

FIRST RECORD OF *PYRENOCOLLEMA HALODYTES* (NYL.) R. HARRIS (PYRENULALES: PYRENULACEAE) FROM THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

Jennifer FIORENTINO¹

ABSTRACT

The marine crustose lichen *Pyrenocollema halodytes* (Nyl.) R. Harris is known to grow on substrates such as limestone, chalk, molluscan shells and barnacles and is consequently considered as a marine lichen. It was formerly placed under the genus *Arthopyrenia* but together with other lichens from this genus all containing cyanobacteria as the symbiont photobiont was placed under the genus *Pyrenocollema*. In this review *Pyrenocollema halodytes* is being recorded for the first time from the Maltese Islands having been found growing at Mistra Bay on the calcareous plates of the Star Barnacle *Chthamalus stellatus* found on rocks of the upper mediolittoral zone.

Keywords: barnacle, cyanobacteria, crustose marine lichen, Maltese Islands, perithecium

INTRODUCTION

The genus *Pyrenocollema* consists of crustose immersed or superficial lichens with cyanobacterial photobionts. The fruiting bodies of lichens of this genus consist of melanised perithecia bearing colourless 1-sepate spores. These lichens may be found growing on calcareous substrates in moist habitats, on wet sand, or on acid rocks in freshwater or marine habitats (Purvis *et al*, 1992). *Pyrenocollema halodytes* (Nyl.) R. Harris is one of the few lichens which can withstand partial submersion in salt water (Nimis, 1993) and consequently can be described as marine. It is a subcosmopolitan lichen and has been reported from a number of regions including the North American and Canadian coasts (Esslinger, 1997), the Californian Pacific coast (Tucker & Jordan, 1979) and along the coast of the British Isles (Purvis *et al*, 1992). *P. halodytes* has also been reported in different parts of the Mediterranean including the North East coast of Spain (Llop and Hladun, 2003) and along various parts of the Italian coast including Calabria (Puntillo, 1996) and Sicily (Nimis and Martellos, 2008).

The lichen has never been reported from the Maltese Islands which is surprising considering that it is considered common in dry, mediterranean Italy (Nimis and Martellos, 2008). The lichen checklist of Sommier and Caruana Gatto (1915) does not include any of the formerly used synonyms of this lichen e.g. *Arthopyrenia halodytes* (Nyl.) Am. It is also not to be found in the well-conserved lichen collection at the Natural History Museum in Mdina. Consequently with all this in mind different substrates including limpets, barnacles and gastropods from the mediolittoral zone along the coast of the Maltese Islands were examined for the presence of this lichen.

Pyrenocollema halodytes was finally localised on the plates of the Star Barnacle *Chthamalus stellatus* which was growing in great numbers on the upper mediolittoral zone in a rocky beach at Mistra Bay (Figure 1). This is the first record of *Pyrenocollema halodytes* (Nyl.) R. Harris from the Maltese Islands.

¹ Department of Biology, University Junior College, Msida, Malta email: jennifer.fiorentino@um.edu.mt



Figure 1. Population of Star Barnacles: *Chthamalus stellatus*

MATERIALS & METHODS

A number of barnacles of species *Chthamalus stellatus* of different sizes were collected. The calcareous plates of these sessile crustaceans were examined with a stereomicroscope at X20 and X40. A compound microscope was used to examine sections of perithecia, asci and spores at X100 and X400.

Morphology: No thallus observed on the plates - thallus endolithic. Fruiting bodies (ascmata) in the form of black perithecia between 0.2mm to 0.35mm in diameter. Some perithecia protruding from the surface of the plate, others immersed. Ostioles were up to 50 μ m in diameter (Figures 2 and 3).

Anatomy: Vertical sections of perithecia mounted in water and observed using a compound microscope. Distinct, black involucrellum, often hemispherical, of between 250-315 μ m diameter and around 40-60 μ m thick (Figure 4). Pale brown excipulum. Paraphyses not separate but forming a branched network.

Asci varying in shape, pyriform to ovoid 50-70 x 15-25 μ m, dimidiate. (Figures 5 and 6). Eight spores in each ascus. Spores 19.5-24 x 8-10.5 μ m, clavate-ovoid, colourless, 1-septate, one cell slightly wider than the other (Figure 7). Tissue from beneath perithecia showed chains of cyanobacterial cells of up to 10 μ m width (Figure 8).

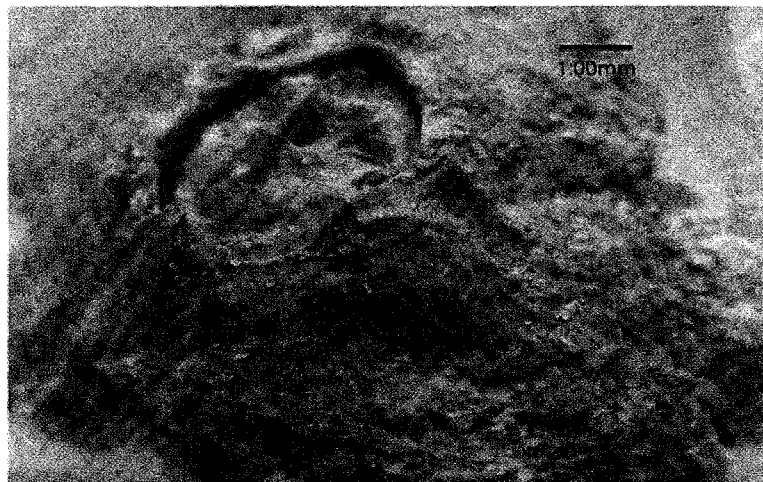


Figure 2. Two perithecia (*arrowed*) on barnacle plates

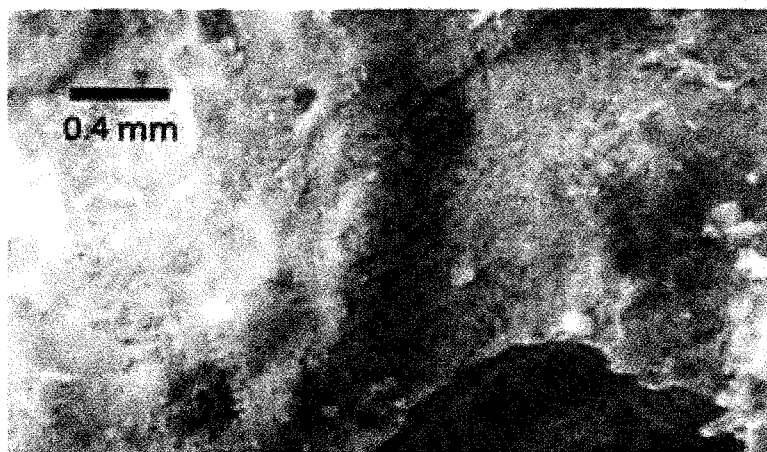


Figure 3. Close up of 2 perithecia with their ostiole

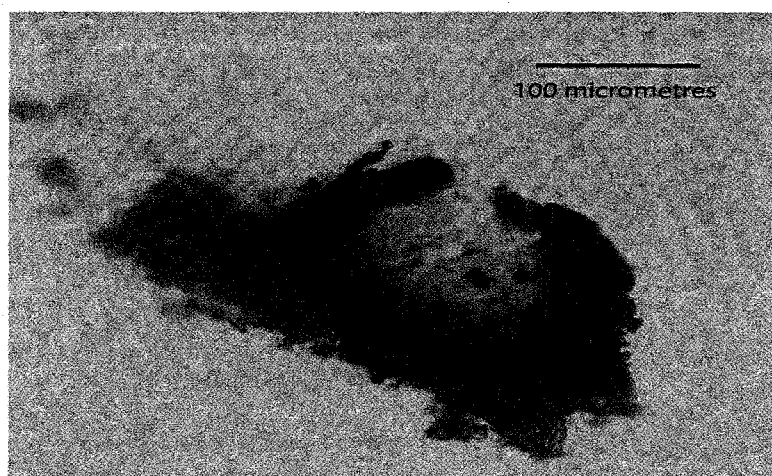


Figure. 4. Perithecium in section showing involucrellum

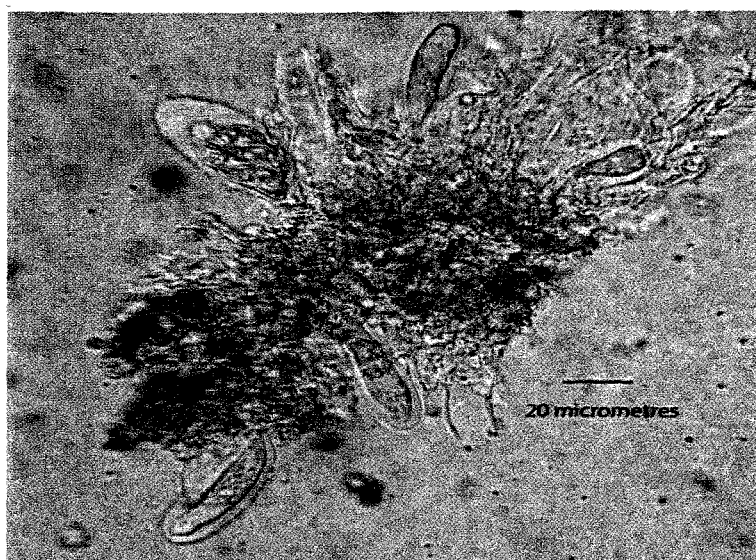


Figure 5. Cluster of asci of *Pyrenocollema halodytes*



Figure 6. Asci of *Pyrenocollema halodytes* with spores

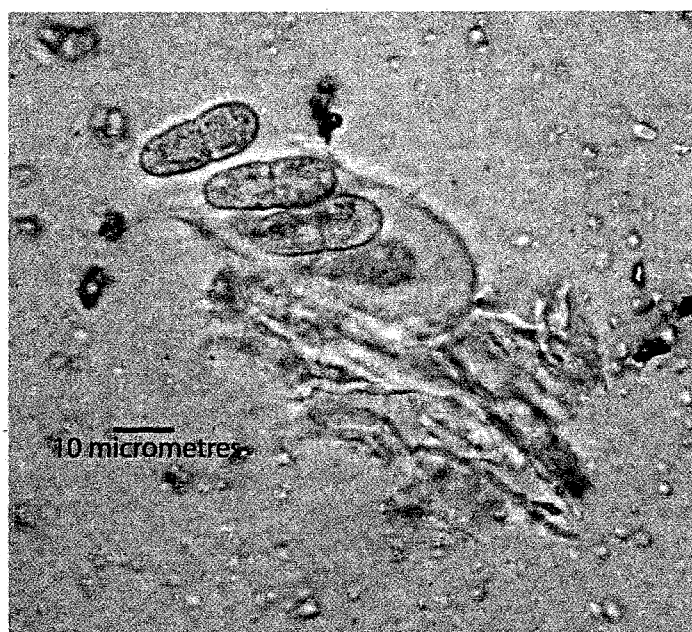


Figure 7. Spores of *Pyrenocollema halodytes*

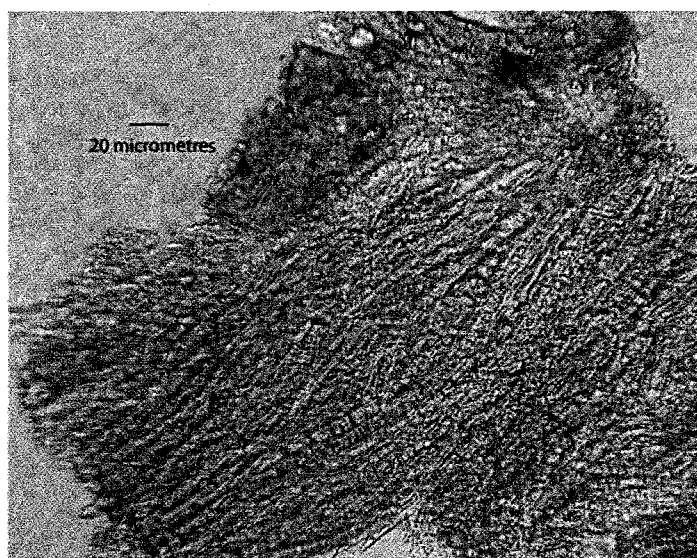


Figure 8. Chains of cyanobacterial cells from beneath a perithecium of *P. halodytes*

DISCUSSION AND CONCLUSION

The genus *Pyrenocollema* was coined in order to group some saxicolous members of the genus *Arthopyrenia* having cyanobacteria as photobionts. A thorough description of *Pyrenocollema halodytes* (Nyl.) R. Harris is given by Swinscow (1965) where he refers to the lichen with its former synonym *Arthopyrenia halodytes* (Nyl.) Arnold. According to Swinscow the thallus of this lichen tends to be immersed in the substratum and not evident if growing

on calcareous shells. This is in agreement with the morphology of the lichen discovered on barnacles at Mistra and described above.

Swinscow (1965) reports perithecia as being from almost sessile to almost wholly immersed with ostiole width varying between 20-100 μm , presence of a black, hemispherical to flattened conical involucrellum 150 - 500 μm in diameter and of a colourless to pale brown excipulum usually about 100-150 μm in diameter. Asci are quoted as being 50-80 x 15-20 μm and spores as being septate, colourless, fusiform-ovate, 12-20 x 5-10 μm with upper cell wider than the other. Clauzade & Roux (1985) and Purvis et al (1992) also give similar observations. These measurements are in agreement with what I observed for my specimen.

The photobionts of lichens belonging to the genus *Pyrenocollema* are cyanobacteria (*Gloeocapsa*, *Hyella* or *Nostoc*) (Purvis et al., 1992). Swinscow (1965) cites the cyanobacterium of *P. halodytes* as being *Hyella caespitosa* Bornet & Flahault often growing in chains of pale yellowish-brown, irregularly elongate to sub-spherical cells, 3-10(-12) μm in diameter. The photobiont cells are arranged loosely and in irregular clumps when the thallus is on a calcareous substratum (Swinscow, 1965). Although no sections of the thallus were made, tissue collected from beneath perithecia did reveal the presence of cyanobacterial filaments of an orange-brown colour similar to *Hyella caespitosa* (Figure 8). The cells were found to be up to 10 μm in diameter. However, as barnacles are always exposed to sea water it is difficult to determine whether these cyanobacteria are actually symbiotic photobionts of *P. halodytes* or simply adventitious cyanobacteria happening to be growing beneath the surface of the barnacle plates.

Hence, based on its marine habitat, general morphology, presence of an involucrellum and excipulum, size and form of spores one can conclude that the lichen found growing on barnacles of the upper mediolittoral zone is *Pyrenocollema halodytes* (Nyl.) R. Harris. This is the first record of this lichen from the Maltese Islands.

ACKNOWLEDGEMENTS

I wish to thank Prof. P.J. Schembri (Department of Biology, University of Malta) for providing me with an identification key for local barnacles which I used to identify *Chthamalus stellatus*. I also appreciate the help of Domenico Puntillo (Museo di Storia Naturale della Calabria ed Orto Botanico, Università della Calabria) for confirming *Hyella caespitosa* as the photobiont of *Pyrenocollema halodytes* before I could access Swinscow (1965).

REFERENCES

- Clauzade, G. & Roux, C. (1985). *Likenoj de Okcidenta Europa. Illustrita Determinlibro*. Bull. Soc. Bot. Centre-Ouest, Nouvelle Série, Numero. Spécial7. 894 pp.
- Egea, J. M. (1996). Catalogue of lichenized and lichenicolous fungi of Morocco. *Bocconea* 6:19-114, 1996 – ISSN 1120-4060.
- Esslinger, T. L. (1997). A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: <http://www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm> (First Posted 1 Dec 1997, Most Recent Update 14 June 2005).
- Llop, E. & Hladun, N. L. (2003). Aportació al coneixement de la flora líquènica del massís de Cadiretes (Girona, NE península Ibèrica). *Butll. Inst. Cat. Hist. Nat.*, 71: 39-50.

Nimis, P.L. & Martellos, S. (2008). - *ITALIC - The Information System on Italian Lichens*. Version 4.0. University of Trieste, Dept. of Biology, IN4.0/1 (<http://dbiodbs.univ.trieste.it/>).

Puntillo, D. (1996). *I Licheni di Calabria*. Monografie 22, Museo Regionale di Scienze Naturali Torino. 229pp. + 42 colour plates + 25 plates.

Purvis, O.W., Coppins, B. J., Hawksworth, D. L., James, P. W. & Moore, D.M. (1992). *The Lichen Flora of Great Britain and Ireland*. Second Edition, Natural History Museum Publications for The British Lichen Society. 710 pp.

Sommier, S. & Caruana Gatto, A. (1915). *Flora Melitensis Nova*, Firenze, Italy. 502pp

Swinscow, T. D. V. (1965). Pyrenocarpous lichens:8. The marine species of *Arthopyrenia* in the British Isles. *Lichenologist* 3: 55-6.

Tucker, S. C., & W. P. Jordan. W.P. 1979 (1978). A catalog of California lichens. *Wasmann Journal of Biology* 36: 1-105.

(Submitted: July 2008)

(Accepted: September 2008)