



## Clarification regarding old records of *Roccella* in the Maltese Islands

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Fiorentino J 2015 – Clarification regarding old records of *Roccella* in the Maltese Islands. Mycosphere 6(6), 673–680, Doi 10.5943/mycosphere/6/6/4

### Abstract

The only checklist of lichens of the Maltese Islands dates back to 1915 and includes both *Roccella phycopsis* and *R. tinctoria*. Material present in local collections and carrying the labels *Roccella fucoides*, *R. phycopsis* and *R. tinctoria* were examined and all were found to be *Roccella phycopsis*. Fresh specimens of *Roccella* from different areas were also collected and identified. Study has led to the conclusion that early records of *R. tinctoria* are incorrect and that to date the only species of this genus found in the Maltese Islands is *Roccella phycopsis* Ach.

**Key words** – Mediterranean – *R. phycopsis* – *R. tinctoria* – Roccellaceae.

### Introduction

*Roccella* DC. is a subtropical genus of lichen fungi within the family Roccellaceae and having a preference for areas with Mediterranean climates but also extending into adjacent temperate and tropical regions. It is predominantly distributed in the northern hemisphere and restricted to coastal habitats where it may locally be very common (Tehler et al. 2009). *Roccella* is a fruticose lichen containing *Trentepohlia* algae as a photobiont. The thallus is a white-greyish to greyish-brown pendent thallus of flattened or terete branches, normally 5–15 cm long. Fruiting bodies are apothecia. Asci contain eight fusiform, 3-septate, hyaline spores, typically within the size range of 15–35 × 4–8 µm. Most species produce soredia for vegetative dispersal. Secondary metabolites are typically orcinol and β-orcinol depsides, and aliphatic acids (Tehler et al. 2009).

A list of lichens of the Maltese Islands appearing in the second volume of *Flora Melitensis Nova* (Sommier & Caruana Gatto 1915) includes two species belonging to this genus. These are *Roccella phycopsis* Ach and *R. tinctoria* DC. A footnote accompanying the lichen section of the volume states that all listed lichens had been identified by Antonio Jatta.

*R. phycopsis* is quoted as being quite common and found growing on old trees including orange and fig trees (Sommier & Caruana Gatto 1915). *R. tinctoria* DC was found growing on rocks and is quoted as frequent and quite common in certain parts of the islands such as Imtaħleb, Girgenti, Ġnejna in Malta, and Xlendi and Mġarr ix-Xini in Gozo. The name in Maltese for *R. tinctoria* is given as "hażis ta żebgha" (Sommier & Caruana Gatto 1915). Loosely translated this means "moss-like growth used for dyeing" suggesting that its extracts had a use in the dyeing of cloth.

## Materials & Methods

Two main lichen collections are found in the Maltese Islands. One is housed at the Natural History Museum at Mdina (NMNH). Here, all lichens are stored in small containers with a glass window and most of the boxes contain their original label inside. Three *Roccella* specimens are found in the NMNH collection. The identification labels accompanying these lichens read: *Roccella fucooides* Vain (a misspelling of Vain) Dingli; *Roccella phycopsis*, orange trees, Imtaħleb and *Roccella tinctoria* Jatta 137.

The second lichen collection is housed at the Argotti Herbarium in Floriana (ARG). For a number of years this collection was rather badly curated and most of the labels went missing or were misplaced. Two *Roccella* specimens are found in the Argotti collection. One has still kept its original label which reads: *R. tinctoria* DC. on rocks, Mtaħleb. The second specimen is really a collection of epiphytic *Roccella* thalli with no identification labels.

The handwriting and wording on the labels of many of the specimens from the lichen collections at the Natural History Museum and the Argotti herbarium (where present) seem to suggest that these collections are replicate and probably belonged to Alfredo Caruana Gatto. Samples from these collections had been sent to Jatta for identification. Consequently a good number of the lichens mentioned in *Flora Melitensis Nova* checklist (Sommier & Caruana Gatto 1915) are included in the collections of Argotti Herbarium or the Natural History Museum or both (Fiorentino 2008). Several lichen specimens in these collections must therefore be around one hundred years old.

For the purpose of this study, all specimens of *Roccella* present in both collections were examined and identified in order to establish whether the two *Roccella* species mentioned in *Flora Melitensis Nova* (Sommier & Caruana Gatto 1915) were correct identifications. Additionally *Roccella* material collected by the author from three regions in the Maltese Islands were identified in order to find out which *Roccella* species are present on the Maltese Islands.

### Natural History Museum specimens

Fig. 1

#### Specimen with label: *Roccella fucooides* Vain

Dingli

Description of lichen – saxicolous greyish thallus, erect and tufted, about 4cm high and 3cm wide. Thalline branches round in cross section, several parts showing some flattening; holdfast medulla ochre-yellow; cortex C+ pale-red disappearing immediately; numerous soralia with C+ pale red soredia, colour persisting longer than cortical colour change; very few apothecia, asci not well developed; few spores observed, 3-septate, 14–18.5  $\mu\text{m}$   $\times$  4.5–7 $\mu\text{m}$ .

The yellow holdfast and C+ red cortex confirm that this specimen is *Roccella phycopsis* Ach (Clauzade & Roux 1985, Smith & al. 2009)

The name *Roccella fucooides* Vain is actually a synonym of *Roccella phycopsis* Ach. There was a widespread usage of both names over the past 100 years though the name *R. phycopsis* is almost exclusively used in many modern lichen checklists by many authors (Tehler, 2002). According to Tehler (2003) *Roccella phycopsis* (Ach.) Ach. is the correct name for this species and *Roccella fucooides* should rather not be used.

Dingli is a coastal region on the south west of Malta. With an altitude of 253m above sea level its coastal cliffs represent the highest point of the Maltese Islands.

#### Specimen with label: *Roccella phycopsis*

Mtaħleb

Description – epiphytic, greyish thallus, erect and tufted, about 2cm high and 3cm wide. Thalline branches round in cross section with some flattening here and there; holdfast showing typical ochre-yellow medullary regions in some parts only; cortex C+ pale red, colour disappearing immediately; both C+ fleeting pale red and C- soredia present; apothecia frequent, round to slightly



**Fig. 1** – *Roccella* specimens from the Natural History Museum (NMNH) at Mdina. Scale bar: 10mm

oblong, 0.2mm to 0.8mm, black disc, sometimes grey pruinose, mostly sessile, with or without a thalline exciple; numerous asci; spores well developed, 3-septate, fusiform, most curved,  $23\text{--}30\mu\text{m} \times 6\text{--}7\mu\text{m}$ .

The yellow exposed medulla at the holdfast and the C+ red cortex confirm that this specimen is *Roccella phycopsis* Ach. (Clauzade & Roux 1985, Smith et al. 2009).

Mtaħleb refers to the locality of the specimen. It lies on the southwest of Malta very close to the coast.

**Specimen with label: *Roccella tinctoria***

**Jatta 137.**

Description – greyish-beige thallus, erect and tufted, about 6cm high and 3cm wide; branches mostly rounded in section with some flattening here and there; a much evident ochre-yellow holdfast; cortex C+ pale red; soralia mostly on the upper parts of the branches leaving the lower part of the thallus clear, soredia C+ pale red; apothecia absent; substrate not quoted and not evident;

The yellow holdfast and C+ red cortex confirm that this specimen is actually *Roccella phycopsis* Ach.

No reference to locality is given on the label.

**Argotti Herbarium specimens**

Fig. 2

**Specimens with missing labels.**

**No reference to sites of collection.**

Description – Epiphytic with bark pieces still showing in most; erect, tufted dull buff-grey thalli of different sizes with largest being 2cm high and 1.5cm wide; branches round in section with some flattening here and there; yellow medulla at holdfasts; C+ light red cortex; both C+ light red and C- soredia; apothecia missing in younger thalli but frequent in the larger thalli, with whole branches carrying apothecia and few soralia and other branches with soralia only; apothecia immersed or sessile most irregular when immersed and roundish or oval when sessile, up to 1.00mm, with or without thalline exciple; spores 3-septate, slightly bent or not, 23–28 $\mu$ m  $\times$  6.0–7.0 $\mu$ m.

The yellow holdfast and C+ red cortex confirm that all specimens represent *Roccella phycopsis* Ach.

**Specimens with label: *Roccella phycopsis***

Description – Epiphytic with bark pieces still showing in most; erect, tufted dull buff-grey thalli of different sizes with largest being 2cm high and 1.5cm wide; branches round in section with some flattening here and there; yellow medulla at holdfasts; C+ light red cortex; both C+ light red and C- soredia; apothecia missing in younger thalli but frequent in the larger thalli, with whole branches carrying apothecia and few soralia and other branches with soralia only; apothecia immersed or sessile most irregular when immersed and roundish or oval when sessile, up to 1.00mm, with or without thalline exciple; spores 3-septate, slightly bent or not, 23–28 $\mu$ m  $\times$  6.0–7.0 $\mu$ m.

The yellow holdfast and C+ red cortex confirm that this specimen is *Roccella phycopsis* Ach.

No reference to site where collected.

**Specimen with label: *Roccella tinctoria***

**On walls and rocks**

**Imtahleb.**

Description – Saxicolous greyish-buff thallus, erect and tufted, about 5cm high and 6cm wide; branches rounded in section but also flattened in many parts; ochre-yellow holdfast; C+ pale red cortex; soredia mostly C+ pale red but some C- soredia also present; no apothecia.

The yellow holdfast and C+ red cortex confirm that this specimen is actually *Roccella phycopsis* Ach.

**Fresh epiphytic and saxicolous *Roccella* specimens**

Fig. 3

*Roccella* specimens from different parts of the Maltese Islands were collected and studied. These included epiphytic specimens growing on trunks and twigs of old Aleppo pines at the semi-natural woodland of Buskett. This area is about 1.5km inland from the South-west coast of Dingli. Saxicolous samples were collected from the North-east facing limestone walls of a Palazzo in the medieval town of Mdina. The town perches on a hill at an altitude of about 200m above sea level and is further inland from Buskett.



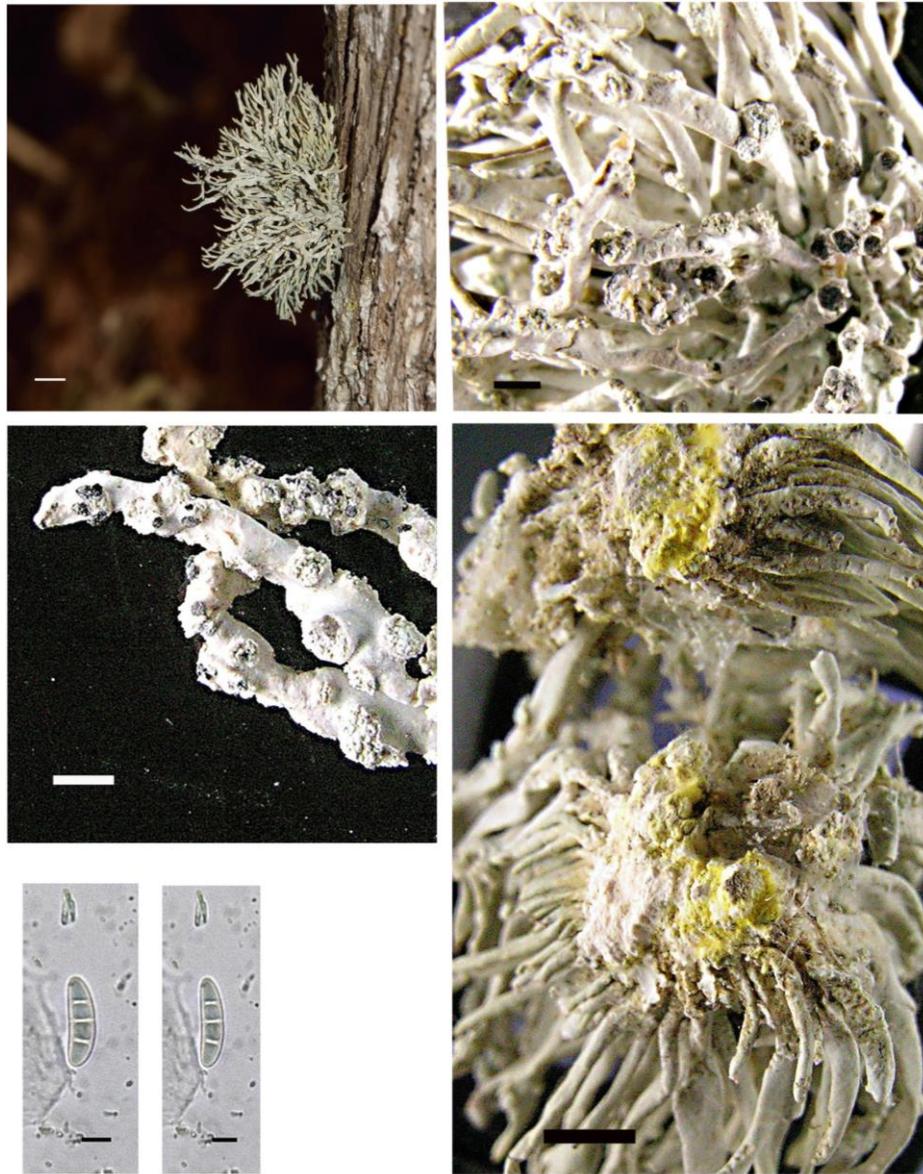
**Fig. 2** – Above: Argotti herbarium (ARG) specimens with missing labels. Centre: Argotti specimen wrongly labelled as *Roccella tinctoria*. Scale bar: 10mm. Below: spores from one of the unlabelled Argotti specimens. Size of spores: 23–28 $\mu$ m  $\times$  6.0–7.0 $\mu$ m.

Other saxicolous specimens were collected from the sister island of Gozo. They were found growing on the calcareous stones of a dry rubble wall in a North-facing coastal region known as taċ-Ċawla about 90m above sea level.

### **Epiphytic *Roccella phycopsis***

Description – Thallus greenish-grey, tufted and erect, branches rounded and lightly flattened in section; up to 3cm high and 3cm wide; holdfast with yellow medulla, in some thalli holdfast colour showing in isolated patches only; C+ light red cortex; both C- and C+ light red soredia present; apothecia absent in many thalli and when present, few, black pruinose, solitary or clustered, thalline exciple present in some; some clustered apothecia looking like an extended apothecium; spores 3-septate, (17) 22–26.5 $\mu$ m  $\times$  6–8 $\mu$ m.

Some apothecia seemed to cause stunted growth of the lichen branches carrying them. Sections of these apothecia were examined and asci containing typical *Roccella* 3-septate spores were found.



**Fig. 3** – Top left: thallus of epiphytic *Rocella phycopsis* from Buskett (scale bar: 10mm) and top right: close-up of saxicolous *R. phycopsis* showing apothecia and soralia. (scale bar: 1.5mm). Centre left: thallus of *R. phycopsis* from taċ-Ċawla, Gozo showing soralia and apothecia of *Paralecanographa grumulosa* (scale bar: 5mm) and below left: a 3- and a 4-septate spore from apothecium of *P. grumulosa*. (scale bar: 5µm). Right: typical yellow medulla at the holdfast of *R. phycopsis* from taċ-Ċawla, Gozo (scale bar: 5mm)

This confirmed that the black apothecia did not belong to *Gelatinopsis roccellae* which is known to parasitise *Rocella* (Etayo et al. 2001) or to some other lichenicolous fungus.

When present on twigs *R. phycopsis* was often associated with *Ramalina lacera* and *Xanthoria parietina*.

### **Saxicolous *Rocella phycopsis***

Description – Thallus greenish-grey looking more silver-grey and rough when soralia are abundant; tufted and erect, up to 4cm high × 3cm wide; branches rounded but also frequently lightly

flattened especially in older thalli; holdfasts with yellow medulla; C+ light red cortex, often giving fleeting colour change, but sometimes colour lasting longer; both C- and C+ light red soredia; many thalli lacking apothecia completely, others with few or several black apothecia, pruinose or not, solitary or clustered, up to 1mm, thalline exciple absent or present; spores from Mdina palazzo wall specimen, 3-septate,  $23\text{--}28\mu\text{m} \times 6.5\text{--}7.0\mu\text{m}$ .

Spores from apothecia of one Gozo specimen mostly 3-septate but some 4- and 5-septate spores also observed,  $14\text{--}16.5\mu\text{m} \times 3.5\text{--}4.5\mu\text{m}$ . The shape, size and number of septa of these spores are atypical of *R. phycopsis* but agree with those quoted for *Lecanactis grumulosa* (Dur.) Fr. in Egea et al. 1993 where *L. grumulosa* is initially described as a variable lichen which loses its thallus when growing parasitically on *Roccella* but later in the same paper is considered as a lichenicolous fungus (Egea et al. 1993).

In Ertz & Tehler (2011) the genus *Paralecanographa* was proposed for *Lecanactis grumulosa* which lichen was renamed *Paralecanographa grumulosa* (Dufour) Ertz & Tehler. Here the lichen is described as initially being a lichenicolous fungus which grows on different hosts including *Roccella* but later develops its own thallus to become a parasitic lichen.

Other black regular and irregular immersed structures resembling apothecia and present on some branches of the Gozo specimens were found to be conglomerations of cyanobacteria of different species.

In general, saxicolous thalli of *R. phycopsis* were larger, more spread out and rougher due to presence of more soralia, than epiphytic thalli.

## Discussion

The inclusion of the taxon *Roccella tinctoria* in Sommier & Caruana Gatto (1915) is incorrect. This is evidenced by examination of specimens housed in the Natural History Museum at Mdina and the Argotti herbarium collections which all belong to *Roccella phycopsis* Ach. It is known that old Italian authors used the name *R. tinctoria* also for *R. phycopsis* (Nimis 1993). In the 19th century and in the beginning of the 20th century the name *Roccella tinctoria* was used commercially as a collective name for various *Roccella* species that were used for dyeing (Tehler 2002).

*Roccella phycopsis* Ach. seems to be the only species of this genus present on the Maltese Islands. This is consistent with conclusions made by Dr. Felix Schumm (Germany) who examined material collected between 1980 and 2008 from four different localities on the Maltese Islands and identified them as *Roccella phycopsis* (personal communication).

## Acknowledgements

The author thanks the curators of the Argotti Herbarium at Floriana and the Mdina Natural History Museum for making material available for examination.

Thanks are also due to Dr. Elfie Stocker-Wörgötter (University of Salzburg, Austria) for the HPLC analysis of fresh specimens of epiphytic *Roccella phycopsis* from Buskett, Dr. Felix Schumm for sharing his observations about spot tests performed on his material from the Maltese Islands and to the reviewer(s) who made very valid suggestions which served to improve the final version of the paper.

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