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Letter to the Editor

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Polycera norvegica is a valid species, and a plea for good taxonomic practices – a reply to Korshunova *et al*., 2021

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Abstract

In this letter we highlight the inconsistencies and dismantle the arguments used by Korshunova *et al.* (2021) where the authors have treated the nudibranch species *Polycera norvegica* as a junior synonym of *Polycera capitata* (original designation: *Thecacera capitata*). We show that in accordance with the International Code of Zoological Nomenclature, *Thecacera capitata* should be considered a *nomen dubium*, and we reinstate *Polycera norvegica* as the valid name of this species.

Introduction

In their recent paper, Korshunova *et al.* (2021) discuss the problem of recognizing cryptic species and the practical measures required to identify and name these taxa through the integration of morphological, molecular phylogenetic, phylogeographic and ecological data with statistical analyses, a methodology which they named 'The multilevel organismal diversity approach'. They used as the model group, the European species of the nudibranch genus *Polycera* Cuvier, 1816 with a focus on the *Polycera quadrilineata–Polycera faeroensis* species groups. The authors have described one new species (*Polycera kernowensis* Korshunova, Driessen, Picton & Martynov, 2021) and have treated the recently described species *Polycera norvegica* Sørensen, Rauch, Pola & Malaquias, 2020 (Sørensen *et al*., (2020) as a junior synonym of *Polycera capitata* (Alder & Hancock, 1854).

Our goal here is neither to judge the methodological framework proposed by Korshunova *et al.* (2021) nor to question the validity of their new species, but to correct a nomenclatural act, that is their synonymization of the valid and distinct species *P. norvegica* with an old and elusive name, *Thecacera capitata* (=?*Polycera*). We here show that the arguments used by Korshunova *et al.* (2021) to synonymize these two species are unfounded. Their emendation, which is both arbitrary and unjustified, is here reverted in the interests of scientific integrity and taxonomic stability.

About misinterpretations of colour patterns

Korshunova *et al.* (2021) have explicitly stated that whereas Sørensen *et al.* (2020) did not investigate the numerous synonyms of *P. quadrilineata* but only referred to the list of names available in MolluscaBase (2020), they have 'carefully investigated all existing available synonyms of *P. quadrilineata* (Figures 1, 2, 3, 4, 5, 6, 7, Table 1, Supplementary information Figure S1)'. This is a misleading statement because it suggests that all the various nominal species names currently considered to be synonyms of *P. quadrilineata* are discussed by Korshunova *et al.* (2021) when in fact their figures and tables illustrate only the new material studied by the authors. There are no comparative figures or discussion or reference to original descriptions and illustrations of the various synonyms, which the authors seem to equally assume are the ones listed in MolluscaBase (2020), but this is not explicitly stated.

The only synonyms of *P. quadrilineata* discussed by Korshunova *et al.* (2021) out of the previous 11 available (10 names after Korshunova *et al*., 2021) (see MolluscaBase, 2021) are *Polycera ornata* d'Orbigny, 1837 and *Thecacera capitata*.

Regarding the name *Polycera ornata*, Korshunova *et al.* (2021) based on the original description by d'Orbigny (1837: 9–12, pl. 107), have argued that it may agree with the lined morphs known for *P. quadrilineata* (Sørensen *et al*., 2020; Korshunova *et al*., 2021), a conclusion with which we agree. Moreover, the lack of available type material of *P. ornata* for comparative analyses would make any other decision equivocal.

When it comes to *Thecacera capitata*, the reasoning given by Korshunova *et al.* (2021) to regard it as the valid name for the recently described species *Polycera norvegica* seems surprisingly different. *Thecacera capitata* was based on a vague description that included no

illustrations of the living animal and was reassigned by Thompson & Brown (1984) to the genus *Polycera*. Korshunova *et al.* (2021) have stressed the fact that in the original description of *T. capitata* by Alder & Hancock (1854) 'the colouration was solely indicated as freckled with brownish greenish that immediately allows exclusion of any morphs with evident black stripes, that are present only in true *P. quadrilineata*'. What Korshunova *et al.* (2021) have not stated was that the specimens studied by Alder & Hancock (1854: 103) were presented to them already preserved in 'spirits'. In fact, in a following paper, Alder & Hancock (1855: appendix iv) went further and specified that among the two specimens given to them 'The larger specimen was nearly colourless when it reached us (in spirits), but had the orange tubercles very distinct … The smaller specimen was darker and more distinctly freckled, but the orange colour of the processes was gone. In this specimen only two tubercles were observed on each side of the veil.' Hence, all that Alder & Hancock had available to study were two whitish specimens the colouration of which was already largely lost, and quite distinct colour patterns between them, certainly because of the effect of preservation. It is well known that sea slugs become colourless or nearly colourless after preservation, not retaining any of the distinctive patterns that living animals exhibit, and, thus, descriptions of colour patterns based on fixed specimens are not reliable or, at the most, can yield only a biased assessment.

The freckled pattern mentioned by Alder & Hancock (1854, 1855) for *T. capitata* could be an effect of the liquid fixative, leading to the disappearance of the dashed or continuous dark lines that characterize morphs of *P. quadrilineata*. But, of course, this remains and will always remain speculative. Overall, the limitations regarding the full details of the pattern of *T. capitata* are well documented in the descriptions provided by Alder & Hancock (1854, 1855) and in their decision to not illustrate the species. Any attempt to reconstruct the colour pattern of this species from the original description can only be regarded as a highly speculative exercise.

Nevertheless, Thompson & Brown (1984: 69, pl. 18c) surprisingly suggested that a discrete and colourful morph – and we quote directly from them here – 'matches well a recognizable variety of *Polycera* quadrilineata' was probably the same as *T. capitata*. They included a drawing of this morph without further explanations; this drawing is in notable contradiction with the original descriptions of *T. capitata* by Alder & Hancock (1854, 1855).

The uncritical approach by Korshunova *et al.* (2021) towards these historical inconsistencies has led the authors to assume that the colour pattern of *Thecacera*/*Polycera capitata* corresponds to the one depicted by Thompson & Brown (1984: pl. 18c). However, as we explain above, it is impossible to ascertain the extent of the colour pattern of the two specimens described by Alder & Hancock (1854, 1855) as *T. capitata*. Additionally, there is one striking feature in the illustration by Thompson & Brown (1984: pl. 18c), which is distinctive of morphs of *P. quadrilineata* (absent in *P. norvegica*), namely the dark colour of the anterior side of the stems of the rhinophores (Sørensen *et al.*, 2020: Figures 3, 4, 7, 8; Korshunova *et al.*, 2021: Figure 1).

Thecacera capitata or *Polycera capitata:* to have or not to have rhinophoral sheaths

In addition, and in contrast to Korshunova *et al.*'s (2021) stated view, uncertainty about the presence of rhinophoral sheaths in *T. capitata* cannot be ignored. Alder & Hancock (1854) referred to 'tentacles retractile within cavities' (in reference to the rhinophoral tentacles) and the same authors referred to the presence of sheaths and used it in fact as the main argument to place the species in the genus *Thecacera* (Alder & Hancock, 1855). Thompson & Brown (1984) after examining the type material of *T. capitata* claimed that they 'can find nothing to distinguish it from *Polycera quadrilineata*' and reassigned the species to the genus *Polycera*, considering it to be a 'probable synonym' of *P. quadrilineata*. This can be interpreted as a sign of the uncertainty of these authors about the taxonomic status and affiliation of *Thecacera capitata*.

Yet, despite all these vague statements and lack of clarity and the fact that retractable rhinophores and rhinophoral sheaths are conspicuous features, Korshunova *et al.* (2021) have assumed that the 'presence of rhinophoral sheaths for *P. capitata* was thus indicated mistakenly' by Alder & Hancock (1854) and that the species name *Thecacera capitata* is undoubtedly a *Polycera*. We must state though, that we also believe that most likely the two specimens studied by Alder & Hancock (1854, 1855) do not belong to the genus *Thecacera*, because of the reference to a 'veil with two to four orange tubercles on each side' (Alder & Hancock, 1854, 1855), a feature absent in the single species of the genus present in European waters (*Thecacera pennigera*). Yet, the discrepancies in the descriptions of *Thecacera*/*Polycera capitata* by Alder & Hancock (1854, 1855) and Thompson & Brown (1984) warrant caution.

About misinterpretations of the internal anatomy

Korshunova *et al.* (2021: supplementary data) have stressed that there are '*considerable errors*' in the diagnostic characters used to discriminate between *P. quadrilineata* and *P. capitata* (=*P. norvegica*) by Sørensen *et al.* (2020). They first focus on incongruences in the radula description since Sørensen *et al.* (2020) mentioned the presence of four outer lateral teeth in *P. norvegica* and five outer lateral teeth in *P. quadrilineata*, whereas Korshunova *et al.* (2021) have shown that *P. norvegica* (as *P. capitata*) can also have five or even six teeth. Although, interestingly in Table 1 (diagnostic characters of species) they stress that four is the common number of outer lateral teeth in *P. norvegica* (as *P. capitata*) and five is the common number in *P. quadrilineata*. In addition, a detailed analysis of Korshunova *et al.*'s (2021) Figure 7, in which the authors depict details of the radulae of several specimens of *P. norvegica* (as *P. capitata*), reveals considerable intraspecific variability, with the number of outer lateral teeth varying between two and five; but, most interestingly, differences also occur within the same specimen with the number of outer lateral teeth varying between radular rows (e.g. Figure 7C [spc. ZMMU Op-766] and Figure 7V [spc. ZMMU Op-770]). These details have apparently escaped the attention of Korshunova *et al.* (2021). Despite recognizing that the number of teeth in *P. norvegica* (as *P. capitata*) is variable and overlaps with that in *P. quadrilineata*, and is therefore a non-diagnostic feature, these authors still have used the presence of four outer lateral teeth, as illustrated in the original figure of the radula of *T. capitata* supplied by Alder & Hancock (1855: pl. 46, Figure 19, supplementary), to support their argument that *T. capitata* and *P. norvegica* are conspecific (Korshunova *et al.*, 2021: Discussion, paragraph 5).

In our paper (Sørensen *et al.*, 2020), we stated that *P. norvegica* only had four outer lateral teeth and *P. quadrilineata* always five – this is because the material examined by us revealed exactly that. On the basis of a larger number of specimens from across a broader geographic span, Korshunova *et al.* (2021) have, however, demonstrated otherwise, showing that this is not a reliable character for separating these two species.

The same is true of Korshunova *et al.*'s (2021) interpretation of the labial cuticle (referred to by them as 'jaws') where they have confirmed that both *P. quadrilineata* and *P. norvegica* (as *P. capitata*) have strong labial cuticles.

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These differences between our results and those by Korshunova *et al*. (2021) are not, to use their phrase, 'considerable errors' but simply the way that science works. New studies provide new evidence that leads to new conclusions and to the reinterpretation of current knowledge.

Concluding remarks

It is unquestionable that the work by Korshunova *et al*. (2021) presents important new data on the chromatic and anatomical variability of *P. norvegica* and on the geographic range of this species, which was originally described as being restricted to Norway. The species *P. norvegica* is now confirmed as being present in Falmouth Bay, SW England, in the Netherlands sector of Dogger Bank (central North Sea), Scotland (based on photographic material; Anderson, 2021), the Republic of Ireland, and Norway (Driessen, 2014; Sørensen *et al*., 2020; Korshunova *et al*., 2021).

As we demonstrate here, Korshunova *et al*.'s (2021) study represents an inexplicable attempt to use a species name, which was based on a poorly documented and incomplete original description, and which was never used as a valid species name, to replace the name *Polycera norvegica*. The species *P. norvegica* was recently described by Sørensen *et al*. (2020) using modern taxonomic standards based on a combination of detailed external characters, anatomical features studied through fine dissection work and scanning electron microscopy, and molecular phylogenetics. Unlike *T. capitata*, *P. norvegica* has been well defined and its taxonomic status is unambiguous.

Based on the lines of evidence presented above and in the interests of maintaining scientific integrity and promoting taxonomic stability, *Thecacera capitata* as described by Alder & Hancock (1854, 1855) is best considered a name of unknown or doubtful application and conforms with the definition of *nomen dubium* (ICZN, 1999). *Thecacera capitata* is either a probable senior synonym of *P. norvegica* or, as suggested by Thompson & Brown (1984), is a synonym of *P. quadrilineata*. We, therefore, reinstate *Polycera norvegica* as the valid species name.

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