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Pennella filosa (Linnaeus, 1758) (Copepoda, Siphonostomatoida, Pennellidae) from *Coryphaena hippurus* Linnaeus, 1758 (Pisces, Coryphaenidae) captured in western Mediterranean (Balearic Islands). Morphological and biological aspects

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ABSTRACT

Sixty one fishes of the species *Coryphaena hippurus* (Linneo, 1758) have been examined for the presence of the pennellid copepod *Pennella filosa* (Linneo, 1758) from western Mediterranean (Balearic Islands). Prevalence was 46%. Head, neck, genital complex and abdomen were measured as well as horns. The cefalotorax of the parasites were attached in different locations on fishes but mainly on fins and dorsolateral muscles. Mean intensity, mean abundance and range were determined and data has been analysed by means of Pearson Correlation Coefficient. Likewise ecological aspects of the parasitism and some data of biological cycle were examined.

KEYWORDS: *pennellid, parasitism, prevalence, abundance, ecology.*

RESUMEN

Se han examinado sesenta y un especímenes de *Coryphaena hippurus* (Linneo, 1758) para hallar la presencia del copépodo del género Pennella Pennella filosa (Linneo, 1758) del Mediterráneo occidental (Islas Baleares). La prevalencia fue del 46%. Se realizaron mediciones de cabeza, cuello, complejo genital y abdomen, así como de los "cuernos". El cefalotórax de los parásitos estaba adherido a diferentes partes del cuerpo de los peces, pero principalmente a las aletas y a los músculos dorsolaterales. Se determinaron la intensidad media, la abundancia media y el rango, y se analizaron los datos mediante el coeficiente de correlación de Pearson. Igualmente, se examinaron aspectos ecológicos del parasitismo y algunos datos del ciclo biológico.

PALABRAS CLAVE: *pennella, parasitismo, prevalencia, abundancia, ecología.*

INTRODUCTION

Coryphaena hippurus L. is a teleost fish with a worldwide distribution in temperate and warm waters of Atlantic and Pacific oceans. Every year, migrate during May-June from Atlantic to Mediterranean Sea for reproduction and in September-October come back to Atlantic Ocean (Massuti and Morales Nin, 1995).

Species of genus *Pennella* Oksen, 1816, are mesoparasitic crustaceans that have been collected from the flesh marine mammals and pelagic fishes as large scombrids (*Thunnus* Sout, 1845), sword fish (*Xiphias gladius* L.), sun fish (*Mola mola* L.), exocoebids and coryphaenids from the Pacific and Atlanctic oceans, as well as Mediterranean sea (Yamaguti, 1963; Kabata, 1992; Pollock, 1994). *Pennella* species have a heterogenous life cycle where larval stages, males and premetamorphic females develop on the gills of cephalopoda mainly cuttlefishes and squids. After mating, infective females leave the cephalopods to attack cetaceans and fishes (Brian, 1906; Rose, 1941; Rose and Hammon, 1953; Kabata, 1981; Raibaut, 1991). Most descriptions of *Penella* species are poor and few criteria for identification has been stablished possibly due to the great morphological variability of this parasite (Kabata, 1979; Hogans, 1987; Raibaut, 1991; Carbonell *et al.,* 1999). The aims of this study were to examine the morphology, biometry and some ecological aspects of *Pennella filosa* collected from *C. hippurus.*

MATERIAL AND METHODS

Sixty-one *C. hippurus* were captured using drifting surface long lines set in the Mediterranean sea (Balearic Islands, western mediterranean) during May-June 1990, 1991 and 1995. In the laboratory the fish were mesured to the nearest centimetre fork length (FL) weighed and sexed. The skin, fins, oral cavity and gills of fishes were examined and all parasites were removed. Sites occupied by parasites as well as the depth to which they were attached, their number and any host damage were noted. Parasites were washed and cleaned in a saline solution and fixed in 70 % alcohol for subsequent examination. Total length, head and horns, neck, trunk and abdomen were measured and antenal papillae and abdominal processes were removed to allow observation of cephalic structures and abdominal filaments. Biometric data were analyzed using the Pearson's correlation coefficient (Nie *et al.,* 1975) whereas infection data were analyzed according to standard methods to determine prevalence, mean intensity and range of the parasites (Bush *et al.,* 1997).

Table 1: Prevalence, intensity, abundance and range of *Pennella filosa* (Linnaeus, 1758) from females and males of *Coryphaena hippurus* Linnaeus, 1758.

	Females	Males
N	31	30
Prevalence (%)	61.3	30
Mean Intensity	9.3±7.7	2.1±1.3
Mean Abundance	5.7±7.5	0.6±1.2
Range	1-33	1-5

RESULTS

From sixty-one fishes examined, thirty-one were females and thirty males. Females measured 96,7 cm ± 15,4 (range 67-124 cm) and weighed 8.3 kg ± 3.1 (range 2,7-15.6 kg) whereas males measured 88.3 kg ± 14,3 (range 62-114 cm) and weighed 7,8 kg ± 4,2 (range 2,3 -15,6 kg). The extraction of parasites was very difficult and consequently only 35 complete parasites were collected being all they ovigerous females, belonging to *P. filosa* species. The ecological data are showed in Table 1 (the length of somatic tagma and horns are detailed in Table 2). Twenty-eight fishes were parasitized (Prevalence 46 %). A higher number of females (19) than males (9) were found to be infected and the mean intensity and abundance were also higher in females.

Table 2: Measurements in mm. of *Penella filosa* (Linnaeus, 1758). $\overline{X}$ = mean. SD = standard desviation and Range. (n = 38)

	$\overline{X}$	SD	Range
Total length	61.5	17.8	40-135
Head (spheric)	3.5	0.4	3-4
Head (subspheric)	3.5 x 4.5	0.3 x 0.4	3-3.5 x 4-5
Neck	21.5	10	10-55
Trunk	18	8.5	10-52
Abdomen	14	6	10-40
Right horn	5.2	1.7	4-8
Left horn	4.3	1.6	3.5-8
Dorsal horn	2.2	0.9	1-4

Fishes parasitized do not showed any symptom of disease.

Parasites were anchored in different locations, but mainly in fins and corporal musculature and, to a lesser degree in the abdominal viscera and skin. Deeply anchored parasites had the cephalotorax and neck included in the flesh or abdominal cavity of the fish, whereas the ones superficially attached had only its cephalotorax encrusted and the neck, trunk and abdomen hanging from the fish.

Parasites were deeply attached in the dorsolateral muscles (24 %) and abdomen (12%), whereas the attachments were superficial at the base of fins, fins rays and skin (dorsal fin 52%, anal fin 55% an in the pelvic, pectoral andperianal skin, 4%). The head, opercula and gills of hosts were not parasitized.

The ovigerous females had a mean of total length of 60 mm with a range from 40 to 135 mm. the cephalotorax and neck were whitish without cuticular striations whereas the trunk and abdomen were black-brown and with cuticular annular striations.

Two types of cephalotorax were observed, spherical or cup-like. The former has a diameter from 3 to 4 mm and numerous small papillae occupying the apical region whereas the latter were 3-3.5 mm long and 4-5 mm wide and the papillae were less numerous, larger and occasionally bilobed. Generally the spherical cephalotorax belonged to parasites with a long deeply anchored neck, whereas the cuplike cephalotorax belonged to parasites with a shorter superficially attached neck. All females had three horns, two laterals similar and the dorsal always the smallest. The parasites deeply anchored showed larger horn than parasites attached to hard tissue (fins rays, bones, etc.).

Necks measured 21.5 mm (S.D. 10 mm), were cylindrical in shape smooth and narrower than trunk. They were longer in parasites with spherical cephalotorax and long horns and shorter in parasites with a cuplike cephalotorax and short horns.

Trunk was cylindrical in shape and slightly shorter than the neck (mean 18 ± 6 mm). Two genital orifices and two long egg strings were present. Egg strings were twice or three times longer than body length.

Abdomen was the shorter somatic tagma and showed typical abdominal processes. The number of filaments was 23 (s.d. 55.5) with a range from 15-45, and they showed branches without ancitomosis. 1st, 2nd, 3rd and 4th branches could be present and the number is higher in parasites attached to anal and caudal fins. Anastomosis was not observed.

DISCUSSION

This work has allowed us to show the epizootic character of *P. fillosa* infection in dolphinfish communities which every year migrate into the Mediterranean Sea. Fishes are presumably infected during the migratory period from the strait of Gibraltar to the Balearic Islands (Alboran Sea) where squid and cuttlefishes are abundant. It seems that these cephalopods are involved in *Penella* sp. vital cycle as intermediate hosts (Brian, 1906; Rose and Hammon, 1953; Kabata, 1981). On the other hand, squid (Lohigo, Eledone) are a important food item in the diet of *C. hippurus* captured in the Mediterranean Sea (Massuti *et al.,* 1998; Carb *et al.,* 1999) whereas in Atlantic and Pacific waters these invertebrates are not common in the diet of these fishes (Rose and Hassler, 1974; Manooch *et al.,* 1984; Sakamoto and Taniguchi, 1993). This observation would explain the great prevalence of *Penella* infection in dolphinfish captured in the Mediterranean Sea.

There were no data about the location of *P. fillosa.*

We have found both, parasites with cup-like cephalotorax superficially attached to hard sites and with a deeply anchored spherical cephalotorax. This agrees with Hogans (1987) since in soft tissue hosts such as *Mola mola,* the cephalotorax remains spherical form, and in tuna, with soft and hard tissues. This is true, even, in a same host with soft and hard tissues. Hogans (1987) also noted that the variability of cephalic papillae is unknown; however, we found large and lobed papillae in the cup-like cephalotorax and small papillae in the spherical cephalotorax.

All the parasites found in our study had three horns, which were long in soft tissues and short in hard tissues. This observation is similar with that of Hogans (1987), although this author reports in his work the presence in some specimens of two horns. The same author also indicated that neck length is directly dependent on depth penetration. Nevertheless, we observed long and short necks in superficially attached parasites, and long necks in deeply anchored parasites. Hogans (1987) also notes that parasite age is the principal factor for variability of the trunk and abdomen. However, we consider that besides age, there are other responsible factors for morphological variability such as host

species, size, and the characteristics of parasitized musculature (e.g. muscle hardness, mass, motility). Additional factors include host behavior, including movement patterns and swimming speed, which determine the degree of water friction, resistance and turbulence and parasite penetration level, whether the attachment is superficial (e.g. fins, rays, tegument, subcutaneous tissue) or deep (e.g. muscles, bones, abdominal cavity, internal organs). Finally, the degree of inflammatory reaction or the capability of the host to develop fibrous tissue around the cephalotorax and neck of the parasite are other responsible factors.

There is too much morphological variability in the characters analyzed to find any taxonomic value in them. Consequently, we believe that it is necessary to study larval copepodites and chalimus stages, as well as premetamorphic females (possibly males also) in order to clarify the systematics of the genus *Pennella*.

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