

DESCRIPTION OF STOMATOPOD LARVAE FROM THE ARABIAN SEA

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ABSTRACT: The Northern Arabian Sea Ecological and Environmental Research (NASEER) Programme cruise I, January, 1992 and other collections from Manora Channel (Karachi) were examined. Six stages i.e. IV, VII, VIII, IX, X and XI of stomatopod larvae are recognized. Day samples taken in 1994 (January to December) from Manora Channel revealed the presence of only three specimens of stage IV. They all belong to the family Squillidae. Each stage is measured, described and illustrated. None of the stages could be correlated to their adults.

KEY WORDS: Stomatopod larvae, Northern Arabian Sea.

INTRODUCTION

Knowledge of stomatopod larvae both taxonomically and ecologically is limited. Of the approximately 350 known stomatopod species, only around 10 percent of the larval stages can be identified (Diaz, 1998). The present paper is based on the larvae of the family Squillidae. A total of 32 samples from 18 NASEER stations were analysed and the larvae were found only in six samples taken at five stations as shown in Figure 1. Samples from Manora Channel (Karachi) were also incorporated in the study. Very few attempts have been made from Pakistan to study the stomatopod larvae to relate the larval forms to their corresponding adults, although the larvae of common species occurring in the Western Indian Ocean have been described by Bindra (1924), Faxon (1939), Gurney (1946), Alikunhi (1950), Fourmanoir (1953), Ingle and Della Croce (1967), Shanbhogue (1975), Tirmizi and Kazmi (1980 & 1984) and Moazzam and Moazzam (2006).

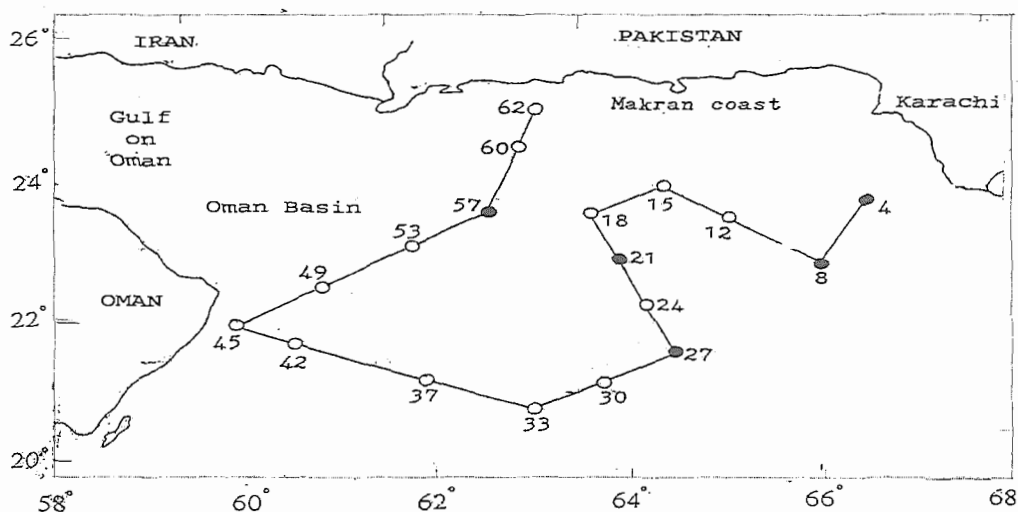


Fig.1. Map of the area where NASEER samples were taken. Circles denote station location, solid circles show the presence of larvae.

MATERIALS AND METHODS

The materials were obtained from two sources (a). The zooplankton samples were taken in waters of the northern Arabian Sea (22°51' – 24°58'N and 60°05' – 65°59'E), under the NASEER programme only in the month of January (1992) using a Bongo net of 300 micron mesh size at a depth of about 5 meter. A flowmeter was attached to the net and the net was towed horizontally for about 10 minutes. The samples were preserved in 5 percent formalin buffered with sodium tetra borax. A total of 32 samples were taken at 18 stations. A single sample was taken from each station, except at stations, 8, 27, 33, 45 and 57. Zooplankton subsamples of 600ml loaned out to us courtesy from National Institute of Oceanography (NIO), Karachi) for further study. The stomatopod larvae were present only at 5 stations. (b). Coastal plankton collections from Manora Channel (24°48'N and 66°59'E) during a study period of one year, January to December 1994, under the Office of Naval Research (ONR, USA) research project executed by the Marine Reference Collection and Resource Center. The stomatopod larvae of these collections were also included in the present study. Initially the stomatopod larval stages from zooplankton samples were sorted, counted and then transferred to 70 percent alcohol. Dissections were made with the aid of Kyowa zoom stereomicroscope using entomological needles. Temporary slides were prepared in glycerin. Illustrations were made with the aid of Nikon camera lucida Labophot-2. Abbreviation TL denotes the total length, measured from the tip of rostrum to posterior margin of telson. The larval stages were defined using the publication of Hamano and Matsuura (1987). For geographical distribution of larvae in the area studied, the NASEER cruise track is followed.

RESULTS

Description of the Larvae:

Stage IV:

4 specimens.

Occurrence: NASEER cruise I Sta. 4 and Manora Channel.

TL: 2.30-3.84 mm.

Carapace (Fig. 2A). Angular with anterolateral, posterolateral and median spines. Rostrum elongated.

Antennule (Fig. 2B). Antennular peduncle 3-segmented. Inner flagellum unsegmented with 3 long setae; outer flagellum with 6 aesthetascs.

Antenna (Fig. 2C). Antennal flagellum absent. Scaphocerite with 8 plumose setae. Mandible (Fig. 2D). Incisor and molar processes with rudimentary teeth.

Maxillule (Fig. 2E). Apex with 1 seta. Basal endite with 3 sharp spines. Coxal endite with 2 teeth on the distal margin.

Maxilla (Fig. 2F). Unsegmented with 5 setae.

Thoracopod I (Fig. 2G). 5-segmented, with 6 serrated setae on propodus; carpus with 1 seta.

Thoracopod II (Fig. 2H). 5-segmented, with one proximal and 20 small spines on propodus; dactylus with 3 small spines.

Thoracopods III VII. Absent.

Pleopod I (Fig. 2I). Biramous. Endopod with 6 plumose setae, exopod with 7 plumose setae.

Pleopod II (Fig. 2J). Biramous. Endopod with 4 plumose setae, exopod with 8 plumose setae.

Pleopod III (Fig. 2K). Biramous. Endopod with 5 plumose setae, exopod with 8 plumose setae.

Pleopod IV (Fig. 2L). Biramous. Endopod with 6 plumose setae, exopod with 7 plumose setae.

Pleopod V. Absent.

Uropods. Absent.

Pleotelson (Fig. 2M). Longer than broad; each side with 1 submedian, 1 intermediate and 1 lateral tooth; 6 intermediate denticles, submedian denticles number 18.

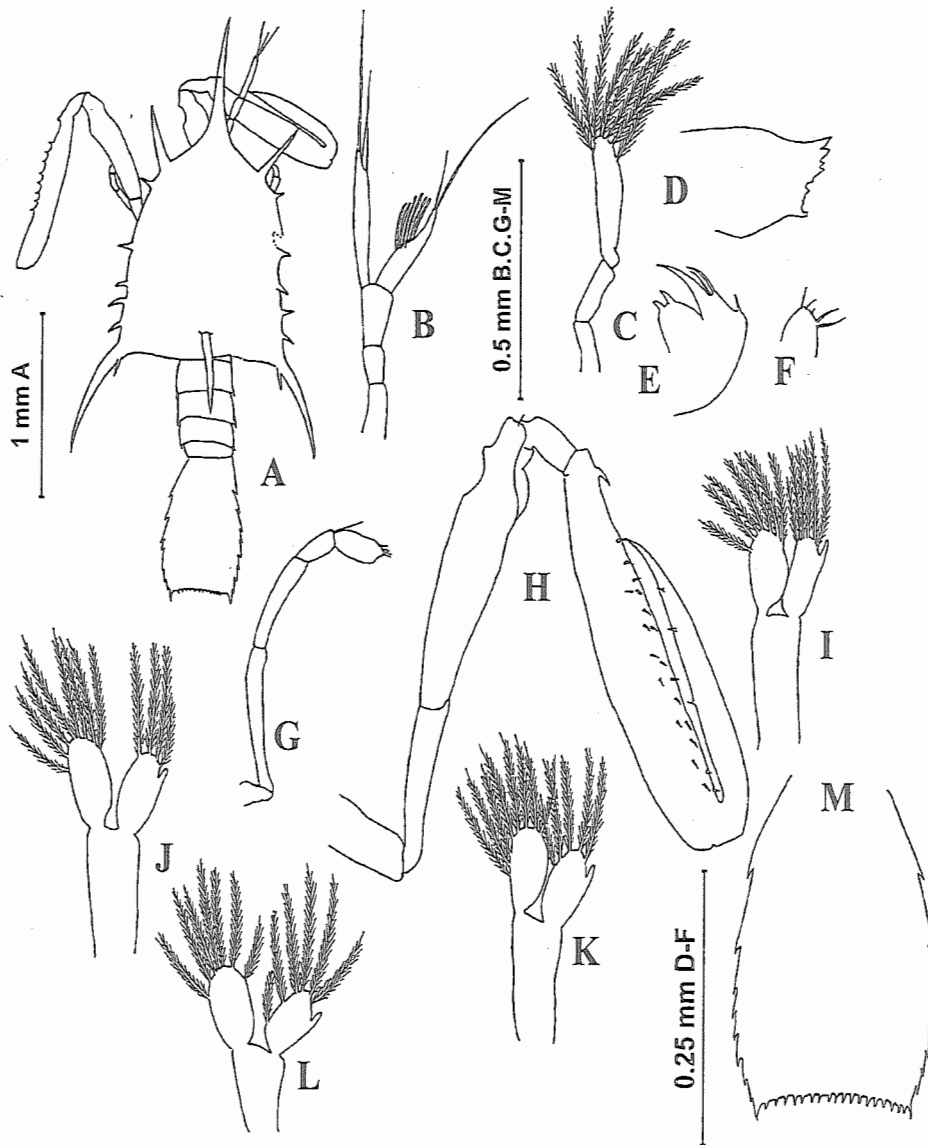


Fig. 2. Stage IV: A, entire; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II; I-L, pleopod I-IV; M, Pleotelson.

Stage VII:

1 specimen (abdomen mutilated).

Occurrence: NASEER cruise I Sta. 4

Carapace (Fig. 3A). Elongated with anterolateral, posterolateral and median spines. Rostrum elongated.

Antennule (Fig. 3B). Antennular peduncle 3-segmented. Inner flagellum unsegmented with 5 setae; median flagellum unsegmented with 3 small setae; outer flagellum with 12 aesthetascs.

Antenna (Fig. 3C). Antennal flagellum long. Scaphocerite with 29 plumose setae. Mandible (Fig. 3D). Incisor process with 6 teeth, molar processes finely serrated.

Maxillule (Fig. 3E). Apex with 2 setae. Basal endite with 2 sharp spines. Coxal endite with 6 teeth.

Maxilla (Fig. 3F). Unsegmented, with 9 setae.

Thoracopod I (Fig. 3G). 5-segmented, with 21 serrated setae on propodus.

Thoracopod II (Fig. 3H). 5-segmented, with 3 proximal teeth and 16 small spines on propodus; dactylus with 8 small spines.

Thoracopod III-V. (Fig 3I) Rudimentary.

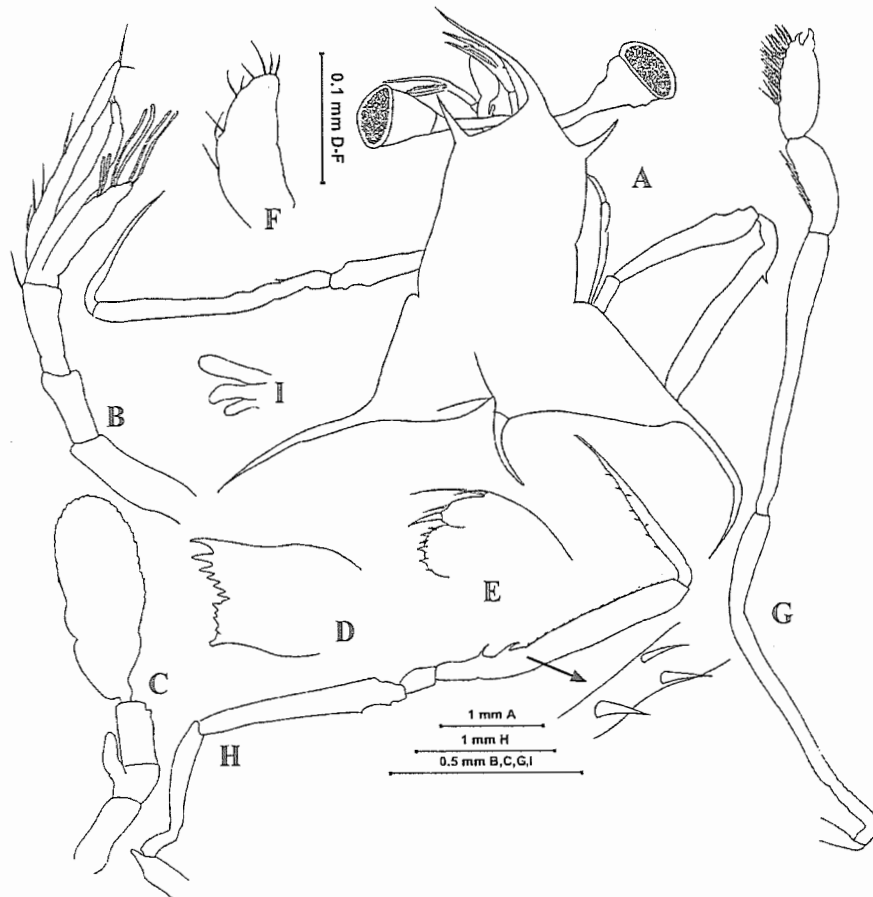


Fig. 3. Stage VII: A, entire ; B., antennule; C, antenna; D, mandible; E, maxillule ; F, maxilla; G, thoracopod I; H, thoracopod II; I, buds of thoracopod III- V.

Stage VIII:

2 specimens.

Occurrence: NASEER cruise I Sta. 57B.

TL: 12.85 and 13.00 mm.

Carapace (Fig. 4A). Elongated with anterolateral, posterolateral and median spines.

Rostrum elongated.

Antennule (Fig. 4B). Antennular peduncle 3-segmented. Inner flagellum 7-segmented; median flagellum 3-segmented; outer flagellum with 15 aesthetascs.

Antenna (Fig. 4C). Antennal flagellum 3-segmented. Scaphocerite with 57 plumose setae.

Mandible (Fig. 4D). Incisor process with 7 teeth, molar processes finely serrated. Maxillule (Fig. 4E). Apex with 1 seta. Basal endite with 2 sharp spines. Coxal endite with 8 teeth.

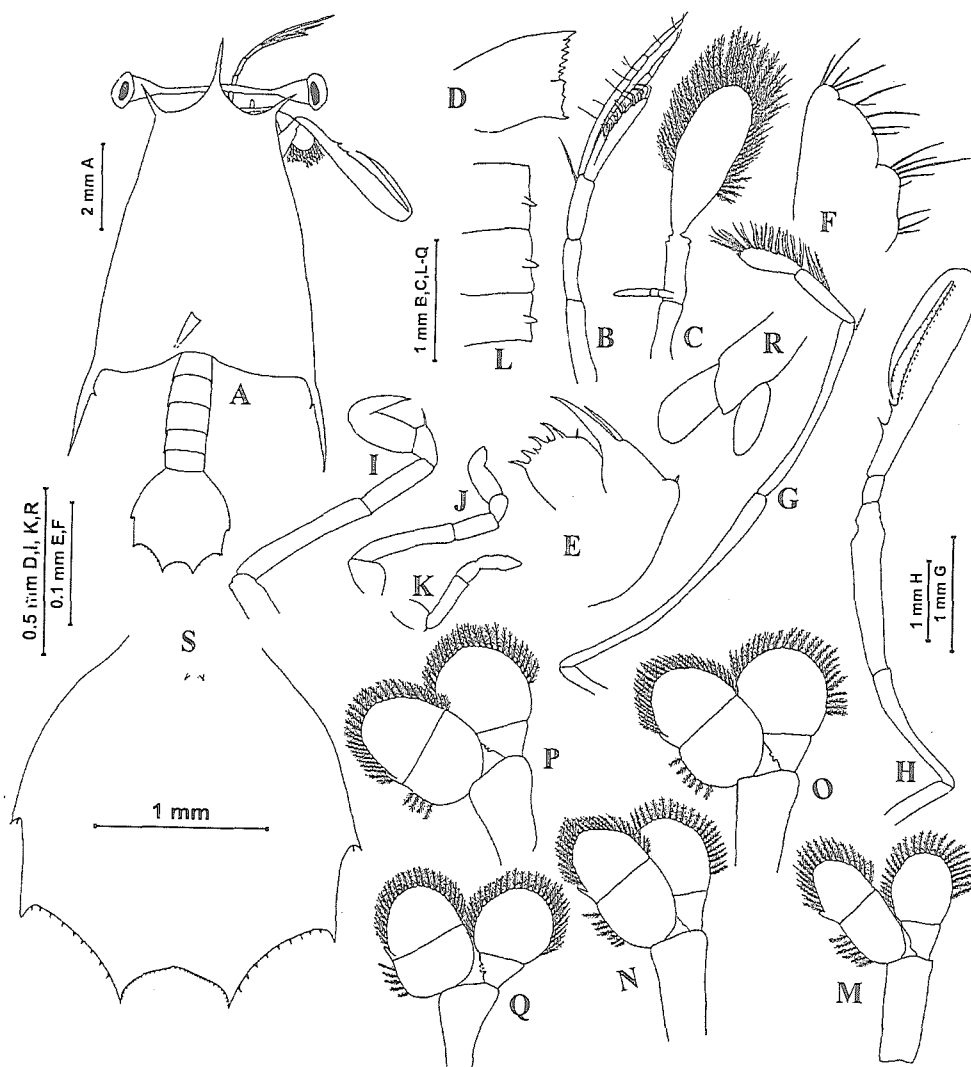


Fig. 4. Stage VIII: A, entire; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II; I-K, thoracopod III-V; L, buds of thoracopod VI-VIII; M-Q, pleopods I-V; R, uropod; S, pleotelson.

Maxilla (Fig. 4F). Unsegmented, with 18 setae.

Thoracopod I (Fig. 4G). 5-segmented, with 30 serrated setae on propodus; carpus with 16 plumose setae; merus with 1 plumose seta.

Thoracopod II (Fig. 4H). 5-segmented, with 3 proximal teeth and 42 small spines on propodus; dactylus with 10 small spines.

Thoracopods III-V (Fig. 4I-K). Long, segmented.

Thoracopods VI-VIII (Fig. 4L)- Rudimentary.

Pleopod I (Fig. 4M)- Biramous. Endopod with 25 plumose setae, exopod with 26 plumose setae. Gills rudimentary.

Pleopod II (Fig. 4N). Biramous. Endopod with 32 plumose setae, exopod with 32 plumose setae. Gills rudimentary.

Pleopod III (Fig. 4O). Biramous. Endopod with 36 plumose setae, exopod with 36 plumose setae. Gills rudimentary. Pleopod IV (Fig. 4P). Biramous. Endopod with 32 plumose setae, exopod with 35 plumose setae. Gills rudimentary.

Pleopod V (Fig. 4Q). Biramous. Endopod with 30 plumose setae, exopod with 29 plumose setae. Gills rudimentary.

Uropods (Fig. 4R). Rudimentary.

Pleotelson (Fig. 4S). Well developed; each side with 1 submedian, 1 intermediate and 1 lateral tooth; 1 lateral and 9 intermediate denticles, submedian denticles number 37.

Stage IX:

2 specimens.

Occurrence: NASEER cruise I Sta.8B, 21 and 57B.

TL: 15.10 and 19.42 mm.

Carapace (Fig. 5A). Elongated with anterolateral, posterolateral and median spines. Rostrum elongated.

Antennule (Fig. 5B). Antennular peduncle 3-segmented. Inner flagellum 8-segmented; median flagellum 4-segmented; outer flagellum with 18 aesthetascs.

Antenna (Fig. 5C). Antennal flagellum 3-segmented. Scaphocerite with 50 plumose setae.

Mandible (Fig. 5D). Incisor process with 5 teeth, molar processes finely serrated. Maxillule (Fig. 5E). Apex with 2 setae. Basal endite with 2 sharp spines. Coxal endite with 10 teeth.

Maxilla (Fig. 5F). Unsegmented, with 16 setae and 3 lobed endite..

Thoracopod I (Fig. 5G). 5-segmented, with 36 serrated setae on propodus; carpus with 34 plumose setae; merus with 1 plumose seta..

Thoracopod II (Fig. 5H). 5-segmented, with 3 proximal teeth and 40 small spines on propodus; dactylus with 9 small spines.

Thoracopods III- V (Fig. 5I-K). 5-segmented, with 1 spine on carpus.

Thoracopods VI-VIII (Fig. 5L). Biramous, elongated biramous buds.

Pleopod I (Fig. 5M).- Biramous. Endopod with 31 plumose setae, exopod with 29 plumose setae. Gills rudimentary.

Pleopod II (Fig. 5N). Biramous. Endopod with 37 plumose setae, exopod with 36 plumose setae. Gills rudimentary.

Pleopod III (Fig. 5O). Biramous. Endopod with 40 plumose setae, exopod with 36 plumose setae. Gills rudimentary.

Pleopod IV (Fig. 4P). Biramous. Endopod with 37 plumose setae, exopod with 30 plumose setae. Gills rudimentary.

Pleopod V (Fig. 5Q). Biramous. Endopod with 36 plumose setae, exopod with 28 plumose setae. Gills rudimentary.

Uropods (Fig. 5R). Rudimentary.

Pleotelson (Fig. 5S). Well developed; each side with 1 submedian, 1 intermediate and 1 lateral tooth; 1 lateral and 9 intermediate denticles, submedian denticles number 33.

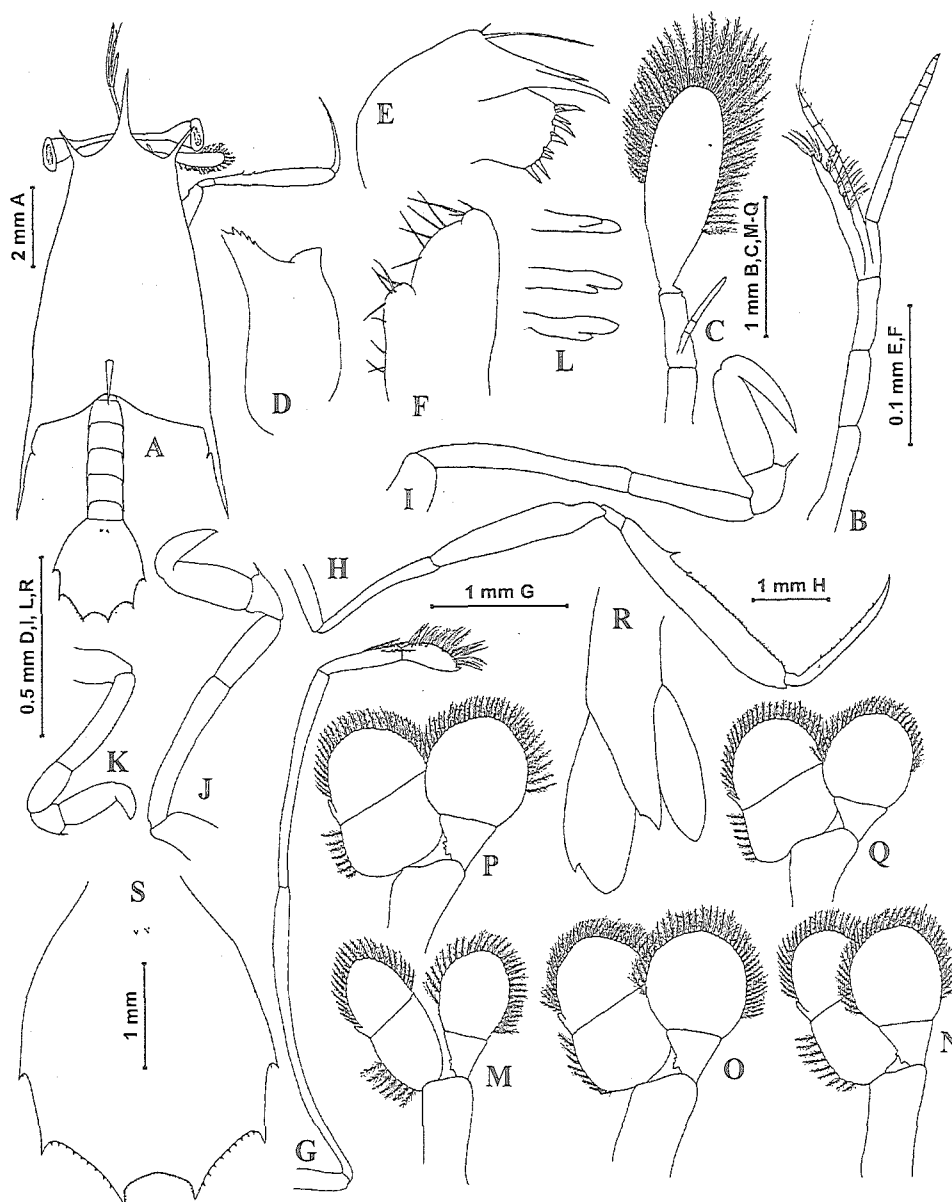


Fig. 5. Stage IX: A, entire; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II; I-K, thoracopod III-V; L, buds of thoracopod VI-VIII; M-Q, pleopods I-V; R, uropod; S, pleotelson..

Stage X:

4 specimens.

Occurrence: NASEER cruise I Sta. 8D, 21.

TL: 18.09-18.71 mm.

Carapace (Fig. 6A). Elongated with anterolateral, posterolateral and median spines. Rostrum elongated.

Antennule (Fig. 6B). Antennular peduncle 3-segmented. Inner flagellum 12-segmented; median flagellum 7-segmented; outer flagellum with 14 aesthetascs.

Antenna (Fig. 6C). Antennal flagellum 3-segmented. Scaphocerite with 57 plumose setae.

Mandible (Fig. 6D). Incisor process with 7 teeth, molar processes finely serrated. Maxillule (Fig. 6E). Apex with 1 seta. Basal endite with 2 sharp spines. Coxal endite with 12 teeth.

Maxilla (Fig. 6F). 3-segmented, with 24 setae.

Thoracopod I (Fig. 6G). 5-segmented, with 33 serrated setae on propodus; carpus with 30 plumose setae; merus with 1 plumose seta.

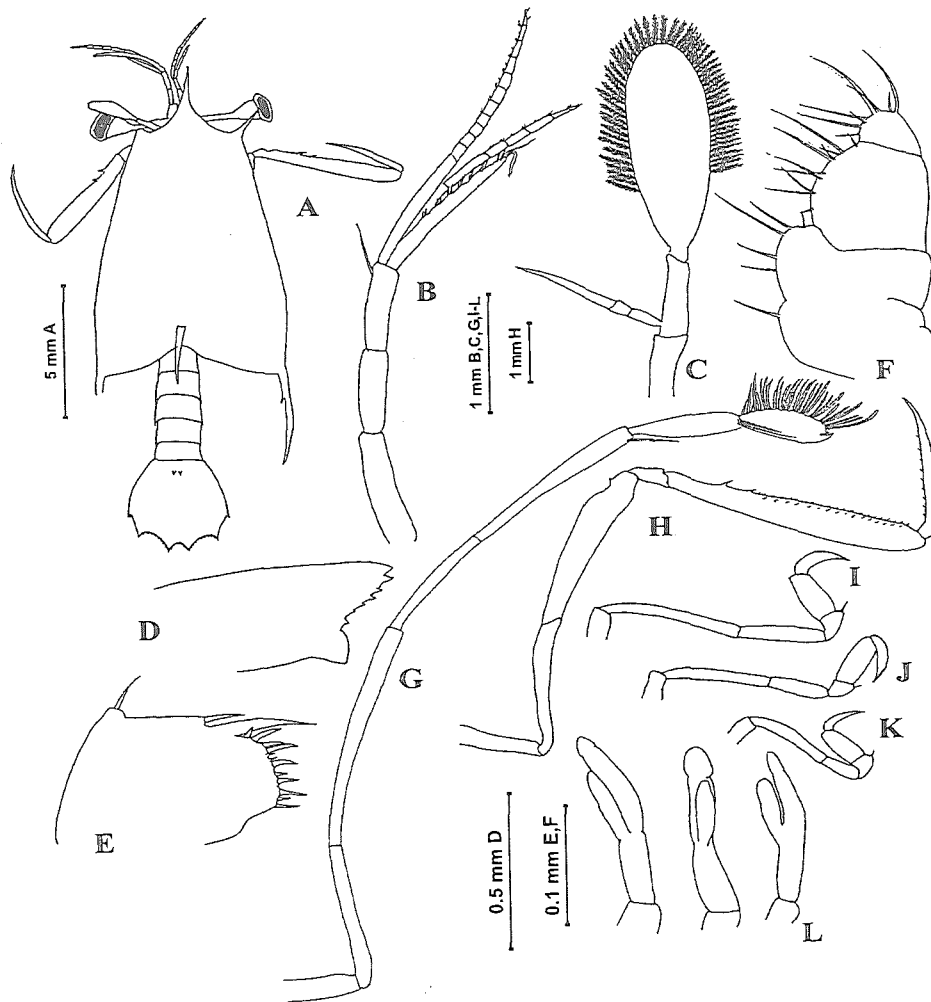


Fig. 6. Stage X: A, entire; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II; I-K, thoracopod III-V; L, buds of thoracopod VI-VII.

Thoracopod II (Fig. 6H). 5-segmented, with 3 proximal teeth and 43 small spines on propodus; dactylus with 9 small spines.

Thoracopods III- V (Fig. 6I-K). 5-segmented, with 1 spine on carpus.

Thoracopods VI-VIII (Fig.6L). Biramous, elongated weakly segmented.

Pleopod I (Fig. 7A). Biramous. Endopod with 27 plumose setae, exopod with 28 plumose setae. Gills rudimentary.

Pleopod II (Fig. 7B). Biramous. Endopod with 37 plumose setae, exopod with 38 plumose setae. Gills rudimentary.

Pleopod III (Fig. 7C). Biramous. Endopod with 40 plumose setae, exopod with 42 plumose setae. Gills rudimentary.

Pleopod IV (Fig. 7D). Biramous. Endopod with 41 plumose setae, exopod with 37 plumose setae. Gills rudimentary.

Pleopod V (Fig. 7E). Biramous. Endopod with 37 plumose setae, exopod with 34 plumose setae. Gills rudimentary.

Uropods (Fig. 7F). Elongated, endopod and exopod without plumose setae, forked ventral process with 2 sharp apices.

Pleotelson (Fig. 7G). Well developed; each side with 1 submedian, 1 intermediate and 1 lateral tooth; 1 lateral and 10 intermediate denticles, submedian denticles number 37.

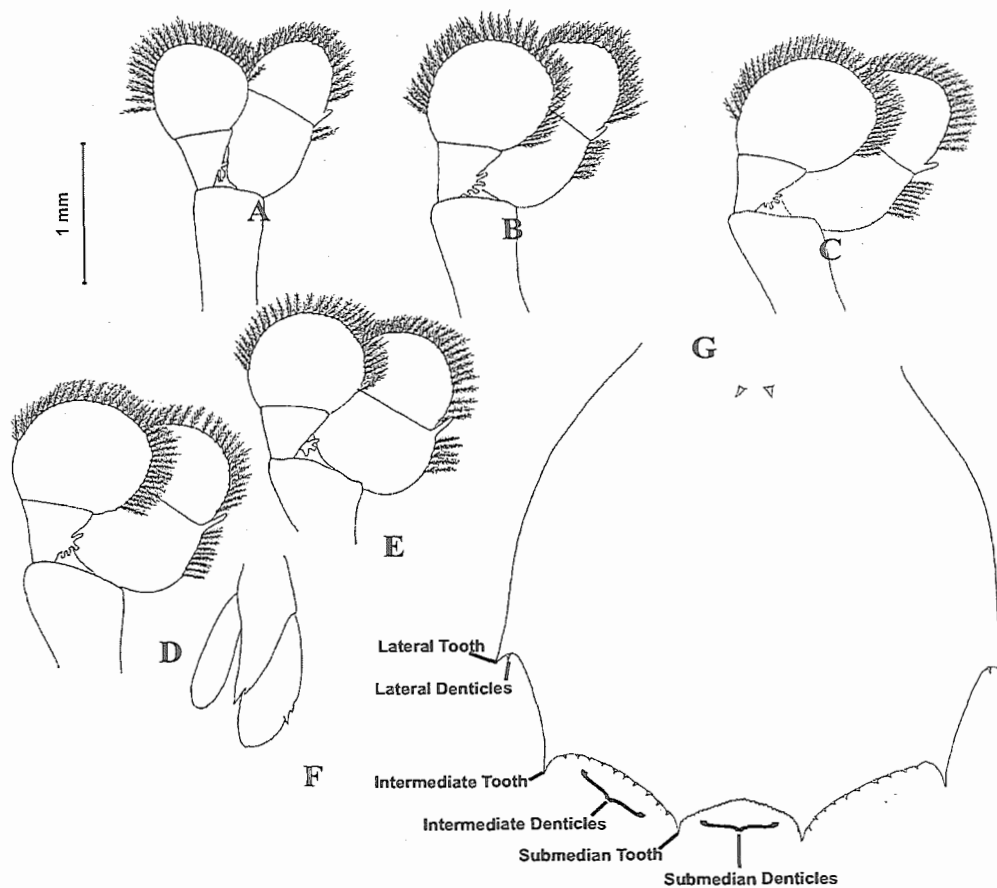


Fig. 7. Stage X: A – E, pleopod I – V; F, uropod; G' pleotelson.

Stage XI:

5 specimens.

Occurrence: NASEER cruise I Sta. 21 and 27D.

TL: 20.00-24.07 mm.

Carapace (Fig. 8A). Elongated with anterolateral, posterolateral and median spines. Rostrum elongated.

Antennule (Fig. 8B)- Antennular peduncle 3-segmented. Inner flagellum 20-segmented; median flagellum 9-segmented; outer flagellum with 52 aesthetascs.

Antenna (Fig. 8C)- Antennal flagellum 6-segmented. Scaphocerite with 66 plumose setae.

Mandible (Fig. 8D). Incisor process with 8 teeth, molar processes finely serrated. Maxillule (Fig. 8E). Apex with 2 setae. Basal endite with 2 sharp spines. Coxal endite with 17 spines.

Maxilla (Fig. 8F)- 3-segmented, with 55 setae.

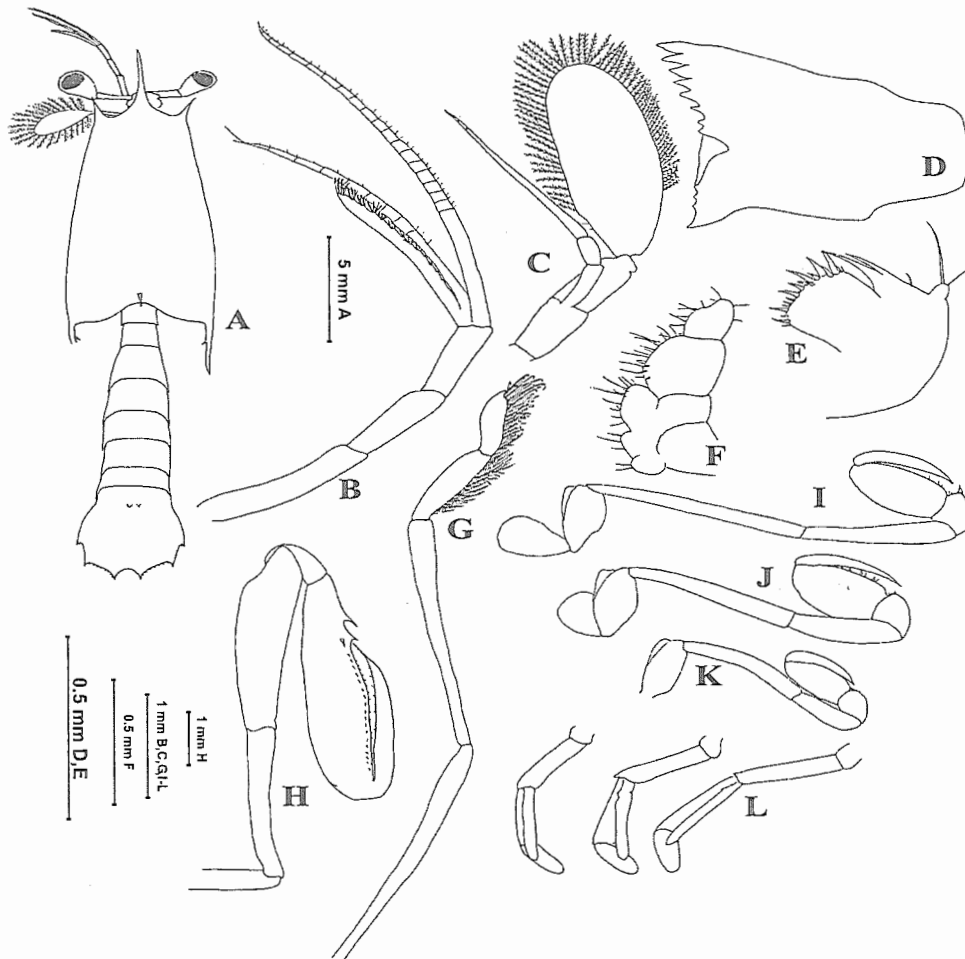


Fig. 8. Stage XI: A, entire; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II; I-K, thoracopod III-V; L, buds of thoracopod VI-VIII.

Thoracopod II (Fig. 8H). 5-segmented, with 3 proximal teeth and 48 small spines on propodus; dactylus with 8 small spines.

Thoracopods III- V (Fig. 8I-K). Developed, each with 1 spine on carpus.

Thoracopods VI-VII (Fig. 8L). Biramous and segmented.

Pleopod I (Fig. 9A). Biramous. Endopod with 47 plumose setae, exopod with 42 plumose setae. Gills rudimentary.

Pleopod II (Fig. 9B). Biramous. Endopod with 53 plumose setae, exopod with 46 plumose setae. Gills rudimentary.

Pleopod III (Fig. 9C). Biramous. Endopod with 59 plumose setae, exopod with 48 plumose setae. Gills rudimentary.

Pleopod IV (Fig. 9D). Biramous. Endopod with 57 plumose setae, exopod with 42 plumose setae. Gills rudimentary.

Pleopod V (Fig. 9E). Biramous. Endopod with 59 plumose setae, exopod with 44 plumose setae. Gills rudimentary.

Uropods (Fig. 9F). Well developed, endopod with 12 short plumose setae along margin, distal margin of exopod with 9 plumose setae along with margin and proximal segment with 4 spines on outer margin.

Pleotelson (Fig. 9G). Well developed; each side with 1 submedian, 1 intermediate and 1 lateral tooth; 1 lateral and 10 intermediate denticles, submedian denticles number 28.

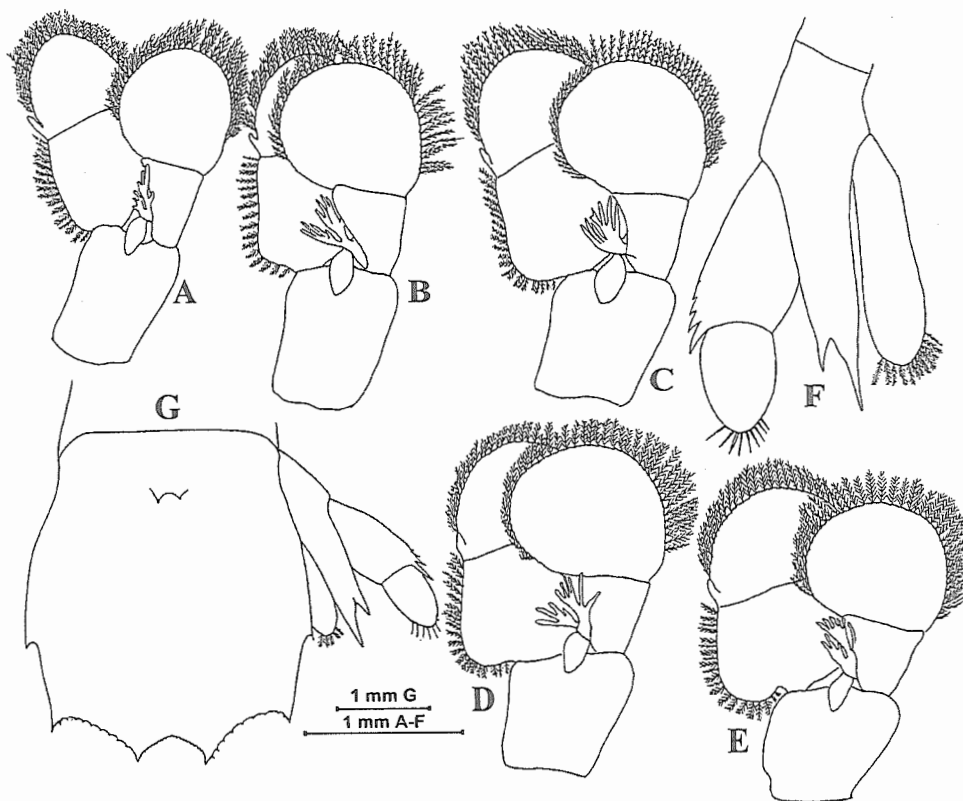


Fig. 9. Stage XI: A – E, pleopod I – V; F, uropod; G, pleotelson.

DISCUSSION

The stomatopod larvae represent a small fraction (0.16 percent) of total crustacean larvae present in NASEER samples. All larvae found in open ocean samples taken away from the Pakistan coast and are not represented at all in the Oman Basin samples. It was also noted that all larvae were obtained in night samples. In one year (1994) coastal collections, all taken during day time obtained three larvae of the two months samples during the months of April and May. The larvae obtained were recognized as stage IV, VII, VIII, IX, X and XI, can be referred to all belonging to the family Squillidae. The presence of larvae from only one family in the NASEER samples is rather surprising, as Moazzam and Moazzam (2006) described larvae collected by "Machera" cruise in Pakistani waters belonging to at least three stomatopod families and the same observations were made while studying the stomatopod larvae collected by "Fridtjof Nansen" cruise, January 1977 (personal observations by second author). Of the five squillids described by Moazzam and Moazzam (2006) the present larvae are close to that given as to *Oratosquilla nepa*, now *Miyakea nepa*. The old genus *Oratosquilla* has been split into at least 3 genera by Manning (1995). Two of the other squillid larval groups described by the former authors belong to adults of *O. gonypetes* and *O. woodmasoni*, not yet recorded from here (Tirmizi *et al.* 1994). Our observations also agree with those of Moazzam and Moazzam (2006) that the later stages of the larvae occur in the offshore waters while earlier stages are common in the near shore waters.

Importance of crustacean larvae in the pelagic food chain is well recognized. Taking into account the number of species known, larvae of large number of species are yet to be identified from the Indian Ocean. No conclusion can be drawn on the seasonal occurrence of stomatopod larvae in NASEER as the sample was collected only in the month of January 1992. The Manora Channel samples had stomatopod larvae in summer collections, where only a single stage i.e stage IV is available; on comparison of stage IV from NASEER samples and that collected from the Manora Channel, both seem to be identical in shape.

Possibly the method of plankton collection may be partly responsible for the thin representation of stomatopod larvae in the shore collections. It is hoped that this preliminary paper will aid identification of some stomatopod larvae occurring in Pakistani waters and stimulate to make more material either preserved or by holding planktonic larvae in the laboratory through one ecdysis to associates larval sequence.

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