



## Phylogenetic analysis reveals two morphologically unique new species in the genera *Astrochapsa* and *Nitidochapsa* (lichenized Ascomycota: Graphidaceae)

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### Abstract

Graphidaceae is the largest family of tropical crustose lichens, with nearly 2,400 known species, and exhibits a large diversity of ascoma morphologies. Ascomata that open by triangular marginal lobules that become recurved to form geaster-like fruiting bodies, so-called chroodiscoid ascomata, were recently shown to have evolved independently several times within the family. A special type of such ascomata is the gyrotremoid form in which the hymenium and excipulum are organized in concentric rings. In the present study, we address the phylogenetic position of two chroodiscoid species collected in Thailand that form aggregate or gyrotremoid, chroodiscoid ascomata, using a molecular phylogeny of nuclear LSU and mitochondrial SSU rDNA sequences of 92 Graphidaceae. Our morphological, chemical and phylogenetic analyses show that one species is an undescribed species in the genus *Astrochapsa*, here newly described as *A. kalbii* Poengsungnoen, Lücking & Lumbsch, with a unique, gyrotremoid ascoma morphology. The second species belongs in the recently established genus *Nitidochapsa*, which is a close relative of *Ocellularia*, and is here described as new species *N. siamensis* Poengsungnoen, Lücking & Lumbsch. Based on these findings, three further new combinations are proposed in the genus *Nitidochapsa*, viz. *N. aggregata* (Hale) Poengsungnoen, Lücking & Lumbsch, *N. phlyctidea* (Vain.) Lücking & Lumbsch, and *N. stictoides* (Leight.) Tehler, Lücking & Lumbsch. A key to all five species is presented.

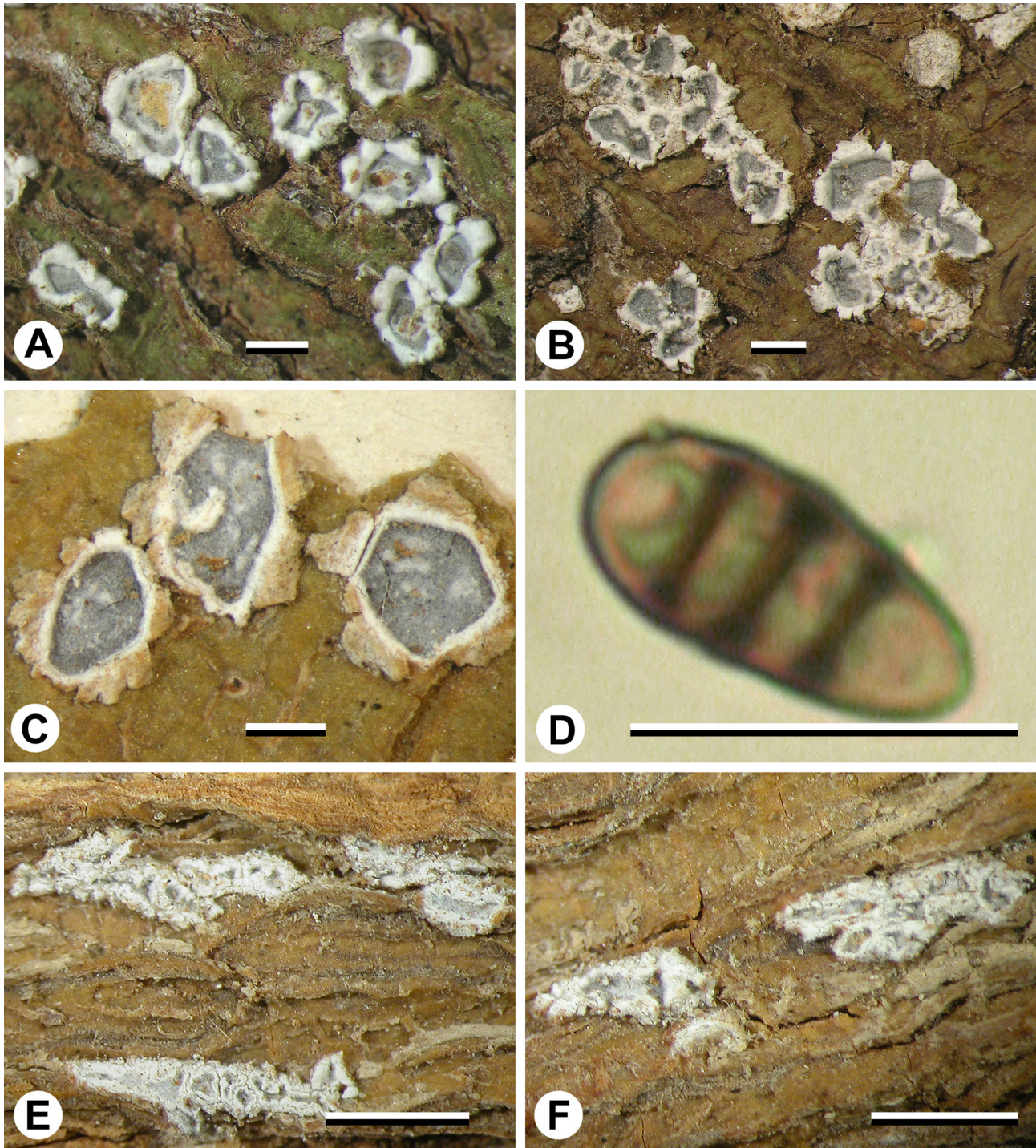
**Keywords:** Lichens, molecular systematics, new species, Ostropales, taxonomy

### Introduction

Graphidaceae Dumortier (1822: 69) is one of the largest families among lichen-forming fungi, with over 2000 species, and constitutes an important part of tropical fungal diversity (Rivas Plata *et al.* 2008; Lücking *et al.* 2009). It includes taxa with widely differing morphological and anatomical characters, including features of the thallus, ascomata, hymenium, ascospores, and chemistry (Staiger 2002; Frisch *et al.* 2006; Rivas Plata *et al.* 2010, 2012a, b, 2013; Rivas Plata & Lumbsch 2011). Ascoma shapes vary widely within the family, including clades with rounded ascomata and others forming lirellate ascomata, and ascomata varying from perithecioid, opening only with a pore to widely open ascomata (Lumbsch 1989; Lumbsch & Tehler 1998; Martin *et al.* 2003; Staiger *et al.* 2006; Lumbsch *et al.* 2008; Mangold *et al.* 2008; Rivas Plata *et al.* 2013). In addition, ascomata can be solitary or aggregate (Rivas Plata *et al.* 2010).

Species in Graphidaceae with so-called chroodiscoid ascomata with widely open discs surrounded by a splitting, lobulate margin, have traditionally been classified in the genera *Chapsa* Massalongo (1860: 257) and





**FIGURE 5.** A–D. *Nitidochapsa leprieurii* (A, Chaves 431; B, Lücking 16047; C–D, isolectotype of *Thelotrema leucastrum*). A–C. Thallus with ascomata. D. Ascospore. E–F. *Nitidochapsa phlyctidea* (isotype), thallus with ascomata. Scale = 1 mm, in D = 10  $\mu$ m.

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