Taxonomical and Ecological Studies on some Polyplacophora
Gray, 1821(Mollusca) Inhabiting Red Sea Coast of Egypt

علي عبدالطيب ثابت
علي عبدالطيب ثابت
أحمد هامد عبیدالله، زيناء عبدالخلاق البكري، عمر سيد عمر

Abstract:

Polyplacophora are known as chitons, entirely marine organisms of intertidal to
subtidal habitats, some species extend to live in deep water. Chitons are characterized
by eight dorsal shell plates, articulated by a muscular girdle, which is supported by
calcareous spines, spineletes or scales. On their ventral body side, chitons have a broad
muscular foot, which is used for creeping on the substrate and a separat head, with a
centrally laying mouth opening. The head and foot are surrounded by the mantle cavity,
which also harbours the ctenidia.

Based on the previous literature, study of the taxonomy and ecology of Polyplacophora
in the Red Sea is scarce. To the best of the present author's knowledge, there were just
For that, the present study was designed and aimed to:
1. Make a horizontal survey and abundance of Polyplacophora species along the Red Sea
coast of Egypt.
2. Study the Taxonomy of Polyplacophora species along the Red Sea coast of Egypt.
3. Make a revision for the recorded species using different morphometric, meristic and
genetic characteristics
4. Design a key for Polyplacophora of the Red Sea coast of Egypt.
5. Study the Effects of some physico-chemical factors (air temperature, water

temperature, pH, dissolved oxygen, total dissolved solids, conductivity and salinity.) on
the density of the collected species.

To achieve the above mentioned goals, Polyplacophoran species were collected during
one year extending from January 2010 till December 2010 from three different sites (I, II
and III) on the Red Sea
coast of Egypt. Also, some ecological factors including air and water temperature, pH,
DO, conductivity, salinity and TDS were measured during sampling period.

For performing the horizontal survey, Polyplacophora specimens were hand collected
randomly, during a period from January till December 2010, from intertidal and shallow
subtidal waters from 28 different sites, including Site I, Site II and site III on the Red Sea
coast of Egypt. To test the present data, statistical analysis was performed using IBM
SPSS Statistics software package (Version 19).

For taxonomical study, light, scanning electron microscope and nuclear ribosomal genes
(18S rRNA) were used. The total 140 of morphological characters of investigated species
were examined and assessed and subjected to cladistic analysis using POY 4.1.2
software. The 18S rRNA sequence is alignment tool of the Geneious software and Clustal
W in MEGA5 software. Construction of the phylogenetic tree was made by using the
distance matrix method of analysis (Neighbor-Joining) (NJ) and maximum likelihood
(ML). Phylogenetic relationships between studied species based on all morphological
characters and molecular data was performed by using POY 4.1.2. Construction of the
phylogenetic tree were made by using the maximum parsimony (MP) using the selected
parameter set (tcm211).

The present study revealed that:

- Six species were recorded during the horizontal survey from the 28 investigated sites
along the Red Sea coast of Egypt. According to the percentage of the frequency in the 28
samples, the 6 recorded species and two morphs of one species were:
- Acanthopleura vaillantii (banded morph) (F% = 75%).
- Acanthopleura vaillantii (non-banded morph) (F% = 54%).
- Tonicia (Lucilina) sueziensis (F% = 14%).
- Chiton (Rhyssoplax) affinis (F% = 10%).
- Acanthochitona penicillata (F% = 7%).
- Ischnochiton (Ischnochiton) yerburyi (F% = 3%).
- Onithochiton erythraeus (F% = 3%).

- Only one species Acanthopleura vaillantii (both morph) was recorded from the three investigated sites, while Onithochiton erythraeus was recorded only from site (III), Tonicia (Lucilina) sueziensis and Chiton (Rhyssoplax) affinis were recorded from site (II) and (III) and Ischnochiton (Ischnochiton) yerburyi and Acanthochitona penicillata were recorded from site (II) only.
- Scanning electron microscope of growth margin of intermediate valve, girdle and the radula has been utilized to resolve the taxonomic status of Polyplacophora.
- Furthermore, the cladistic and phylogenetic analysis had indicated that:
  1. Acanthochitona penicillata belongs to suborder Acanthochitonina.
  2. The other studied species belong to suborder Chitonina. The subfamily Chitoniinae is a sister taxon to family Ischnochitonidae, while the subfamily Tonicinae is a sister taxon to family Acanthopleurinae and belong to family Chitonidae.
- For studying the effects of the environmental factors on the density of the species which were collected from the three main sites, correlation analysis and stepwise multiple regression were applied to select model equations controlling these relations. It was concluded that:
  1. The density of C. (R.) affinis is positively correlated with the conductivity (r = 0.448, P<0.01), salinity (r = 0.454, P<0.01), temperature of air (r = 0.404, P<0.05), temperature of water (r=0.363, P<0.05) and with the total dissolved solids (r = 0.378, P<0.05). Its abundance was affected by the conductivity (R=0.4, P<0.01).
   The model equation is: The number of C. (R.) affinis in one hour= -33.14 + 0.606 COND.
  2. The density of T. (L.) sueziensis is positively correlated with the temperature of air (r = 0.349, P<0.05) and with the conductivity (r=0.419, P<0.05). Its abundance was affected by the conductivity (R=0.42, P<0.01).
   The model equation is: The number of T. (L.) sueziensis in one hour= -19 + 0.345 COND.
  3. The density of A. vaillantii (banded morph) was negatively correlated with the conductivity (r = -0.432, P<0.01), salinity (r = - 0.427, P<0.01) and positively correlated with total dissolved solids (r = 0.389, P<0.05). Its abundance was affected by the conductivity and pH (R=0.603, P<0.05).
   The model equation is: The number of A. vaillantii (Banded morph) in one hour= 140.8 - 3.88 COND + 11.7 pH.
  4. The density of A. vaillantii (non-banded morph) was negatively correlated with salinity (r = -0.554, P<0.01), total dissolved solids (r = -0.582, P<0.01) and with conductivity (r = - 0.364, P<0.05). It was affected by the total dissolved solids (R=0.582, P<0.01).
   The model equation is: The number of A. vaillantii (Non Banded morph) in one hour= 67.25 - 1.8 TDS.
  5. The density of Acanthochitona penicillata is not significantly correlated or affected with any of the measured ecological factors.


236

...