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A Study of the Gastric Mill of Prawn of Genus *Parapenaeopsis*

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Abstract: The present paper is based on the study of gastric mill of four species of penaeid prawn belonging to genus *Parapenaeopsis*. A careful examination of gastric mill with particular emphasis on the position and structure of plates and ossicles has revealed that each ossicle is specific and shape may also afford important generic characters.

Key words: Gastric, prawn, genus, *Parapenaeopsis*

Introduction

The gastric mill is a term applied to the complicated apparatus found in the stomach. Since the gastric mill is responsible for converting food into a stage that it can be utilized by the animal an understanding of this apparatus is of considerable importance. Its structure can also help in judging the nature of food required by the animal.

The notable work carried out only Patwardhan (1935) and Kubo (1949). The study of gastric mill is the first of its kind in Pakistan.

Present study is based on the four species of the genus *Parapenaeopsis*: *P. stylifera*, *P. sculptilis*, *P. hardwicki* and *P. pacclivirostris* which are found along the Sindh and Makran Coast (Northern Arabian Sea).

Materials and Methods

Fresh specimens were collected from the Fish harbour and other local fish markets of Karachi. They were immediately dissected and studied for the gastric studies. The tissue were fixed in Bouins fluid, embedded in paraffin and stained with hematoxylin and eosin. Keep the stomachs in one or two days in decalcifying solution (Formic acid and Sodium citrate solution 1:1) after-fixation gastric mill of the four species of the genus *Parapenaeopsis* have studied.

Following abbreviations are used in the text and figures. The terminology adopted after Patwardhan (1935).

Cardiac plate	(Cp)
Cardiac ossicle	(Co)
Comb plate	(Cop)
Lateral denticles	(ld)
Lateral fold	(lf)
Lateral ridge	(lr)
Median fold	(mf)
Median ridge	(mr)
Prepyloric ossicle	(Pp)
Pterocardiac ossicle	(Po)
Urocardiac ossicle	(Uo)
Zygocardiac ossicle	(Zo)

Results and Discussion

The stomodeal apparatus in the species belonging to the genus *Parapenaeopsis* consists of a paired, unpaired

ossicles and a pair of hastate or cardiac plate, median and lateral ridges and folds. Detailed description of each unit is given below.

Gastric mill of *P. stylifera* (Milne-Edwards, 1837).

Cardiac Plate: The floor of the cardiac stomach has a pair of triangular plates called hastate or cardiac plate (Fig. 1, Cp). They are posteriorly continuous with the zygocardiac ossicle (Zo). The cardiac plate is about five times as broad as the median and lateral ridges. Each lateral margin of the cardiac plate is armed with rows of 27 acutely pointed small teeth, which are aligned longitudinally and the number of teeth show specific variation. Each plate has a soft central part, the inner margin of which is supported by a cuticular ridges bearing setae.

Lateral Ridges: A pair of long cultural ridges, the lateral ridges (Fig. 1, lr) run parallel to the lateral margin of each cardiac plate. They are provided with regularly arranged rows of short hairs on their inner borders forming a comb like structure-the combed plate (Fig. 1, Cp).

Median Ridges: Another pair of ridges which can be differentiated from the lateral ridges, are the median ridges (Fig. 1, mr) much narrower than the lateral ones and gradually converging posteriorly, so that their tips fuse together. The size and arrangement of the hairs is more or less same as seen on the lateral ridges.

Median and Lateral Folds: On either side of the comb plates are the longitudinal lateral folds (Fig. 1, lf) and median folds (Fig. 1, mf) which are sometimes blue-black in colour.

Cardiac or Mesocardiac Ossicle: (Fig. 2, Co): It is a small, unpaired, thick sub-triangular plate. Its posterior end is attached to the urocardiac ossicle and on either side it joints the pterocardiac ossicle.

Pterocardiac Ossicle (Fig. 2, Po): Paired ossicles, situated antero-lateral to the urocardiac ossicle. Each ossicle is elongated, narrow and bar like, runs obliquely downwards of the base of the cardiac ossicle. Laterally it is connected to the zygocardiac ossicle by means of a strong ligament.

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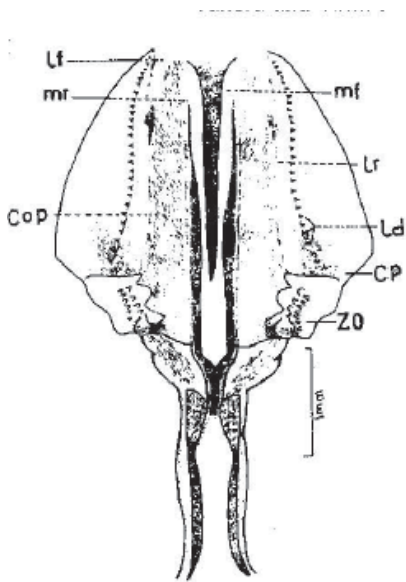


Fig. 1: *Parapenaeopsis stylifera* (Milne-Edwards, 1837).
Hastate plate

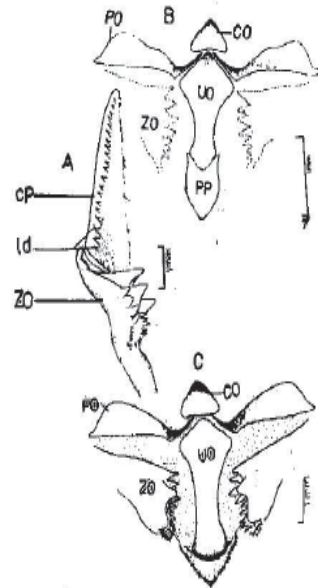


Fig. 3: *Parapenaeopsis sculptilis* (Heller, 1862). A, cardiac plate; B, ossicles, dorsal view; C, same, ventral view

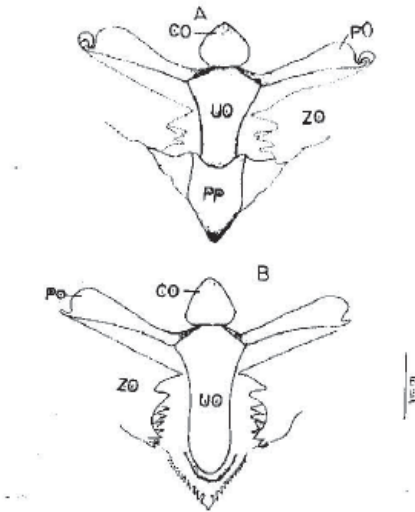


Fig. 2: *Parapenaeopsis stylifera*. A, ossicles, dorsal view,
B, same, ventral view

Pterocardiac ossicle is narrow at the beginning but at the outer end it becomes slightly sigmoid and acute with the convex margin forward.

Urocardiac Ossicle: The unpaired, elongated, thick plate, situated immediately in front of the cardiac ossicle. The urocardiac ossicle (Fig. 2, UO) is posteriorly fused with the lower end of the prepyloric ossicle. It is sub rectangular medially placed and with its sides curved inwards. Near the anterior portion it becomes considerably wide. The anterior end is, however, conical and articulates with the posterior

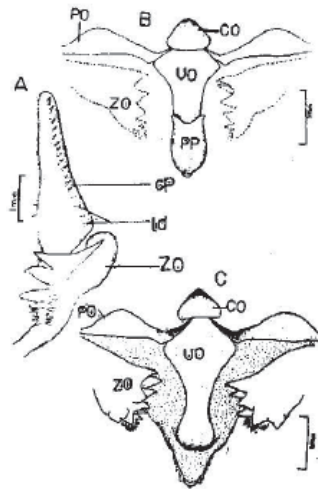


Fig. 4: *Parapenaeopsis hardwickii* (Miers, 1878). A, cardiac plate; B, ossicles, dorsal view; C, same, ventral view

margin of the mesocardiac ossicle, lateral edges run parallel to the antero-lateral margins of pterocardiac ossicle.

Zygocardiac Ossicle: Zygocardiac ossicle (Fig. 2, Zo) are the strongest and stoutest highly calcified paired ossicles of the gastric mill. Somewhat triangular in shape, Each lies obliquely on the lateral wall of the cardiac chamber. Its anterior end is connected with the lower end of pterocardiac and prezygocardiac and posterior end with cardiac plate. Posteriorly it is attached with the prepyloric

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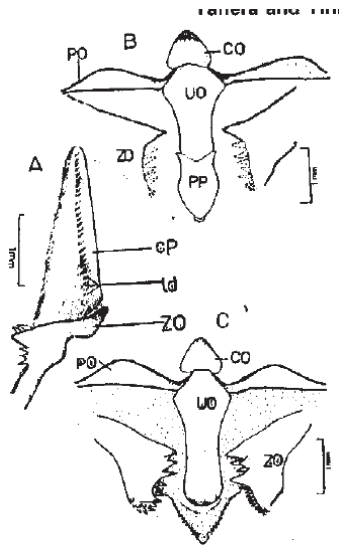


Fig. 5: *Parapenaeopsis acclivirostris* (Alcock, 1905). A, cardiac plate; B, ossicles, dorsal view; C, same, ventral view

by a membrane. Its anterior margin is extremely thick and dentate. Which are strongly impregnated with deep brown pigment. The number of teeth is constant of these three are large and pointed in between them there are smaller teeth which become progressively smaller posteriorly.

Prepyloric Ossicle: The prepyloric (Fig. 2, Pp) is of moderate size rather thick and wedge shaped, its anterior portion is closely connected to the posterior end of the urocardiac. Anterior margin of the ossicle is deeply concave. The ossicle gradually narrow, towards the postero-lateral border, armed with many sharp teeth which are yellowish brown in colour and 13 on each half.

According to Patwardhan (1935) the yellowish brown coloration is always associated with those part of the hard structure which masticate food material. It is interesting to note that a similar colour is developed on the molar processes of the mandibles, in the teeth of zygocardiac ossicle or also in a thick chitinous lining of a birds gizzard. Gastric mill of *Parapenaeopsis sculptilis* (Heller, 1862) The gastric mill also shows a close resemblance to that of *P. stylifera* except in details which are given below:

Cardiac Plates: The cardiac plates (Fig. 3A) after from that of the previous species in having fewer number of lateral denticles (ld). The number, however varies from 16-20.

Cardiac Ossicle: The cardiac ossicle (Fig. 3B, C) is characterized by have slightly concave posterior margins. The ossicle is one and half time as wide as long.

Urocardiac Ossicle: Urocardiac ossicle (Fig. 3B, C) is appreciably wider anteriorly its tip is acutely pointed.

Pterocardiac Ossicles: The pterocardiac ossicle (Fig. 3B, C) are also wider but very slender medially as illustrated in (Fig. 3A) having wavy anterior margin.

Zygocardiac Ossicles: It is closely resemble (Fig. 3B, C) that of the previous species.

Prepyloric Ossicle: Prepyloric ossicle (Fig. 3B, C) carries 11 acute teeth on each posterior-lateral margin. Gastric mill of *Parapenaeopsis hardwickii* (Miers, 1878). Gastric mill also shows close resemblance to that of *P. stylifera* except the following details.

Cardiac Plates: Cardiac plate (Fig. 4A) carries 16-18 lateral denticles. Ossicles found in the gastric mill resemble very much those of *P. sculptilis*.

Cardiac Ossicle: It is a triangular plate with the apex and the postern-lateral angles rounded. The posterior border is slightly concave. The ossicle is a trifle wider than long as seen in figure 4B and C.

Pterocardiac Ossicles: It is bar shaped, with curved thin inner and outer terminal portions (Fig. 4B, C) and a greatly expanded middle portion.

Urocardiac Ossicle: Urocardiac ossicle (Fig. 4B, C) is pointed at the anterior end, it has a pair of large triangular lateral expansion near anterior end.

Zygocardiac Ossicles: It shows a close resemblance to that of *P. stylifera*.

Prepyloric Ossicle: Prepyloric ossicle ends in a large, blunt medially placed tooth. Each postero-lateral margin bears 18 teeth which become gradually larger in size posteriorly. The median tooth, however, is much larger.

Gastric mill of *P. acclivirostris* (Alcock, 1905). The gastric mill of *P. acclivirostris* agrees rather well with that of *P. stylifera*. A careful examination show that there are some difference in details.

Cardiac Plate: Cardiac plates (Fig. 5A) carry altogether twenty six (26) teeth.

Cardiac Ossicle: Small, unpaired and sub triangular as in figure 5B, C.

Pterocardiac Ossicles: The ossicle resembles that of *P. hardwickii* except that it is not quite as broad (Fig. 5B, C).

Urocardiac Ossicles: It is rather long and narrow with slightly projecting lateral process (Fig. 5B, C).

Zygocardiac Ossicles: The structure of zygocardiac ossicle is similar to that of *P. stylifera*.

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Prepyloric Ossicle: Each half of the prepyloric ossicle (Fig. 5B, C) carries fourteen (14) teeth.

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