# Epibiont communities of the two spider crabs *Schizophrys aspera* (H. Milne Edwards, 1834) and *Hyastenus hilgendorfi* (De Man, 1887) in Great Bitter Lakes, Suez Canal, Egypt.

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## ABSTRACT

The epibiont communities of the two spider crabs *Schizophrys aspera* and *Hyastenus hilgendorfi* in Great Bitter Lakes were studied during spring and summer of 2011. A sum of six taxa including twelve species of epibionts was recorded on each of the two investigated crabs. Most of the epibionts were including Protozoa, Hydrozoa, Polychaeta, Cirripedia, Bryozoa and tunicates. Generally, Cirripedia and Polychaeta dominated the other epibiont species on the two investigated spider crabs. Barnacles were the most widespread species on the four examined parts of *Schizophrys aspera,* whereas the abdomen of *Hyastenus hilgendorfi* was commonly covered with polychaetes, followed by barnacles while tunicates were dominating on mouth parts, carapace and limbs. Abundance of epibionts increased as the crab size increased.

**Key words:** Spider crab, epibiont, Bitter Lakes, Suez Canal

## INTRODUCTION

Epibiosis is an association of two organisms; the epibiont and the basibiont, both describe an ecological function (Wahl, 1989). The term ‘‘epibiont’’ includes organisms that, during the settlement of their life cycle, are attached to the surface of a living substratum, while the ‘‘basibiont’’ lodges and gives support to the epibiont (Threlkeld *et al.*, 1993).

Space is considered a limiting factor for sessile organisms requiring hard substrata particularly in marine habitats where sediment is widespread (Connell and Keough, 1985). The crab's epibionts had been studied in different areas and depths; that may provide valuable information on the spatial variability of fouling communities and help to estimate the role of different factors in determining infestation rates (Savoie *et al*., 2007). Available hard substrata, including body surfaces of marine invertebrates, are subjected to colonization (fouling) by bacteria, diatoms, protozoans, fungi and other macroorganisms (Wahl, 1989). The study of epibiotic organisms, which rarely have a free-living life stage and are difficult to collect, may provide important information about their biology (Williams and Mc Dermott, 2004). Many hydrozoan polyps (hydroids) have been described as epibionts on a great variety of living substrata. Molluscs, fish and crustaceans have been found to be basibionts for hydroids (Bouillon, 1993).

Many marine organisms (sponges, octocorals, and ascidians) possess efficient mechanical, physical, chemical and biological mechanisms to prevent fouling (Stoecker, 1978; Barthel and Wohlfahrt, 1989; Davis *et al*., 1989; Wahl and Sonnichsen, 1992). The calcified body surfaces of crustaceans are suitable settling sites for sessile organisms (Connell and Keough, 1985). Some crab taxa such as Majidae and Dromidae acquire a dense protective cover of epibionts (Coutress *et al*., 1970; McLay, 1983; Maldonado and Uriz, 1992). However, many other crab species seem almost lacking epibionts. This suggests the existence of efficient defence (antifouling) mechanisms. Glynn (1970); Mori and Zunino (1987) and Svavarsson & Davidsdottir (1994) suggested that crustaceans bury in the sediment to avoid colonization.

Moulting is another mechanism thought to remove epibionts (Barnes and Bagenal, 1951) although some epibionts coordinate their life cycle with the moulting events of their hosts (Fenchel, 1965; Jeffries *et al*., 1992). Information about chemical defense is scarce (Luckenbach and Orth, 1990).

Most previous studies described epibionts on large crabs caught in deep waters (Bakay *et al*., 1998; Jansen *et al*., 1998) and small crabs from shallower sites (Dvoretsky, 2008; Dvoretsky and Dvoretsky, 2009).

However, little is known about the fouling that colonize spider crabs in Suez Canal Lakes. So, the aim of the present study was to describe the fouling community of the two spider crabs *Schizophrys aspera* and *Hyastenus hilgendorfi* in Great Bitter Lakes, Suez Canal, in addition to evaluate the percentage of occurrence and intensity of epibionts on the investigated crabs and to determine factors affecting the distribution of epibionts on the basibiont crabs.

## MATERIALS AND METHODS

### Study area

The Bitter Lakes are the central and most important water body of the Suez Canal (Fig. 1). According to Thorson's (1971), it contains 85% of the waters of the canal system. The study area is bounded by latitudes 30°:10′ - 30°:26′ N, and longitudes 32°:10′ - 32°:40′ E. The Bitter Lakes consist of Great Bitter Lake and Little Bitter Lake which are connected to each other as shown in Figure 1. The total length of the lake is 36 km, which separates the basin into a northern part (the Great Bitter Lake with a maximum width of 13 km) and a much narrower southern part (the Little Bitter Lake). The western shore is steeper and a few rock outcrops are formed. The maximum water temperatures recorded were in July and August (30$^{o}$C), while the water temperature started to decline from September reaching the minimum value in January (15$^{o}$C). On the other hand, the salinity showed a great fluctuation from a month to another. It attained the maximum value in October (38‰) and February (41‰) where as the minimum value has been recorded in January (10%) (Ahmed *et al*., 2004).

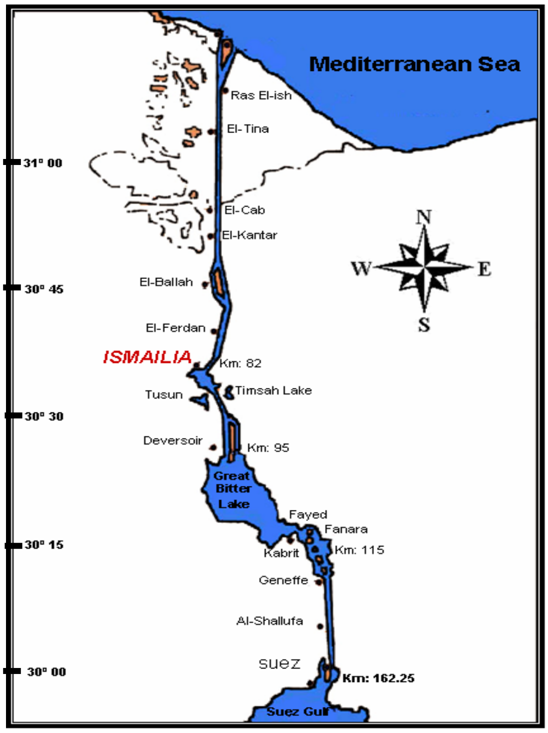


Fig. 1: Sampling sites in Great Bitter Lakes, Suez Canal, Egypt.

**Field sampling**

A total of 64 specimens of *Schizophrys aspera* and 56 specimens of *Hyastenus hilgendorfi* had been collected during spring and summer of 2011 from the western side of Great Bitter Lakes, Suez Canal. Specimens were collected by hand from above buoys in the subtidal zone and jetties in the intertidal zone as well as by fishermen at Deversoir and Fayed (Fig. 1). All crabs were characterized by having old and very old carapace according to the moulting stage which was determined by Donaldson and Byersdorfer (2005).

**Sample processing**

Each crab specimen was sexed and checked for epibionts, and then they were removed from the crab and preserved using 4% formaldehyde/ sea water solution.

Comparing the percentage occurrence of epibionts between both sexes of the two investigated species was tested by chi-square. The crab body was divided into four parts: carapace (dorsal surface), abdomen, limbs (including chelae) and mouth parts, while the epibionts occurred on each part were recorded and identified to the species level.

The carapace width (CW, the greatest straight-line distance across the carapace of the lower lateral margin excluding spines according to Donaldson and Byersdorfer, 2005) was measured. Collections of the two crab species were classified into different size groups. Differences in epibionts occurrence among different size groups were recorded.

## RESULTS

In the present study, a total of 64 specimens (28 females, 43.75% and 36 males, 56.25%) of *Schizophrys aspera* and 56 specimens (24 females, 42.9% and 32 males, 57.1%) of *Hyastenus hilgendorfi* were examined for associated organisms.

**Taxa composition of the epibionts**

All the crabs collected had various epibionts on their body. A sum of six taxa including twelve species of epibionts was recorded on each of the two investigated crab (Table 1). Species composition of epibionts on *Schizophrys aspera* was similar to these on *Hyastenus hilgendorfi*. Most of the epibionts were the passive sedentary forms, including Protozoa, Hydrozoa, Polychaeta, Cirripedia, Bryozoa and tunicates (Fig 2.).

Of the six epibiont taxa recorded on *Schizophrys aspera*, Polychaeta and Cirripedia were the dominant representing 50.8% and 34.6% respectively, the other epibiont species varied from 5% (Hydrozoa and Bryozoa) to 1% (Protozoa) (Fig. 2).

Table 1: List of taxa and the number of epibionts per crab.

| Taxa | *Schizophrys aspera* | | | | *Hyastenus hilgendorfi* | | | |
|---|---|---|---|---|---|---|---|---|
| **Protozoa** | **min** | **max** | **mean** | **±SD** | **min** | **max** | **mean** | **±SD** |
| *Ephelota gemmipara* (Hertwig, 1875) | 0 | 2 | 1.3 | 0.3 | 1 | 1 | 1 | 0 |
| **Hydrozoa** | | | | | | | | |
| *Obelia geniculata* (Linnaeus, 1758) | 0 | 7 | 4.2 | 6.4 | 1 | 2 | 1.5 | 0.3 |
| *O. dichotoma* (Linnaeus, 1758) | 0 | 5 | 2.2 | 2.8 | 0 | 1 | 0.5 | 1.2 |
| **Polychaeta** | | | | | | | | |
| *Hydroides elegans* (Haswell, 1883) | 4 | 93 | 63.8 | 7.7 | 3 | 72 | 37.5 | 8.2 |
| **Cirripedia** | | | | | | | | |
| *Balanus amphitrite* (Darwin, 1854) | 4 | 38 | 30.4 | 12.8 | 2 | 29 | 15.5 | 8.1 |
| *B. eburueus* (Gould, 1841) | 3 | 22 | 13 | 2.3 | 3 | 19 | 11 | 2.5 |
| **Bryozoa** | | | | | | | | |
| *Bugula neritina* (Linnaeus, 1758) | 0 | 12 | 6.3 | 0.4 | 0 | 8 | 4 | 0.2 |
| **Tunicates** | | | | | | | | |
| *Styela partita* (Stimpson, 1852) | 0 | 2 | 1.2 | 0.9 | 2 | 5 | 3.5 | 0.6 |
| *S. canopus* (Savigny, 1816) | 0 | 1 | 0.8 | 0.2 | 1 | 4 | 2.5 | 0.3 |
| *Ciona intestinalis* (linnaeus, 1767) | 0 | 1 | 0.5 | 0.2 | 0 | 4 | 2 | 0.3 |
| *Microcosmus pupa* (Savigny, 1816) | 1 | 1 | 1 | 0 | 2 | 2 | 2 | 0 |
| *Polyclinum constellatum* (Savigny, 1816) | 0 | 1 | 0.8 | 0.2 | 1 | 4 | 2.5 | 1.3 |

In *Hyastenus hilgendorfi*, Tunicates, Polychaeta and Cirripedia dominated the other epibiont species, representing 45%, 20% and 14.7% respectively, followed by Bryozoa (4.8%) and Hydrozoa (2.4%), while the Protozoa attained a minimum value of 1.2%. (Fig. 3).

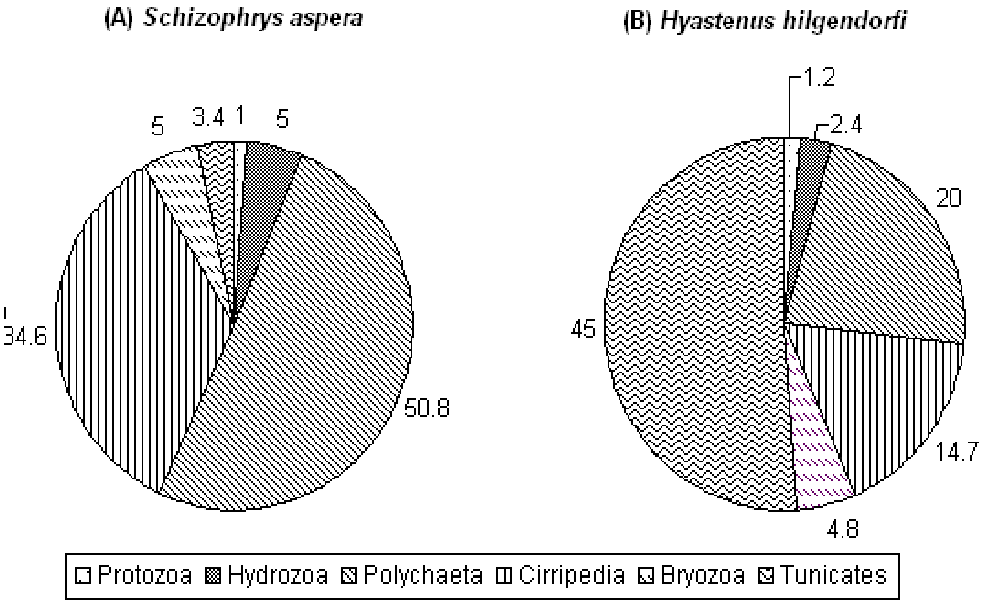


Fig. 3: Taxa composition of the epibionts on the two investigated crab species.

The percentage of occurrence of ebipionts for males and females did not differ significantly ($\chi2 = 1.04$, $P= 0.1$) and ($\chi2= 2.01$, $P= 0.1$) for *Schizophrys aspera* and *Hyastenus hilgendorfi*, respectively.

**The epibiont distribution on different body parts**

The body was divided into four parts; carapace (dorsal surface), abdomen, limbs (including chelae) and mouth parts. The barnacles *Balanus amphitrite* and *B.ebureus* were the most abundant species, being present on the four examined parts of *Schizophrys aspera* (Fig. 4) with a maximal distribution on the mouth parts (39.5% and 25.5%) of the total mean number of epibionts per crab part. The polychaete *Hydroides elegans* followed the barnacles in distribution and was found on all parts of the crab, colonization intensity was observed on mouth parts (35%), abdomen (17.8%), limbs (9.4%) and carapace (6.5%). The two hydrozoan species could be found as epibionts on carapace 17%, limbs 17% and abdomen 11% while they were lacking from the mouth parts. Protozoa, Bryozoa and tunicates were reported on carapace and limbs only, whereas they could not be found on other crab parts.

In *Hyastenus hilgendorfi*, the abdomen was commonly covered with the polychaete, *Hydroides elegans* (29.9%), followed by the two barnacle species *Balanus ebureus* (23%) and *B. amphitrite* (21%). Tunicates were represented by the two species *Microcosmus pupa* (16%) and *Polyclinum constella* (4%). Hydrozoa reached the minimum value represented by 14%.

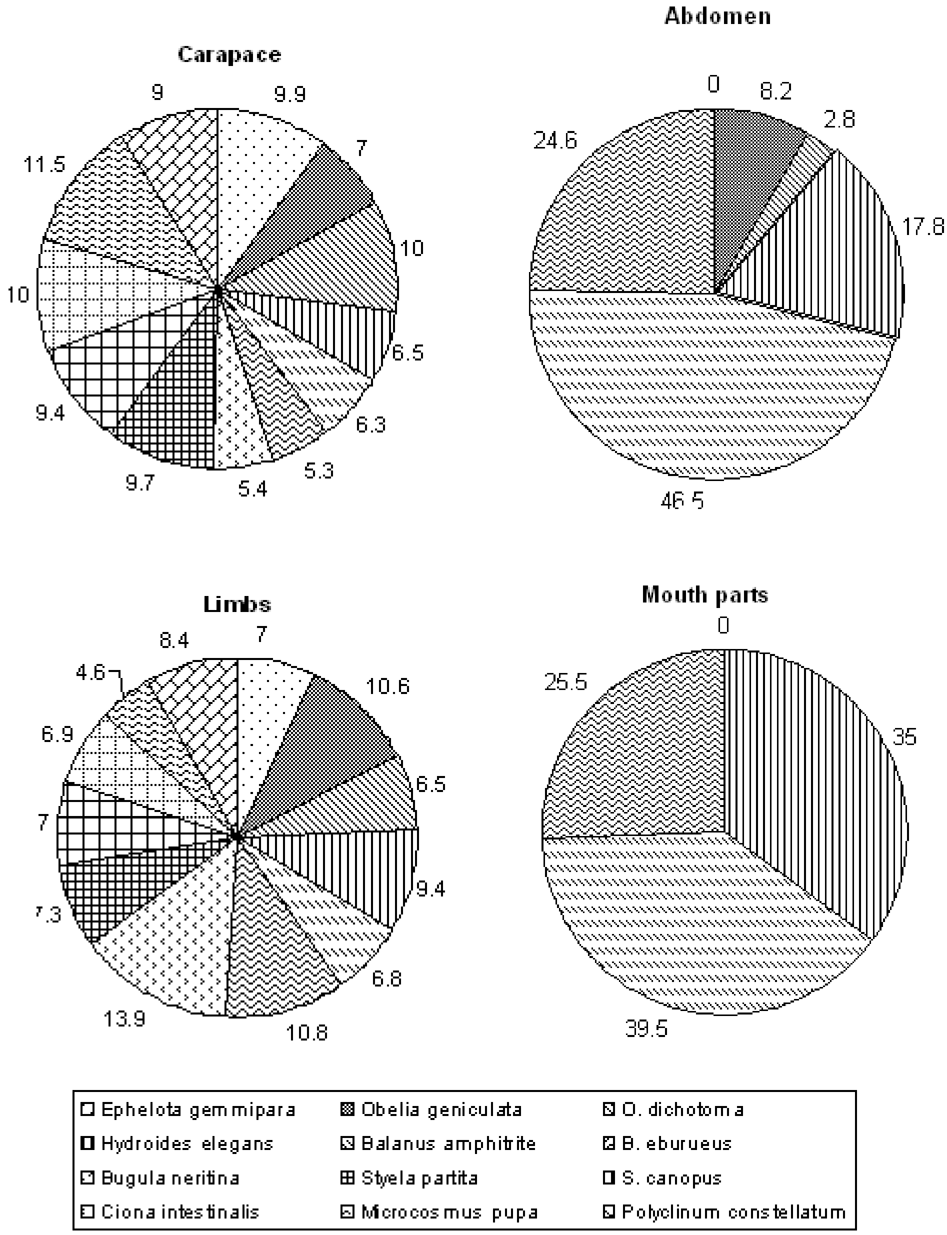


Fig. 4: Percentage occurrence of epibiont taxa on each of the four parts of *Schizophrys aspera*

Tunicate species dominated the other taxa on mouth parts, carapace and limbs of 69.1%, 50.5% and 19.6%, respectively, while polychaetes attained the least values on carapace (5.7%), mouth parts (9.2%) and limbs (10.2%) (Fig. 5).

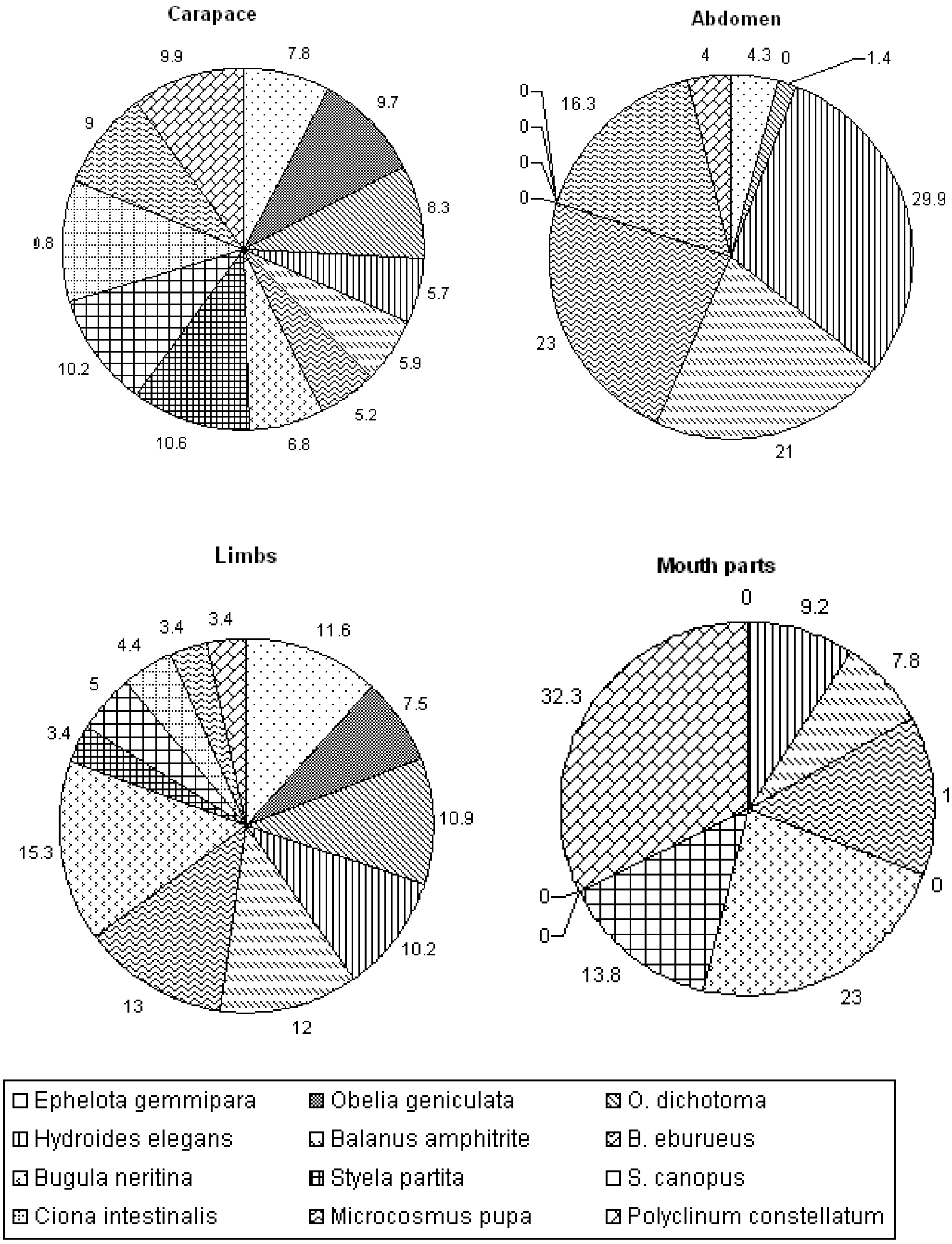


Fig. 5: Percentage occurrence of epibiont taxa on each of the four parts of *Hyastenus hilgendorfi*

## Abundance of epibionts on different crab size

Generally, abundance of epibiont species increased with the increase of the crab size. In *Schizophrys aspera*, carapace width was differentiated into six size classes that varied between 25- 75 mm. Maximal values attained 90% at size class > 70mm. where as the minimal value (12.7%) was represented at the least size range (25 - 35mm) carapace width. The same trend could be recorded in *Hyastenus hilgendorfi,* where maximum value of epibionts (86%) was attained at maximum carapace width >28mm. while minimum value (9.2%), was recorded at the least size range (20 – 22 mm.) carapace width (Fig. 6).

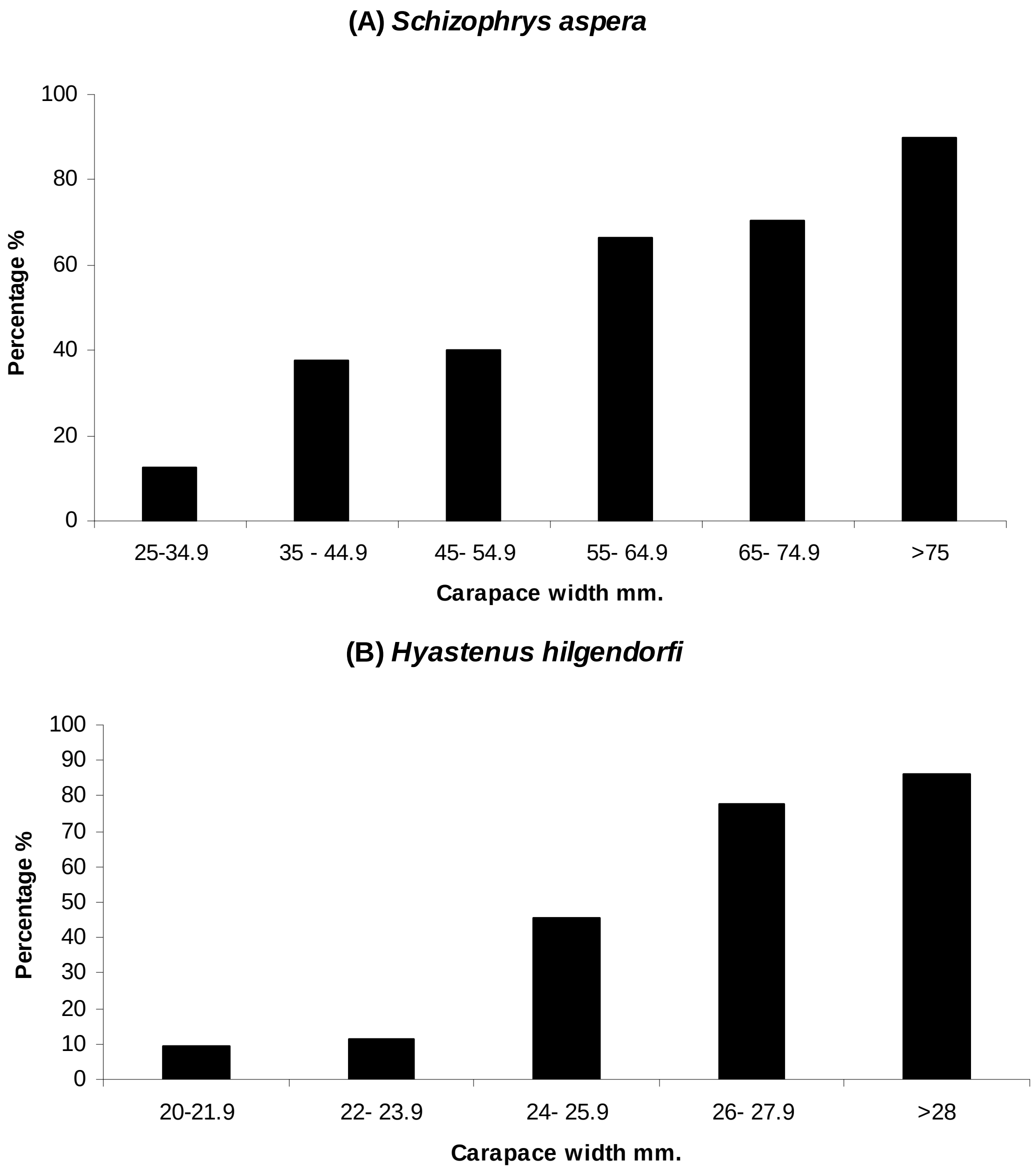


Fig. 6: Abundance of investigated crabs epibionts with different size classes.

## DISCUSSION

Epibiosis on spider crabs is beneficial for the epibiont species, since it enhances food acquisition, increases epibionts mobility and affords them a degree of protection from predators (Wahl, 1989, McGaw, 2006 and Fernandez-Leborans, 2010). On the other hand, there may be negative effects for basibiont, where epibionts could represent more weight for the crab and could reduce its mobility by modifying the hydrodynamic equilibrium of their appendages. These circumstances could cause crabs to be vulnerable to their predators (Overstreet, 1983 and Williams & McDermott, 2004). Also, Epibionts could compete with basibionts for available nutrients (Wahl, 1989). Conversely, the basibionts carrying an extra load of epibionts acting as camouflage would be better protected from predators as has been recorded from a number of brachyuran crabs (Wicksten, 1993 and Berke *et al*., 2006).

The species list of the epibiont species found on the two investigated crabs was compared with the identification list of Panteleeva, 2003 and Dvoretsky & Dvoretsky, 2008. The majority of epibiont species observed may be considered as non-symbiotic organisms, growing attached to a living surface (Wahl, 1989). There were typical attached animals such as barnacles, polychaetes, hydrozoans, bryozoans and tunicates that exploited the biogenic substrata for settling; especially in soft bottoms (study area), where few hard substrates are available for attachment. The predominance of barnacles on crabs is expected because *Balanus* species are one of the most common epibiont species in Bitter Lakes (Elkhawass, 2006). Barnacles are also known as epibionts of different crustaceans such as the spider crab *Hyas* spp. (Kuznetsov, 1964), snow crabs *Chionoecetes* spp. (Savoie *et al*., 2007) and the red king crab *Paralithodes camtschaticbls* (Dvoretsky and Dvoretsky, 2009). The polychaete is also a crab commensal species. This was proven by the high colonization intensity ratio on both investigated crabs (Dvoretsky and Dvoretsky, 2009). All identified attached species had no preferred surface (live or dead) for settlement. Hence, they might be considered as incidental associates (Dvoretsky and Dvoretsky, 2008). The higher diversity of epibionts in our study could be explained by Kuznetsov (1964) who focused on spider crabs. He concluded that spider crabs have a more scabrous carapace surface and with a great number of spines. Such irregular surface may be a more favorable habitat for settlement of the attached fauna (polychaetes, barnacles, hydrozoans and bryozoans). It was also explained that larvae of epibiotic organisms prefer surfaces with a bacterial film which can take several months to form on crab (Williams, 1964 and Gili *et al*., 1993). In addition, elder crabs are exposed to higher number of larvae that could settle and grow because crabs with old shells could reach a terminal moult (Dvoretsky and Dvoretsky, 2009).

It was found that male and female crabs had epibionts of equal proportions. This is in agreement with Dvoretsky, 2011(personal communication) who studied the epibionts of *Hyas araneus*.

The majority of epibionts were found on carapace and limbs of both investigated species. These largest basibiont parts may be the most accessible areas for epibiont species to settle. These results are in agreement with that of *Hyas araneus* (Dvoretsky, 2011), the red king crab (Dvoretsky and Dvoretsky, 2010) and *Emerita* sp. (Firstater *et al*., 2009). Both investigated species show the highest number of epibionts belonging to barnacles and polychaetes with dominance on mouth parts and limbs. This distribution pattern could be explained by the protected (mouth parts) and wider surface (limbs) with sufficient organic particles from the feeding activities of the crab (Fernandez-Leborans and Cardenas, 2009).

Abundance of epibionts was increased with the crab size for both investigated species. This is well-known fact, because increasing crab size makes more surfaces available for the epibiont settlement (Dvoretsky and Dvoretsky, 2008).

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**(A)**

**Tunicates** **Polychate** **Barnacles**

(B)

**Polychaete**

**Barnacles**

Fig. 2: Heavily infested spider crabs (A) *Schyzophrys aspera* and (B) *Hyastenus hilgendorfi*

## ARABIC SUMMARY

**مجتمعات الكائنات الفوقية على السرطانات العنكبوتية *شيزوفراس اسبيرا* و *هيستينس هلجندورفي* في البحيرات المرة الكبرى- قناة السويس- مصر**

**نسرين قدري مرسي**
قسم علوم البحار- كلية العلوم- جامعة قناة السويس- الاسماعيلية – مصر.

تم دراسة مجتمعات الكائنات الفوقية على السرطانات العنكبوتية في البحيرات المرة الكبرى- قناة السويس- مصر خلال موسمي ربيع و صيف 2011. و قد تم تسجيل ست مجموعات يندرج تحتها اثنا عشر نوعا من الكائنات الفوقية الموجودة على السرطانات. و قد تمثلت هذه الكائنات بمجموعة الأوليات و الهيدرات و الديدان عديدة الأشواك و ذؤابية الأقدام القشرية و الحزازيات الحيوانية و الغلالليات. و قد شكلت ذؤابية الأقدام و الديدان عديدة الأشواك المجموعات الأكثر شيوعا. و كانت البرنقيلات الجالسة من اكثر المجموعات انتشارا على الأجزاء الأربعة المختلفة لسرطان *شيزوفراس اسبيرا* في حين غطت مجموعة الديدان عديدة الأشواك بطن *هيستينس هلجندورفي* ثم تلتها مجموعة البرقيلات و كانت مجموعة الغلالليات تغطي بكثافة الأجزاء الفمية و الدرقة و الأطراف. وفي المجمل فان كثافة هذه الكائنات الفوقية كانت تزداد بزيادة حجم السرطان.