

## New Record of Four Ophiuroids (Brittle Star) from Andaman and Nicobar Islands

<sup>1</sup>Koushik Sadhukhan, <sup>1</sup>C. Raghunathan and <sup>2</sup>K. Venkataraman

<sup>1</sup>Zoological Survey of India, Andaman and Nicobar Regional Centre,  
Port Blair-744102, Andaman and Nicobar Islands, India

<sup>2</sup>Zoological Survey of India, Prani Vigyan Bhavan, Kolkata-700053, India

**Abstract:** Although the Ophiuroids species are well distributed in the Indo-West Pacific Islands, in Andaman and Nicobar Islands, they are not well investigated marine animals. Ophiuroids represent major concentration of benthic biomass and play important role in functioning of their local ecosystem. During an extensive underwater survey in Rani Jhansi Marine National Park of South Andaman from April to December, 2010, four species of Ophiuroids named as *Ophioplectron vitiensis*, *Ophionereis degeneri*, *Ophiophrax savignyi* and *Ophiophrax (Theophrax) pussila*, belonging to the family Ophiotrichidae and Ophionereidae, were reported as new record from Andaman and Nicobar Islands as well as from India. The detail accounts on taxonomic characters and morphological features of these four Ophiuroids are discussed in the present study.

**Key words:** Ophiotrichidae • Ophionereidae • Taxonomic Characters • Ecosystem • Rani Jhansi Marine National Park • Andaman and Nicobar Islands

### INTRODUCTION

Andaman and Nicobar Islands are the richest of the Indian region in marine biodiversity, consisting of 572 islands in the chain. The Islands occupy an area of 8,293 km<sup>2</sup> with a coastline of 1,962 km and account for 30% of the Indian Exclusive Economic Zone [1]. These Islands represent marine biodiversity of 5440 species of which 138 are endemic [2]. Most Ophiuroids species which are found abundantly in shallow warm water have been extensively studied in *insitu* and *exsitu* by biologists of various disciplines like ecology, biotechnology and Systematic aspects [3]. In the world, Ophiuroids represent two thousands species which are traditionally assigned to two orders namely as Euryalida and Ophiurida [4]. At earlier some taxonomic works of Ophiuroids were carried out in Andaman and Nicobar Islands as well as in India [5-8]. Recently, two new reports of brittle star were also added to the checklists of Indian echinoderms [9]. In 2010, Martynov [10] presented numerous taxonomic contradictions caused by “over-applying” of external characters to traditional ophiuroid systematic which have found and analyzed. Among newly applied microstructural characters, the shape of the arm spine articulations is found to be of great importance for ophiuroid taxonomy at all levels, from order to species.

An identification key of the ophiuroid families based exclusively on the shape of the arm spine articulations is presented. In the present study, four Ophiuroids species, named as *Ophioplectron vitiensis*, *Ophionereis degeneri*, *Ophiophrax savignyi* and *Ophiophrax (Theophrax) pussila*, have been reported as new record to Andaman and Nicobar Islands as well as Indian subcontinent. The morphological and taxonomical features of these species have also been described in this study.

### MATERIALS AND METHODS

The survey was conducted in three Islands of Rani Jhansi Marine National Park in Ritchie's Archipelago during 5<sup>th</sup> February' 2010–28<sup>th</sup> April'2011 by using self-contained underwater breathing apparatus (SCUBA) diving. The coordinates of these three islands are as follows:

- John Lawrence Island: Lat: 12°08.853'N Long: 93°00.310'E
- Henry Lawrence Island: Lat: 12°10.005'N Long: 93°01.750'E
- Outram Island: Lat: 12°14'35.22"N Long: 93°04'1.92"E (Fig. 1)



Fig. 1: Study area

Specimens were collected during Scuba diving and transferred the animal into fresh water for killing. The specimens were then carefully lifted and preserved with 95% ethanol, oral side down with arms spread out [11]. In Laboratory we used Leica M205 microscope to examine the specimen characters in detail. Identification of the specimens was done by *ex situ* observation and photographs in conjunction with [12, 13].

## RESULTS

### *Ophiopterion vitiensis* (Koehler, 1927) Fig. 2a-2e

#### Systematic Position:

Class: Ophiuroidea  
Order: Ophiurida  
Family: Ophiotrichidae  
Genus: Ophiopterion

**Morphometric Measurements:** ZSI/ANRC reg. no. 6858 (Sample 1): Disc diameter: 1.139mm; Length of radial shields: 0.487mm (Fig. 2c); Length of arm spines (Mean value): 0.281mm; Length of arm plate: 0.168mm).

**Key Characters:** Arm spines free not webbed together by skin into vertical fans.....Genus: *Ophiopterion*

**Radial Shields Are like Kidney Shaped:** Dorsal arm plates are irregular in shape and possess thorny stumps.

Length of the Oral papillae along with the oral plates vary in size.....*Ophiopterion vitiensis*

**Diagonastic Characters:** The disc appears as a lobe-like structure and disc granules are compactly arranged. The disc is uniformly pink in color (Fig. 2a). Arms relatively short, only about the four times the disc diameter. Spot on arms usually forming a single longitudinal series. Dorsal side of the arm is distinctly arched and arm plates are triangular in shape (Fig. 2e). Ventral side of the disc comprised with a more or less extensive covering of spinelets (Fig. 2b). Six oral papillae on the oral plate form a digitate structure (Fig. 2d). The dorsal surface of the arms is marked with purple either side of the midline which is pink in color. Arm spines are transparent with light blue markings.

**Distribution:** Ceylon area, Philippines, North Australia, East Indies.

**Remarks:** *Ophiopterion vitiensis* is a new record to Indian subcontinent and it is found in Henry Lawrence Island of Ritchie's Archipelago, Andaman and Nicobar Islands. The similar species *Ophiotrix elegans* is distinguished by presence of a slight membrane in the spinules of disc stumps which united to form funnels.

### *Ophionereis degeneri* (A.H. Clark, 1949) Fig. 3a-3f

#### Systematic Position:

Class: Ophiuroidea  
Order: Ophiurida  
Family: Ophionereidae  
Genus: *Ophionereis*

**Morphometric Measurements:** ZSI/ANRC reg. no. 6860 (Sample1); Disc diameter: 7.256mm; Dorsal arm plate: 0.573mm; Ventral arm plate: 0.614; Arm spine: 1.446mm; Length of oral shield: 0.937mm.

**Key Characters:** Arms inserted below the disc; arms spines rarely much shorter than the segment, projecting sideways from the arm; a pair of supplementary dorsal arm plates present on each arm Genus: *Ophionereis*

Ventral arm plates widest distal to the tentacle pores; dorsal arm plates hexagonal and distinctly tapering to their distal ends *Ophionereis degeneri*

**Diagonastic Characters:** Disc is densely granulated with smooth appearance (Fig. 3c). Disc scales and oral shields are naked. Arms somewhat dorso-ventrally compressed in

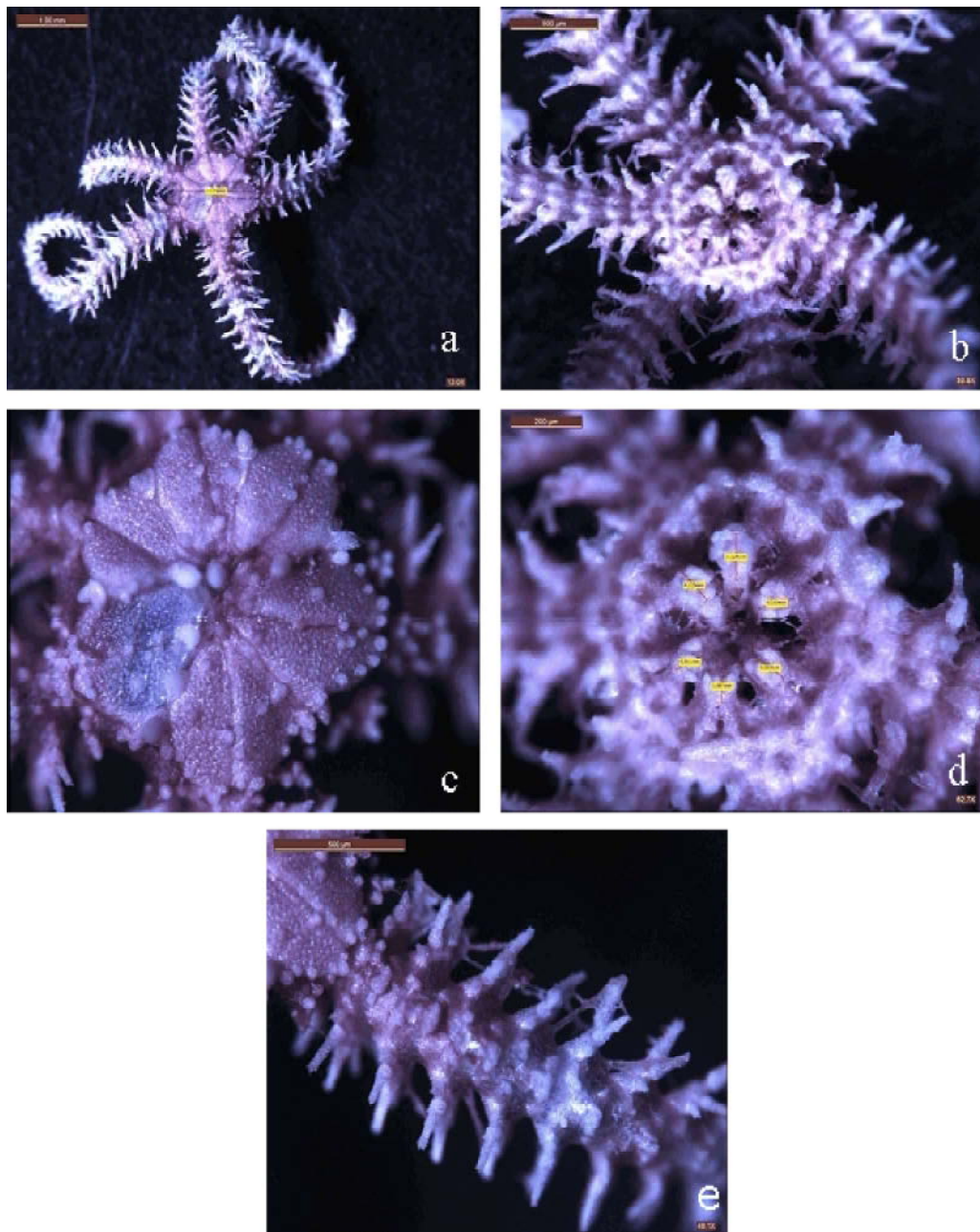


Fig. 2: a. General dorsal view of *Ophioplectron vitiensis*; b. Entire ventral view; c. Showing disc diameter (1.139mm), arrangement of scales and stumps; d. details of oral plates and dental papillae; e. Arms, dorsal view.

appearance due to long, horizontally projecting lateral arm spines. Jaws with small peg shaped dental papillae on ventral apex, larger papillae on lateral edges. Oral shield pentagonal, centrally depressed, with slightly concave on the lateral side, long convex distal edge and corner rounded (Fig. 3d). Dorsal arm plates are rhombic, somewhat convex or keeled, wider than long with convex proximal edges and concave distal edges (Fig. 3e).

Adjacent dorsal plates in contact or nearly so, ventral arm plates markedly reduced in size, barely contiguous. First ventral arm plate in mouth angle with medial slot separating 2 proximally directed points; 2-3 most basal plates centrally depressed, overlapping, longer than wide, centrally depressed (Fig. 3f). The color of the disc is brown with black patches and dorsal arm spines are white with small pale violet color patches.



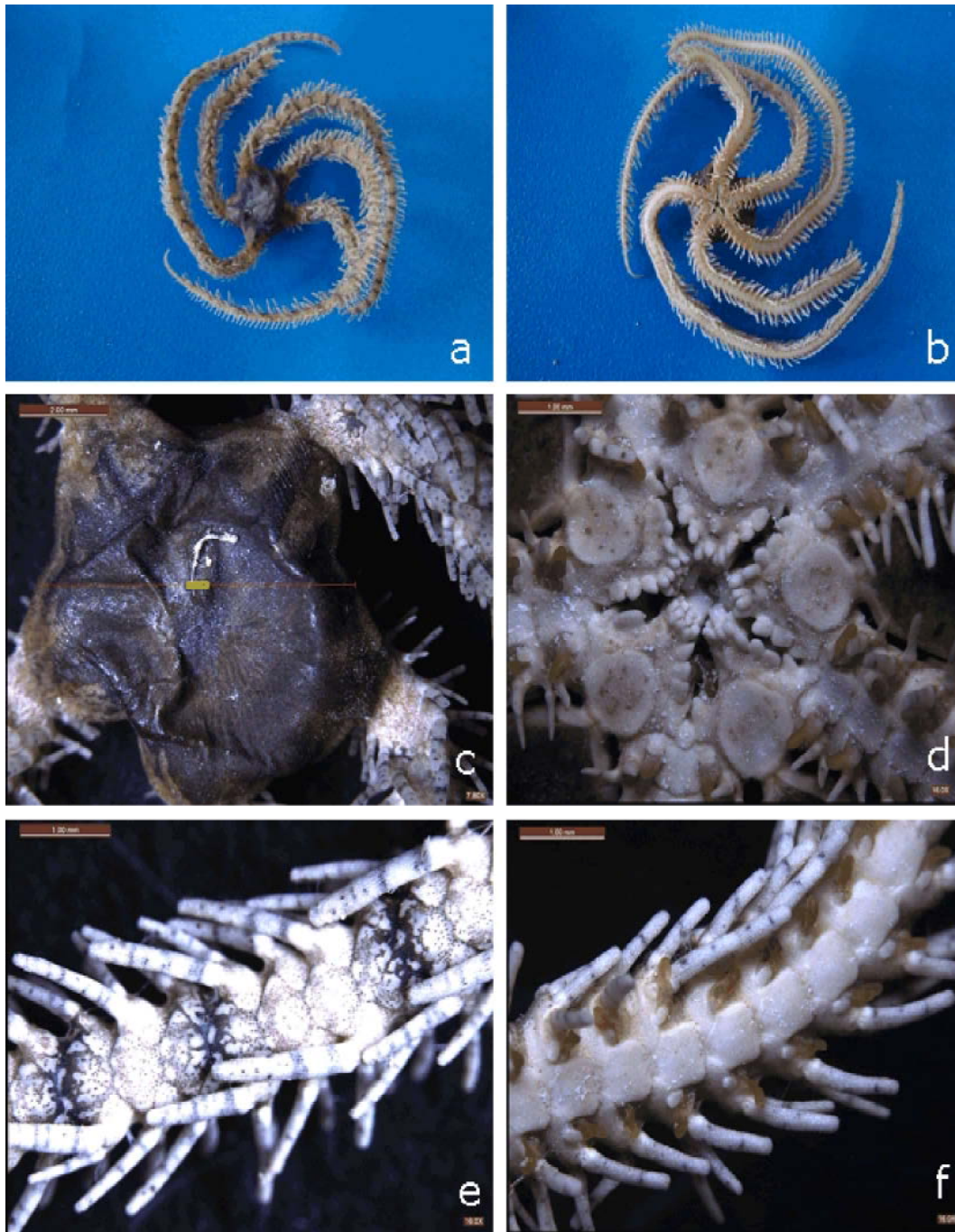


Fig. 3: a. General dorsal view of *Ophionereis degeneri*; b. ventral view. c. Disk and the base of the arms- dorsal view; d. Detail of oral frame, showing structures associated with jaw; e. Dorsal arm plates and arm spines; f. Ventral arm plates and arm spines.

**Distribution:** China and South Japan, East Indies, Ceylon area.

**Remarks:** This species is a new record to India and it is found in John Lawrence Island of

Ritchie's Archipelago, Andaman and Nicobar Islands. *Ophionereis degeneri* mainly inhabits below the crevices, rocks and it comes outside when intertidal area becomes fully exposed at the time of low tide.

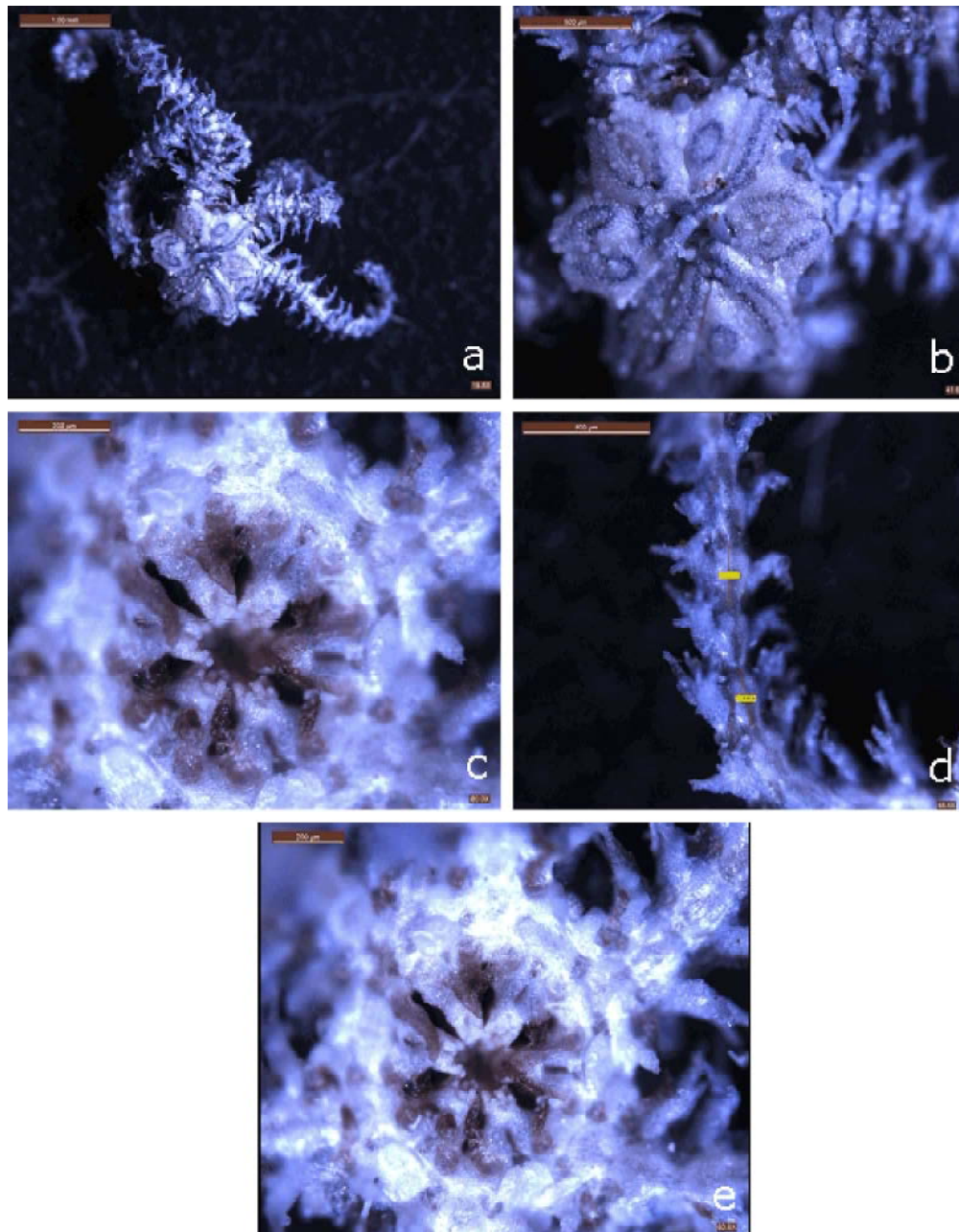


Fig. 4: a. General dorsal view; b. Disk structure with prominent radial shields and stumps; c. Detail of oral plates and dental papillae; d. Dorsal view of arm plates and arm spines; e. Showing the association of arm plates with oral frames.

***Ophiothrix savignyi* (Muller and Troschel, 1842)**

**Fig. 4a-4e**

**Systematic Position:**

Class: Ophiuroidea

Order: Ophiurida

Family: Ophiotrichidae

Genus: *Ophiothrix*

**Morphometric Measurements:** ZSI/ANRC reg. no. 6857 (Sample 4); Disc diameter: 1.231mm; Dorsal arm plate: 0.200mm; Length of radial shield: 0.451mm; Arm spine: 0.347mm; Length of oral plate: 0.042mm.

**Key Characters:** Dorsal arm plate hexagonal, elliptical, trilobed or broad fan shaped, markedly broader than long and broadly contiguous.



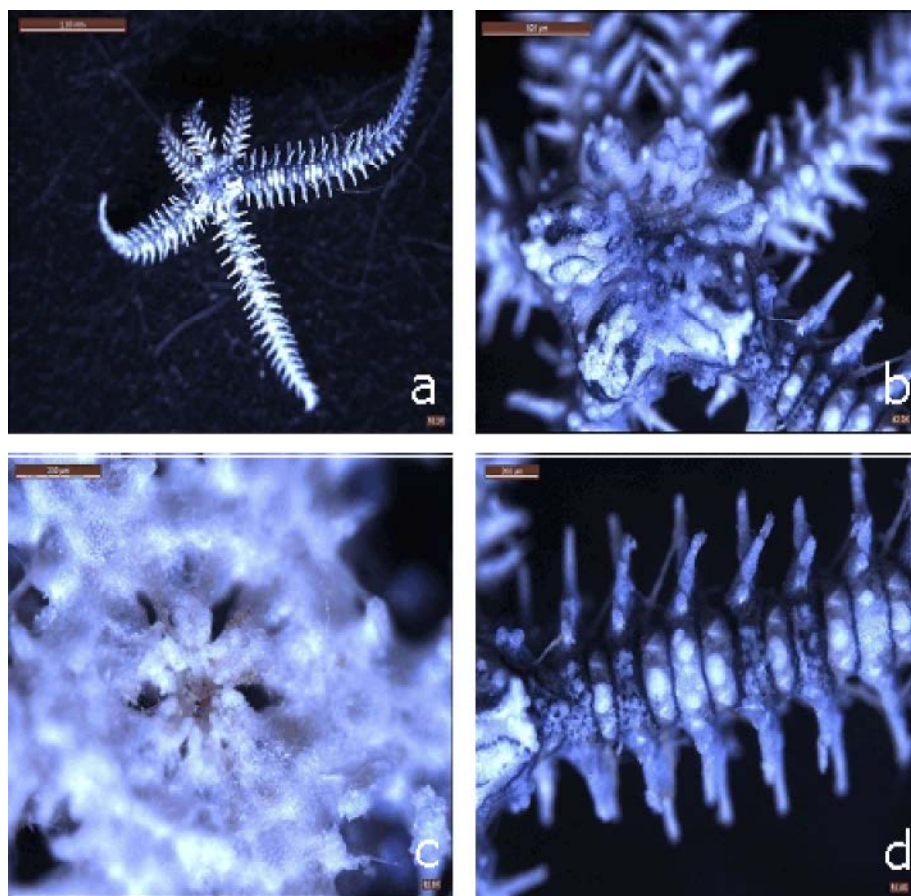


Fig. 5: a. General Dorsal view of *Ophiothrix (Theophrix) pussila*; b. Detail of Disk structure- Disc diameter. (1.055mm); c. Structure of oral frames; d. Detail of dorsal arm plates and arm spines.

Arm spines more or less webbed      *Genus: Ophiothrix*

Radial shields bearing some or many, thorny tipped, usually trifid stumps, often obscuring their limits.

Disc scales usually also obscured by stumps, sometimes intermixed with spines.

Dorsal arm plates armed with fine thorns

*Ophiothrix savignyi*

**Diagnostic Characters:** Disc generally lobe shaped, inflated, dorsal margin sharply demarcated from naked ventral interradius. Scales are small, rounded, tessellate, partially obscured by integument, bearing prominent stumps (Fig. 4b). Jaw with short, peg-shaped dental papillae on ventral apex, larger papillae on lateral edges surrounding inner series of shorter papillae (Fig. 4c). Oral shields are subtriangular and centrally depressed with straight or somewhat concave lateral edges (Fig. 4e). Dorsal arm plates thin, hexagonal, flat in structure, not keeled. Successive plates closely abutting, in contact for about one-third width of the plate (Fig. 4d). In preserved

specimens, disc dark purplish-gray with black patches in color. Arm spines and arm plates are very transparent containing purple colors.

**Distribution:** Mascarene Island, East Africa and Madagascar, Red Sea, South East Arabia, Persian Gulf, West India and Pakistan, Ceylon area, Philippines Island.

**Remarks:** *Ophiothrix savignyi* is first time reported from Andaman and Nicobar Islands. This species is mostly found on soft corals beyond the depth of 5 meters.

***Ophiothrix (Theophrix) pussila* (Lyman, 1874) Fig.5a-5d**

**Morphometric Measurements:** ZSI/ANRC reg. no. - 6859 (Sample -7 no); Disc diameter: 1.055mm; Length of Ventral arm plate: 0.272mm; Length of Oral Papillae: 0.143mm

**Key Characters:** Dorsal arm plates are longitudinally ovate, much longer than wide.

Oral papillae are very short and digitate in structure.

The disc densely covered with short trifid stump.

Radial shields clearly visible on the disc lining

*Ophiothrix (Theophrix) pussila*.

**Diagonastic Characters:** The disc is covered by dense granules which scattered in horizontal and ventral row (Fig. 5b). The radial shields are well exposed, are somewhat tear shaped and twice as long as broad. The shield of each pair has blue marking at the top. The oral shields are pear shaped. The dorsal shields are triangular in shape and are separated either side of the oral shields. The oral plates are square shaped and slightly curved at the proximal end. Oral papillae are fused with oral plates on each side of the jaw. The arms are very small, up to 3.7mm tapering gradually to the tip. The dorsal arm plate's are compactly arranged along with the arms. The size of the arm plates is small at the tip of the arms. The color pattern is distinctive. The disc and arm spines are blue with white patches without any thorny stumps. The periphery of the oral shield is cream in color. The arm spines are blue with edges of the spines paler along their length.

**Distribution:** East Indies, Philippines Islands.

**Remarks:** This species is first time reported from Outram Island of Ritchie's Archipelago, Andaman and Nicobar Islands as well as from India. This species is mainly found beyond 5m depth. It mainly inhabits on soft corals named as Gorgonoids. The similar species *Ophiothrix ciliaris* is distinguished by their dorsal arm plate armed with multiple thorns along the distal edge.

## DISCUSSION

Ophiuroids are the significant contributors to species diversity, abundance and biomass of the fauna in many benthic communities of the world oceans (14 and 15). The detail description of the four Ophiuroids species belonging to the family Ophiotrichidae (3 species) and Ophionereidae (1 species) have the significant documentation for the taxonomic study of Indian echinoderms. The synonymous species of *Ophiothrix savignyi* is *Ophiothrix purpureae*, described by Clark [12], which distinguished by the estimation for the degree of attenuation of the arms. In *Ophiothrix purpureae*, the arm segments are wider than *Ophiothrix savignyi*. Doderlein [16] differentiate *Ophiothrix vitrea* with *Ophiothrix pussila*, but its arm spines are much longer, up

to four times the corresponding segment length as opposed to less than twice the segment length in *pussila*, where the shape of the elongated dorsal arm plates is ovate and the trifid stumps have short rather than long points. In *Ophiothrix vitrea*, the distal edge is convex and much wider than the proximal; they are probably elongate fan- shaped. The genus *Ophioplectron* represents two species [17] among which *Ophioplectron elegans* differs from *Ophioplectron vitiens* by disc stumps with a slight development of a membrane. In Andaman and Nicobar Islands, Ophiuroids represent 103 species which belongs to 2 orders, 13 families and 44 genera [18]. Recently Sadhukhan and Raghunathan [9] also included two species (*Ophiothela venusta* and *Dougaloplus echinatus*) of brittle star in the checklist of Indian echinoderms as an indicator of increasing Ophiuroids database. Ophiuroids can be found at a wide depth as well as temperature range [19]. Therefore we can expect many tropical species to occur in Andaman and Nicobar Islands. In a marine ecosystem, Ophiuroids play an important ecological role by feeding on mucus and floating microorganisms which helps to clean the water and reducing silt load on corals [20]. Among the various inhabitants of the coral reef ecosystems of Andaman and Nicobar Islands, echinoderms are conspicuous by their size abundance and role in the ecosystem altogether 224 species of echinoderms [21]. Recent studies also revealed that various environmental factors affect the diversity of marine animals in tropical islands ecosystem [22]. The investigation of these Ophiuroids will be helpful for the conservation and management action plan for the biodiversity of marine organisms in Andaman and Nicobar Islands.

## CONCLUSION

Findings of new report of brittle star from Andaman and Nicobar Islands as well as from India indicate that more studies can be brought out some new reports and new findings of brittle star from this region. We strongly stressed the need for the detailed taxonomic studies on Ophiuroids at Rani Jhansi Marine National Park, aiming to provide a precise taxonomic inventory of the echinoderm fauna within marine protected area.

## ACKNOWLEDGEMENTS

The authors express their gratitude to the Director, Zoological Survey of India for facilities and Ministry of Environment and Forests, Govt. of India for providing financial support.

## REFERENCES

1. Jeyabaskaran, R., 1999. Report on rapid assessment of coral reefs of Andaman and Nicobar Islands. GOI/UNDP/GEF Project on management of coral reef ecosystem of Andaman and Nicobar Islands. Published by Zoological Survey of India, Port Blair, pp: 110.
2. Sreeraj, C., C. Sivaperuman and C. Raghunathan, 2012. Report on ten newly recorded opisthobranchs (Opisthobranchia: Gastropoda) from Andaman and Nicobar Islands, India. Int. J. Oceanogr. Marine Ecol. Sys., 1(2): 50-59.
3. Hendler, H., 2005. Two new brittle star species of the genus *ophiothrix* (Echinodermata: Ophiuroidea: Ophiotrichidae) from coral reefs in the Southern Caribbean Sea, with Notes on Their Biology. Caribbean Journal of Science, 41(3): 583-599.
4. Kuranlu, N., T. Valinassab, S. Jamili and S.R.M. Fatemi, 2010. Diversity of ophiuroidea from Lenghe Port and Qeshm Island in the Persian Gulf. Journal of Fish and Aquatic Science, 5(1): 42-48.
5. Bell, F.J., 1887. Report on a collection of echinoderms from the Andaman Islands. Proceedings of Zoological Society of London, 1887: 139-145.
6. Koehler, R., 1898. *Echinoderms recueillis* part 1'Investigateur dans l'Océan Indien. Les *Ophiures Littorales*. Bull. Scient. Fr. Belg., 2(31): 55-125.
7. Doderlein, L., 1927. Indopacifische Euryalae. Abhandlungen Bayerische Akademie Der. Wissenschaften, 31: 1-105.
8. Clark, A.M., 1953b. A revision of the genus *Ophioneis*. Proceedings of Zoological Society, London, 123: 65-94.
9. Sadhukhan, K. and C. Raghunathan, 2011. First Report of Two Brittle Star *Ophiethela venusta* (Family: Ophiotrichidae) and *Dougaloplus echinatus* (Family: Amphipruridae) from Andaman and Nicobar Islands, India. World Journal of Zoology, 6(4): 334-338.
10. Martynov, A., 2010. Reassessment of the classification of the Ophiuroidea (Echinodermata), based on morphological characters. I. General character evaluation and delineation of the families Ophiomyxidae and Ophiacanthidae. Zootaxa, 2697: 1-154.
11. Alfred, J.R.B. and Ramakrishna, 2004. Collection, preservation and identification of animals (Book). Rec. Zool. Surv. India, pp: 1-130.
12. Clark, A.M. and F.W.E. Rowe, 1971. Mangrove of Shallow water Indo-West Pacific echinoderms. British Museum (Natural History), London, pp: 238.
13. Clark, A.M., 1968. Notes on some tropical Indo-Pacific Ophiotrichids and Ophiidermatids (Ophiuroidea). Bulletin of the British Museum Association, 16: 275-322.
14. Gerdes, D., M. Klages, W.E. Arntz, R.L. Herman, J. Galéron and S. Hain, 1992. Quantitative investigations on macrobenthos communities of the southeastern Weddell Sea shelf based on multibox corer samples. Polar Biol., 12: 291-301.
15. Dahm, C. and T. Brey, 1996. Ökologie und Populationsdynamik antarktischer Ophiuroiden (Echinodermata). Ber. Polarforsch., 194: 1-289.
16. Döderlein, L., 1896. Bericht über die von Herrn Professor Semon bei Amboina und Thursday Island gesammelten Ophiuroidea. Denkschriften medizinisch-naturwissenschaftliche Gesellschaft Jena, 8: 279-300.
17. Mortensen, T., 1932. On an extraordinary ophiurid *Ophiocanops fugiens* Koehler: with remarks on *Astrogym*, notes *Ophiopetron* and on albino *Ophiocoma*. Vidensk. Meddr dansk naturh. Foren, 93: 1-21.
18. Sastry, D.R.K., 2005. Echinodermata of Andaman and Nicobar Islands, Bay of Bengal: An annotated list. Records of Zoological Survey of India, 233: 127.
19. Brey, T., C. Dham, M. Gorny, M. Klages, M. Stiller and W.E. Arntz, 1996. Do Antarctic benthic invertebrates show an extended level of eurybathy? Antarctic Sci., 8: 3-6.
20. Sastry, D.R.K., 2002. Echinodermata associated with coral reefs of Andaman and Nicobar Islands. Rec. Zool. Surv. India, 100(Part3-4): 21-60.
21. Karupaiyan, M. and K. Raja, 2007. New Records of Two Asteroids *Calliaster children* Gray, 1840 and *Pentaceraster horridus* (Gray, 1840) from the Bay of Bengal. International Journal of Zoological Research, 3(4): 227-230.
22. Valavi, H., A. Savari, A. Yavari, P. Kochanian, A. Safaheih and A. Sedighi, 2010. Coral Reefs anthropogenic impact bio-indicators in the northern part of the Persian Gulf. J. Fish. Aquat. Sci., 5: 70-81.