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Rapid Communication

# First record of the recently described Korean bryozoan *Primavelans glabricollaris* Min, Chae, Yang, Noh, Lee & Seo, 2021 (Cheilostomatida: Pacificincolidae) from the North-east Atlantic

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## Abstract

*Primavelans glabricollaris* is a cheilostomatid bryozoan described in 2021 from Korean coastal waters. Here, we report the first observations of this Pacific species from samples at two different locations during soft-bottom surveys of the North Sea in 2019. Its European discovery predates the actual species description from the year 2021. The Pacificincolidae are not native to Europe, and since *Primavelans glabricollaris* was found only recently, despite earlier surveys at the same locations, we regard it as a non-indigenous species. Its disjunct distribution within the North Sea as well as its rare occurrence in soft-bottom habitats far off the coasts of the Netherlands and Germany might indicate some specific anthropogenic introduction mechanism different from the usual ballast water or shellfish import vectors known for these coasts.

**Key words:** North Sea, cryptogenic, non-indigenous species, alien species, Bryozoa

## Introduction

The family Pacificincolidae was established by Liu and Liu (1999) and initially only included the type genus *Pacificincola* Liu & Liu, 1999. The second genus *Primavelans* was introduced by De Blauwe (2006) based on characters of the early astogeny, and later verified by NJ (Neighboring Joining) analysis, an algorithm using molecular data to establish distances between taxa (Min et al. 2021). The third genus *Burdwoodipora* was added to this family by López-Gappa et al. (2017).

Currently, the family Pacificincolidae includes six known species worldwide. In *Pacificincola* (two species), the ancestrular frontal shield remains exposed, while in *Primavelans* (three species), the daughter zooids cover the frontal shield of the ancestrula and form a median longitudinal ridge. The only species of the genus *Burdwoodipora* is an obligate associate of pagurid hermit crabs in the Southern hemisphere and was attributed to the

Pacificincolidae based on the combination of an imperforate ovicell, pseudoporous frontal shield and suboral heterozooid. Its placement within the family Pacificincolidae, however, was questionable and molecular sequencing is needed to settle the matter (Dennis Gordon *pers. comm.*).

There are no species of Pacificincolidae known to be indigenous to Europe. *Pacificincola perforata* (Okada & Mawatari, 1937) was found in 2001 on the Atlantic coast of France (De Blauwe 2006) and in 2004 in the North Sea on the coast of the Netherlands (Faasse et al. 2013), both in moderately sheltered environments used for shellfish culture.

In 2019, colonies of Pacificincolidae were collected in the North Sea, far away from the sheltered shellfish cultures. Although these colonies exhibit the characteristics of *Primavelans* ancestrula, they differ in other features from the two hitherto known species, *Primavelans insculpta* (Hincks, 1883) and *Primavelans mexicana* (Soule, Soule & Chaney, 1995). In the meantime, a taxonomic study on the Pacificincolidae (Min et al. 2021) revealed the presence of two species in Korean waters, i.e. *Pacificincola perforata* and a new species of *Primavelans*. During the process of describing the new species as *Primavelans glabricollaris*, it became clear that the colonies discovered in the North Sea are identical to it. Until now, *Primavelans glabricollaris* was known only from Korea and Japan (Rho and Seo 1985; Min et al. 2021).

In this study, we report the non-indigenous *Primavelans glabricollaris* collected from different locations in the German and Dutch North Sea in 2019, and discuss possible future dispersal and establishment of this species.

## Materials and methods

Macrozoobenthos of soft-bottom habitats was investigated in the north-eastern regions of the German Exclusive Economic Zone of the North Sea on 24 August, 2019 and in the Dutch North Sea on 19 March, 2019 (Figure 1, Supplementary material Table S1). Samples were taken with a beam trawl and a HAMON grab, respectively. HAMON (HAven beMONstering, Dutch for "harbour sampling") grab is specifically designed for soft sediment mixed with stones or pebbles.

The samples were preserved in 4% formalin until examination in the laboratory. Specimens of *Primavelans glabricollaris* were identified using a stereomicroscope (Olympus SZX10) and a light microscope (Olympus BX51). Colony fragments of *Primavelans glabricollaris* were stored in 70% ethanol at the species collection of the Institute for Applied Ecosystem Research in Neu Broderstorf (catalogue number: SBRO-X40470), as well as in personal species collections of the authors BK and HB.

Photos were taken with an Olympus microscope camera (UC 30) and with a Sony NEX-5 on an Olympus stereoscope SZX12 (1,2x Planapo objective). Morphological measurements were conducted using the Olympus CellSens

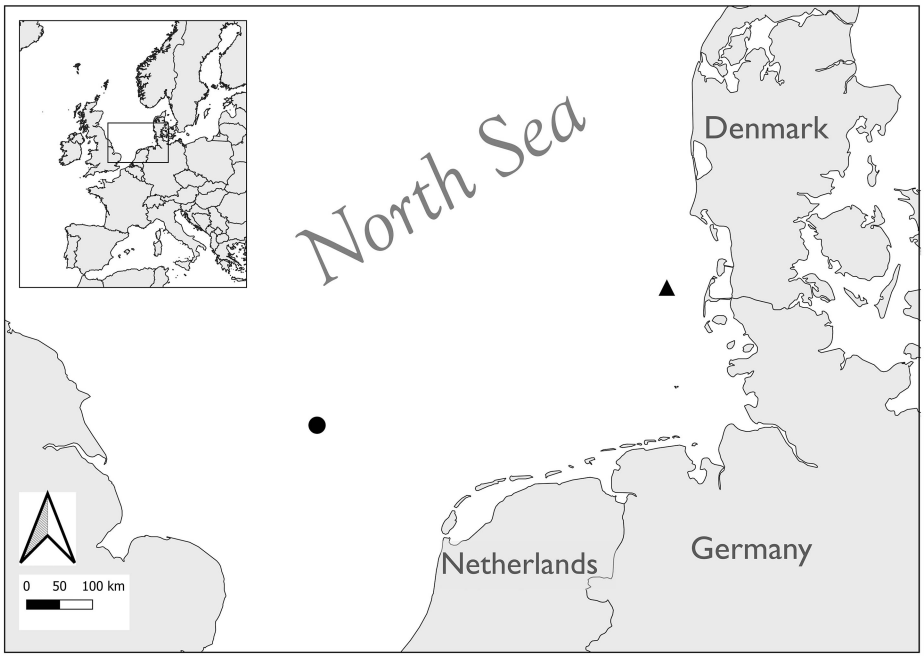


**Figure 1.** Sampling locations of *Primavelans glabricollaris* in the Dutch North Sea in spring of 2019 (black circle) and in the German North Sea in summer of 2019 (black triangle). Small map displays the general geographical location of the sampling area in Europe. See Table S1 for details.

Dimension program, version 1.4.1. SEM images were taken with an Environmental Scanning Electron Microscope (ESEM) Thermofisher Quanta 200 Tungsten Filament using secondary electrons; recordings made in LOW VAC MODE (reduced pressure water vapor atmosphere, 0.38 mm Hg) applied to gold-coated specimens. 10–15nm Au with a BAL-TEC SCD 050 Sputter-Coater.

Practical salinity scale was used for salinity determination. All figures and maps were arranged and labelled using the software Gimp 2.10.8 and QGIS version 3.18.0.

## Results

Colonies of *Primavelans glabricollaris* were found at two locations in the North Sea (Figure 1). In the following, we present the collection data for the two stations.

German record: Two of the colonies grew epizoically on campanulariid hydroids (*Obelia bidentata* and *Obelia longissima*). Water depth of the sample sites varied between 19 m and 21 m. Water temperature was 19 °C, and salinity approximately 33 PSU. The substrate was characterized by medium and coarse sand.

Dutch record: A few loose colonies of *Primavelans glabricollaris* were found in a mixed sample of 35 liter sediment, consisting of sand, gravel and pebbles. The sampling location (19HA_KLA49) is on the Klaverbank (Cleaver Bank). The EUNIS code of the location is EcoA5.27. Water depth was 35 m. The Klaverbank is one of the very few areas in the Dutch part of the North Sea with coarse sediment, mostly sand and pebbles, locally with

**Table 1.** Morphological details of *Primavelans glabricollaris* from Korea (Min et al. 2021) and Europe (this study). Measurements (in mm) of zooid length (LZ), zooid width (WZ), orificium length (LOr), orificium width (WOr), ovicell length (LOv), and ovicell width (WOv).

| | LZ | WZ | LOr | WOr | LOv | WOv |
|---|---|---|---|---|---|---|
| *Primavelans glabricollaris* (Korea) | 0.45–0.84 | 0.20–0.29 | 0.14–0.21 | 0.16–0.21 | 0.29–0.35 | 0.25–0.29 |
| *Primavelans glabricollaris* (Germany) | 0.46–0.73 | 0.28–0.37 | 0.17 | 0.18–0.20 | 0.37 | 0.31–0.34 |
| *Primavelans glabricollaris* (Netherlands) | 0.62–0.79 | 0.30–0.45 | 0.17 | 0.14–0.19 | 0.32–0.38 | 0.39–0.41 |

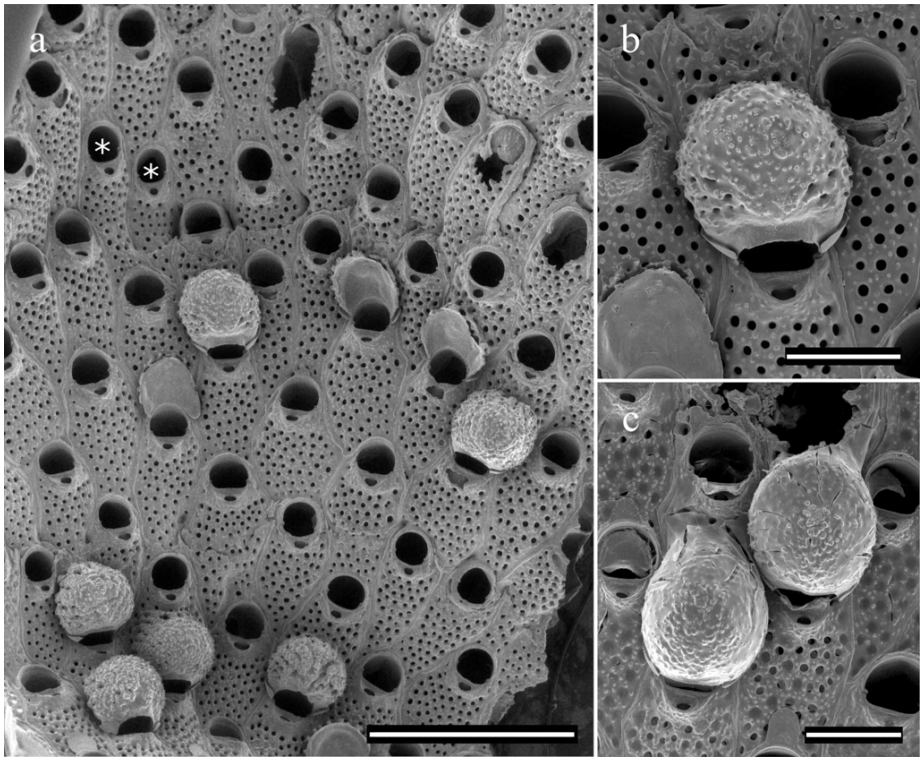


**Figure 2.** *Primavelans glabricollaris* from the Netherlands (a, b) and Germany (c). a) colony, arrangement of zooids and ovicells; asterisks show smaller, probably male zooids; scale bar: 1 mm; b) perforated ovicell with lateral flanges and eponymous smooth proximal zone, c) zooid and aperture details. Scale bar b) and c): 250 µm. Photomicrographs by Hans De Blauwe.

some larger boulders. *Escharella immersa* (Fleming, 1828) was an accompanying bryozoan species.

## *Systematics*

Order: Cheilostomatida Busk, 1852

Family: Pacificincolidae Liu & Liu, 1999

Genus: *Primavelans* De Blauwe, 2006

**Species: *Primavelans glabricollaris* Min, Chae, Yang, Noh, Lee & Seo, 2021**

Description of European material of *Primavelans glabricollaris*

Colony unilaminar, encrusting when young; growing into bilaminar erect blades. Size of the colonies found is very small (at most approx. 1 cm), maximal size unknown. Color of preserved material yellowish white. Zooids irregularly rectangular to hexagonal, 0.46–0.79 mm long, 0.28–0.45 mm wide (Table 1, Figure 2a). Frontal wall flat to slightly convex, evenly perforated, pustulose between perforations.

Orifice wider than long; rarely longer than wide, especially in smaller (male?) zooids (Figure 2a, asterisks); orifice D-shaped; sinus broad with straight proximal edge, flanked by blunt condyles. Peristome not developed laterally nor distally. Prominent suboral umbo incorporating a heterozooid, with a foramen facing distally, nearly perpendicular to the frontal plane.

Ovicells hyperstomial, 0.31–0.45 mm long, 0.33–0.38 mm wide, reaching to condyles, closed by the zooidal operculum. Ooecium formed by the distal autozooid. Entooecium completely calcified, young ovicells show tubercles and pits and depressions in radiating series from the proximal border to the contact zone with the distal zooid. Mature ovicells have only some proximolateral pores left, others having disappeared by secondary calcification. A mature ovicell has a smooth proximal border, typical for this species. Ectooecium membraneous, with calcified proximolateral flanges lateral to the ovicell opening (Figures 2b, 2c, 3a, 3b).

Spines and avicularia lacking. Interzooidal communication via multiporous septula (Figure 3c). Ancestrula budding a distal and two distolateral primary daughter zooids (Figure 3d, 3e); frontal wall of ancestrula covered by the two lateral daughter zooids, having a median longitudinal ridge, only the ancestrular orifice remaining free.

Remarks

A key for the identification of Pacificincolidae is given by Min et al. (2021), and was found to be useful for material from European waters. It is important to note that only colonies with ancestrulae and ovicells can be identified with certainty.

## Discussion

*Origin*: The type locality of *P. glabricollaris* is Munseom Island, Korea. The species is widespread along the southern and eastern coast of Korea (Min et al. 2021). Nevertheless, it is not clear if the species is indigenous to that region, or has been introduced there by anthropogenic means. It should therefore be considered as cryptogenic, although its occurrence in Europe is most likely the result of an introduction.

*Distribution in Europe*: In the Atlantic Ocean, *P. glabricollaris* is hitherto known from the German and Dutch parts of the North Sea only. The two locations are widely separated in the east and west of the southern North Sea (Figure 1). Both locations are characterised by sandy sediments, and at the Dutch station, additionally gravel and pebbles were present. The colonies were found either attached to campanulariid hydroids or as detached fragments. It is, therefore, not sure whether this species in the North-east Atlantic region prefers to grow mainly on larger sediment particles or epizoically (on hydrozoans, oyster shells, rocks, buoys), as described by Min et al. (2021).

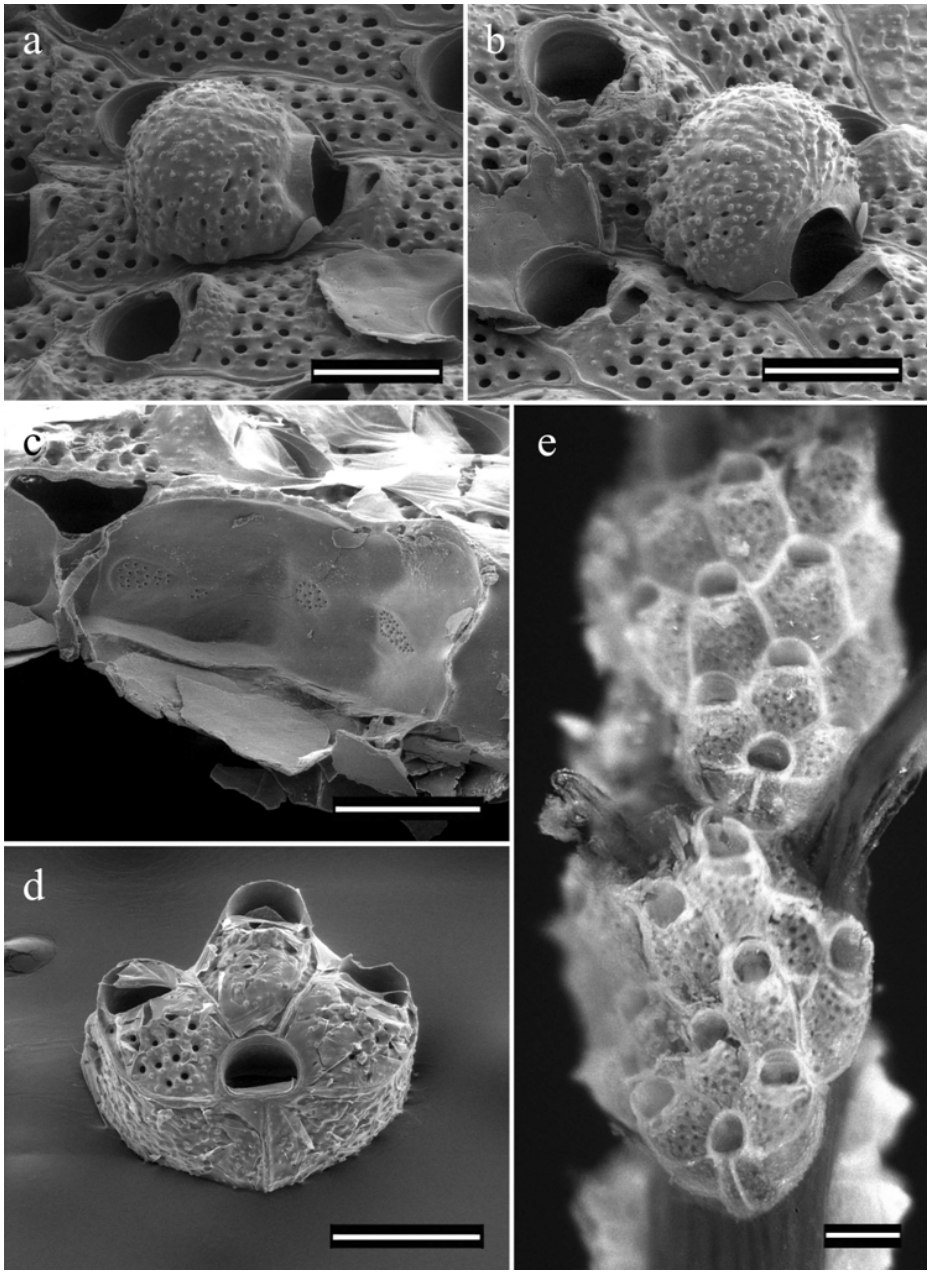


**Figure 3.** *Primavelans glabricollaris* from the Netherlands (a, b) and Germany (c–e). a) and b) perforated ovicell with lateral flanges and eponymous smooth proximal zone, c) interzooidal communication via multiporous septula, d) genus specific ancestrula with three daughter zooids covering its frontal shield, e) young colonies on hydroid stem with ancestrulae. Scale bar a)–e): 250 µm. Photomicrographs by Hans de Blauwe.

In view of the widely separated offshore locations, it is likely that the species occurs more widespread either inshore or offshore, but has gone unnoticed so far. The usual pattern of the spread of an introduced bryozoan species is most often a gradual dispersal along the coast from an introduction site in inshore waters (Cook et al. 2013; Kind and Kuhlenkamp 2016). In our case, the bryozoan has not yet been found in inshore waters. It is unlikely that an introduction of *P. glabricollaris* occurred at both of the two offshore locations separately, which lie far apart, or that the colonization of one of the sample locations was initiated

from a source population at the other site. The reason for the absence in coastal waters could be a lack of investigation by experienced taxonomic specialists, or might more likely be based on certain ecological preferences of the species such as stenohalinity. At present, however, there is not enough data on the ecology of this species in order to describe any environmental preferences.

*Introduction vector*: If *P. glabricollaris* is indeed absent in inshore waters, some common vectors for marine species introductions (Kuhlenkamp and Kind 2018), like import of shellfish and recreational boating, could be ruled out. Other vectors, like ballast water release and introduction by hull fouling by international shipping, are also less likely since the stations are not within major shipping routes. One possibility is an initial introduction of *P. glabricollaris* to oil rigs or windfarm installations in the North Sea by service or construction vessels.

*Further spread*: It is possible that *P. glabricollaris* will expand its actual known range from the very few sites in the North Sea since its character as a fouling species settling on a wide variety of substrates and with a preference for artificial hard substrates (Min et al. 2021) makes it a predestined invader. On the other hand, the environmental conditions in the North Sea differ from the Korean waters, which are characterised by higher mean water temperatures than the European North Sea. There is no evidence of the species being eurytherm or euryhaline which would support dispersal to colder regions or estuaries. Low temperatures as they regularly occur in the North Sea might be the limiting factor for this new species. In 2019, however, increased numbers of thermophilic species were observed in North Sea samples (personal observations), indicating higher seawater temperatures. That situation could have favoured the sporadic settlement of *P. glabricollaris* in the North Sea.

*Impact*: In Korea, where *P. glabricollaris* preferably grows on anthropogenic structures, a negative impact has been observed for aquaculture (Min et al. 2021). It is therefore necessary to put this species on the watchlist of possible invasive neobiota for the North-east Atlantic region.

The colonies in this study were found in 2019, but could only be identified in 2021 after the description by Min et al. (2021). This is another example showing the importance of species knowledge: many marine species are still unknown or undescribed. For the investigation of (anthropogenic) faunal changes and species introductions, we depend on the extensive knowledge of species inventories from regions all over the world and also on the presence of educated and experienced taxonomists able to recognize the species.

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## Authors' contribution

LS and JL drafted the initial version of the manuscript. HB contributed SEM images. JL prepared figures and map. All authors contributed to writing and revising, and approved the final version of the manuscript.

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**Supplementary material**

The following supplementary material is available for this article:

**Table S1.** Sampling sites of *Primavelans glabricollaris* in two different locations in the year 2019.

This material is available as part of online article from:
http://www.reabic.net/journals/bir/2022/Supplements/BIR_2022_Schuler_etal_SupplementaryMaterial.xlsx