SUMMARY

Limpets are various gastropod snails, with a low conical shell, adhere tightly to rocks with their strong foot. Most limpets have a definite place of their own on the same rock, and roam up at night to mate and scrape algae off rocks with their radula then return to the same spot. In spite, using limpets as a diet; their shells for jewelry and recently using Keyhole limpet hemocyanin (KLH) as a promising tumor vaccine carrier, very limited studies are known about them in Egypt. So, this study planned to throw light on their taxonomy, anatomy and sperm forms of dominant species. In addition, ecological investigations and histological and histopathological investigations of some organs of the dominant species were carried out.

11 limpet species were recorded during the present study at different habitats of the Egyptian marine water, one of them was recorded for the first time in Egypt. These species belonging to 2 subclasses, Prosobranchia and Pulmonata; 2 orders, Archaeogastropoda and Basommatophora; 3 families, Patellidae, Fissurellidae and Siphonariidae and 4 genera, *Patella, Cellana, Diodora* and *Siphonaria.*

The anatomical investigations of *Patella caerulea, Diodora italica* and *Siphonaria kurracheensis* reveal that the shell of *P. caerulea* is conical without apical opening or any canal, *D. italica* has an opening at the apex of the shell while, *S. kurracheensis* has a small canal at the

right side of the shell. The foot is oval in the three species and attached to the shell by shell muscle. The cephalic tentacles of *S. kurracheensis* is flattened and more reduced than those of *P. caerula* and *D. italica*.

The mantle cavity of *D. italica* is larger than those of *P. caerula* and *S. kurracheensis* which contain two bipectinate gills. *P. caerula* has secondary gills around all the body. In *S. kurracheensis*, the gills are absent but the mantle roof act as a lung for respiration.

The digestive system consists of the same structure in the three species with few exceptions, such as, the radula has radular cartilages in *P. caerula* and *D. italica*; the oesophagus has many folds also in *P. caerula* and *D. italica*; the intestine of *P. caerula* is very long, has many loops and makes fecal pelets; in *D. italica*, it is short and lacking loops while in *S. kurracheensis* the intestine has S-shaped.

The heart is two chambers in *P. caerula* and *S. kurracheensis* while in *D. italica* it consists of three chambers. The excretory system consists of two kidneys in *P. caerula* and *D. italica* and one kidney in *S. kurracheensis*. The sexes are separate in *P. caerula* and *D. italica*, each individual has one large gonad and the fertilization is external while, *S. kurracheensis* is a hermaphrodite and use internal fertilization. The nervous system is similar in the three species which consists basically of six pairs of ganglia, connectives and commissures.

The sperms of *Patella caerulea* and *Diodora italica* are of primitive type typical to animals using external fertilization. The sperm consists of a head region which is composed of acrosome and nucleus, a simple

mitochondrial midpiece and a flagellum with 9+2 arrangement. The differences between the sperms of the two species represented by length(L): breadth(B) of the acrosome and nucleus and the number and shape of mitochondria.

The sperm of *Siphonaria kurracheensis* is of modified type typical to animals using internal fertilization. It consists of five divisions, the acrosome; nucleus; midpiece which composed of three parts, neck region, glycogen helix and mitochondrial derivative region; glycogen piece and the end piece.

The ecological studies revealed that, there are marked differences between stations in Physico-chemical parameters of water. Also, the heavy metals content in sea water and in soft tissues of *Patella caerulea* showed marked differences between stations in most metals concentrations. El-Mex station reported the highest values of Cd and Pb while El-Anfushi reported the highest values of Co and Zn and Abu-Qir recorded the highest value of Fe in sea water surface. Heavy metals recorded highly significant differences between sea water and *Patella caerulea* soft tissues.

18 species were collected from Abu-Qir, El-Anfushi and El-Mex. These species belonging to 13 families and 3 classes. Gastropods dominated the fauna in term of species abundance while bivalves dominated the fauna in term of number of individuals. Patellidae was the most common family of Gastropoda while Mytilidae was the most common family of Bivalvia. *Mytilis minimus* was the most abundant rocky shores molluscs species which dominated all examined stations.

Abu-Qir recorded the highest number of species and individuals while El-Mex station recorded the lowest values. El-Anfushi recorded the highest values of species diversity and evenness and Abu-Qir recorded the highest value of species richness while El-Mex recorded the lowest value of species diversity, evenness and richness.

El-Anfushi revealed the highest number of limpet individuals and species while, El-Mex has the lowest number. *Patella caerulea* is a dominant species of genus *Patella* and *Diodora italica* is the dominant species of genus *Diodora*.

The digestive gland of *Patella caerulea* made up of branching tubules, each tubule has a lumen of secretion and two types of cells, digestive cells and basophilic cells. Samples exposed to 0.5, 0.7 and 1 ppm Cd showed no alterations compared to controls after 24 h. but for 48 h., apical microvacuolisation increase and the basophilic cells decrease. At the same concentrations, an intense autolysis occur for 72 h. while, at 5^{th} day all the tubules showed a great loss in their structures. Specimens exposed to 1.5 and 2 ppm Cd revealed the presence of large vacuoles for 24 and 48 h. and the tubules loss their structure at 72 h. The effect of Cu revealed a great autolysis in all cells for 72h. at 0.5 and 0.7 ppm and for 24 and 48 h. at 1 ppm Cu.

The foot of *Patella caerulea* is formed of pedal epithelium, compact fibrous layer and muscular portion. The pedal epithelium consists of two types of cells and the muscular portion contains blood cells, vesicles, pigments and nerves. The effect of Cd and Cu represented by the increase of glands content, increase the mucus secretion and lossing of muscle fibers directions.