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OCCURRENCE OF THE ECTOPARASITE *ISOCYAMUS DELTOBRANCHIUM* (AMPHIPODA: CYAMIDAE) ON CETACEANS FROM ATLANTIC WATERS

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ABSTRACT: The cyamids collected from a True's beaked whale (*Mesoplodon mirus*), a common dolphin (*Delphinus delphis*), and a harbour porpoise (*Phocoena phocoena*) stranded in Galicia (NW Spain) were identified as *Isocyamus deltobranchium*, extending the range of this species to the Atlantic Ocean. The 3 cetacean species examined are new hosts for this parasite. The microscopic examination of female specimens reveals that certain important taxonomic characters may be present or absent depending on the maturation stage, a taxonomic feature that should be considered in future studies describing cyamid species.

Cyamids (whale lice) are amphipod ectoparasites that live and feed on the skin of cetaceans (Rowntree, 1996; Schell et al., 2000; Dailey, 2001). They mostly aggregate in skin areas with reduced turbulences such as folds, areas around barnacles, blowholes, margins of lips, genital and mammary slits, wounds, and pits and grooves between callosities (Pfeiffer, 2002). To date, 28 species of cyamids belonging to 6 genera have been reported from cetaceans worldwide (Martin and Heyning, 1999; Haney et al., 2004). *Isocyamus* Gervais and Van Beneden, 1859, was originally regarded as monotypic, comprising a single species, *Isocyamus delphinii* (Leung, 1967). In addition to *I. delphinii*, which has been reported from at least 13 odontoceti species worldwide (Wardle et al., 2000; Pfeiffer, 2002), 2 other species are currently included in the genus: *I. kogiae* Sedlak-Weinstein, 1992, found in *Kogia breviceps* (pygmy sperm whale) from Moreton Island (Australia) and Southern California (Sedlak-Weinstein, 1992a; Martin and Heyning, 1999), and *I. deltobranchium*, described from *Globicephala macrorhynchus* (short-finned pilot whale) and *G. melas* (long-finned pilot whale) in Japanese and Tasmanian waters, respectively (Sedlak-Weinstein, 1992b).

Herein, *I. deltobranchium* is identified for the first time from cetaceans stranded on the Atlantic coast of Spain. In addition, the presence of this species on *Mesoplodon mirus* (True's beaked whale), *Delphinus delphis* (common dolphin), and *Phocoena phocoena* (harbour porpoise) represent new host records for the parasite.

MATERIALS AND METHODS

Fifty-seven (31 females and 26 males), 12 (5 females, 4 males, and 3 juveniles), and 92 (17 females, 44 males, and 31 juveniles) cyamids were collected from, respectively, the surface of a True's beaked whale (stranded in Caión, 43°19′N, 8°36′W; Galicia, NW Spain; October 2001), a common dolphin (stranded in Fisterra, 42°55′N, 9°17′W; Galicia, NW Spain; September 2004), and a harbour porpoise (stranded in Ons islands, 42°22′N, 8°56′W; Galicia, NW Spain; January 2007). Cyamids were found in skin wounds located in the mandible and in the ventral region of the True's beaked whale; in the left side of the head and body and in the left pectoral fin of the common dolphin; and in the caudal peduncle and flukes of the harbour porpoise.

Specimens were fixed in 70% ethanol and examined using light (after clearing with lactophenol) and scanning electron microscopy (SEM). In some females, the second pair of oostegites was carefully separated with the aid of a needle to allow the observation of ventral spines on pereon segment 5. Length was measured from head (excluding antennae) to pleon, inclusive, and width was taken from the widest pereon segment. Specimens examined by SEM were cleaned by light sonication to remove debris attached to the cuticle and dehydrated through a graded ethanol series. After treatment with isoamyl acetate, the specimens were critical-point dried, gold-coated with a sputter coater, and observed and photographed with a Philips XL30 scanning electron microscope (Philips, Eindhoven, Netherlands).

Mature specimens (2 males and 2 females) collected from *P. phocoena* were deposited in the crustacean collection of the Natural History Museum, London, U.K. (2008; 153–156).

RESULTS

The morphological characteristics of the cyamids recovered from the 3 cetacean species (Figs. 1, 2) basically conform to those of *I. deltobranchium* given by Sedlak-Weinstein (1992b). Male specimens (Fig. 1C) are 2.7–5.4 mm in length and 1.3–2.5 mm in width. Females (Fig. 2A) are 2.7–4 mm in length and 1.3–1.9 mm in width. Our observations confirm that the presence or absence of certain taxonomic characteristics in females depends on the maturation stage of each specimen. Thus, while no ventral spines are observed at the base of the genital valves on pereon segment 5 of mature females (Fig. 2B), these spines are small-sized to practically inconspicuous in females close to maturation (Fig. 2C) and are medium- to large-sized in juvenile females (Fig. 2D). In addition, the marginal setae of oostegites (Fig. 2B) become evident as females mature sexually.

DISCUSSION

Sedlak-Weinstein (1992b) described both sexes of *I. deltobranchium* as having a pair of ventral spines on each of the pereon segments 5 through 7. In fact, according to the key for *Isocyamus* spp. proposed by this author, the presence or absence of these spines permits the differentiation of *I. kogiae* (no ventral spines on segments 5 through 7) from the other 2 species in the genus, *I. delphinii* and *I. deltobranchium* (a pair of ventral spines on each of somites 5 through 7). In our female specimens, however, the presence or absence of ventral spines on somite 5 depends on the stage of maturation. Thus, the conspicuous spines located at the base of the incipient genital valves, which are easily visualized in juvenile females, disappear as maturation proceeds. Our observations are important because the ventral spines of somite 5 are a frequent point of disagreement between descriptions of cyamids. Thus, while Barnard (1932) describes the females of *I. delphinii* as lacking

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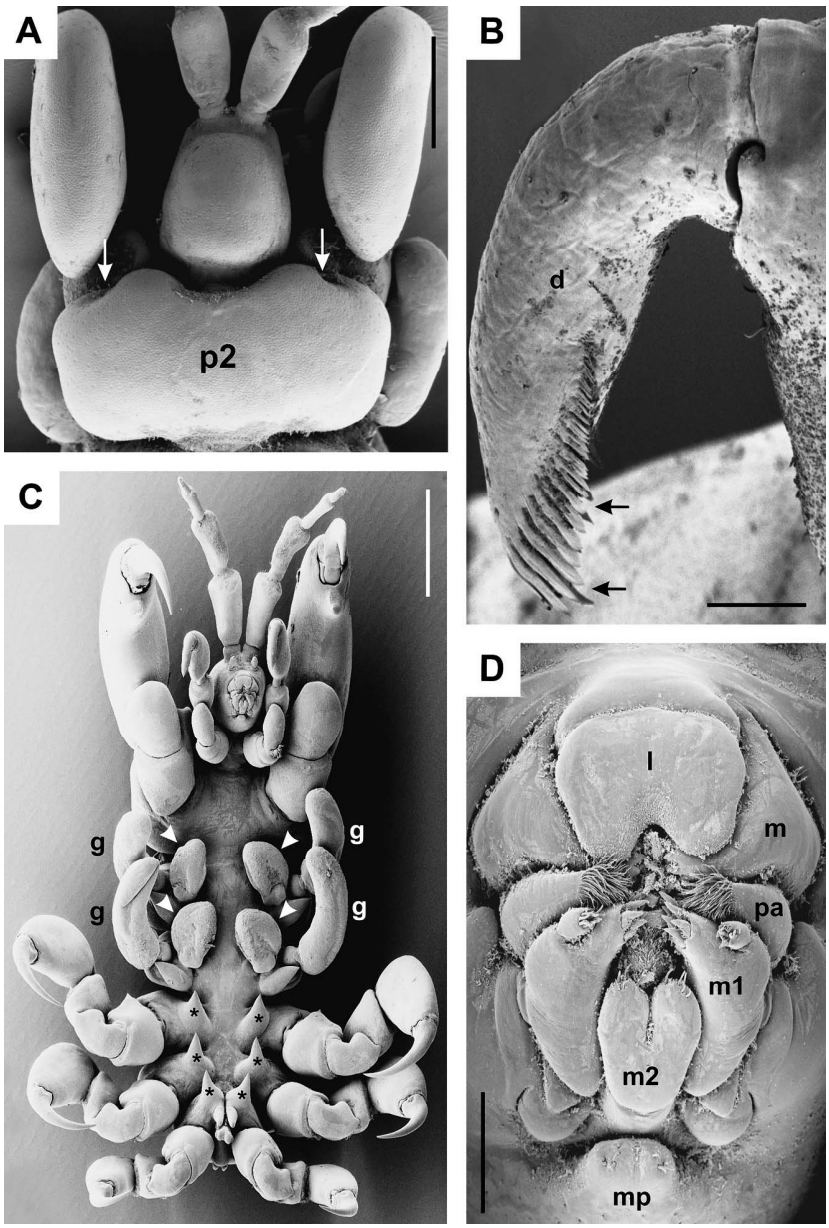

FIGURE 1. SEM photographs of *I. deltobranchium*. (**A**) Detail of pereon 2 (p2) of a male specimen showing the typical antero-dorsal epaulet-like cuticular infoldings (arrows). Scale bar = 0.5 mm. (**B**) Detail of the single dentate comb (arrows) surrounding the unguis of dactylus (d) of the first gnathopod. Scale bar = 0.05 mm. (**C**) Ventral view of a male showing the characteristic accessory gills (arrowheads), triangular in form, slightly flattened and 1/2 to 1/3 shorter than the cylindrical primary gills (g) and a pair of ventral spines (asterisks) on each of the pereon segments 5, 6, and 7. Scale bar = 1 mm. (**D**) Ventral view of the head of a male showing the different mouthparts (l: labrum, m: mandible, pa: paragnath, m1: maxilla 1, m2: maxilla 2, mp: maxilliped). Scale bar = 0.1 mm.

this character, a pair of very small spines is reported by Sedlak-Weinstein (1991). Similarly, Raga (1988) and Sedlak-Weinstein (1991) describe the presence of a pair of ventral spines on pereon segment 5 of *Syncyamus aequus* females, while Lincoln and Hurley (1981) did not observe such structures. At this time, we do not know if the maturation-dependent changes observed in our *I. deltobranchium* specimens also occur in specimens from Indo-Pacific waters belonging to the same species or in other cyamids. However, the use of specimens at different stages of maturation for final descriptions may explain the disagreements cited above. On the other hand, the possibility that cyamids show intraspecific variability in the presence or absence of ventral spines of somite 5, depending on the host or the distribution area, cannot be rejected. In this sense, the specimens of *I. delphinii* and *I. deltobranchium* described by Sedlak-Weinstein (1991, 1992b), and those described by Barnard (1932) and us (this work), were recovered from different host species and geographic locations. Whatever the origin of these morphological variations, future studies on cyamids should be focused on describing the structural changes associated to maturation. The

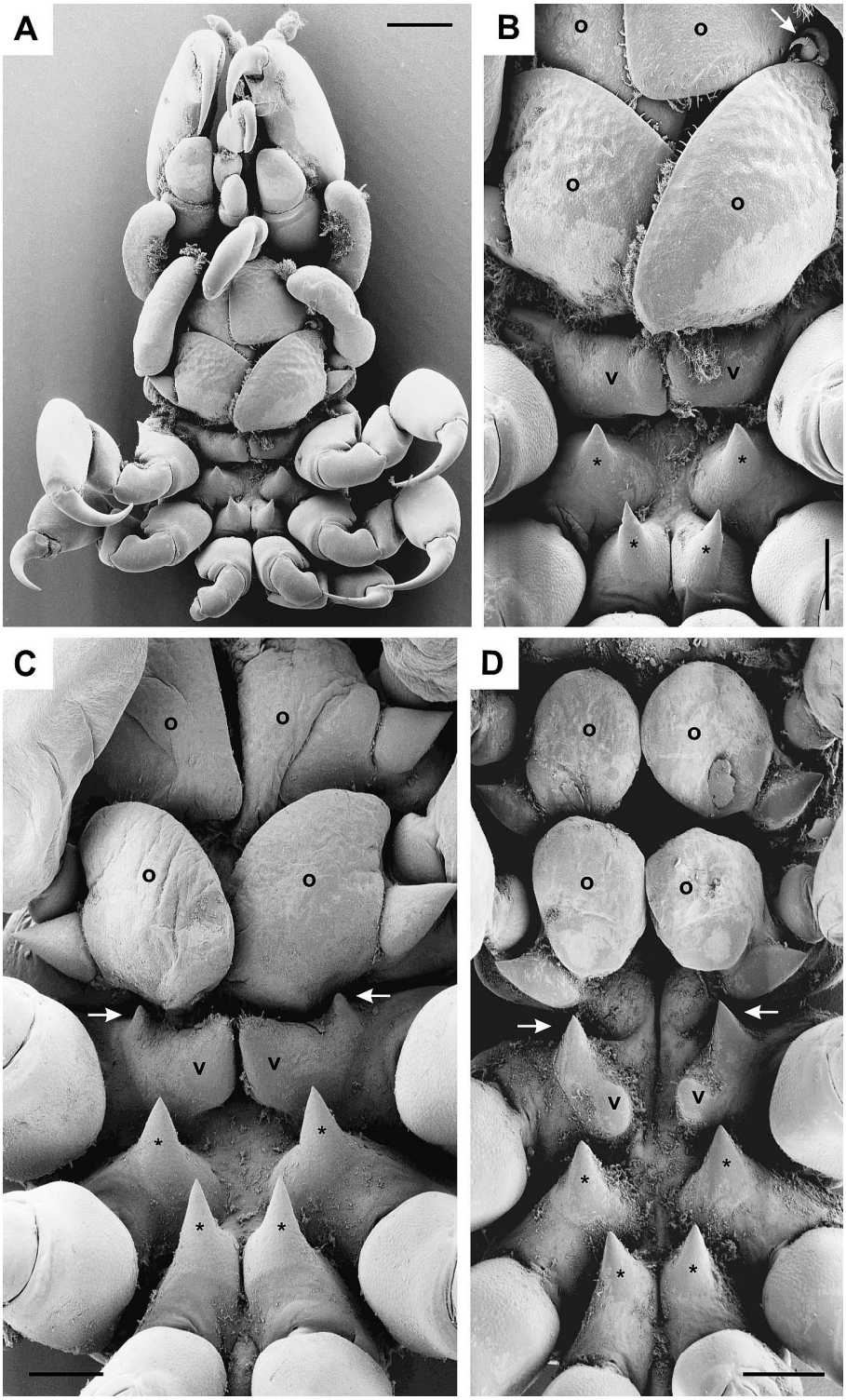

FIGURE 2. S.E.M. photographs of *I. deltobranchium* females at different stages of maturation. (**A**) Ventral view of a female with newly hatched juveniles within the marsupium. The right pereiopod 7 was broken during collection. Scale bar = 0.5 mm. (**B**) Detail of the ventral body region of the female in figure A showing the four oostegites (o) with setose edges, the genital valves (v) on the pereon segment 5, and a pair of ventral spines (asterisks) on each of the pereon segments 6 and 7. Note that no ventral spines are observed at the base of the genital valves on somite 5. Two pereiopods (arrow) of a newly hatched juvenile can be observed protruding from the marsupium. Scale bar = 0.2 mm. (**C**) Ventral body region of an immature female with oostegites (o) and genital valves (v) practically formed. Note that oostegites still lack marginal setae, and spines (arrows) at the base of the genital valves are significantly smaller than those on the pereon segments 6 and 7 (asterisks). Scale bar = 0.2 mm. (**D**) Ventral body region of a juvenile female with developing oostegites (o) and incipient genital valves (v). Note that the conspicuous ventral spines (arrows) at the base of the genital valves are similar in size to those on somites 6 and 7 (asterisks). Scale bar = 0.2 mm.

use of both light microscopy and SEM would be helpful to successfully complete these studies.

This is the first time that cyamids from Atlantic waters are correctly identified as *I. deltobranchium*. However, it is not the first time that this species has been detected. A review of the literature reveals that specimens found on 2 *P. phocoena* from Dutch waters (Stock, 1973) and 1 *Grampus griseus* (Risso's dolphin) stranded in northwestern Spanish coast (Cabaleiro, 1997; Abollo et al., 1998) were erroneously identified as *I. delphinii*. Drawings or SEM micrographs corresponding to these specimens show that the accessory gills of the males are, as in the case of *I. deltobranchium*, triangular in shape, slightly flattened, and at least 1/3 shorter than the primary gills. In light of these considerations and our findings, *G. griseus*, as well as *D. delphis*, *P. phocoena*, and *M. mirus*, must be considered new hosts for *I. deltobranchium*. The finding of this whale louse on 6 species of cetaceans, i.e., *G. macrorhynchus*, *G. melas*, and the 4 cited above, belonging to the Delphinidae, Phocoenidae, and Ziphiidae (and found in Atlantic and Indo-Pacific waters), confirms that this species (as *I. delphinii*) has a wide host specificity and a broad distribution. This is in agreement with a previous hypothesis stating that whale lice of small- to medium-sized odontocetes have a wider host specificity than those of large cetaceans (Leung, 1970).

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