SHORT COMMUNICATION

Ectoparasitic sea lice, *Caligus minimus* (Otto 1821, Copepoda: Caligidae) on Brawn wrasse, *Labrus merula* L., in Izmir Bay, Aegean Sea

Tansel T. Tanrikul, Fatih Percin
Faculty of Fisheries, Ege University, Bornova, Izmir, Turkey

Abstract

This paper reports on the species of *Caligus minimus* of the genus *Caligus* (Siphonostomatoida: Caligidae), parasitic on marine fish, brawn wrasse (*Labrus merula*), genus Labridae, of Izmir Bay, Aegean Sea. The sea lice, *C. minimus*, is identified from the gill and external surfaces of the brawn wrasse (total length, 30 cm; weight, 210 gr.), particularly on its head. The entire collection of sea lice consists of 11-12 specimens, all of which are female. Ectoparasitic copepods especially belong to the Caligidae family, the most common crustacean parasites on fish. *C. minimus* can be found in Atlantic coasts, British waters, the North Sea, and the Mediterranean Sea. *C. minimus* ectoparasite is a host and mainly minimus the North Sea, and the Mediterranean Sea. can be found in Atlantic coasts, British waters, the host parasite, with change in environment, present the richness of the parasite. These researchers concluded that the ability to migrate is a factor that increases the chance of becoming infested with the ectoparasitic copepod species. Additionally, these migrations generally occur in association with other fishes and likely leads to increased contact with the parasite species within in the host population. In addition, migratory fish with environmental changes are characterized by high parasitic richness. Labridae family such as *Labrus merula* or *Symphodus melanocercus* are richest in parasites (gregarious), compared to nearly all other migrant fishes. This behaviour would facilitate the transmission of parasitism (Bron and Treasurer, 1992; Combes, 1995).

Studies on ectoparasites, mainly parasitic copepods on marine fish, are scarce in Turkey. To our knowledge, this is the first paper concerning the *C. minimus* infestations reported in brawn wrasse in the Aegean Sea (Izmir Bay). Additionally geographical and host records and photograph are presented.

Materials and methods

Brawn wrasse was obtained from the Urla coasts of Izmir Bay in Aegean Sea in March 2010. It was caught by gill nets from the Aegean Sea (38° 22'N; 26° 50'E). Total length, standard length and weight of the fish were found to be 30 cm, 26 cm and 210 gr, respectively. *C. minimus* parasites were fixed and preserved in 100% ethanol. Later they were identified, after clearing in lactic acid, mounting on slides and examination under high-power microscopy, while referring to taxonomic descriptions and illustrations in Kabata (1979), Ho et al. (2000), and Ho and Lin (2004). Microscopic photographs of the parasites were taken and one of them is magnified by 4X (Figure 1). The size was measured using an ocular micrometer. The anatomical terminology used conforms mostly to that of Kabata (1979).

Results and discussion

Female *C. minimus* parasites were collected from the surface of the epidermis and abundance of mucus surrounding the gill filaments and on the inner surface of the operculum. Then, 11-12 parasitic copepods were count and collected from brawn wrasse. The total lengths of the copepods were 3-5 mm. The description and systematic part of the parasite is given below.

Description and systematic part

Order Siphonostomatoida Burmeister, 1835
Family Caligidae Burmeister, 1835
Genus *Caligus* Müller, 1785
*Caligus minimus* Otto, 1821

General view of the female *C. minimus* is shown in Figure 1. Lunules, the first and second antennae of the parasites, can be clearly noticed and separated in front plates identified at the mid-dorsal line, where the lunules are large. A part of the cephalothorax, the cephalic zone, lateral zones, and thoracic zone are clearly identified. The posterior segment of the cephalothorax is joined with an apron that includes the tagma and third leg, as shown. The length of the tagma is greater than the thoracic zone of shield. In addition, the fourth leg-bearing segment of the thorax and genital segment are called the genital complex, as
shown in Figure 1. In the genital segment, the oviduct channel, intestine, and immature eggs are also definable. In addition, semen glands in both sides of the genital segment are detectable. The last part of the C. minimus is the abdomen (posterior tagma), which includes an abdomen and caudal rami, can be clearly recognized. In addition mature and immature eggs and the egg column are identified. The left egg column includes 19 eggs, but the right egg column contains only 16 eggs. The shape of the eggs is cylindrical but some of them are flattened. The description is defined according to Kabata (1979), Ho and Lin (2004) and Özak (2006).

Infestation rate

C. minimus was recorded with a high prevalence of Dicentrarchus labrax, mainly sea-cage cultured fish. Moreover, it is involved in an epidemic infecting a marine sea bass farm in Turkey. The mean intensity per fish and the minimum-maximum parasite load per infested fish were 100%, 10-12, and 2-30, respectively, in the Aegean Sea coasts (Yeler, 1988). In addition, Pavoletti et al. (1999) indicated fish from 30 g to 2 kg in size were infected with an average of 40 copepods per fish in Italy. Additionally, low prevalence of the infestation of this parasite was recorded in cultured fish such as Pagellus bogaraveo, Umbrina cirrosa, and Mugil cephalus by Paperna (1980) and Papoutsoglou et al. (1996). Hence, C. minimus comes from wild fish and lives in the vicinity of the farms.

The area of the catching brown wrasse in Izmir Bay was closed to sea-cage fish farms, especially sea bass and sea bream cages, and the parasitic infections (mainly caligus infestations) are an important problem for marine fish farms in Izmir Bay. In spring and early summer, the infection can be shown. Thus, the rate of infestations probably related with the water temperature, stocking density and unhealthy conditions in sea-cages by Yeler (1988) and Tokşen (1999). According to these knowledge’s, one possible explanation is that the fish likely migrate around the fish farms to feed, and the fish might be influenced and infected by parasitic copepods, C. minimus.

Geographical range and hosts

C. minimus is distributed broadly across the Mediterranean Sea, Eastern Atlantic coasts, British Waters and North Sea. In the Mediterranean Sea, C. minimus is identified from France, Italy, Greece, and Turkey (Kabata, 1979; Paperna, 1980; Pavoletti et al., 1999; Ragias et al., 2004; Özak 2006).

Percifloris is one of the target fish species for parasites mainly C. minimus. Moreover, D. labrax, P. bogaraveo, U. cirrosa, and M. cephalus are more prevalent infestation fishes from the Mediterranean and Atlantic coasts. Furthermore, C. minimus have recorded from various fish species, such as Gadus morhua (Atlantic cod) Melanogrammus aeglefinus (haddock) and Ophiodon elongus (Ling fish) and the Gadoid and Mugilid species (Kabata, 1979; Ragias et al., 2004). On the other hand, some of the Caligid species infested many fish species. For example C. curtus, C. labracis, C. bonito, C. centrodonti, C. diaphanous and C. elongates influenced marine Labrids such as Labrus merula indicated by Kabata (1979), Ho et al. (2000), Ho and Lin (2004), Öktener and Oğuz (2007) and Öktener and Trilles (2009).

In Turkey, Caligus previously reported from Turkish waters are C. pageni on M. cephalus, Liza saliens, Liza ramada and Chelon labrosus from the Aegean Sea, C. minimus on D. labrax from the Aegean Sea, Pseudocaligus apodus on M. cephalus, L. saliens, L. ramada and C. labrosus from the Aegean Sea, Caligus sp. on Sardina pilchardus from the Sea of Marmara, Lepeophtheirus europanensis on Platichthys flesus from Ekinli Lagoon, C. bonito on Coryphaena hippurus, and C. mauritanicus on Dentex dentex from the Aegean Sea (Demirhindi, 1961; Tokşen, 1999; Oğuz and Öktener, 2007; Öktener and Trilles, 2009). However, it could not found a reference on Caligus infestation in marine Labrids such as Labrus merula in the Aegean Sea.

Conclusions

Caligus minimus on D. labrax in sea-cages was reported from the Turkish Aegean Sea by Yeler (1988) and Tokşen (1999), and from the Eastern Mediterranean coasts of Turkey by Özak (2006), but for the first time, it has been observed on brown wrasse (Labrus merula) in Izmir Bay, Aegean Sea.

Thus, the study demonstrated for the first time sea lice infestations (C. minimus) exists on brown wrasse in the Aegean Sea. Most likely, the fish were influenced and hosted by these parasites when migrating close to sea cages (sea bass and sea bream farms) of farms for feeding. In addition these ectoparasites might influence other coastal marine fish species. The study also examined and showed some parts and organelles of the female C. minimus through magnified photographs.
References

Benmansour, B., Hassine, K.B., 1998. Preliminary analysis of parasitic copepod species richness among coastal fishes of Tunisia. Ital. J. Zool. 65:341-344.

Boxshall, G.A., Halsey, S.H., 2004. An introduction to copepod diversity. The Ray Society Ed., London, UK.

Bron, J.E., Treasurer, J.W., 1992. Sea lice (Caligidae) on wrasse (Labridae) from selected British wild and salmon-farm sources. J. Mar. Biol. Assoc. UK 72:645-650.

Combes, C., 1995. Intérptions durables. Ecologie et évolution du parasitisme. Masson Ed., Paris, France.

Demirhindi, U., 1961. Stomach content in Sardine (Sardine pilchardus Walbaum). Istanbul University J. Hydrobiol. Inst. 6:60-67.

Ho, J.S., Lin, C.L., 2004. Sea Lice of Taiwan. Copepoda: Siphonostomatoida: Caligidae. Sueichan Press, Taiwan.

Ho, J.S., Lin, C.L., Chen, S.N., 2000. Species of Caligus Müller, 785 (Copepoda: Caligidae) parasitic on marine fishes of Taiwan. Syst. Parasitol. 46:159-179.

Kabata, Z., 1979. Parasitic Copepoda of British fishes. The Ray Society Ed., London, UK.

Oguz, M.C., Öktener, A., 2007. Four parasitic crustacean species from marine fishes of Turkey. Acta Parasitologica Turcica 31:79-83.

Öktener, A., Trilles, J.P., 2009. Four parasitic copepods on marine fish (Teleostei and Chondrichthyes) from Turkey. Acta Adriat. 50:121-128.

Özak, A.A., 2006. Studies on the Biology of Parasitic Copepoda; Caligus minutus, Otto 1821 on Sea bass (Dicentrarchus labrax, L. 1758). Degree Diss., University of Çukurova, Turkey.

Paperna, I., 1980. Study of the Caligus minutus (Otto, 1821), (Caligidae Copepoda) infectious of the sea bass D. labrax (L) in Bardawil Lagoon. Ann. Parasitol. Hum. Comp. 55:687-706.

Papoutsoglou, S., Costello, M.J., Stamou, E., Tziha, G., 1996. Environmental conditions at sea cages, and ectoparasites on farmed European sea bass Dicentrarchus labrax and gilt-head sea bream Sparus aurata at two farms in Greece. Aquac. Res. 27:25-34.

Pavoletti, E., Fioravanti, M.L., Prearo, M., Ghittino, C., 1999. Osservazioni sulla Caligosi in spigole d’allevamento. Boll. Soc. Ital. Patol. Ittica 11:2-9.

Ragias, V., Tontis, D., Athanassopoulou, F., 2004. Incidence of an intense Caligus minutus Otto 1821, C. pageti Russel, 1925, C. mugilis Brian, 1935 and C. apodus Brian, 1924 infection in lagoon cultured sea bass (Dicentrarchus labrax L.) in Greece, 2004. Aquaculture 242:727-733.

Tokşen, E., 1999. Metazoan gill parasites of culture gilthead sea bream (Sparus aurata L) and sea bass (Dicentrarchus labrax L) in the Aegean Sea Coast and their treatment. Degree Diss., University of Ege, Turkey.

Yeler, S., 1988. Investigation of the parasites of sea bass (Dicentrarchus labrax L) under culture conditions in bodrum. Master Degree Diss., Ankara Science Institution, Turkey.
Comparative study of growth performance, meat quality and haematological parameters of Fayoumi, Rhode Island Red and their reciprocal crossbred chickens

Tabinda Khawaja,1 Sohail Hassan Khan,2 Nasir Mukhtar,1 Abida Parveen2
1Department of Poultry Sciences, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan
2Poultry Research Institute, Shamsabad Rawalpindi, Pakistan

Abstract

A total of 2001 unsexed day-old-chicks of each Fayoumi, Rhode Island Red (RIR), RIR × Fayoumi (RIFI) and Fayoumi × RIR (FIRI) were obtained from hatchery of Poultry Research Institute, Rawalpindi. The birds were maintained on deep litter system for a period of 20 weeks. The results revealed that the average day old weight was highest in RIR and FIRI, intermediate in RIFI and lowest in Fayoumi chickens. The RIR breed consumed more feed and gained maximum (P<0.05) weight gain than those of Fayoumi and crossbred chickens at all ages of growing phase. The poor (P<0.05) feed conversion was observed in Fayoumi and better feed conversion was recorded in RIR and both crossbred chickens. The crossbred chickens had lowest (P<0.05) mortality than purebred chickens. The highest dressing percentage was observed in FIRI (62.60) followed by RIFI (62.40%), RIR (57.50) and Fayoumi (54.08) chickens. The breast and thigh meat composition had non-significant (P=0.05) difference among pure and crossbred chickens. There was non-significant (P>0.05) difference in haematological values among all chickens. The total erythrocyte number, haemoglobin and packed cell volume increased with the advancement of age. However, erythrocyte sedimentation rate, mean corpuscular volume and mean corpuscular haemoglobin values decreased gradually with the advancement of age. It may be concluded that crossbred chickens gained better body weight than Fayoumi and moderate than RIR chickens with lower mortality. The crossbred chickens of FIRI showed better performance in all traits than crossbred chickens of RIFI.

Introduction

Genetic progress can be attained either by selection or crossbreeding (Adebambo et al., 2011). Crossbreeding of the indigenous stock with exotic commercial birds will take advantage of artificial selection for productivity in the exotic birds and natural selection for hardness in the indigenous birds. A crossbreeding could lead to production of birds that will be better in growth rate, efficiency of feed conversion and reproductive traits without sacrificing adaptation to the local environment, thereby resulting in reduced cost of production (Adebambo et al., 2011). The outcome of crossbreeding is due to the phenomenon of heterosis, which is expressed in the performance of the hybrids. Since heterosis is almost exclusively the aggregate of all single locus dominance effects, and as these are usually positive or beneficial, heterosis can be expected to be usually in the favourable direction (Kitayi, 1998). To utilize the good adaptive characteristics of the indigenous chickens and possibly exploit the phenomenon of heterosis, Ouyemi et al. (1979) proposed that crossbreeding programmes including upgrading local chickens with suitable exotic stocks would be more appreciable. A study by Njenga (2005) revealed that the crossbred offspring of Rhode Island Red and Fayoumi had the best level of body weight and highest cost-benefit ratio with low mortality among four different breeds under a semi-scavenging system of production in Kenya. The genetic potential of the indigenous chickens could be improved by crossing them with selected but still robust exotic breeds (Gueye, 1998).

In a crossbreeding study in Pakistan, Yaqoob (1970) developed a rural poultry breed known as Lyallpur Silver Black (LSB). He used four breeds viz., Desi, New Hampshire, White Leghorn and White Cornish and a four-way crosses method was applied to produce this breed. The LSB was claimed to be superior to Desi fowl in all the economic traits, i.e. matured 32 days earlier and laid 77 more eggs/heyear. A selection of Desi chickens was undertaken by Safalaaah (2001) in which he crossed Australorp males with indigenous female chickens in Malawi. The progeny of the cross gained higher body weight, fertility rate (77% vs 91%), hatchability (84 es 92%) and early sexual maturity (158 days es 153 days). The above cited evidence has provided some base line information which is very useful for future cross breeding work.

Two breeds of exotic chickens [Rhode Island Red (RIR) and Fayoumi] were imported to Pakistan since the 1980s (Sahota and Bhatti, 2003). The Fayoumi breed as the rural poultry flock is surviving normally with the farmers as a scavenger bird but Fayoumi is a small sized bird, lays smaller eggs, low carcass yield and hence low economic return (Rajput et al., 2005). On the contrary, Rhode Island Red, which is successfully maintained under rural as well as farming conditions in different parts of the country and have potentials of a higher economic return as layers and / or broilers (Javed et al., 2003). The high egg and meat production genes, present in RIR, can possibly be transferred to Fayoumi, which already has genes for survival under harsh scavenging conditions of countryside, so as to produce a breed having higher survival and better economic returns. Exotic breeds like RIR and Fayoumi, which are typically used for cross-breeding, were imported into Pakistan many decades ago. So the purity of such imported breeds is doubtful and continuous inbreeding may now have caused them to be less productive. Genetic improvement of important economic traits would increase the production efficiency of native fowl and profitability of these birds. The body weight at 8 weeks of age is the most important trait for improving the economic efficiency of native fowl (Kianianmanesh, 2000). The information on growth pattern in chickens of reciprocal crossing between RIR and Fayoumi breeds are lacking. Likewise, the literature on haematological val-