intertidal marine bivalve *Glauconome chinenensis* (Chinese glauconome) from subtropical region of Western Pacific. It is a burrowing animal in the intertidal zone of coastal ecosystem. The specimen buried themselves in coastal benthic region along with the soft muddy to sandy sediments dotted with mangrove vegetation. The genus is characterised by two hinged shells with two long siphons as well as a large prominent foot. The studied specimens are mostly gonochoric but some are protandric hermaphrodites. The embryo of the *Glauconome chinenensis* develops into free-swimming trochophore larvae. Then the trochophore succeeded by the veliger, resembling a minute calm (Gray 1828).

The present paper reports *Glauconome chinenensis* from Talsari in the intertidal zone of Subarnarekha estuary of West Bengal-Odisha coast, India for the first time and furnishes few morphological features.

## 2. Material and methods

### 2.1. Locality of the study area:

The intertidal regions of the siliciclastic Talsari (situated between 21°35'48" Northern Latitude and 87°27'17" Eastern Longitude) coastline exhibit distinctive features, with sedimentary layers arranged in a linear pattern running from east to west, parallel to the shore. This arrangement transitions smoothly from the sea to the land, with mudflats spanning approximately 350 to 400 meters wide along the creek edges, flanked by beach-barrier bars ranging from 250 to 300 meters wide towards the sea, and coastal dunes towards the land. Situated between the sandy beaches of Digha to the east and the meeting point of the non-perennial Subarnarekha River and the Bay of Bengal to the west, the Talsari coast encompasses a blend of sand, mud, and mixed sediment types, gradually shifting from one to the other (Fig-1). This coastal area experiences moderate tides influenced by

tropical oceanic conditions, with a slight daily variation and three distinct seasons: Winter (November to February), Summer (March to June), and Monsoon (July to October).

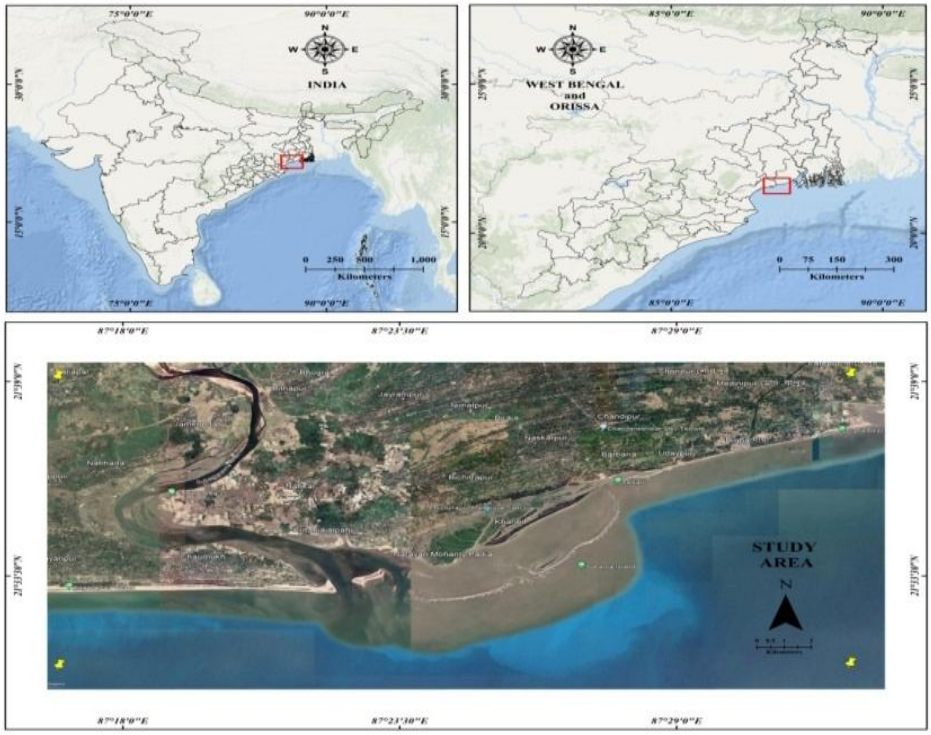


Fig-1: Sampling sites.

### 2.2. Sample collection and preservation:

The bivalve specimen, *Glauconome chinensis* was collected from Talsari, the intertidal belt of Subarnarekha estuary of West Bengal-Odhisha coast with Bay of Bengal during an evaluation of the molluscan fauna in mangrove areas. The specimens were unearthed and collected from study sites in November 2021. For further study the alive specimens were preserved in 70% alcohol.

### 2.3. Identification of the specimen:

All the observation of the specimens was done with Nikon D7500. Preliminary study of the specimens was done under Binocular microscope, Model CH20iBIMF. All the drawing were completed under Camera lucida and collected data were compared with various literature. For the correct identification, the studied specimens were deposited at the Ministry of Environment, Forest and Climate Change; Zoological Survey of India, Prani Vigyan Bhavan, Kolkata, West Bengal.

### 2.4. Tempo-spatial variation of the study area:

Temperature, pH, salinity of the intertidal sea water and soil were measured by water quality checker (TOA, Model No-WQC22A, Japan) in the sampling area [5].

### 2.5. Statistical Analysis:

Univariate description of variables based on calculation of sample statistics such as mean, SD, maximum and minimum values have been done on pooled dataset of studied area [6]. All the statistical analysis was carried out using the Past-4.0.2. software.

## 3. Results

### 3.1. Abiotic data of the water and soil samples of the studied area:

Ecological variables showed distinct seasonal variations in both the studied water and soil samples during the investigation time. In water sample, temperature showed 30.17°C ±3.08 with minimum and maximum temperature values of 25.11°C and 33.53°C, respectively whereas dissolved oxygen (DO) recorded as 4.44 ±0.67 mg/l and fluctuate in between 3.44mg/l to 6.32mg/l. In study area highest salinity was 24.50mg/l while it dropped to 6.94mg/l. The mean pH values exhibited as7.58 ±0.29 with variated from 7.06 to 8.14 in surface water. Turbidity content of the water samples varied from 242.50mg/l to 368.75mg/l with mean value of 316.25 ±31.23 mg/l, while the average conductivity of the water was 2.52 ±0.32 mg/l and found to oscillate from 1.91mg/l to 3.30mg/l. The environmental variables showed distinct variations in the studied water samples (Table-1).

Table-1: Water quality parameters of the study area.

| Water Parameter | Average (±SD) | Min | Max |
|---|---|---|---|
| pH | 7.58 ±0.29 | 7.06 | 8.14 |
| Temperature (˚C) | 30.17 ±3.08 | 25.11 | 33.53 |
| DO (mg/l) | 4.44 ±0.67 | 3.44 | 6.32 |
| Salinity (mg/l) | 14.33 ±5.67 | 6.94 | 24.50 |
| Turbidity (mg/l) | 316.25 ±31.32 | 242.50 | 368.75 |
| Conductivity (µmhos/cm) | 2.52 ±0.32 | 1.91 | 3.30 |

In soil samples, the values of mean pH 8.96 ±1.89, and it's varied from 7.32 to 9.76. At soil samples, the soil temperatures fluctuated from 20.24°C to 33.54°C with mean temperature 29.49˚C ±3.84. Salinity concentrations were found to remain in between 11.25mg/l to 32.21mg/l with average salinity 20.97 ±7.97mg/l at this study site in soil samples. The soil samples were categorized as clay, sand and silt during the investigation times. The particle size distribution was found as 94.39(±1.60)%sand, 2.57(±2.07)%clay, and 3.42(±1.53)% silt in the collected soil samples. Table-2 shows different soil particle proportions, the upper and lower limits and the central points of the studied soil samples.

Table-2: Water quality parameters of the study area.

| Soil Parameter | Average (±SD) | Min | Max |
|---|---|---|---|
| pH | 8.96 ±1.89 | 7.32 | 9.76 |
| Temperature (˚C) | 29.49 ±3.84 | 20.24 | 33.54 |
| Salinity (mg/l) | 20.97 ±7.97 | 11.25 | 32.21 |
| Clay (%) | 2.57 ±2.07 | 0.12 | 7.79 |
| Sand (%) | 94.39 ±1.60 | 89.22 | 97.53 |
| Silt (%) | 3.42 ±1.53 | 0.14 | 7.69 |

### 3.2. Sample description:

The sampled specimen *Glauconome chinensis* are mostly found in muddy area carrying high sandy loam content with mangrove associated plant species. They showed clumped distribution pattern. The collected specimens were identified depending on their characteristic features. The Mean length of the specimen is 39.2(mm) ±0.393. The Mean width of the specimen is 14.5(mm) ±0.351. The Mean biomass of the specimen is 3.89(gm) ±0.382 (Fig-2). The shell of the specimen contains two similar valves. The valves are semi-convex, ovate, elongate and with a pointed umbo. Valves of the studied animal are mostly blackish-brown in colour. The outer surface of the valves is mostly smooth but indicating growth lines, and Different ornamental features are designed in the inner surfaces of the valves [7].

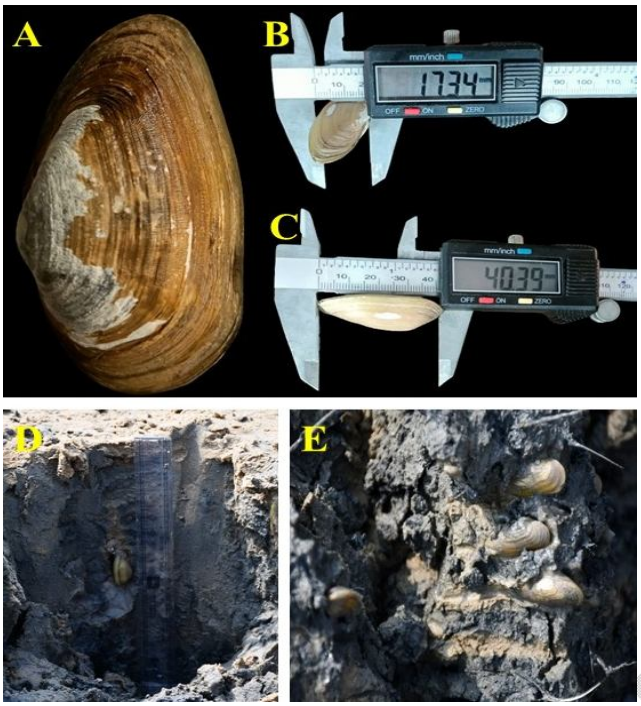


Fig-2: A) An adult species of *Glauconome chinenensis*, B) Measuring the width size of the species, C) Length measurement of *Glauconome chinenensis*, D & E) Species distribution patterns in soil sample at the study area.

### 3.3. Species Systematics

Domain: Eukaryota (Whittaker & Margulis, 1972)
Kingdom: Animalia (Linnaeus, 1758)
Subkingdom: Bilateria (Hatschek, 1888)
Branch: Protostomia (Grobben, 1908)
Infra kingdom: Lophotrochozoa
Super phylum: Eutrochozoa
Phylum: Mollusca (Linnaeus, 1758)
Class: Bivalvia (Linnaeus, 1758)
Infraclas: Heteroconchia
Subclass: Autobranchia
Super order: Imparidentia
Order: Venerida (H. & A. Adams, 1856)
Super family: Cyrenoidea
Family: Glauconomidae
Genus: Glauconome
Species: *chinensis* (Gray, 1828)

### 3.4. Specimens studied

The collected species was identified from Ministry of Environment, Forest and Climate Change; Zoological Survey of India, Prani Vigyan Bhavan, Kolkata, West Bengal.Sample Regd. Number-M.36321/10.

### 3.5. Habitat

Sampled specimens were collected from soft muddy to sandy sediments dotted with mangrove associated plants (*Acanthus ilicifolius, Avicennia alba, Avicennia marina, Sauedasp, salicornia sp)* of intertidal zone of Talsari, West Bengal-Odisha coast, India.

## 4. Discussion

Mantle of *Glauconome chinensis* is a thin membrane and covered the internal soft parts. It is greyish white in colour and formed with thick tissue sheath. Mantle tissue is strongly attached to the bivalve shell. There are mainly 3 parts in the mantle known as marginal, middle, and apical zones [8]. The marginal mantle is also composed of 3 folds (inner, middle, and outer) and the inner fold is strongly developed region [9]. Mantle is covered by inner (facing the mantle cavity) and outer epidermis (directed to the shell) layer. Mucous cells are also visible in the bivalve mantle which mainly developed from epidermis to connective tissue [10,11]. *Glauconome chinensis* is deep burrowing species with long, highly mobile siphons and burrows nearly about 20-30 cm below the surface. At the posterior position of specimen, thick siphons are observed known as inhalant siphon (incurrent siphon) and exhalant siphon (excurrent siphon) originate from the mantle cavity which are united to their tips [12]. They can extend the siphon two to three times longer of the shell to reach the substratum. Through the inhalant siphon water enters into the mantle cavity. Then the water transferred into the gills, circulated into the body and finally came out from the body by exhalent siphon [13]. On the margin of the inhalant siphon rows of tentacles are found which are directed inward [14] (Fig-3).

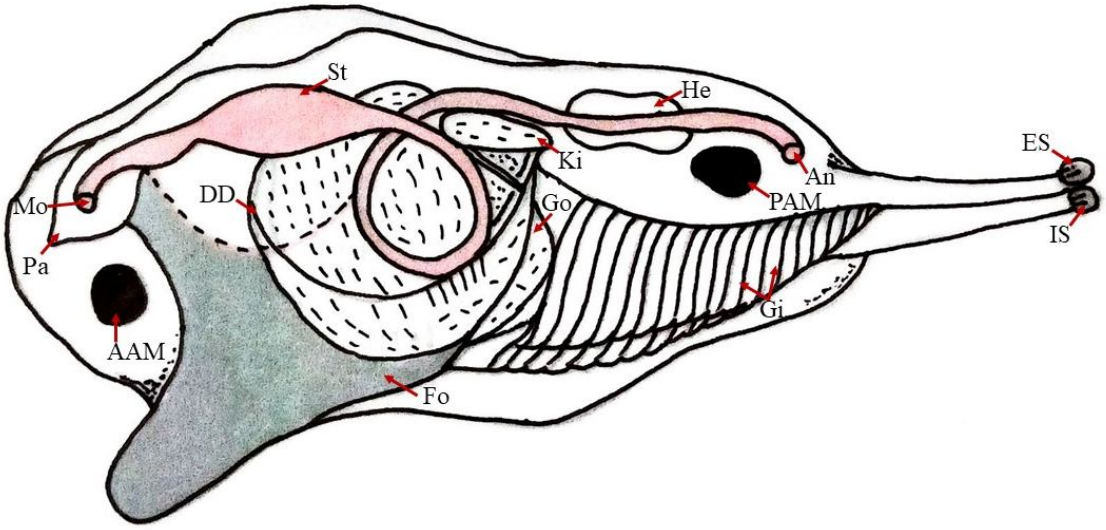


Fig-3: Schematic diagram of a typical of *Glauconome chinenensis*, showing various characteristics on the inner (medial surface). Where, Pa- Palp, Mo- Mouth, St- Stomach, Ki- Kidney, He- Heart, PAM- Posterior adductor muscle, An- Anus, ES- Exhalent siphon, IS- Inhalent siphon, Gi- Gill, Go- Gonad, Fo- Foot, AAM- Anterior adductor muscle, DD- Digestive diverticulum.

In *Glauconome chinensis* one pair of gills present behind the siphon. Gill is formed by outer and inner demibranch lined by two lamellae known as ctenidium. They are large and arranged in a V shape [15]. The lamellae are connected by inter-lamellar junctions which contain blood vessels. Ctenidium contain highly efficient surface for filter feeding [16]. The gill filaments formed a longitudinal array and adjacent filaments those are lined by an epithelium formed of a single row cell, short cuboidal adiphase and tall columner towards the tip and the gill filaments performs the respiratory function [17,18 ]. There have anterior and posterior adductor muscles located underneath the mantle of the body. When the muscles are contract, the valves come to close very tightly. At the low water levels, presence of predators, adductor muscles are contract and the shell valves automatically pulled open when adductor muscles relax [19]. Through the contracting and reluxing process the species can move in water.

During the present investigation it was observed that the bivalve species have a retractable, muscular foot. foot is the locomotory organ chiefly employed for burrowing and is formed of an outer dense epithelium. The muscular wall of the foot surrounds the coelomic phase which itself is lined by coelomic epithelium [20,21]. The outer borders of the epithelium have dense cilia. The digestive gland consists of diverticula and their ducts, which connected to be, an inter diverticula tissue [22]. Digestive gland with four ducts surrounding the stomach. Ducts were pale yellowish in colour have been observed. In sampled specimen gonad is running along the digestive tract [23]. The gonad is composed of many-branched, ciliated ducts from which numerous sacs, termed follicles, open [24]. They are mostly gonochoric or protandric hermaphrodites [25] (Fig-4).

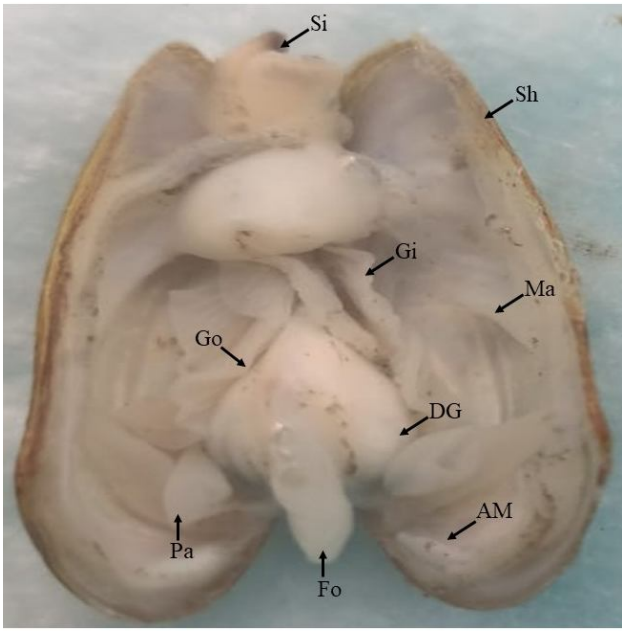


Fig-4: Dissection image of a typical of *Glauconome chinenensis*, showing various characteristics on the inner surface. Where, Pa- Palp, Fo- Foot, AM- Adductor muscle, Go- Gonad, DG- Digestive gland, Ma- Mantel, Gi- Gill, Sh- Shell, Si- Siphon.

## 5. Conclusions

The present study confirms the first record of the intertidal bivalve *Glauconome chinensis* from Talsari of West Bengal-Odisha coast, India. All the experiment proved that in the study area the specimens are well established. In future, more studies on its eco-biology, distribution, population density will help to known its impact on the marine ecosystem and surrounding native species.

**Ethical Approval:**

We again declare that all the guidelines (national, international and institutional) are followed during the present study for sampled specimen treatment. We also obeyed all legislation for sampling and research on marine ecosystem in Talsari, West Bengal-Odisha coast. Any experiment has not been carried out against Ethical clearance for the animal use in scientific research.

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