Light and Scan Electron Microscopes on *Caligus kuwaitensis* (Copepoda: Siphonostomatoida), from Arabian Gulf Doubleur Bream, *Acanthopagrus bifasciatus*, Off Dammam, Saudi Arabia

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**Abstract:** This paper reports on the species of *Caligus kuwaitensis* of the genus *Caligus* (Siphonostomatoida: Caligidae), parasitic on Doubleur Bream, *Acanthopagrus bifasciatus*, Off Dammam, Saudi Arabia with total prevalence 38.18% (21 out of 55 examined *A. bifasciatus*). The obtained parasite was comprehensively described though light and scanning electron microscopy and its characteristic features were compared with that of previously described related species. The obtained copepod parasite is characterized by greatly reduced abdomen. It also has smaller dimensions than that previously described species. Body dimensions of female and male were measured 2.2 (2.00–2.42) and 1.65 (1.42–2.13) mm long, respectively. The same observation was reported for cephalothoracic, genital complex and abdomen.

**Key words:** Fish Parasites, Copepoda, *Caligus kuwaitensis*, *Acanthopagrus bifasciatus*, Saudi Arabia.

**INTRODUCTION**

Crustaceans are largely aquatic and more than 36,000 species have been described including copepods, branchiurans and isopods (Noga, 2000; Boualleg et al. 2010). Copepods, a class in the crustaceans, are found in fresh and sea water (Costello, 2006; Suárez-Morales et al., 2008). It can also impact wild populations. The family Caligidae currently contains 445 species in 33 genera; more than three quarters of these species are members of the genera *Caligus* (239 species) (Ho et al., 2000; Woo, 2006).

Copepod genus *Caligus* affect wild fish of commercial significance and are the most diverse and widely distributed groups of parasites in the world seas (Boxshall and Halsey 2004; Suárez-Morales et al., 2008; Özak et. al., 2012). They have long been recognized to have the potential to affect the growth, fecundity and survival of wild hosts where, they damage their hosts directly by their attachment mechanisms and by their feeding activities (Johnson et al., 1996 & 2004; Bayoumy et al., 2012). Thousands of species are already known, but many potential host groups have not been examined and for these reason even approximate estimates of species numbers are impossible (Rohde, 2005; Trilles and Justine, 2010).

*Caligus* Müller, 1785 is the largest genus of parasitic copepods, containing more than 250 species (Ho and Lin, 2004). This genus copepod parasite is influence host survival or cause unsightly changes in the flesh (Woo, 2006; Boxshall & El-Rashidy, 2009; Özak et al., 2010).

In spite of Doubleur bream, *Acanthopagrus bifasciatus* is one of the most important commercial fish at the Arabian Gulf, but literatures about parasites infesting them especially copepod are relatively rare. Therefore, this paper presents the discovery of parasitic copepods: *Caligus kuwaitensis* (Kabata and Tareen, 1984) on from Doubleur Bream, *A. bifasciatus*, Off Dammam, Saudi Arabia. The host fish were caught in the southern Arabian Gulf: off Dammam: and it became new host for the caligid parasite.

**MATERIALS AND METHODS**

**Fish Samples:**
A total of 40 Doubleur bream, *A. bifasciatus* were sampled purchased, freshly-caught, from the local fish market in DammamArea for parasitological examinations.

**Light Microscopy:**
The copepods were removed from the gills, the buccal cavity (pharyngeal cavity) and the mouth of the investigated fish species. The copepods were preserved in 70% ethyl alcohol. Then, the specimens were cleared in lactic acid for 2 h, then dissected and mounted in lactophenol as temporary slide preparations and examined on an Olympus compound microscope. Terminology of the body parts and appendages follows that of Ho and Lin (2004).
**Scanning Electron Microscopy:**

The crustacean copepods that removed from the investigated fish, washed repeatedly with seawater to free them from mucus, fixed in cold (4°C) 2.5% glutaraldehyde in 0.1 M sodium cacodylate buffer at pH 7.2, dehydrated through a graded acetone series (30%, 50%, 75%, 90%, and 100%), critical-point-dried, and sputter-coated with gold/palladium. Samples were examined under a HITACHI S-3400-N scanning electron microscope operated at an accelerating voltage of 20 kV. Terminology follows the usage adopted by Kabata (1979).

**Results:**

In the present investigation, only one Caligid species identified as *Caligus kuwaitensis* (Kabata and Tareen, 1984) was detected from the gills, pharyngeal cavity and the mouth cavities of 40 Doubleur bream, *A. bifasciatus*.

**Prevalence:** 38.18% (21 out of 55 examined *A. bifasciatus*)

**Description:** Dimensions based on 20 permanent slide of the parasite (Figures 1–3).

**Female:** Body (Fig. 1A&2A) 2.2 (2.00–2.42) mm long, excluding setae on caudal rami. Cephalothoracic shield suborbicular, slightly wider than long, with posterior margin of thoracic zone protruding well beyond tips of lateral zones; posterior sinuses shallow; lunules prominent, extending almost entire width of frontal plates; tips of first antennae not extending beyond lateral limits of shield. Fourth pedigerous segment distinctly wider than long, its demarcation from genital complex indistinct. Genital complex longer than thoracic zone of cephalothoracic shield, longer than wide, with sloping anterolateral margins and rounded posterolateral corners. Abdomen 1-segmented, subconical, broadly fused to genital complex, its length about, or less than, 10% that of genital complex. Cephalothoracic shield 0.93 (0.75–1.14) mm long and 0.97 (0.84–1.22) mm wide, excluding lateral hyaline membranes. Lunules (Fig. 1B) 279 μm wide; distance between lunules only slightly longer than their diameters. Genital complex trapezoidal, 0.71 (0.67–0.75) mm long and 0.62 (0.58–0.65) mm wide. Abdomen longer than wide and indistinctly 2-segmented, with much longer anterior somite. Strip of membrane on ventral surface of distal abdominal segment (Fig. 3B). Caudal ramus (Fig. 1A) slightly longer than wide (85×70 μm), armed with 3 short and 3 long plumose setae.

Egg-sac less one-half of body length, containing c. 4 eggs. Antennule without distinguishing characteristics. Antenna with posterior spine of second segment acuminate and provided with narrow flange on one margin. Postantennal process small but sharply pointed, bearing 2 basal papillae with each carrying 4 setules (Fig.1B&2D). Another similar papilla located nearby on sternum. Mandible (Fig. 1C) 13 teeth on medial margin of distal blade. Maxillule (Fig. 1D) comprising small, conical process and papilla with 3 setae. Maxilla (Fig. 1C) 2-segmented; proximal segment (lacertus) unarmed, slender; distal segment (brachium) carrying small subterminal hyaline membrane on outer edge and 2 unequal elements (calamus and canna) terminally. Maxilliped (Fig. 1B&C) 3-segmented; proximal segment (corpus) robust, protruded on medial surface into large pointed cone; middle and distal segments fused to form strong claw carrying medial seta. Sternal furca with subquadrate box straight (Fig. 1B and 2B&D). Leg 1 (Fig. 1B) protopod with long outer (anterior) seta and short inner (posterior) seta; endopod a small process tipped with 1 setule; first segment of exopod with row of setules on posterior edge; middle 2 of 4 terminal elements on last segment of exopod (Fig. 2B) with pectinate tip and also bearing accessory process. Leg 2 (Fig. 2C) coxa small, with large plumose seta on posterior edge; basis with small, naked outer seta; external spines on 3 exopod segments (Fig. 2D); endopod first segment with with fringe of fine setules on lateral margin of second segment and tufts of similar setules on first and third segments. Leg 3 (Fig. 1C&D and 2D) protopod (apron) with row of denticles on outer edge; medial, coxal seta longer than outer, basal seta. Leg 4 protopod with long, plumose outer seta; pectens on exopod segments at insertion of first and last outer spines. Leg 5 much reduced and represented by 2 small papillae on posterolateral margin of genital complex, 1 tipped with small plumose seta, other with 2 similar setae. Uropod (Fig.1A &2A) much reduced, with weak terminal armature.

**Male:**

Body (Fig. 3A) smaller than body of female 1.65 (1.42–2.13) mm long, but with same caligiform shape. Cephalothoracic shield similar to that of female, but with relatively deeper posterior sinuses and posterior margin of thoracic zone less protruding beyond tips of lateral zones, 1.31 (1.25-1.42) mm long, excluding marginal hyaline membrane. Fourth pedigerous segment shorter than wide, indistinctly delimited from genital complex. Latter suboval, shorter than thoracic zone of shield. Genital complex longer than wide, 0.35 (0.28-0.39) mm; with rounded corners and slightly convex to parallel sides. Abdomen one-segmented, about 40% shorter than genital complex, subrectangular, slightly broader posteriorly. Abdomen 0.25 (2.1–2.9) mm long and wider (0.21 mm) posteriorly. Caudal ramus longer than wide.

Antennule as in female. Antenna 3-segmented; proximal segment slender and unarmed; middle segment largest, armed with 4 corrugated pads; terminal segment smallest, with medial seta in basal region (Fig. 3E). Postantennal process (Fig. 3B) sickle-shaped. Maxillule (Fig.3C) reduced to small knob and papilla with 3 setae.
Corpus of maxilliped (Fig. 3B) with bifid tip at protruded medial surface. Both legs 5 and 6 (Fig. 3C) represented by 2 papillae, 1 tipped with small plumose seta and other with 2 similar setae.

Fig. 1: A light microscopic photomicrograph of an adult female *Caligus kuwaitensis*: A. Habitus of an adult female (ventral view); B. Well developed mouth cone; C. Ventral view of thorax and its appendages; Note. The mouth complex; D. Abdomen and its appendages. (Abbreviations: an, antenna; exp, exopod; md, mandible; seg, segment; sf, sterna furca).

Fig. 2: Scanning electron microscopy of adult female *Caligus kuwaitensis*: A. Complete specimen, ventral view; b lunulae and first antenna; c mouth cone; d second leg; e third leg. (Abbreviations: es, egg sac; seg, segment; sf, sterna furca).
Discussion:

*Caligus kuwaitensis* was described for the first time from the skin of *Plotossus anguillaris* in Kuwait Bay by Kabata and Tareen (1984). The previous authors reported that, the most characteristic feature of this species is the nearly vestigial condition of its abdomen.

The morphological features of our adult females revealed similarities both in shape and morphometrics to *C. kuwaitensis* as described by Kabata and Tareen (1984). The body proportions of our females are also in the range given by the previous authors. However, our female and males differ slightly from those of Kabata and Tareen (1984) in having relatively smaller body length, 1.65 (1.42-2.13) vs. (2.51) 2.36-2.60 mm) and 1.65 (1.42-2.13) vs. (1.21) 1.20-1.24, respectively. In addition, the same report for the measurements of cephalothorax female and males, 0.93 (0.75–1.14) vs. (1.39) 1.36-1.40 and 1.31 (1.25-1.42) vs. (1.39) 1.36-1.40, respectively. The same observation for both genital complex and abdomen dimensions. This difference in dimensions between the obtained parasite and that of Kabata and Tareen (1984) may be due to difference of both host and locality. The rest characters except previous report of the parasite under discussion are the same to that reported by Kabata and Tareen (1984). Our observations confirm that the parasitic copepods we found in the gills, pharyngeal and the mouth cavities of *A. bifasciatus* are clearly identifiable as *C. kuwaitensis* (Kabata and Tareen, 1984). The present investigation revealed the the gills, pharyngeal cavity recorded as new sites of infection for the present parasite. Moreover, Doubleur bream, *A. bifasciatus* and Dammam Area, Saudi Arabia are recorded as new host and locality for the parasite under discussion, respectively.

REFERENCES


