



### Short Communication

## Spine structure of scaly stingray, *Himantura imbricata* (Bloch & Schneider, 1801)

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### Abstract

The spine structure of the scaly stingray, *Himantura imbricata* was studied by SEM observation. Morphometric and meristic characteristics of the stingray (disc width: 7.3 to 25 cm) were also recorded. The SEM study revealed that two spines (one overlapping the other) have glandular tissues and a sheath. They were highly pigmented and dark brown in color. The middle part of the spine was hard and thick with dermis material. There were 31 to 35 laterally arranged arrow-shaped and serrated spines in the left and right sides respectively. The length and breadth of the spine tip ranged from 86.1 to 395  $\mu\text{m}$  and from 54.1  $\mu\text{m}$  to 331  $\mu\text{m}$ , respectively.

**Keywords:** Stingray, *Himantura imbricata*, spine, SEM observation

### Introduction

Stingrays (Chondrichthyes: Rajiformes) occur in the coastal waters of temperate and tropical regions. They are cartilaginous, bottom-dwelling, free swimming fishes, evolved with a flattened disc-like body. Most noticeably, stingrays have single or many formidable and arrow-shaped serrated spines at the base of the tail. They lash generally only as a defensive measure when caught, stepped on, or otherwise disturbed. Halstead (1970) described that each spine is grooved to help the venom travel to the tip and the sting is enveloped in a sheath including a venom gland at its base. Mullarney (1970) reported that if the wound caused by the sting is not treated immediately, there is characteristic nausea, vomiting, headache, dizziness and respiratory embarrassment. In recent years, many stingray injuries were reported in and around Parangipettai and there is a need to create awareness on handling the stingrays as well as other venomous organisms while fishing.

A perusal of literature revealed that many studies have been carried out on stingrays on various aspects including food and feeding habits and length-weight relationship (Devadoss, 1983,

1998; Raje, 2000, 2003), distribution (Ramaiyan and Sivakumar, 1988; Ishihara *et al.*, 2001; Ravi, 2006), reproduction (Devadoss, 1998) etc. Recently Schwartz (2005) studied the spine of stingray found in the Mediterranean waters. Studies on the spine structure and morphology of stingray have not been conducted in the Indian waters. Considering the paucity of information, an attempt has been made to understand the ultrastructure of the venomous spine of the stingray *Himantura imbricata* caught in Parangipettai waters.

### Material and methods

Parangipettai (11°29'N lat.; 79°46'E long.) is a coastal village situated on the northern bank of Vellar estuary, Tamil Nadu, southeast coast of India. The stingray *H. imbricata* landed by gillnet (*Thirukkai valai*) along with other commercial fishes were used for the present study (Plate 1a, b).

Morphometric and meristic characteristics were measured following the method of Jayaram (2002). Spines of the stingray, *H. imbricata* (disc width: 7.3 – 25 cm; weight: 60 – 375 g) were removed carefully and dehydrated with ethanol and 9 mm of its length was cut without causing any damage and kept in ethanol again. The sample was then

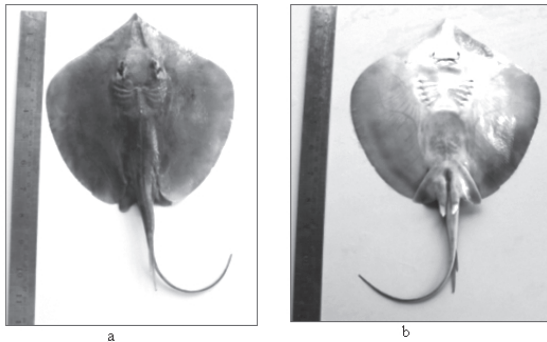


Fig.1. a. The stingray, *H. imbricata* - dorsal view  
b. ventral view

air-dried for a while. Scanning Electron Microscopy (JEOL-SEM-INSA-Eds) observation was made in the Centre for Instrumentation, Annamalai University.

## Results

### *Morphometric and meristic characteristics:*

The morphometric and meristic characteristics of the stingray, *H. imbricata* are presented in Table 1. The spine structure of the stingray through microscopic and SEM observation is given in Fig. 2 a-f. The stingray has characteristically two spines (one overlaps the other) in the tail region. The II spine situated beneath was larger than the overlapped I spine with a distance range of 30 to 60 mm while the length of the spine's barb varied from 55 to 140  $\mu\text{m}$  ( $104.28 \pm 22.32 \mu\text{m}$ ).

**Spine structure:** The venom apparatus of the stingray *H. imbricata* had glandular tissues and a sheath. The microscopic observations revealed that the spines were fixed in the fibrous tissue of the dorsal roof of the tail especially from vasodentine covered with a layer of very hard vitrodentine. During stinging act, the sheath is allegedly presumed to break the venom and mechanically expressed the wound. The sheath is highly pigmented with dark brown materials. There were 31 and 35 small arrow-shaped and serrated spines arranged laterally in both the left and right sides, respectively.

SEM observation revealed that the breadth of the spine tip ranged from 86.1  $\mu\text{m}$  to 395  $\mu\text{m}$ . The

Table 1. The morphometric and meristic characteristics of *H.imbricata* (disc width: 7.3 – 25 cm and weight: 60-375 g); SD refers to Standard Deviation

Characters	Range	Mean	SD
Maximum snout disc width (cm)	4-10	7.51	1.94
Eye width (disc-between the two eyes) (cm)	1.5-3.3	2.64	0.67
Eye diameter (cm)	0.4-0.9	0.73	0.15
Clasper length (cm)	1-4.5	3.65	1.43
Between spiracles (cm)	1.5-3.5	2.75	0.71
Mouth opening (cm)	0.9-3.5	1.96	0.63
Distance between nostrils (cm)	0.8-2.2	1.90	0.57
Snout-tip lower jaw (cm)	2.3-6.5	4.81	1.37
Snout to cloaca (cm)	7.1-19.4	14.5	4.03
Distance between I gill slits (cm)	1.9-5.0	3.83	1.03
Distance between II gill slits (cm)	1.3-4.7	2.44	0.54
Caudal fin length (cm)	7.5-26.0	17.45	5.95
I sting length (cm)	1.7-4.9	3.40	1.45
II sting length (cm)	4-5.5	3.82	1.92
Length of the barb ( $\mu\text{m}$ )	55-140	104.28	22.32

barbs of the spine were enveloped by epithelial tissues and the breadth varied between 54.1  $\mu\text{m}$  and 331  $\mu\text{m}$ . The middle portion of the spine was hard and thick with dermis material.

## Discussion

Stingray often buries in the sandy or muddy bottom and may remain motionless until disturbed. The stingray twists the tail upward and forward, driving the spine into the victim when disturbed. As the sting enters into the flesh the integumentary sheath of the spine is ruptured and the venom escapes into the victim's tissues (Russell, 1965). Many cases of injuries of stingrays have been reported from warmer tropical regions (David *et al.*, 2002; Haddad *et al.*, 2004; Brisset *et al.*, 2006). Russell *et al.* (1958a, b) reported that the venom of the stingray, *Urolophus halleri* is colorless to grayish with a fishy taste and ammonia-like smell.

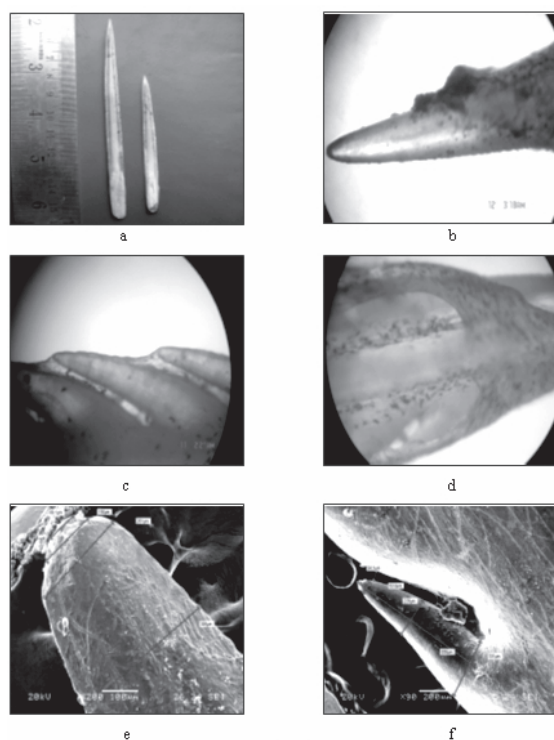


Fig. 2. Spine structure of *H. imbricata*

- a. two spines of the stingray; b. microscopic view of the spine tip of the stingray; c. sheath enveloping the serrated spines; d. sheath enveloping below spine; e. SEM view of the spine tip; f. SEM view of the serrated spine

The venom of the present specimen was similar to that description.

SEM studies reveal that the entire spine is enveloped with epithelial tissues, with distinct brown pigmentation and it is hard and thick. From the above observations, it is evident that the stingray *H. imbricata* has a venomous apparatus which is capable of lacerating and releasing the venom into the victim by breaking open its enveloping sheath. Liu *et al.* (2001) noticed that the venom tissue consists of stratified epithelium in the ventral lateral grooves and the epithelium consists of about 4 layers of cells from the base to the surface. The present study provides baseline information and a detailed study on epidemiology, venom properties and clinical findings is needed.

## Acknowledgements

The authors are grateful to Prof. Dr. T. Balasubramanian, Director, Centre of Advanced Study in Marine Biology, Parangipettai for the support and encouragement and to the authorities of Annamalai University for the facilities.

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Received: 07 October 2008  
Accepted: 28 December 2008