First record of *Neocyamus physeteris* (Pouchet, 1888) (Crustacea: Amphipoda: Cyamidae), ectoparasite of the sperm whale (*Physeter macrocephalus* Linnaeus, 1758) off the Balearic Islands and iberian waters

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The marine cyamid amphipod *Neocyamus physeteris*, ectoparasite of the sperm whale *Physeter macrocephalus*, is recorded for the first time off the Balearic Islands and in Iberian waters. The species has been reported only a few occasions in the Mediterranean Sea. The specimens were collected in 2018 on a stranded female sperm whale, dead, in the Bay of Pollença (island of Mallorca, western Mediterranean).
Key words: *Stranding, Mallorca, Pollença bay, Cetacea, Odontoceti, Crustacean, Isocyaminae, parasite.*

PRIMER REGISTRE DE *Neocyamus physeteris* (POUCHET, 1888) (CRUSTACEA: AMPHIPODA: CYAMIDAE), ECTOPARÀSIT DEL CATXALOT (*Physeter macrocephalus* LINNAEUS, 1758) A LES ILLES BALEARS I EN AIGÜES IBÈRIQUES. L'amfípode marí ciàmid *Neocyamus physeteris*, paràsit del catxalot *Physeter macrocephalus*, es registra per primera vegada en aigües de les illes Balears i ibèriques. L'espècie ha estat citada en poques ocasions a la mar Mediterrània. Els exemplars es van capturar sobre un exemplar femella de catxalot, ja mort, encallat el 2018 a la badia de Pollença (illa de Mallorca, Mediterrània occidental).
Paraulas clau: *Encallament, Mallorca, badia de Pollença, Cetaci, Odontocets, Crustaci, Isocyaminae, paràsit.*

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Introduction

Cyamidae Rafinesque, 1815 is a family of amphipod crustaceans currently classified within the suborder Corophiida Leach, 1814 and the superfamily Caprelloidea Leach, 1841 (Iwasa-Arai & Serejo, 2018). All the ca. 30 species included in this group are ectoparasites exclusively of cetaceans (Mammalia) (baleen whales, sperm whales,

dolphin, porpoises and relatives) (Lützen, 2005; Iwasa-Arai & Serejo, 2018). Their parasitization is assumed to be widespread, occurring upon direct contact between cetacean individuals, as cyamids lack free larval phases (like the rest of amphipods) (Schmitt, 1965; Schram, 1986). However, reports of these crustaceans are scarce in the literature, especially in the Mediterranean Sea.

Besides the difficulty of sampling parasites and epibionts in living cetaceans (Hermosilla *et al.*, 2015), it is noteworthy that cyamids are likely to quickly leave the carcasses of marine mammals once they die (Oliver & Trilles, 2000). Therefore, in case of cetaceans found dead at sea or stranded, usually those parasites either go unnoticed by observers or simply they no longer occur on the body *post mortem*.

In this note we report, for the first time in the Balearic and iberian waters, the cyamid *Neocyamus physeteris* (Pouchet, 1888) based on some live specimens collected on the carcass of a sperm whale (*Physeter macrocephalus* Linnaeus, 1758) stranded on the north coast of Mallorca Island (NW Mediterranean).

Material and Methods

The specimens were hand-collected from inside the mouth of the sperm whale. They were found only on the gum of the upper jaw and between the alveoli where the teeth are inserted. They were kept in the fridge and later fixed in ethanol 96% and preserved in ethanol 70%. The collected specimens were identified by comparing their morphological characters with those described in the literature available (Leung, 1967; Oliver & Trilles, 2000; Iwasa-Arai & Serejo, 2018). Some specimens were photographed *in situ* and, subsequently, an entire specimen was drawn *in toto* using a camera lucida coupled to a Motic K-400 stereomicroscope. One of the embryos occurring in the marsupium of a female was rinsed with Amman lactophenol, and subsequently prepared to be photographed with an optical microscope.

Results

Taxonomy

Subphylum Crustacea Brünnich, 1772
Class Malacostraca Latreille, 1802
Order Amphipoda Latreille, 1816
Infraorder Corophiida Leach, 1814
Superfamily Caprelloidea Leach, 1814
Family Cyamidae Rafinesque, 1815
Subfamily Isocyaminae Iwasa-Arai & Serejo, 2018
Genus *Neocyamus* Margolis, 1955 (monotypic)

***Neocyamus physeteris* (Pouchet, 1888)**
(Figs. 1-3)
Examined material: SPAIN, Balearic Islands, Mallorca, Bay of Pollença, 15-01-2018; 3♀ (2 carrying embryos), 4 ♂; on *Physeter macrocephalus* (♀); leg. Gabriel Morey and Miguel Pozo. Specimens in ethanol 70%, kept at Museu Balear de Ciències Naturals under collection numbers MBCN 27404 and 27405 (gravid ♀♀); MBCN 27406 (♀) and MBCN 27407, 27408, 27409 and 27410 (♂♂).

Remarks

The examined specimens were identified unequivocally as *Neocyamus physteris* because they meet the following combination of morphological characteristics (Figs, 1 A-B): slender body; antenna 1 short, consisting of four segments, without setal arrangement; antenna 2 very small, biarticulate; palm of the gnatopod 1 with a

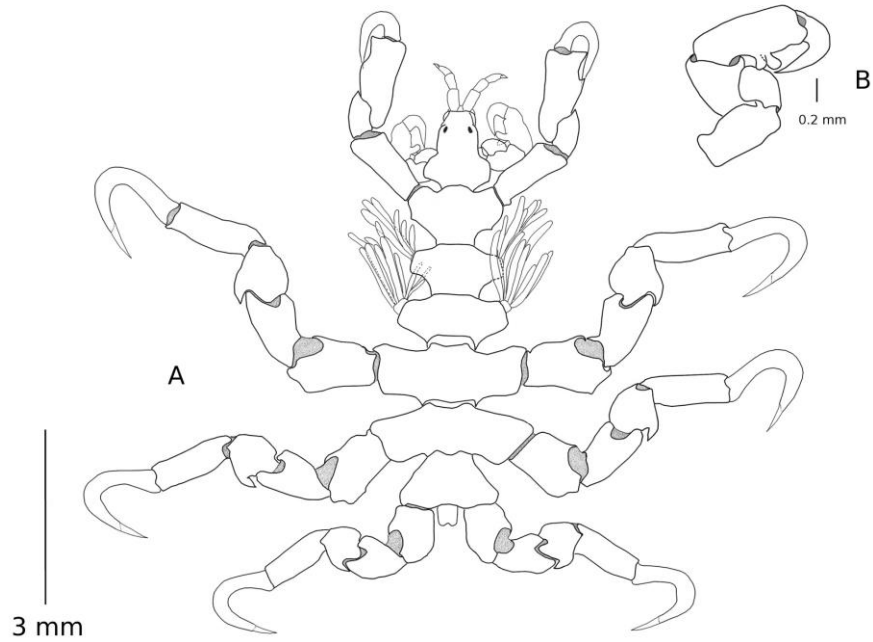

Fig. 1. *Neocyamus physeteris* (♂). a. Habitus, dorsal view. B. Detail of the first gnatopod.
Fig. 1. Neocyamus physeteris *(♂). A. Habitus, vista dorsal. B. Detall del primer gnatopodi.*

Fig. 2. *Neocyamus physeteris*, in situ photograph of a specimen on the gum of the host sperm whale.
Fig. 2. Neocyamus physeteris, *exemplar fotografiat in situ sobre la geniva del catxalot hoste.*

single central bilobed expansion: pereonites 2 and 4 very narrow with multibranched lateral gills, and females displaying vestigial pleopods. This set of features does not match any other Cyamidae species (Iwasa-Arai & Serejo, 2018).

Specimens have a whitish colouring when alive, although they were apparently

Fig. 3. *Neocyamus physeteris* embryo. Scale bar: 1 mm.
Fig. 3. *Embrió de* Neocyamus physeteris. *Escala gràfica 1 mm.*

reddish when on the sperm whale due to the blood of the host. This reddish colour disappeared completely once the specimens were preserved in ethanol (Fig. 2).

N. physeteris is, so far, the only known species of the monotypic genus *Neocyamus*, being very diferent from all the other cyamids known up to date, constituting alone the subfamily Isocyaminae (Iwasa-Arai & Serejo, 2018).

The sampled female specimens had the marsupium with the embryos (*pulli*) already in their last phase of development. The *pulli* measured 2.84 mm and were practically identical to the miniature adults, with the exception of a lower development of the external gills (Fig. 3). According to Oliver & Trilles (2000), the number of external gills increases in correlation with the size of the individuals.

Fig. 4. *Physeter macrocephalus*. Female specimen stranded on the north coast of Mallorca (white arrow), on which the *Neocyamus physeteris* specimens were collected.
Fig. 4. Physeter macrocephalus. *Exemplar femella encallat a la costa nord de Mallorca (fletxa blanca) sobre el qual es van recollir els exemplars de* Neocyamus physeteris.

The *pulli* of the Mallorcan specimens have 2 gills on each side of pereonites 3-4. In an adult female of 7.9 mm total length, up to 15 gills were observed on each lateral margin of the carrier pereonites.

Information on the host

The *N. physeteris* specimens were collected in the Bay of Pollença (Mallorca, Balearic Isalnds, NW Mediterranean) on 15 January 2018 from a dead female sperm whale *Physeter macrocephalus* 9.50 m total length, which was in an advanced state of decomposition (M5), probably stranded a few days earlier (Fig. 4).

Discussion

The presence of Cyamidae on cetaceans has been recorded on few occasions in Iberian waters. Previous records of cyamids in these waters included *Syncyamus aequus* Lincoln & Hurley, 1981, *Isocyamus delphinii* (Guérin-Méneville, 1836), *I. deltobranchium* Sedlak-Weinstein, 1992 and *Cyamus boopis* (Lütken, 1870), collected on different cetacean species stranded or found dead in Spanish waters (Raga & Raduan, 1982; Raga *et al.*, 1983; Abollo *et al.*, 1998; Martínez *et al.*, 2008, Fraija-Fernández *et al.*, 2017) (Table 1).*N. physeteris* is an ectoparasite to the Odontoceti *Physeter macrocephalus*, although other Cyamidae species do parasite the sperm whale as well, such as *Cyamus catodontis* Margolis 1954, recorded by Fransen & Smeenk (1991) on the same cetacean species in Atlantic waters off the Netherlands. On the other hand, there is a single record of *N. physeteris* parasitizing a different species of cetacean, since it was recorded on the Dall's porpoise, *Phocoenoides dalli* (True, 1885), in the

Cyamid species	Cetacean host (s)	Marine area	Reference (s)
Syncyamus aequus	*Stenella coeruleoalba* (Meyen, 1833)	Valencia-Catalunya (Eastern Spain)	Raga & Raduan (1982) Raga (1988) Fraija-Fernández *et al.* (2017)
Isocyamus delphinii	(1) *Grampus griseus* (G. Cuvier, 1812) (2) *Globicephala melas* (Traill, 1892)	(1) Galicia (NW Spain) (2) Alicante (Eastern Spain)	(1) Abollo *et al.* (1998) (2) Raga *et al.* (1983)
Isocyamus deltobranchium	(1) *Mesoplodon mirus* True, 1913 (2) *Delphinus delphis* Linnaeus, 1758 (3) *Phocoena phocoena* (Linnaeus, 1758)	(1,2,3) Galicia (NW Spain)	(1,2,3) Martínez *et al.* (2008)
Cyamus boopis	*Megaptera novaeangliae* (Borowski, 1781)	Galicia (NW Spain)	Abollo *et al.* (1998)
Neocyamus physeteris	*Physeter macrocephalus*	Mallorca (Balearic islands)	This paper

Table 1. Records of Cyamidae in the Iberian-Balearic waters.
Taula 1. *Cites de Cyamidae a les aigües Ibero-Balears.*

Northern Pacific Ocean (Leung, 1967; see Ten *et al.*, 2022).

N. physeteris has only been cited three times in the Mediterranean Sea, being documented for the first time in this sea by Lloze & Daumas (1985). Later, Oliver & Trilles (2000) reported it in the Gulf of Lions, and Mazzariol *et al.* (2018) mentioned its occurrence on sperm whales stranded in the Adriatic coasts of Italy. In addition to the Mediterranean records already mentioned, there are records of *N. physeteris* in the Azores Islands, Bermuda and the Pacific Ocean (see Oliver & Trilles, 2000).

The absolute lack of records of *N. physeteris* in Iberian waters can only be due to the difficulty in sampling species associated with live cetaceans (Hermosilla *et al.,* 2015) or, in the case of strandings or deaths caused accidentally because they have gone unnoticed.

Iwasa-Arai & Serejo (2018) considered *N. physeteris* to be an Atlantic species. Since the sperm whale is cosmopolitan in distribution, its specific parasite should probably have the same distribution. Nevertheless, there is evidence of the existence of a genetic isolation between Mediterranean and Atlantic sperm whales (Rendell & Frantzis, 2016). For this reason, future research is necessary to look for morphological and/or genetic differences between Mediterranean specimens of *N. physeteris* and those from the Atlantic and other oceans.

In fact, in other cyamids collected in the Mediterranean Sea, such as *Syncyamus aequus*, morphological differences have been described in relation to populations from other marine regions, which could be due to intraspecific variability or indicative of an incipient speciation process (see Raga, 1988).

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