

## Two new species of *Pyrenula* with a red or orange thallus from Vale do Catimbau National Park, Pernambuco, Brazil

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**Abstract:** The new species *Pyrenula reginae* and *P. rubromamillana* are described from NE Brazil. Both have a conspicuous red or orange thallus, an inspersed hamathecium and relatively small ascospores, but they differ clearly in colour and ascoma organization.

**Key words:** anthraquinones, Caatinga, lichen, new taxa, *Pyrenulaceae*, semi-arid

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### Introduction

The North-eastern Region of Brazil is rich in crustose lichens, including many endemic species (Cáceres 2007). The vegetation is mainly Caatinga, dry open forest, with some dense rainforest enclaves at higher altitudes. During ecological studies by the first author in the Vale do Catimbau National Park (a conservation unit of Caatinga vegetation in Pernambuco State, NE Brazil), two undescribed species of *Pyrenula* were found and are described here.

The Vale do Catimbau National Park is one of the most important conservation areas of the Caatinga biome (IBAMA 2002), with a surface area of 62 300 hectares, and altitude range of 900–1000 m. The Vale do Catimbau comprises not only a typical hyperxerophytic Caatinga vegetation but also shows influences of other Brazilian ecosystems such as the Atlantic rainforest, Restinga, Cerrado and rocky fields (Siqueira 2006; Ferreira 2009).

The genus *Pyrenula* comprises at least 169 species worldwide (Aptroot 2012). The present species both differ from all species known so far in the genus by the combination of a red or orange-brown thallus with anthraquinones, inspersed hamathecium and relatively small ascospores. They differ from each other in many characters, for example ascoma aggregation, thallus colour, ascospore size and arrangement of the ascospores within the ascus.

### Material and Methods

Identification and descriptive work were carried out in Itabaiana, Universidade Federal de Sergipe, using a Leica EZ4 stereomicroscope and a Leica DM500 compound microscope, and also in Soest using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections were mounted in tap water, in which all measurements were taken. The chemistry of the type specimens was investigated by thin-layer chromatography (TLC) using solvent A (Orange *et al.* 2001). The specimens from this study are preserved in URM and ISE.

### The Species

***Pyrenula reginae* E. L. Lima, Aptroot & M. Cáceres sp. nov.**

MycoBank No.: MB 801058

*Pyrenula* with dark carmine red thallus, aggregated ascomata with fused walls but separate ostioles, inspersed hymenium, and biseriolate ascospores  $12\text{--}15 \times 6\text{--}8 \mu\text{m}$ .

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Type: Brazil, Pernambuco, Buíque, Vale do Catimbau National Park, on bark of tree, c. 885 m alt., 7 August 2011, *E. L. Lima* 0010 (URM—holotype; ISE—isotype).

(Fig. 1A–F)

*Thallus* corticate, dull, rough, continuous, thin, dark carmine red, without pseudocyphellae, without prothallus; algae trentepohlioid.

*Ascomata* perithecioid, associated in groups of 2–20 with partly fused walls but with separate ostioles, hemispherical, emergent, 0.2–0.4 mm diam., tops glossy black, edges with thallus covering; often only the ostioles black. *Wall* only carbonized above, extending sideways as a clypeus, without crystals, KOH–, c. 70 µm thick. *Ostioles* black, apical. *Hamathecium* hyaline, densely inspersed with oil droplets. *Asci* cylindrico-clavate, IKI–, with 8 biseriate ascospores. *Ascospores* brown, IKI–, 3-septate, fusiform, without constrictions at the septa, 12–15 × 6–8 µm, ends rounded, middle lumina broadly diamond-shaped, end lumina triangular, separated from the wall by thick endospore layer.

*Pycnidia* not observed.

*Chemistry.* Thallus UV–, KOH+ purple. TLC: anthraquinone.

*Ecology and distribution.* On smooth bark of trees in primary forest. Known only from Brazil. The type specimen grows together with *Protoparmelia multifera* (Nyl.) Kantvilas *et al.*

*Discussion.* This species is close in many characters to *P. rubroanomala* Aptroot & Lücking (Aptroot *et al.* 2008). The main differences are the smaller ascospores and the inspersed hamathecium. It would key out at B67 in the world key to the species of the genus *Pyrenula* (Aptroot 2012).

*Additional specimens seen.* **Brazil:** same as the type, July 2012 (ISE—3 topotypes).

***Pyrenula rubromamillana* E. L. Lima, Aptroot & M. Cáceres sp. nov.**

MycoBank No.: MB 801059

*Pyrenula* with orange-brown thallus, dispersed ascomata, inspersed hamathecium, and uniseriate ascospores (15–) 17–20 × 5.5–7.0 µm.

Type: Brazil, Pernambuco, Buíque, Vale do Catimbau National Park, on bark of tree, c. 880 m alt., 7 August 2011, *E. L. Lima* 367 (ISE—holotype).

(Fig. 1G–K)

*Thallus* corticate, smooth, continuous, thin, orange-brown, without pseudocyphellae, surrounded by a black prothallus line; algae trentepohlioid.

*Ascomata* perithecioid, simple, dispersed, hemispherical, emergent, 0.5–0.9 mm diam., black, edges with thallus covering. *Wall* only carbonized above, extending sideways as a clypeus, without crystals, KOH–, c. 150 µm thick. *Ostioles* black, apical. *Hamathecium* hyaline, densely inspersed with oil droplets. *Asci* cylindrico-clavate, IKI–, with 8 uniseriate ascospores. *Ascospores* brown, IKI–, 3-septate, fusiform, often with constrictions at the septa, (15–)17–20 × 5.5–7.0 µm, ends rounded, middle lumina broadly diamond-shaped, end lumina triangular, separated from the wall by thick endospore layer.

*Pycnidia* not observed.

*Chemistry.* Thallus UV–, KOH+ purple. TLC: anthraquinone.

*Ecology and distribution.* On smooth bark of trees in primary forest. Known only from Brazil. The specimens grow together with *Fissurina dumastii* Fée, *Pyrenula anomala* (Ach.) Vain., and *Pyrenula mamillana* (Ach.) Trevis.

*Discussion.* This species is close in many characters to *P. mamillana*, with which it co-occurs. The main difference is the orange-brown thallus colour due to the presence of an anthraquinone. It would key out in B67 in the world key to the species of the genus *Pyrenula* (Aptroot 2012).

*Additional specimens seen.* **Brazil:** *Sergipe:* Areia Branca, Serra de Itabaiana National Park, on bark of tree, c. 350 m alt., 1 May 2010, *M. E. S. Cáceres* 6958 (ISE).

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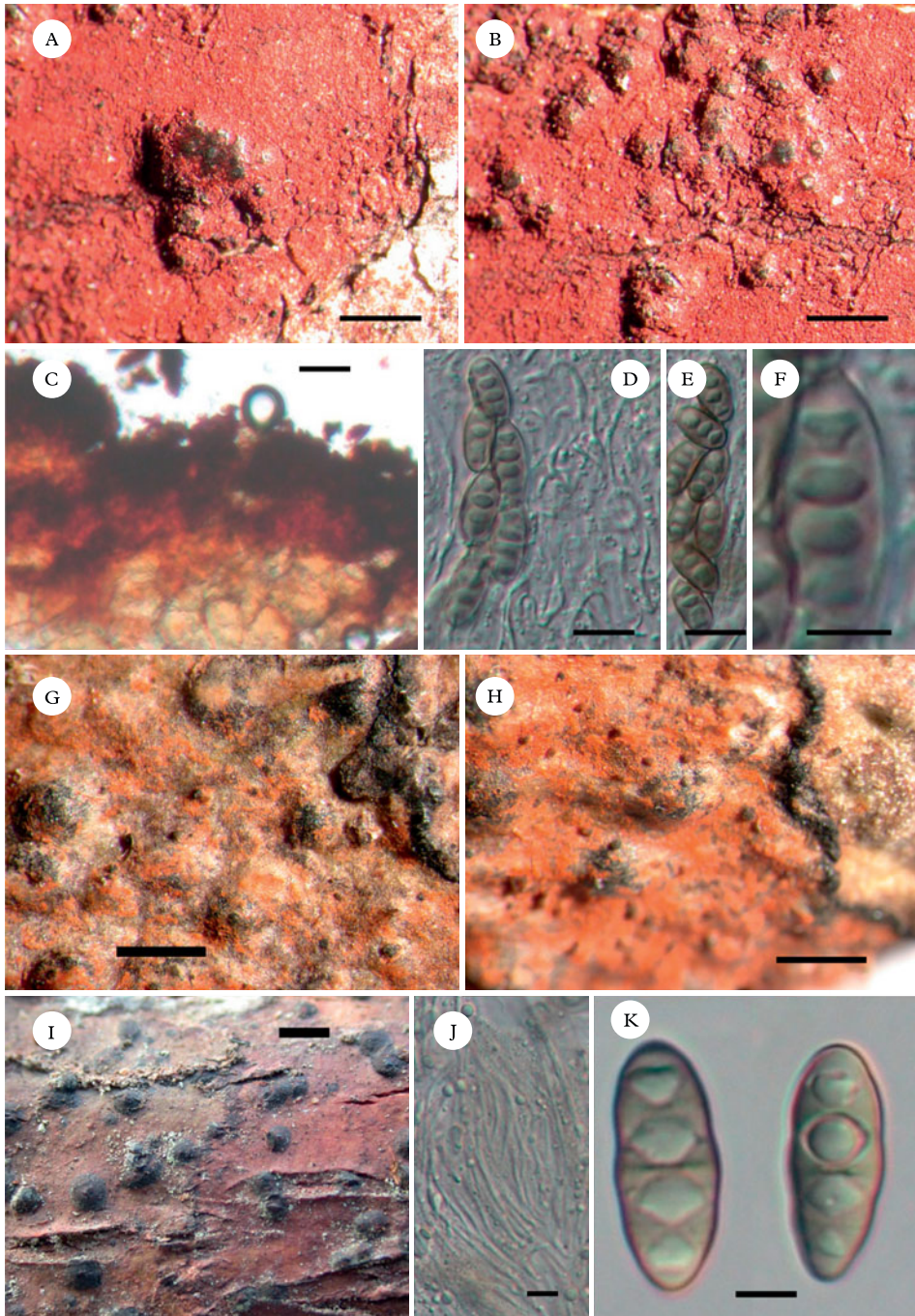


FIG. 1. A–F, *Pyrenula reginae* (holotype); A & B, habitus; C, section through thallus showing distribution of pigment; D & E, asci; F, ascospores. G–K, *Pyrenula rubromamillana*; G & H, habitus (holotype); I, habitus (right), with *P. mamillana* (left) (Cáceres 6958); J, hamathecium (holotype); K, ascospores (holotype). Scales: A & B, G–I = 1 mm; C–E = 10  $\mu$ m, F, J & K = 5  $\mu$ m.

## REFERENCES

- Aptroot, A. (2012) A world key to the species of *Anthra-cothecium* and *Pyrenula*. *Lichenologist* **44**: 1–54.
- Aptroot, A., Lücking, R., Sipman, H. J. M., Umaña, L. & Chaves, J. L. (2008) Pyrenocarpous lichens with bitunicate asci: a first assessment of the lichen biodiversity inventory in Costa Rica. *Bibliotheca Lichenologica* **97**: 1–162.
- Cáceres, M. E. S. (2007) Corticolous crustose and microfoliose lichens of northeastern Brazil. *Libri Botanici* **22**: 1–168.
- Ferreira, R. R. (2009) *Ecoturismo no município de Buíque – Pernambuco: Avaliação crítico-reflexiva à luz do desenvolvimento local sustentável*. Dissertação (mestrado), Universidade de Pernambuco, Recife.
- IBAMA (2002) *Decreto, s/n, de 13 de dezembro de 2002. Dispõe sobre a criação do Parque Nacional do Catimbau, nos Municípios de Ibirimir, Tupanatinga e Buíque, no Estado de Pernambuco, e dá outras providências*. Brasília.
- Orange, A., James, P. W. & White, F. J. (2001) *Microchemical Methods for the Identification of Lichens*. London: British Lichen Society.
- Siqueira, G. R. (2006) *Avaliação da implementação do Parque Nacional do Catimbau – PE: Uma análise do desenvolvimento sustentável na perspectiva do ecoturismo e da comunidade local*. Dissertação (mestrado), Universidade Federal de Pernambuco, Recife.