

Occurrence of the alien ascidian *Perophora japonica* at Plymouth

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Several colonies of the phlebobranch ascidian *Perophora japonica* were found during 1999 at a marina in Plymouth Sound, Devon, UK. The species was still present in the spring of 2000. This appears to be the first record from British coasts of the species, which is native to Japan and Korea but is previously known from northern France. The stolons of *P. japonica* bear distinctive, star-shaped terminal buds, which are bright yellow in the Plymouth population. Comparison is made with Atlantic representatives of the genus, particularly the native British species *P. listeri*.

On 8 August 1999, an unfamiliar species of ascidian was noticed growing on a detached fragment of hydroid (believed to be *Nemertesia antennina*) tangled with settlement panels which had just been retrieved from Queen Anne's Battery Marina, Plymouth Sound, Devon, UK. The colony bore terminal structures on the stolons very reminiscent of the star-shaped buds of *Perophora japonica* Oka, 1927, familiar to J.D.D.B. and A.D.S. only from illustrations in the literature (Tokioka, 1953; Mukai et al., 1983). On a subsequent visit to the marina on 13 September, several small colonies of the same species were seen growing on settlement panels and the racks that held them. On 21 October 1999 five colonies were noted, and samples taken, from the settlement racks and from fucoid algae spread over a ~140 m stretch of the seaward pontoon of the marina. It was evident that these colonies had settled and grown *in situ*. Small colonies were present on some of the same settlement racks in March, April and June 2000, suggesting that the population had over-wintered. The species had not been noticed during repeated visits to tend settlement panels in the same locality over the two years prior to August 1999.

Some of the 1999 specimens were relaxed, preserved, and sent to T.N. for identification, along with comparative material of the native species *Perophora listeri* Forbes, 1848 from Church Island and Port Dinorwic Marina (both Menai Strait, North Wales). The taxonomic notes that follow are based on T.N.'s examination of these specimens.

The Plymouth specimens are clearly referable to *P. japonica*, agreeing well with previous descriptions of the species (e.g. Tokioka, 1953; Nishikawa, 1991). Distinctive characteristics of the internal anatomy are as follows: (1) the mantle musculature is composed of fine bundles confined to the region around both siphons; (2) there are 24–30 stigmata in each half of four rows; (3) the internal longitudinal vessels are incomplete, although never rudimentary; and (4) there are 7–8 branchial papillae on each side. *Perophora listeri* is similar to *P. japonica* in the limited extent of mantle muscles and the presence of four rows of stigmata. The most striking internal differences between *P. japonica* and *P. listeri* concern the branchial basket: the latter species shows a complete absence of internal longitudinal vessels and a smaller number of stigmata in each half-row, about 20–24 (based on previous descriptions given by Garstang (1891),

Ärnbäck-Christie-Linde (1934) and Berrill (1950), and confirmed in the Menai Strait specimens).

The conspicuous terminal buds of *P. japonica*, which are angular and commonly star-shaped (Figure 1), have not been reported in *P. listeri* or any other *Perophora* species. The Plymouth specimens of *P. japonica*, when alive, have a marked yellow or greenish-yellow coloration in younger parts of the colony, while the terminal buds, often in clusters, are bright yellow. Tokioka (1953) and Nishikawa (1991) noted yellowish-green or greenish coloration in Japanese specimens. In contrast, *P. listeri* lacks noticeable coloration.

Perophora listeri is the only *Perophora* species previously recorded from British waters (Hayward & Ryland, 1990; Howson & Picton, 1997), although *P. japonica* is known from the Channel coast of France (Monniot & Monniot, 1985). When taking the whole European and Atlantic ascidian fauna into account, another four or five congeneric species need to be considered: *P. viridis* Verrill, 1871 (= *P. dellavallei* Neppi, 1921 and *P. banyulensis* Lahille, 1887) from North American coasts and tropical waters (e.g. Van Name, 1945; Goodbody, 1994) and the Mediterranean (e.g. Brunetti, 1979); *P. multiclathrata* (Sluiter, 1904) from tropical waters (e.g. Goodbody, 1994); *P. bermudensis* Berrill, 1932, if distinct from *P. multiclathrata*, from tropical waters (see Goodbody, 1994); and *P. regina* Goodbody & Cole, 1987 and *P. carpenteria* Goodbody, 1994 from Central America (Goodbody & Cole, 1987; Goodbody, 1994). *Perophora multiclathrata*, *P. bermudensis* and *P. carpenteria* are furnished with five rows of stigmata. *Perophora regina* has four rows, but its mantle musculature consists of fine bundles over the whole surface of the body. *Perophora viridis* resembles *P. japonica* (and *P. listeri*) in the restricted occurrence of mantle muscles and the possession of four rows of stigmata, and is similar to *P. japonica* in the existence (although incomplete) of internal longitudinal vessels and in their number (as represented by branchial papillae). However, *P. viridis* is distinguishable from *P. japonica* by the slightly more extensive mantle musculature and the smaller number of stigmata: 9–20 (usually 16–18) per half-row in *P. viridis* instead of 24–30 in *P. japonica*.

In Japan, *Perophora japonica* is known from widely scattered localities on both the Sea of Japan and Pacific Ocean coasts of Hokkaido and Honshu, and from Shikoku; it has also been recorded on the Korean side of the Korea Strait (records

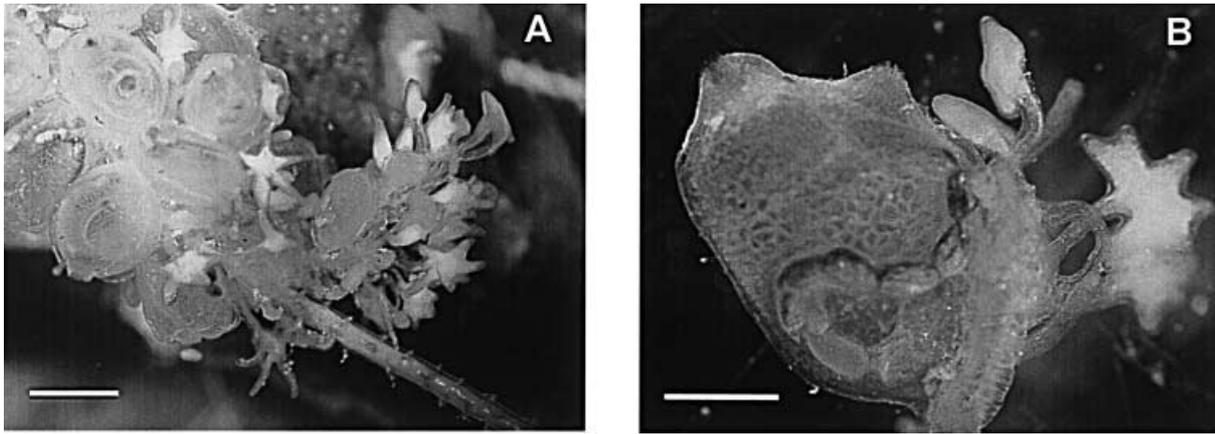


Figure 1. *Perophora japonica* from Queen Anne's Battery Marina, Plymouth. (A) Several zooids with cluster of terminal buds from colony growing on a hydroid (denuded stem of hydroid visible in lower right part of picture). (B) Zooid and terminal buds from the same colony at higher magnification. Scale bars: A, 2 mm; B, 1 mm. Scales are approximate; fully-grown zooid is ~ 4 mm long.

summarized by Nishikawa, 1991). The species was recorded by Monniot & Monniot (1985) from Normandy and the north coast of Brittany (north-west France), sometimes associated with the non-native alga *Sargassum muticum*. It is apparently a new arrival in Plymouth and perhaps in the British Isles, probably from France following the route suggested for *S. muticum* (Farnham et al., 1973; Eno et al., 1997). The naturalized unitary ascidian *Styela clava*, also a native of the Far East, apparently spread in the opposite direction, being noted first in Plymouth and subsequently in France (Eno et al., 1997). In addition to sexual reproduction to produce tadpole larvae, *P. japonica* can also spread asexually by detachment and dispersal of the terminal buds (Mukai et al., 1983), which stick to firm surfaces and produce stolons which soon bear zooids. Detached terminal buds from Plymouth specimens produced colonies in the laboratory and these have been kept in culture, albeit with limited growth, from August 1999 to the time of writing (June 2000).

Colour images of *P. japonica* from Plymouth are on the relevant Species Information Page of the MBA MarLIN website (www.marlin.ac.uk). Specimens have been deposited at the City of Plymouth Museum, Accession numbers PLYMG: NH2000.2.1 and PLYMG: NH2000.2.2, and the specimens examined by T.N. will be deposited in the Nagoya University Museum.

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