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Abundance of the Boring Polychaetes of Eunicidae (Annelida) in Great Nicobar Islands

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ABSTRACT
Bioerosion is a major destructive force by mechanisms of grazing and boring organisms harmful on coral reef. The name of crypto fauna is associated with colonies of dead coral due to their role as bioeroding that alter the physical structure of reefs. Analysis of the cryptic polychaetes, totally 874 individuals were collected belonging to eight families among these families Eunicidae (14 species) is the best represented families, varied from 6 to 14 species in all the stations, where as the least number of species and numbers were collected in Johinder nagar (16.66 %) and maximum abundant in Bcori (52.56 %). The mean density of all the three stations varied from 8.785 ± 9.175 (Bcori), 5.142 ± 5.545 (Breakwater) and 2.785 ± 4.370 Johinder nagar. During this survey most abundant species *Lydice collaris* (30.34 %) followed by *Eunice afra punctata* (16.66%), *L.ninetta* (10.68%) and *E. antennata* (10.25 %) in all the three stations. They accounted for up to 50 % of the total number of individuals collected on dead corals and hard substrates. This study to evaluate the knowledge of the coral inhabiting polychaete distribution and to assist forthcoming researchers to know the particular groups taxonomy and towards better understanding utilization, in coral patches of the Nicobar areas.

***Key Words*:** Borer, Dead coral, Polychaetes, Nicobar Island, Crypto fauna, Eunicidae

Introduction

Term of bioerosion is various activates of organisms resulting in the removal of lithic of $CaCo_3$ from coral coined (Neumann 1966). Which leads to bioeroders, are broadly classified into two different groups viz external and internal bioeroders (Glynn 1997), based on the mode of boring they can classify chemical borers and mechanical borers (Hutchings 1986). This community of organisms, associated with the reef's calcareous skeleton, inhabits cracks and holes and is classified into borers and opportunists, using spaces available in coral rock is made up mainly by a large number of invertebrates (Klumpp *et al.* 1988). Borers make cavities in the calcareous layer thus increasing the surface for colonization by availability of organisms such as sponges, bivalves, crustaceans, sipunculans and polychaete (Hutchings 1974; 1992).Present day coral reefs are affecting in to serious threats by a various manmade and natural causes (Rajasuriya *et al.* 2002). The Cryptofauna refers to the living in coral substrates and certain fauna living on the surface of the substrates (Peyrot 1974).The organisms associated with dead corals were more and abundant than those with live corals, both live and dead coral are subject to biological destruction of boring, although different suites of organisms are responsible (Ebbs 1966, Reish 1968, McCloskey 1970, Kohn and Lloyd 1973, Hutchings *et al.* 1992). Most of earlier findings are reported concerning the polychaete bioerosion (Hutchings 1974; 1983, Hutching and Murray 1982, Hutching 1986) it has been dominant among the non- colonial cryptic groups and there are often the initial settlers of dead coral substrates. It making short to long, straight to sinuous bore holes into the coral substrate and all the cryptic polychaetes are not boring, some of the bored polychaetes are clearly illustrates the boring patterns of the coral reef (Bromley 1978). The figure highly branched network made by eunicides to have two size groups of tunnels with more than one opening to the outside. Naveen 2004 has agreed with description and he suggested that the two opening could probably be an escape mechanism.

Aim of this study considers only dead coral substrate, which constitutes on the particular groups has abundant in dead coral and rocky substrata. Earlier studies have demonstrate the rate of bioerosion in dead coral substrate can be used as a monitoring tool to determine the ‘‘health’’ of a reef (Holmes *et al.* 2000). The distribution of boring eunicids and determine the species availability and understand the colonization to evaluate the increasing of dead coral patches of the three different shores of the Nicobar Island.

Materials and methods

Description of the study areas

Campbell bay is the gate way of the Great Nicobar Island, as the boat jetty is situated here. The Bcori (S1) (6º 41’ N 93º 56’5 E) is situated on the coast of the southern side of Campbell bay and the opposite side of the Bcori dead coral patches are found between the jetty and break waters(S2) (6º 59’N 93º 56’E).The Johinder nager(S3) (6º 59’ N, 93º 55’ E) is located in 7 km away from Cambell bay, during the low tide level all the three station having well exposed dead coral patches and rocks, the open coasts of the Great Nicobar Islands are mostly bordered with coastal vegetation consisting of trees. The northern half of the Great Nicobar Island is dominated by mountain ranges and hills, while the southern side is flat and stretches of land dominate the coastal regions.

Field methods

The polychaete samples were took place from the intertidal region of well exposed coral patches of three different sites (Figure 1) during June 2010. Polychaetes associated with dead corals were collected by breaking them with a hammer and chisel, the collected material was washed in seawater and immersed in isotonic $MgCl^2$ solution to relax and prevent contortion of the specimens, before fixation, these polychaetes were dropped suddenly into strong alcohol for dissecting their pharynx, as features of the pharynx are essential for identification of this families. They were fixed in 10% formalin diluted with seawater and later transferred to 70% ethanol, for taxonomic purpose, it is necessary to dissect out the proboscis to examine the jaws and other structures of the parapodia of the polychaete under a microscope. The features of the polychaetes studied were drawn with a prism type camera Lucida and the measurements were taken using a micro-occulometer.

Results

During the present study total of 234 individuals were collected, belonging to the 14 genera of the family eunicidae, Among the 14 species maximum number of individuals were collected in Bcori, compare to the Breakwater area and Johinder nagar. The total numbers of species were varied between 8 to 14.Where as the least number was recorded in Johinder nagar (16.66 %) and maximum abundant in Bcori rocky shore (52.56 %), The mean density of all the three station varied from 8.785 ± 9.175 (Bcori), 5.142 ± 5.545 (Breakwater) and 2.785 ± 4.370 Johinder nagar. Respectively the most abundant species *L. collaris* (30.34 %) followed by *E. afra punctata* (16.66%), *L. ninetta* (10.68%) and *E. antennata* (10.25 %) in all the three stations.Fig.2.

Taxonomical account of the most abundant species

Eunice (Palola) siciliensis Grube 1840

Eunice siciliensis Grube 1840 : 83; Fauvel 1923: 405, fig.159 e-m; Gravier 1900 : 261, pl.13 figs. 78-49, text figs. 130-133.

Eunice (Palola) siciliensis Day 1967: 382, fig. 17.2, a-f; Soota *&* Rao *1977 : 203, 1981 : 78;* Soota *et al. 1981: 97*

Material examined: 18 specimens collected from St. I (11), St II (5) and St.III (2).

Diagnosis: Body cylindrical flattened posterior region, prostomium is notched. parapodia without branchiae, it present on 60th segment usually simple filaments. Dorsal cirri are long, smooth, anteriorly slender, gradually diminish in size posteriorly (Figure 3.b and c), simple capillary setae and compound falciger (Figure 3.d and e).

Distribution: Tropical Indo-west Pacific and Atlantic Oceans, Meditrranean Sea India: Andaman and Nicobar Islands, Gulf of Mannar, Lakshadweep and Gujarat.

Eunice antennata Savigny 1820.

Leodice antennata Savigny 1820 :50.

Eunice antennate Crossland 1904: 312 ; Gravely 1927:17; Fauvel 1953 :138; 1953: 240; Day 1967: 384, fig.17.2.k-q; Parulekar 1971 : 743; Soota and Rao 1977 : 204; Misra and Chakraborty 1991 : 148.

Material examined**:** 24 specimens st. I (12) st.II (7) and st.III (5).

Diagnosis: Prostomium bilobed, prostomial tentacles five tentacular cirri found in the second apodus segments, dorsal and anal cirri are monili form. The first apodous segment is three and a half times long in the second apodous segment (Figure 4.a).Setae arranged in two bundles, bundle of simple capillaries at the base of the dorsal cirrus (Figure 4.b). Branchiae first start on 6th segment well developed between 10 and 25 segments, 6 or 7 filaments to decrease 2 or 3 in median region; in posterior segments the filaments will increase (Figure 4.c). The anal segment bears two long anal cirri; acicular setae present in 19th segment; yellow in color, tridentate and distally hooded (Figure 4.e), some of the setae slender and capillary (Figure 4.f), falcigers, bidentate compound with rounded hood (Figure 4.d), pectinate setae are laterally, asymmetrical extensions.

Distribution: Red Sea, Persian Gulf, Indian Ocean, Philippine Island, Pacific Ocean, Indo-China, Ceylon. India: Lakshadweep, Gulf of Mannar, Andaman and Nicobar Islands and Maharashtra Coast.

Eunice indica (Kinberg 1865)

Eunice indica Kinberg 1865: 562: Crossland 1904: 318, pl. 21 figs. 9-12: Fauvel 1953: 241, fig. 119 g; Day 1967: 386, 17.3.f-j.

Material examined: 8 specimens collected from St. I (5) and II (3).

Diagnosis: Body 20- 24 mm long, peristomium is dark red, it continues on the median anterior border of each segment from the third, prostomium in slightly notched. Antennae are smooth, branchiae are present from setigerous segment 3 to 23 (Figure 5.a). It terminates on behind the posterior end, less than 55% of total number of setigers present. First branchiae single filament and other branch are pectinate; maximum 8 filaments. Sub acicular setae are yellow, distally tridentate (Figure 5.b), and transverse series parapodium. Compound setae distally bidentate covered by a pointed hood (Figure 5.c).

Eunice afra punctata (Peters 1854)

Eunice punctata Peters 1854:611.

Eunice afra var. *punctata* : Day 1957 : 89; 1967: 393; Soota and Rao 1977 : 204; Soota *et al.* 1980: 59; Misra and Chakraborty 1991 : 150.

Material examined: 39 specimens collected St. I (19) st. II (11) and st.III (9).

Diagnosis: Body 130-140 mm 181 segments long, brown, dotted with tiny white punctations only over the anterior portion. Prostomial antennae are smooth and peristomial cirri long (Figure 6.a). Branchiae present 16, with 2-4 filaments (Figure 6.b); they are pectinately divided maximum of 8 filaments at 30th setiger; the last 10 segments lack of them (Figure 6.c). Two acicula each of the first 28 to 30th parapodia and only one in other parapodia, acicular hooks are present in 30th segment; they are distally bidentate and subdistal tooth directed laterally. Other setae are of three kinds: slender capillary (Figure 6.d), pectinate (Figure 6.f), and bidentate compound falcigers in which the hood is distally rounded (Figure 6.e).

Distribution: South Africa. India: Lakshadweep, Gulf of Mannar and Andaman and Nicobar Islands

Marphysa corallina Kinberg 1865

Nauphanata corallina Kinberg 1865: 564.

Marphysa corallinaa: Hartman 1948: 81, pl.11 fig 4-7: Day 1954:19; 1967: 400, fig.17.7.a-e; Soota and Rao 1977: 333; Misra and Chakraborty 1991: 151.

Material examined**:** 11 specimens collected from st.I (3),st.II (4) and st.III (4).

Diagnosis: Anterior part rounded and the posterior part flattened, prostomium bilobed, long antennae smooth (Figure 6.a). Gills start from 20th – 50 th foot deponding on the size, maximum of six filaments and start to the posterior end filaments number are reduced (Figure 6.b). Comb setae 20-25 teeth, neurosetae compound falciger (Figure 6.d) Acicula dark with pale blunt tips, acicular setae pale and bidentate with small guards (Figure 6.c).

Distribution: Indian and Atlantic Oceans, Mediterranean and Red Sea, Australia, New Caledonia. India: Andaman & Nicobar Islands, Visakhapatnam, Pondichery, Gulf of Mannar, Pamban, Tuticorin, Travancore, Daman, Marmagoa Bay, Gujarat, Cochin estuary. Lakshadweep and Gopalpur (Orissa).

Lysidice collaris Grube 1870

Lysidice collaris Grube 1870 : 495; Gravier 1900: 272, pl. 14 figs. 93-95, text –figs. 144-147.; Day 1967: 402- 403, fig.17.8.a-f; Fauvel 1953 : 248; fig.124 a-g; Soota and Rao 1977 : 205; Rao and Soota 1981 : 78.

Material examined: 71 specimens collected St.I(35), st.II(21), and st.III (15).

Description: Prostomium distinctly bilobed and pair of reniform eyes located near the outer base of the paired antennae , Three prostomial antennae slender, heavy teeth are present in second dental plate. In anterior segments the dorsal cirri are slenderer than ventral ones (Figure 7.a). In posterior segments the dorsal cirri become shorter, include capillary setae (Figure 7.c), bidentate composite falcigers (Figure 7.d), comb setae (Figure 7.e) bidentate subacicular hooks are first present at 21^{th} setiger (Figure 7.b) posteriorly continued.

Distribution: Indian Ocean, Pacific Ocean, Persian Gulf, Red Sea. India**:** Andaman and Nicobar Islands, Kilakarai, Pamban, Gujarat coast and Gulf of Mannar.

Lysidice ninetta **(**Audouin and Milne Edwards 1833)

Lysidice ninetta Audouin and Milne Edwards 1833 : 235; Fauvel 1923 : 411, fig. 162 a-f; Day 1967: 403, fig.17.8.g-I, Misra and Chakraborty 1991 : 150.

Material examined**:** 25 specimens collected from St. I (14), St.II (9) and St.III(2).

Description: Body 75 – 100 mm long, reddish with white spots and white bar on setiger 2 and 5 (Figure 8.a). Prostomial antennae are short, three in number, peristomial appendages and gills absent. Parapodia bluntly, conical dorsal cirrus, rounded ventral cirrus are broad setigerous lobe (Figure 8.b).Setae capillaries, pectinate, composite falcigers and bidentate acicular hooks (Figure 8.c). Acicula black with blunt tips.Bidentate subacicular hooks from setiger 22-25 onwards.

Distribution: Red Sea, Indo- West Pacific, North Atlantic, North Carolina, Mediterranean Sea, Angola. India: Lakshadweep, Kilakarai, Pamban and Andaman and Nicobar Isalnds.

Remarks: Every specimen agrees well with the earlier descriptions.

Discussion

The major groups of boring polychaete of eunicdae inhabiting the dead coral substrata across different dead coral patches of the Nicobar Island have been quantified. Polychaeates are really the most important boring animals in coral rocks (Ebbs 1966). Among the polychaetes observed, eunicids are best represented family and similar observations have also been reported from Lakshadweep by Misra and Chakraborty (1991) and Andaman and Nicobar lsands 26 species (Soota *et al*, 1980) 17 species of (Rajasekaran 2004). The most important coral degrading polychaete belongs to the family is Eunicidae (Hartman, 1954). Hartman 1954 has studied the cryptic polychaetes in the corals the eunicidae and syllidae is the dominant fauna, and made a number of valuable suggestions on the roles of these polychaetes in the destruction of coral, characterized by the possession of unique proboscidial armature consisting of a ventral pair of medially fused mandibles, and a dorsal series of maxillae of varying complexity.

Boring is effected chiefly by the abrasion action of hard pharyngeal structures, such as those possessed by eunicids (Ebbs, 1966). The importance of the boring activity of polychaetes was

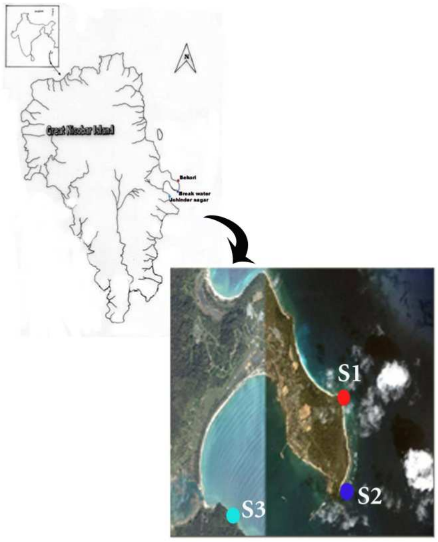


Figure 1.The map showing location of the sampling site

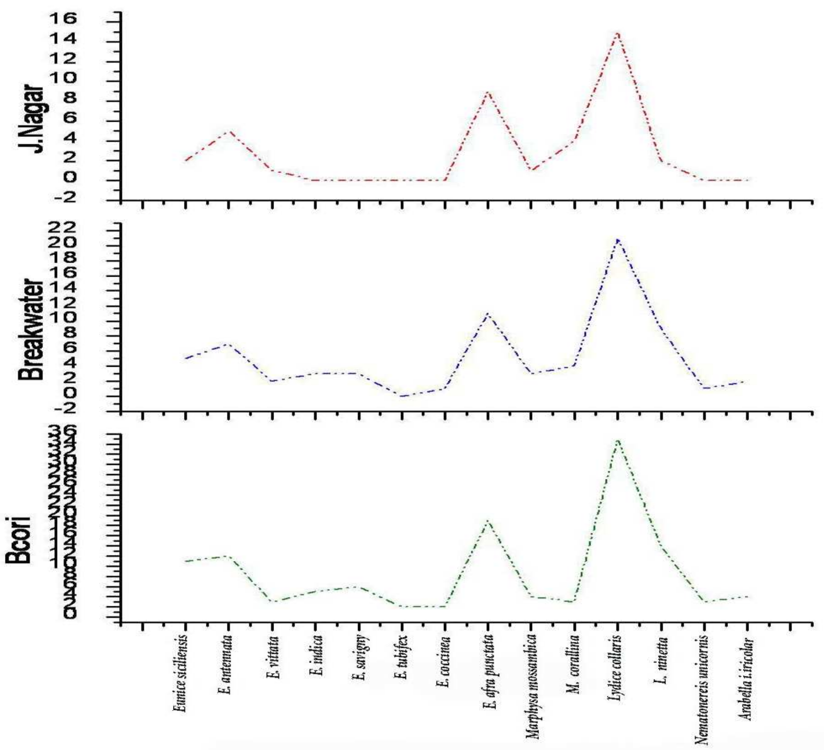


Figure.2. Showing list of polychaete species

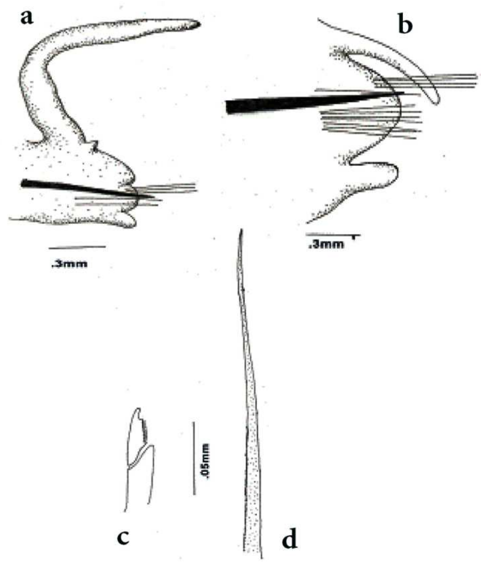


Figure.3. *Eunice (Palola) siciliensis* a) Anterior end b) Anterior foot c) Middle foot d) Simple capillary e) Hetergomph falciger

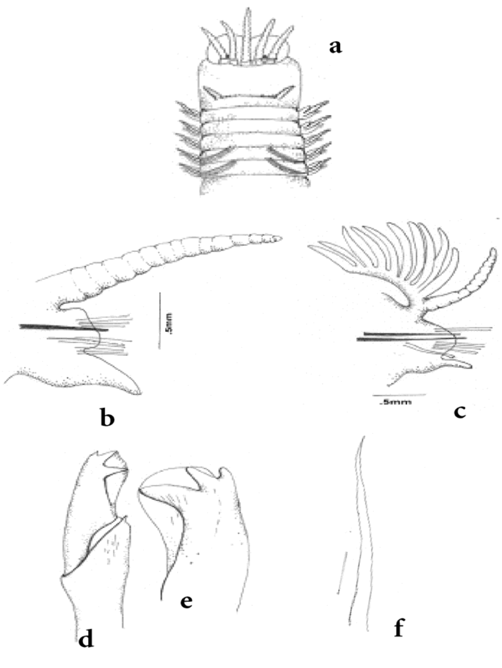


Figure.4. *Eunice antennata* a) Anterior end b) Anterior foot c) Posterior foot d) Falciger e) seta f) Simple capillary

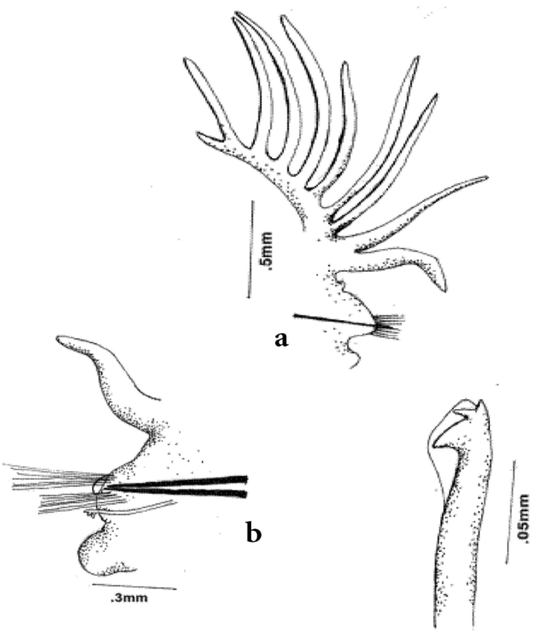


Figure 5. *Eunice indica* a) Anterior foot b) Posterior foot c) acicular seta

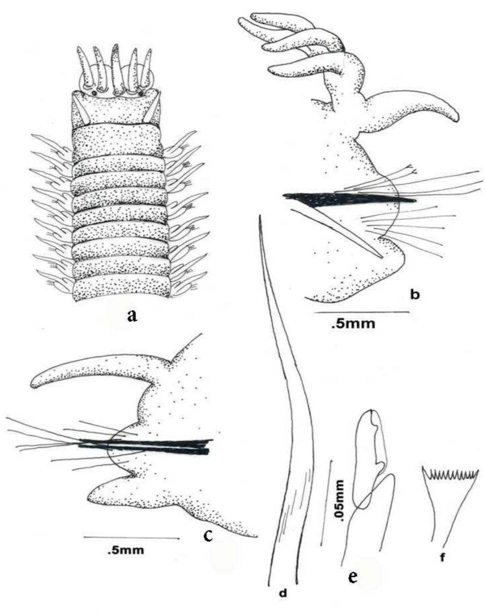


Figure 6. *Eunice afra punctata* a) Anterior end b) Anterior foot c) Posterior foot d) Simple seta e) Heterogomph falciger f) Comb seta

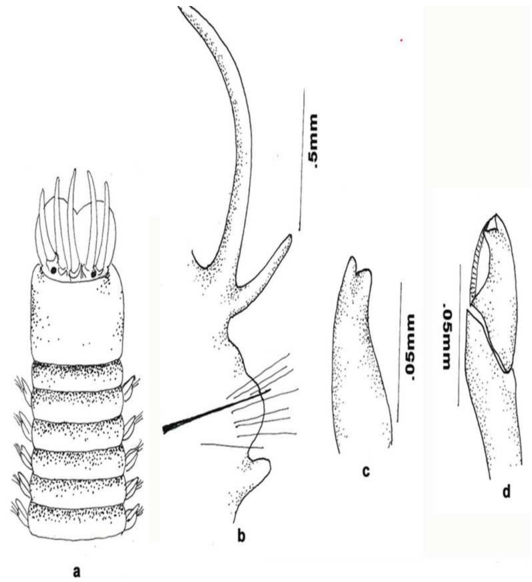


Figure 7. *Marphysa corallina* a) Anterior end b) Posterior foot c) Acicular seta d) Compound falciger .

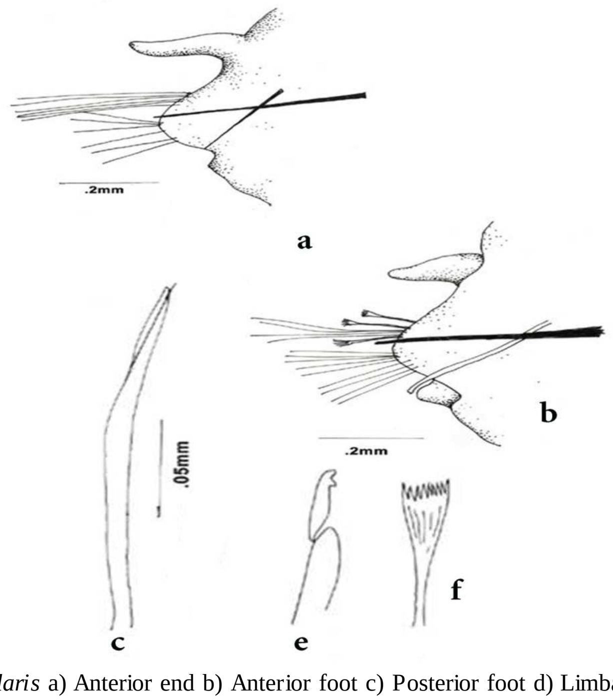


Figure 8. *Lysidice collaris* a) Anterior end b) Anterior foot c) Posterior foot d) Limbate capillary e) Falciger f) Comb setae.

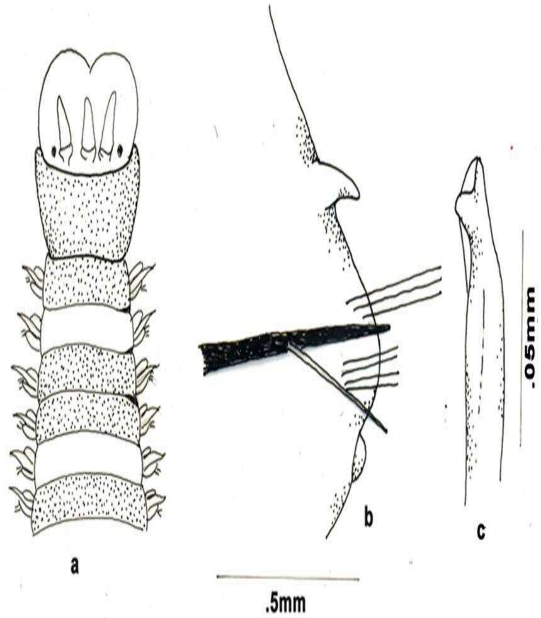
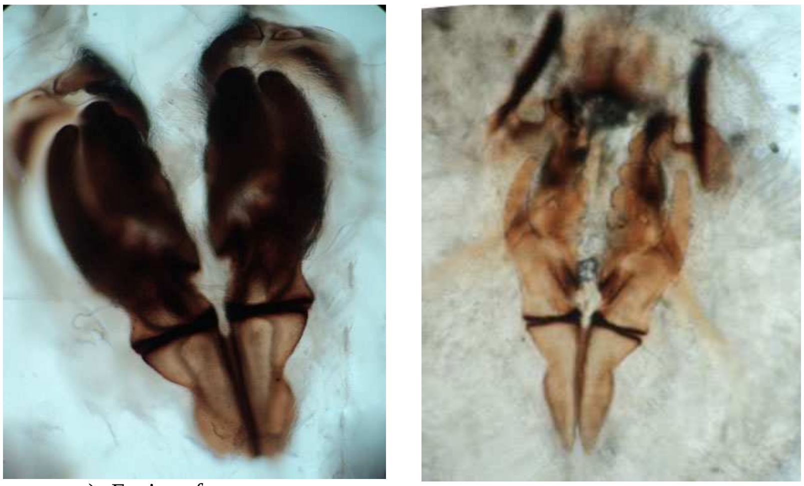


Figure 9. *Lysidice ninetta* a) Anterior end b) Middle foot c) Acicular seta

Species	Boring Habitat	Number of Individuals		
		Bcori	B.water	J.Nagar
Eunice siciliensis	DC and BR	11	5	2
E. antennata	"	12	7	5
E. vittata	DC	3	2	1
E. indica	"	5	3	0
E. savigny	DC and BR	6	3	0
E. tubifex	"	2	0	0
E. coccinea	"	2	1	0
E. afra punctata	"	19	11	9
Marphysa mossambica	SS and LR	4	3	1
M. corallina	DC and BR	3	4	4
Lydice collaris	"	35	21	15
L. ninetta	DC	14	9	2
Nematonereis unicornis	DC and Sw	3	1	0
Arabella irricolor iricolar	DC	4	2	0



a) *Eunice afra punctata* b) *Lysidice collaris*

Figure 10. Dissected jaws of some Eunicidae species

recognized by Hutching (1986). Peyrot 1974 has described eunicidae is the best represented family (16 species) for coral cryptic. In this family *Eunice afra punctata, Lydice collaris, E.antennata* and *E.siciliensis* were dominant cryptic polychaetes in the precise family of eunicidae in Great reef of Tulear. Present investigation those species were the dominant species in Bcori and Breakwater areas.

Most of the coral destroyed polychaetes observed from the dead coral basis (Hutching 1986). In the cryptic dead coral surfaces are known to occupy by a variety of organisms (Abele and Patton 1976) and these substrates diversity is high and considering the numbers and variety of defensive mechanism employed by corals, (Lang and Chornesky 1990). According to Davies and Hutchings 1983) the detailed environment the boring polychaetes is high in nature and most of the endolithic borers bore into the coral reef and some of the eunicids the mandible to excavate (Haigler 1969).

Ebbs 1966 are suggested the eunicids with the help of their powerful mandibles bore the substrate for food digesting the substrate removed by their jaws. This certainly could explain the presence of the paste like deposits found inside the galleries and the bling endings of tunnels. The results suggest that the sampling site of harbors of highest diversity of boring eunicids form. The investigation could be attributing to the fact that east side was more thoroughly sampled for bioeroders than the west side. Naveen 2004 had investigated in Cambell bay had a higher diversity bioeroders compare than the other station. Whereas the present investigations the boring polychaete distribution are high in Bcori and Break water area compare to the Johinder nagar, the both station dead coral patches is high in nature, the results represent to dead coral colonies provide fresh area for settlement of diverse group of boring fauna (Hutchings

1986). The initial colonizers are often polychaetes followed by sponges and sipunculans which reduce the coral skeleton with extensive tunnels and galleries. The results were indicating that lot of cryptic species offered in the dead coral surfaces and these group species were the most abundant in the selected sites.

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