The southwestern Baltic Sea–Kattegat area: a hotspot for the lichen genus Xanthoria s.l.

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Introduction

The genus *Xanthoria* (Teloschistaceae) comprised approximately 50 species before the molecular era (Kärnefelt 1989). Since then, the number of recognized species has increased, while the genus has been divided into several segregates, which resulted in 13 species belonging to *Xanthoria* sensu stricto (Kondratyuk et al. 2022). The rapid development of systematics has made many sequences in GenBank difficult to interpret. For example, more than 350 ITS-sequences attributed to the well-known species *Xanthoria parietina* often represent different species within the three genera *Xanthoria*, *Rusavskia,* and *Massjukiella*. Few species of *Xanthoria* were reported from the south-western Baltic Sea–Kattegat area prior to our study, as lichens of this genus were largely neglected in collecting efforts.

Materials and Methods

More than 3,500 samples of the lichen genus *Xanthoria* s.l. were collected from 135 localities in the south-western Baltic Sea–Kattegat area between 2022 and 2025 (Figs 1–2). A method for collecting epilithic lichen thalli without damaging the substrate was developed, using water-spray pretreatment. For each specimen, at least 50 ascospores outside the asci were measured. In total, 177 specimens from our collection were selected for phylogenetic analyses, always using nrITS sequences and occasionally mtSSU sequences.

Results and Discussion

The phylogenetic tree of *Xanthoria* s.str. reveals 24 clades that may correspond to species, all of which occur in the studied area. Six of these clades are already described as species, namely *X. calcicola* Oxner*, X. coomae* S.Y. Kondr. & Kärnefelt*, X. ectaneoides* (Nyl.) Zahlbr.*, X. pedersenii* S.Y. Kondr., Kärnefelt & A. Thell*, X. pylyporlykii* S.Y. Kondr., Kärnefelt & A. Thell and *X. wennergrenii* S.Y. Kondr., Kärnefelt & A. Thell.

Rusavskia drevlyanica S.Y. Kondr. & O.O. Orlov and *Xanthoria coomae* are confirmed from the studied area for the first time. A close relationship between *Rusavskia drevlyanica* and *Zeroviella esfahanensis* S.Y. Kondr., Zarei-Darki & Hur is revealed (Fig. 3).

Molecular data for specimens of *Xanthoria ectaneoides*, identical to Nylander's type specimen, are presented in this study. According to our results, this species is positioned in a separate subclade and is therefore not synonymous with *X. aureola* in the *Xanthoria calcicola* subclade (Fig. 4), as previously believed (Kondratyuk et al. 2024).

Fig. 1. One of the 135 localities: the cemetery wall at Väsby Church, Kullen Peninsula, north-western Scania, hosting several species of the genus *Xanthoria*. Species of *Xanthoria* usually exhibit a yellow-orange colour, in contrast to the deep orange characteristic of *Rusavskia* species (see Fig. 2).

Fig. 2. *Rusavskia drevlyanica,* Hörby — new to Sweden.

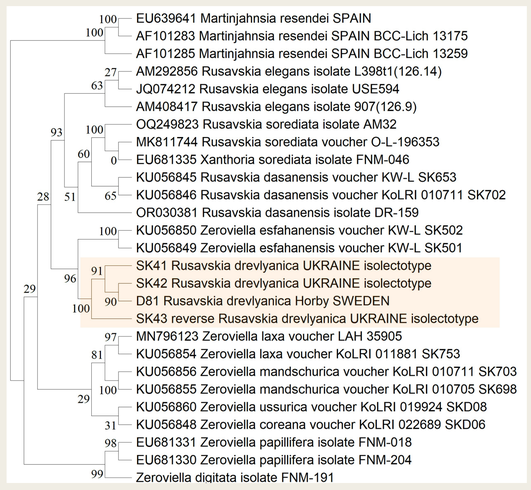

Fig. 3. Consensus MP tree based on nrITS sequences of the members of the genera *Rusavskia* and *Zeroviella,* showing the systematic position of *R. drevlyanica* forming a well-supported clade with *Z. esfahanensis*.

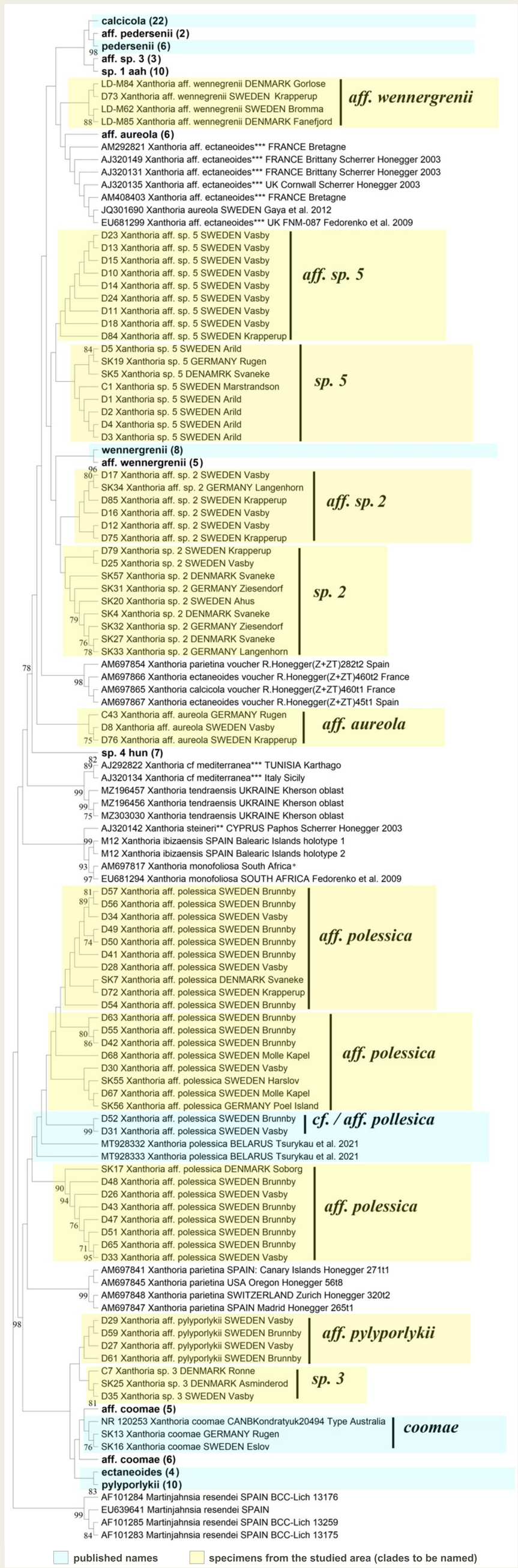

Fig. 4. Consensus MP tree based on nrITS sequences of members of the genus *Xanthoria.* Data submitted to GenBank: * — as *X. parietina*, ** — as *Xanthoria* sp., *** — as *X. ectaneoides*.

Conclusion

The studied area is undoubtedly a hotspot for the genus *Xanthoria* s.l., and the number of species is considerably higher than expected.

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ACKNOWLEDGEMENTS

We would like to thank Dr N. Thell and P.-E. Persson (Sweden), Prof. R. Honegger (Switzerland), Drs E. Farkas and L. Lőkös (Hungary), and Prof. M.R.D. Seaward (UK) for their kind assistance with specimens and for corrections to the English in this presentation. This work was supported by the Ove Almborn Foundation, the Gyllenstierna Krapperup Foundation (for AT), the Wenner-Gren Foundations, the Carl Stenholm Foundation, and Erasmus+ (for SK).

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