International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

E-ISSN 2347-2677
P-ISSN 2394-0522
www.faunajournal.com
IJFBS 2021; 8(1): 86-90
Received: 13-11-2020
Accepted: 18-12-2020

Farhana S Ghory
Marine Reference Collection and Resource Centre, University of Karachi, Karachi, Pakistan

Corresponding Author:
Farhana S Ghory
Marine Reference Collection and Resource Centre, University of Karachi, Karachi, Pakistan

Morphological study of planktonic caught squillid species (Stomatopoda: Squillidae) from Pakistani waters (Karachi, Pakistan)

Farhana S Ghory

DOI: https://doi.org/10.22271/23940522.2021.v8.i1b.797

Abstract
The zooplankton samples were taken from Clifton (Lat. 24º47'42"N Long. 66º59'06"E) (Karachi, Pakistan) during 2011. Third larval stage of Squillid sp. was found in the planktonic sample. The stage is described, illustrated and compared with available literature.

Keywords: Planktonic caught, Squillidae, Karachi, Pakistan

Introduction
Stomatopods are burrowers in the mud or sand bottom. The growth pattern suggests that the larval body size may indicate the developmental stage, development occurs in three distinct phases, one embryological, one propelagic, and one pelagic, ended by the stomatopod moult at which time some adult characters begin to appear in the postlarvae. The first larval stage remains in the burrows of the mother shrimp and/ or on the bottom, unable to swim. The second larval stage occasionally swims using the pleopods. Active swimming and feeding starts at the third larval stage. The larvae show positive photo taxis during third to final stages. Tenth and eleventh stage often stay near the bottom. The first juvenile behaves similarly to the adult (Hamano & Matsuura, 1987) [15]. The larvae are known to be associated with coral reefs (Barber *et al.*, 2002) [10].
Clause (1871) [12] termed the larvae in the super family Lysiosquilloidea as antizoea larvae, having 5 pairs of thoracic appendages, and in later stage called erichthus larva the pleopods are present. In the Squilloidea, aspseudo zoea larva later develops into an alima larva, while in Gonodactyloidea, aspseudozoea develope into an erichthus larva.
Recent workers declined to adopt such names (Hamano and Matsuura, 1987) [15]. For delineating the stages I followed Hamano and Matsuura (1987) [15] from Japan for *Oratosquilla oratoria.* The problem of correlation of larvae to their adults was confronted by workers studying preserved plankton material and this brought out the need to study the complete life histories from eggs hatched in the laboratory. Efforts were made towards this end and several workers studied the development from eggs reared in the laboratory.
But this still was not the final solution as rearing was a difficult process, this has forced investigators to base their accounts on reconstructions made from preserved specimens or from holding planktonic larvae through one ecdysis to connect successive stages. The studies on preserved plankton material continued which have contributed substantially to our knowledge of the group. A successful attempt through eye abalation was made Monvises (1998) on *Oratosquilla nepa* from Thailand.
Knowledge of stomatopod larvae, both taxonomically and ecologically, is limited. At least 450 extant species have been described worldwide (Ahyong, 2001) [1] arrayed in 17 families and 7 superfamilies (Ahyong and Lowry, 2010) [2]. In Pakistan Stomatopods are represented by 7 families and 20 species.
All attempt to capture live mantis shrimp failed due to the reason that females bearing eggs masses are rarely collected in field and spawning seldom occurs in the laboratory. Only on two occasions in the history of MRC&RC culture lab live females with egg mass were collected (a) *Miyakella* with egg mass was captured and maintained for a week in the laboratory till its death. No hatching occurred during that period (1995). (b) Ovigerous female *Mesacturoides fimbriatus* of family Takedae was spawned in laboratory (Tirmizi and Kazmi, 1980) [25].

Materials and Methods

The planktonic samples for the larvae were collected from Clifton, during 2011. The collections for planktonic specimens are made using Bongo net of 300 micron mesh size with horizontally attached flow meter in a tow time of 10 minutes. The depth of samples were 15'-20', samples were preserved in 5% buffered formalin. Measurement of each stage was made with the aid of micrometer. The present larvae belong to stage III of family Squillidae. The total length (TL) was determined from the tip of the rostrum to the mid posterior border of the telson. The illustrations were made with the help of Olympus BH2 microscope (1.25X4, 10, 20 and 40 magnifications) with Nomarski Differential Interference Contrast (D/C) and camera lucida attachment. The preserved larvae are deposited in the Marine Reference Collection and Resource Centre, University of Karachi.

Description of the Larvae

Squillidae Latreille, 1802
Squillid sp.
Stage III: (Figs. 1A - 2E)
Size.- TL= 2.24 - 2.35mm

Diagnostic Features

Carapace (Fig. 1A).- Carapace angular; rostrum long with pointed tip; 1 pair of anterolateral spines; 4 pairs of ventrolateral spines; 1 pair of posteriolateral spines armed with 1 minute spine and 1 median spine present on the posterior margin; eyes stalked.

Antennule (Fig. 1B).- Biramous; peduncle 3-segmented; inner flagellum (endopod) 2-segmented with 2 and 3 plumodenticulate setae respectively; outer flagellum (exopod) unsegmented with 2 plumodenticulate setae and 7 aesthetascs.
Antenna (Fig. 1C).- Uniramous; peduncle 2-segmented, distal segment with 1 spine; scaphocerite with 8 setae.
Mandible (Fig. 1D).- Well developed.
Maxillule (Fig. 1E).-Coxal endite with 3 setae; basial endite with 2 cuspidate and 2
Plumodenticulate setae.
Maxilla (Fig. 1F).- Unsegmented with 6 plumodenticulate setae.
Thoracopod I (Fig. 1G).- Five segmented, dactylus with 5 setae.
Thoracopod II (Fig. 1H).- Five segmented, with 1 proximal and 8 small spines on propodus; dactylus with few simple setae, remaining segment unarmed.
Pleopod I (Fig. 2A).- Biramous; endopod with 4 setae and 2 hooks; exopod with 7 setae.
Pleopod II (Fig. 2B).- Biramous; endopod with 5 setaeand 2 hooks; exopod with 7 setae.
Pleopod III (Fig.2C).- Biramous; endopod with 4 setaeand 2 hooks; exopod with 7 setae.
Pleopod IV (Fig.2D).- Biramous; endopod with 4 setae and 2 hooks; exopod with 7 setae.
Pleotelson (Fig. 2E).- Longer than broad, with 7 pairs of lateral spines; 1 pair of submedian spines and 12 submedian denticles present.

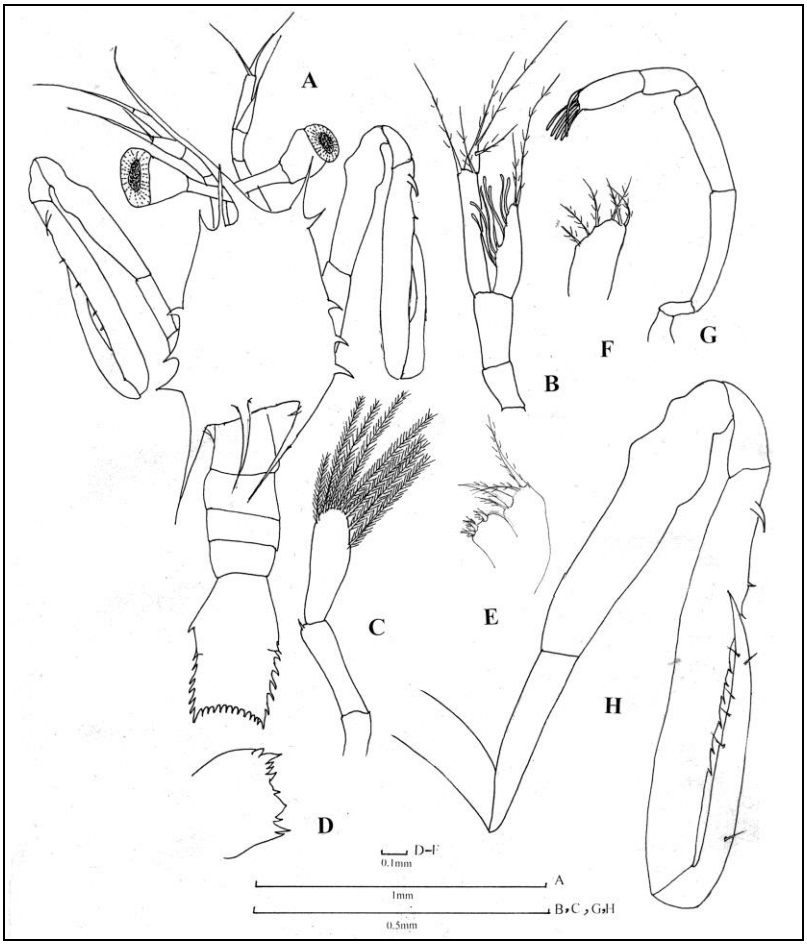

Fig 1: Squillid sp. Stage III: A, entire, lateral view; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, thoracopod I; H, thoracopod II.

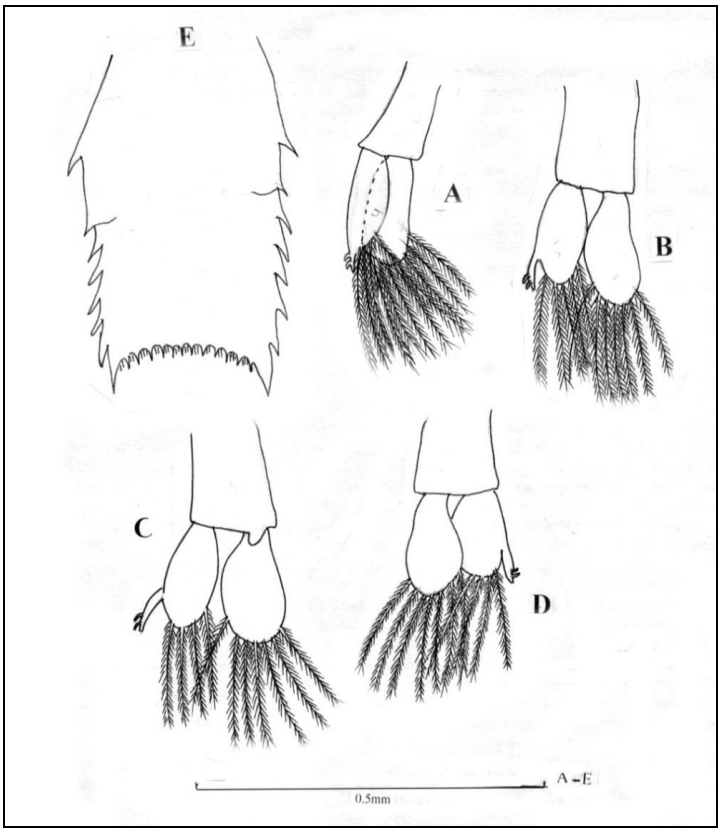

Fig 2: Squillid sp. Stage III: A-D, pleopodsI-IV; E, pleotelson.

Results and Discussion

The stomatopod larvae provide an alternative life stage to study biodiversity in spite of the fact that these larvae are notoriously difficult to identify morphologically. Of the 350 known species of stomatopods, only 1 in 10 can be identified with their larvae and only 1 has been reared from hatching to metamorphosis. Difficulty in rearing the larvae has forced investigators to base their accounts on reconstructions made from preserved specimens or from holding planktonic larvae through one ecdysis to connect successive stages. Stomatopod larvae have been described from the Indian Ocean by scores of authors (Bindra, 1924; Alikunhi, 1952, 1958, 1967, Alikunhi and Aiyar, 1942; Shanbhogue, 1975; Ingle and Croce, 1967; Tirmizi and Kazmi, 1980, 1984; Moazam and Moazam, 2006; Bano and Kazmi, 2007, 2011) [11, 3, 5, 7, 8, 9, 22, 17, 25, 26, 18].

The characters given by Gurney (1942 and 1946) [13, 14], Alikunhi (1952) [3] and Morgan and Provenzano (1979) [20] may be used for specific determinations. In the manner in which all species of the Squillidae develop is similar. All Squillidae hatch as pseudozeae with four pairs of pleopods and develop into the alima form. Squillid species are known to have as many as 8 or 9 pelagic instars and persist in the plankton for a number of months. The interesting observation is also included in literature as observation on shrinkage in length during metamorphosis. It is not unusual for postlarvae to be smaller than the last pelagic larva (Alikunhi, 1967) [5]. Alikunhi (1975) [6] reared planktonic larvae of *Oratosquilla nepa* new *Miyakella nepa* in aquaria through metamorphosis until they reached adulthood, breed, and produced eggs.

Table 1: Comparison between planktonic caught stage III of unidentified Squillid sp. (present study) and *Oratosquilla oratoria.* Stage III:

Characters	Unidentified Squillid sp. present study	*O.oratoria* Hamano & Matsuura (1987) [15]
Carapace		
Ventrolateral teeth	4	4
Antennule		
Endopod	2-segmented with 2,3 setae	2-segmented with 1,3 setae
Exopod	7 aesthetacs +2 setae	5 aesthetacs +2 setae
Maxillule		
Coxalendite	3 setae	4 setae
Maxilla		
Setae	6 setae	5 setae
Thoracopod I		
Propodus	5 seta	3 setae
Carpus	setae absent	setae absent
Thoracopod II		
Propodus proximal setae	9 setae	8-15 setae
Pleotelson		
Interamediate Dentation	5	5
Submedian dentition	12	13 (12-14)

The present Pakistani larval stages of stomatopods fit in the Squillidae characters; but not matching to any stage of the genera described by the local authors dealing within the family. The family is a diversified one. The local literature is not very helpful for determination of species. A pair of spines present on the posterior margin of the carapace in *Cloridopsis scorpio* from the Indian Ocean (Alikunhi, 1952, 1967) [3, 5]. The spines may be diagnostic for the genus *Cloridopsis*. To distinguish squillid genera, other characters, such as the presence or absence of a spine on the basis of the second maxilliped, must be relied on. My specimen posses the posterior spines but spine on the basis of the second maxillipedis not seen. It is very difficult to define the present genus by comparing the local literature. Alikunhi and Aiyar (1942) [7] did not give any description, their photographs are not clear enough. Shanbhogue (1975) [22] did not delineate any stages. Alikunhi, 1958; Tirmizi and Kazmi (1984) [26] did not mention the mother species name under larvae although the study is dealt with the genus *Oratosquilla*. The genus once included 20 species from the Indian Ocean including *O. nepa* now shifted to *Miyakella nepa.* In the taxonomist's observations *M. nepa* is single known Pakistani species of the genus *Miyakella* and understood to be the commonest squillid of Pakistan, both as adult and as larvae (Moazzam and Moazzam, 2006) [18]. So the absence of any other species of the genus also supports my identification. I am inferred to refer my sample to *M. nepa* with some reservations.

Although generally these larvae are reported to be common in the seas around to form large swarms during certain months but no swarm has been observed in our water till now (Moazzam and Moazzam, 2006) [18]. According to them earlier stages are found near coast line, but the stage described by them is final stage collected near coast. Another atypical case is given in Bano and Kazmi (2011) [9] where stage 4 is described from inshore channel as well as from a distant station of NASEER Cruise in the Arabian Sea.

The other squillid genera from Pakistan are not known for their larvae except in a report by Moazzam and Moazzam (2006) [18] larvae are from offshore water, diversified and in advance stages, the composition of species in this work showed that some species of larvae were found to occur in the plankton community that are not known to settle or recruit in our waters, they are *Erugosquilla wood-masoni*, *Quollastria gonypetes*, *Lysierichthus duvaucelli*, and *Acanthosquilla multifasciata* but distributed in the western Indian Ocean and Persian Gulf. Although stomatopods produce larvae whose planktonic phase varies from approximately one too many months (Provenzano and Manning, 1978) [21], dispersal among different geographic sub regions appears to be relatively rare, as is shown by their distribution patterns (Reaka and Manning, 1987) [22]. It can be assumed that these larvae are from the adults in our deeper waters.

The stomatopod larvae provide an alternative life stage to study biodiversity in spite of the fact that these larvae are notoriously difficult to identify morphologically. The microscopic keying out of morphological characters to determine the developmental stage in stomatopods is understood very time-consuming. In recent years using DNA barcodes have overcome the problem associated with the lack of identification keys or taxonomic descriptions (Tang *et al.*, 2010) [23]. It is hoped that in future Pakistani workers applying these techniques would also overcome such hurdles.

It has also been reported that reared larvae are smaller than those from nature in the same stage (Hamano *et al.*, 1994) [16]. It is probable that this larva in the plankton community may belong to the species that is not known to settle or recant in Pakistani waters, there might still be unknown diversity that is yet to be discovers.

Reference

1. Ahyong ST. Revision of the Australian Stomatopod Crustacea. Records of the Australian Museum Supplement 2001;26:1-326.
2. Ahyong ST, Lowry JK. Stomatopoda: Families". World Crustacea. Australian M useum. http://crustacean.net/crustace/stomatopoda/index.htm. Retrieved 2010. doi:10.1111/j.1096-3642.1907.tb00072.x
3. Alikunhi KH. On the food of young carp fry. Jour. Zool. Soc. India 1952;4:77-84.
4. Alikunhi KH. Observations on the feeding habits of young carp fry. Ind. Jour. Fish 1958;5(1):95-106.
5. Alikunhi KH. An account of the post-larval development, moulting, and growth of the common stomatopods of the Madras coast. Proc 1967. Symposium on Crustacea - II: 824 – 945, text-figs. 1-194; PI. I-III.
6. Alikunhi KH. Studies on Indonesian stomatopods 1. Growth, maturity and Spawning of *Squilla nepa*. Bull. Shrimp Cult. Res. Cent 1975;1(1):27-32.
7. Alikunhi KH, Aiyar RG. On some Squilla Larvae from the Madras Plankton 1942, 56-58.
8. Bano H, Kazmi QB. Description of stomatopod larvae from the Arabian sea. Pakistan Jour. Mar. Sci 2007;16(2):89-101.
9. Bano H, Kazmi QB. Crustacean larvae of the Northern Arabian Sea. Larval stage of zooplanktonic crustaceans. VDM Verlag Dr. Müller Publisher 2011, pp 1-134.
10. Barber PH, Palumbi SR, Erdmann MV, Moosa MK. Sharp genetic breaker among populations of *Haptosquilla pulchella* (Stomatopoda) indicates limits of larval transports patterns, causes and consequences. Molecular Ecology 2002;11:659-674.
11. Bindra SS. Crustacean plankton from Karachi Harbour. Proc. Lahore Phil. Soc 1924;3:78-80.
12. Claus C. Die Metamorphose der Squilliden. Abhandlungen der königlichen Gesellschaft der Wissenschaften zu Göttingen 1871;16:111-163, pls. 1-8.
13. Gurney R. larvae of decapod crustacea. London: Ray Society 1942, 1-306.
14. Gurney R. Notes on stomatopod larvae. Proc. zool. Soc. Lond 1946;116:133-175.
15. Hamano T, Matsuura S. Egg size, duration of incubation and larval development of the Japanese Mantis Shrimp in the laboratory. Nippon Suisan Gakkaishi 1987;53(1):23-39.
16. Hamano T, Torisawa M, Mitsihashi M, Hayashi KI. Burrow of a stomatopod crustacean *Oratosquilla oratoria* (De Haan, 1844) in Iishikari Bay, Japan. Crustacean Research 1994;23:5-11.
17. Ingle RW, Croce D. Stomatopod larvae from Mozambique Channel. Bull. Mus. 1st Biol. Univ 1967;35:55-73.
18. Moazzam N, Moazzam M. Stomatopod larvae from Pakistan coast- I. taxonomic enumeration. Pakistan Jour. Zool 2006;38(3):177-184.
19. Monvises A. Larval development of *Nepa* mantis shrimp *Oratosquilla nepa* (Latreille, 1825) from egg masses

spawned by eyestalk ablation method. Thesis (unpublished) 1998.
20. Morgan SG, JR AJ. Provenzano. Development of pelagic larvae and postlarva of *Squilla empusa* (Crustacea: Stomatopoda) with an assessment of larval characters within the Squillidae. Fishery Bull. Fish. Wildl. Serv. U.S 1979;77:61-90.
21. Provenzano AJ, Manning RB. Studies on development of stomatopod Crustacea. II. The later larval stages of *Gonodactylus oerstedii* Hansen reared in the laboratory. Bull. Mar. Sci 1978;28:297-315.
22. Reaka ML, Manning RB. The significance of body size, dispersal potential, and habitat for rates of morphological evolution in stomatopod crustacea. Smithsonian Contributions to Shanbhogue, S.L., 1975.Descriptions of stomatopod larvae from the Arabian Sea with a list of stomatopod larvae and adults from the Indian Ocean and a key for their identification. Part II. Jour. Mar. Biol. Ass. India 1987;17(1):522-544. Zoology, 448.
23. Tang RWK, Cynthia Y, Wai-Chuen NG. Identification of stomatopod larvae (Crustacea: Stomatopoda) from Hong Kong waters using DNA barcodes. Molecular Ecology Resources 2010;10(3):439-448.
24. Tirmizi NM, Kazmi QB. A new species of Mesacturoides from Karachi waters with notes on its first larva (Stomatopoda: Gonodactylidae). Crustaceana 1980;38(1):61-66.
25. Tirmizi NM, Kazmi QB. A hand book on a Pakistani mantis shrimp *Oratosquilla* (Ed.R.B. Manning) CEMB University Karachi, Pakistan. Publ 1984;4:101.