NOTES AND NEWS

THE OCCURRENCE OF THE BARNACLE, *CHELONIBIA PATULA* (RANZANI, 1818), ON AN INANIMATE SUBSTRATUM (CIRRIPEDIA, THORACICA)

BY

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Barnacles of the subfamily Chelonibiinae, often referred to as "turtle barnacles", are previously unrecorded on inanimate substrata. A record of occurrence on an inanimate, floating object is reported; this involves *Chelonibia patula* (Ranzani, 1818), morphologically and ecologically the most generalized of the chelonibiines. Despite the fact that *C. patula* occurs on a wider variety of substrata than do any of its congeners, it has never been recorded from a marine turtle – one of the most common hosts for members of this subfamily of barnacles, nor has this species ever been previously verified on an inanimate surface – a common substratum for many barnacles. The present note raises questions about the evolution of the symbiotic habit in Chelonibiinae.

The subfamilies Chelonibiinae and Platylepadinae contain 5 genera and 7 species of sessile barnacles characterized as epizoic on certain large marine animals, notably marine turtles (chelonians of the families Cheloniidae and Dermochelyidae). Indeed, the identity of the host is a valuable distinguishing character for many of the barnacle species of these two subfamilies, and the occurrence of these crustaceans on inanimate objects is previously unverified (Ross & Newman, 1967; Newman & Ross, 1976; Newman, pers. comm.). This note records an instance of numerous specimens of a large and conspicuous chelonibiine on an inanimate substratum; it also raises questions of why the most generalized "turtle barnacle" is not found on one of the most common substrata for the family, and also why the occurrence of this unspecialized chelonibiine on inanimate objects is so rare.

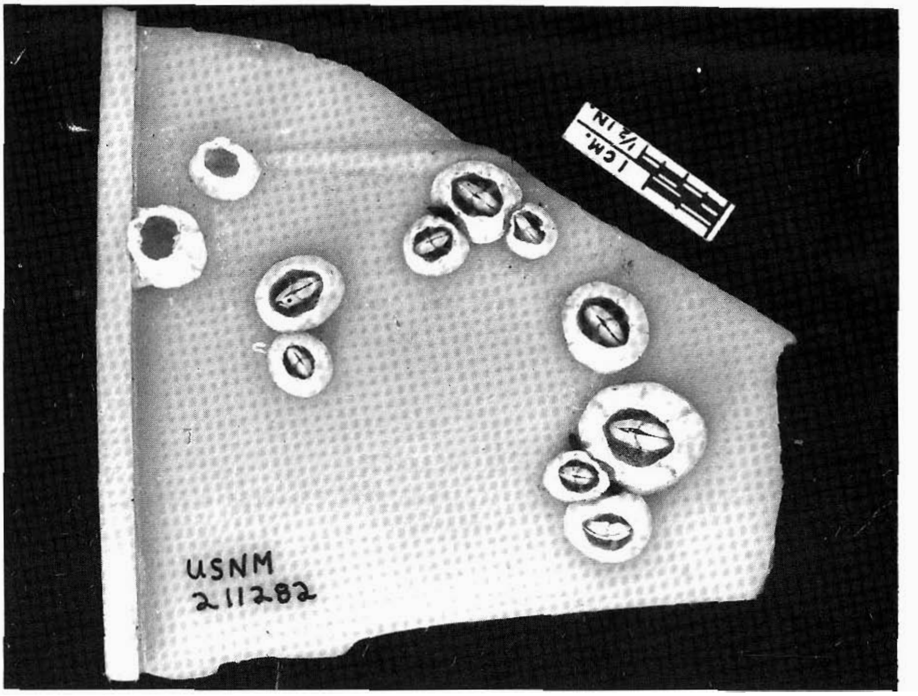

Fig. 1. A portion of the yellow plastic with *Chelonibia patula* (Ranzani, 1818) attached (USNM 211282).

On 14 July 1982 a piece of yellow plastic was found by D. Margaritoulis about 8 m from the surf on a beach of West Peloponnesus, Greece (37°20'N 21°42'E). Attached to it was a community of epizoa, dead and dry. This included: about 15 mussels, *Mytilus* sp., 1-3 mm in length; three oysters, *Ostrea edulis* L., 1758, 20.7 to 31.9 mm in length; numerous tubes of annelid worms, less than 1.5 mm in diameter; several stalked barnacles, *Lepas* sp., 2-4 mm in plate length; and 35 sessile barnacles. W. A. Newman, verified by V. Zullo, (Newman in litt., 7 October 1986) identified the sessile barnacles (fig. 1) as *Chelonibia patula* (Ranzani, 1818)[1]).

The rostro-carinal diameters of the *Chelonibia* specimens varied from 6.7 to 16.4 mm, averaging 10.63 mm (st. dev. = 2.52). Although the distribution of diameters displays two modes, at 9 and at 11 mm (fig. 2), there is no significant difference between this distribution and a uniform distribution ($\chi^2 = 12$; d.f. = 9; $p > 0.05$).

[1]) There is disagreement about the correct spelling of the generic name. Darwin (1854), and some other early workers, used *Chelonobia*; and Crisp (1983) argued that this is the correct form. However, in accordance with Article 32, c, ii, of the International Code of Zoological Nomenclature (Ride et al., 1985), an inappropriate connecting vowel is not an inadvertant error; and, therefore, the original spelling of Leach (1814), *Chelonibia*, is used here.

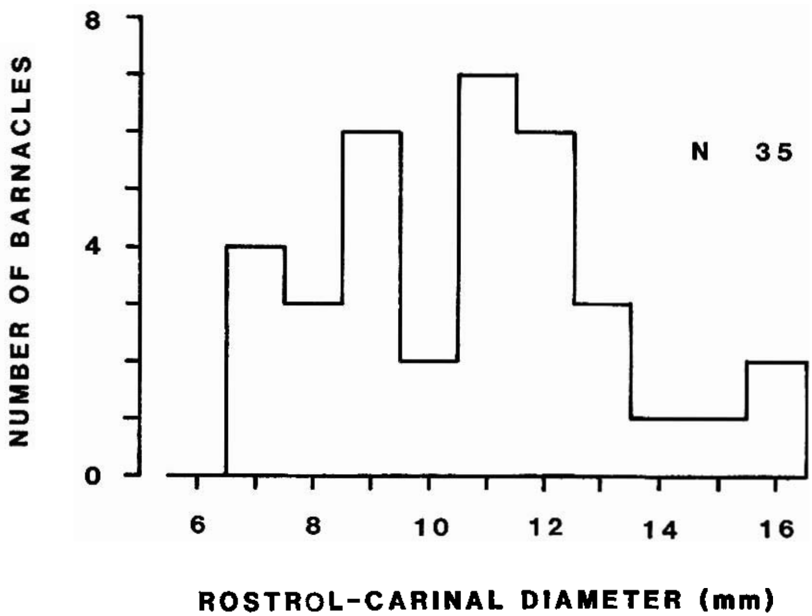

Fig. 2. Size-frequency distribution of *Chelonibia patula* (Ranzani, 1818) attached to yellow plastic (USNM 211282).

A portion of plastic (25 cm long, 12 cm wide and 2 mm thick) was salvaged from what appeared to have been a positively buoyant pail; the barnacles were affixed to the curved outer side, the oysters to the flat bottom. The color matches "Spectrum yellow" (Color 55) of the standard color series (Smithe, 1975); however, the color probably bleached while the plastic was floating at sea, exposed to the sun. The plastic, high density polyethylene, was evidently impregnated with an organic dye, not an inorganic pigment (Appendix). A portion, 85 × 83 mm with barnacles attached, is deposited in the U.S. National Museum of Natural History (USNM 211282; fig. 1).

Ross & Newman (1967: 16, fig. 7) commented that *Chelonibia patula* and *Platylepas* spp. are the "most generalized" of the "turtle barnacles" – the epizoic species of the balanomorphan superfamily Coronuloidea (see Newman & Ross, 1977). *Chelonibia patula* has been recorded on more substrata than any other species of *Chelonibia*; Darwin (1854: 396) wrote that it is "Attached to Crustacea, smooth univalve shells, and *apparently* to ships' bottoms" [italics added]. The full list of hosts includes: gastropods, stomatopod and decapod crustaceans, xiphosurans, and sea snakes (Ross & Newman, 1967). Ross & Jackson (1972) reported the only known record of this barnacle from a chelonian, a dying female diamondback terrapin, *Malaclemys terrapin macrospilota* Hay, 1904, from California Swamp, Florida. Newman (in litt., 12 September

1984) noted that "there was no obvious reason why it [*Chelonibia patula*] would not do well on a rock (if something didn't eat it)".

However, despite the singular diversity of substrata on which it is found, there is not a single verified, previous record of *C. patula* (or any other chelonibiinae) on an inanimate object. After more than a century there has been no confirmation of Darwin's suggestion that *Chelonibia patula* (or any other species of this genus) occurs on ships. In addition, there is no record of *C. patula* on a marine turtle (Ross & Jackson, 1972: 204; Newman, in litt., 30 October 1984). These negative records are germane to understanding the ecological and evolutionary history of the "turtle barnacles".

The previous lack of records of any barnacle of the Chelonibiinae, *C. patula* in particular, on an inanimate object is important. It shows that these barnacles — even the most generalized species — are essentially obligate commensals highly specialized for substrates of live animals, be they with calcareous, chitinous, or keratinous coverings.

This being the first record of "turtle barnacles" on an inanimate substratum, it is not possible to explain what factors are related to the unusual association. Possibly, the relatively stable polyethylene with a trace of organic (dye) compound in some way resembles the hard shell (either calcareous, chitinous of keratinous) of animals usually settled upon by the barnacles. The fact that the plastic is positively buoyant may be relevant, although *Chelonibia patula* is recorded to have settled on both free-swimming and motile, bottom-dwelling animals.

The absence of records of *C. patula* on marine turtles raises another question: why is the least host-specific form of *Chelonibia* not found on the most common substratum for the chelonibiine barnacles? The problem is compounded by a lack of detailed ontogenetic and taxonomic studies in this subfamily.

Although there is possible confusion between species and ecotypes in this genus (e.g. *Chelonibia manati lobatibasis* Pilsbry, 1916 may be a form of *C. testudinaria* (L., 1758); see Zullo in Seigel, 1983: 35), the primitive, unspecialized morphology of *C. patula* is unmistakable – it is very unlikely that it could be confused with the highly specialized form of its congeners. *C. patula* is comparatively fragile with a relatively highly conical profile; it lacks the internally buttressed plates that are broadly and strongly locked together, found in other *Chelonibia* spp. This conformation makes *C. patula* unlikely to survive physical bumps and bangs if its host were to knock into other turtles, the bottom, reefs, or other solid objects. The flattened, strengthened configuration of the other more specialized species would be less liable to physical damage that could be incurred while on a marine turtle. This selective disadvantage in *C. patula* may be coupled with an aversion to settling on marine turtles (Newman, in litt., 1 March 1989).

The record reported herein shows that, although it is evidently rare, at least one chelonibiine, "turtle barnacle", can settle on floating, inanimate objects and grow to 16 mm in diameter. Whether or not chelonibiines will grow or settle on submerged, inanimate substrata is unknown, but the question is relevant to the physio-ecological adaptations involved in the evolution of the epizoic forms. The evolutionary sequence thought to have occurred between ancestral, rock-dwelling coronuloids and specialized, epizoic, "turtle barnacles" may have included transitional nonspecies-specific substrata. The fact that at least *Chelonibia patula* is common on hard-shelled invertebrates and rare on inanimate and floating objects indicates that the chelonibiines have not adapted to exploit floating objects which are inanimate, a habitat which the stalked barnacles, *Lepas* spp. commonly dominate. There is a need for more observations on the substrate used successfully by chelonibiines and for studies of their ontogeny.

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APPENDIX

Analysis of the plastic in USNM 211282

The polymer was shown to be high density polyethylene by specific gravity (0.96), melting point (131-136°C) and infrared spectroscopy (rapid decreases in %-transmittance at 700, 1470, and 2900 cm^{-1}).

X-ray emission analysis showed peaks corresponding to chlorine, silicon, sulfur, calcium, potassium, aluminium and possibly iron. A relatively high chlorine peak, in the absence of sodium or phosphorus was unusual, and chlorine was not detected by Beilstein's test (sensitive to organically bound chlorine). The amount of chlorine may be small, compared to the amounts of carbon and hydrogen which make up the polymer but do not show up on the X-ray emission spectrum.

No particles of coloring matter were observed under either plane or crosspolarized light at 500 ×. No heavy elements, characteristic of inorganic pigments, were detected by X-ray emission analysis. It was thus assumed that the yellow coloring matter is more likely to be an organic dye, probably only a trace constituent, and may be a chlorine containing compound.

Walter R. Hopwood and Martha Goodway, Conservation Analytical Laboratory, Smithsonian Institution (CAL No. 4529).

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