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Author(s): André Aptroot and Ralph S. Common

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Pyrenula clavatispora, a new species from Florida with narrowly clavate ascospores, with a key to similar species

André Aptroot^{1,3} and Ralph S. Common²

¹ ABL Herbarium, Gerrit van der Veenstraat 107, NL-3762 XK Soest, The Netherlands; ² 534 Fenton Str., Lansing MI 48910, U.S.A.

ABSTRACT. The new species *Pyrenula clavatispora* is described from Florida. It has 7–12-septate, narrowly clavate ascospores and clavate asci. The only somewhat similar species are distributed over various islands in the Pacific Ocean. A key is provided for all species of *Pyrenula* with ascospores over 4 times as long as wide.

KEYWORDS. *Pyrenulaceae*, lichen, corticolous, Pacific.



The genus *Pyrenula* contains ca. 225 species worldwide (Aptroot 2012; Aptroot et al. 2013, 2015; Mendonça et al. 2016), as many as 46 of which are known from Florida (Harris 1995; Lücking et al. 2011). Most species have ellipsoid to fusiform ascospores, but some have filiform to narrowly clavate ascospores. Such elongated ascospores usually are multiseptate, and it is often unclear how far the terminal lumina reach into the tips. The phylogenetic position of such species within the genus *Pyrenula* is so far unknown (Gueidan et al. 2016), but it seems probable that at least some are closely related.

Pyrenula species with filiform ascospores are mostly known from Pacific islands, ranging from the Japanese Ryukyo Islands (Kashiwadani 1989) and the Mariana Islands (Harada 1993) to New Caledonia and Campbell Island (Aptroot 2014), but also from the Neotropics, especially from Brazil (Aptroot et al. 2013, 2015). Here we describe a species with narrowly clavate ascospores from Florida. It is described in the genus *Pyrenula* because of the presence of an epiphloeodic thallus which is lichenized with trentepohlioid algae, unbranched paraphyses, and brown, distoseptate ascospores. The ascospores somewhat resemble those of the common bark-inhabiting saprobic fungus *Rebentischia*, which is often collected by lichenologists and mistaken for a lichen. However, the resemblance is only superfi-

cial. *Rebentischia* differs in several characters from *Pyrenula*, as it is not lichenized, the ascoma wall is composed of compressed cells, the hamathecium contains cellular pseudoparaphyses and the tail-bearing cell of the ascospore is pallid and euseptate, in contrast to the other cells and all *Pyrenula* ascospore cells, which are brown and distoseptate. A key is presented to all *Pyrenula* species with ascospores (including appendages) over 4 times as long as wide.

MATERIALS AND METHODS

Sections of thallus and ascomata have been mounted in tap water, in which also all measurements were taken. The reactions with 0.15% IKI without and with pretreatment by KOH were subsequently examined. Spores were photographed with a Nikon FXA microscope, 60x planapochromatic objective, and Nikon D5000 camera. Thalli were photographed with a Wild M400 microscope with Apozoom objective and Nikon D700 camera. Depth of field was extended using image stacks processed with Helicon Focus software.

***Pyrenula clavatispora* Common & Aptroot, sp. nov.**

Fig. 1

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Pyrenula with thallus covering most part of the ascomata, asci clavate and ascospores 7–12-septate, narrowly clavate, 50–65 × 4–5 μm, with lower end attenuated.

³ Corresponding author's e-mail: andreaaptroot@gmail.com

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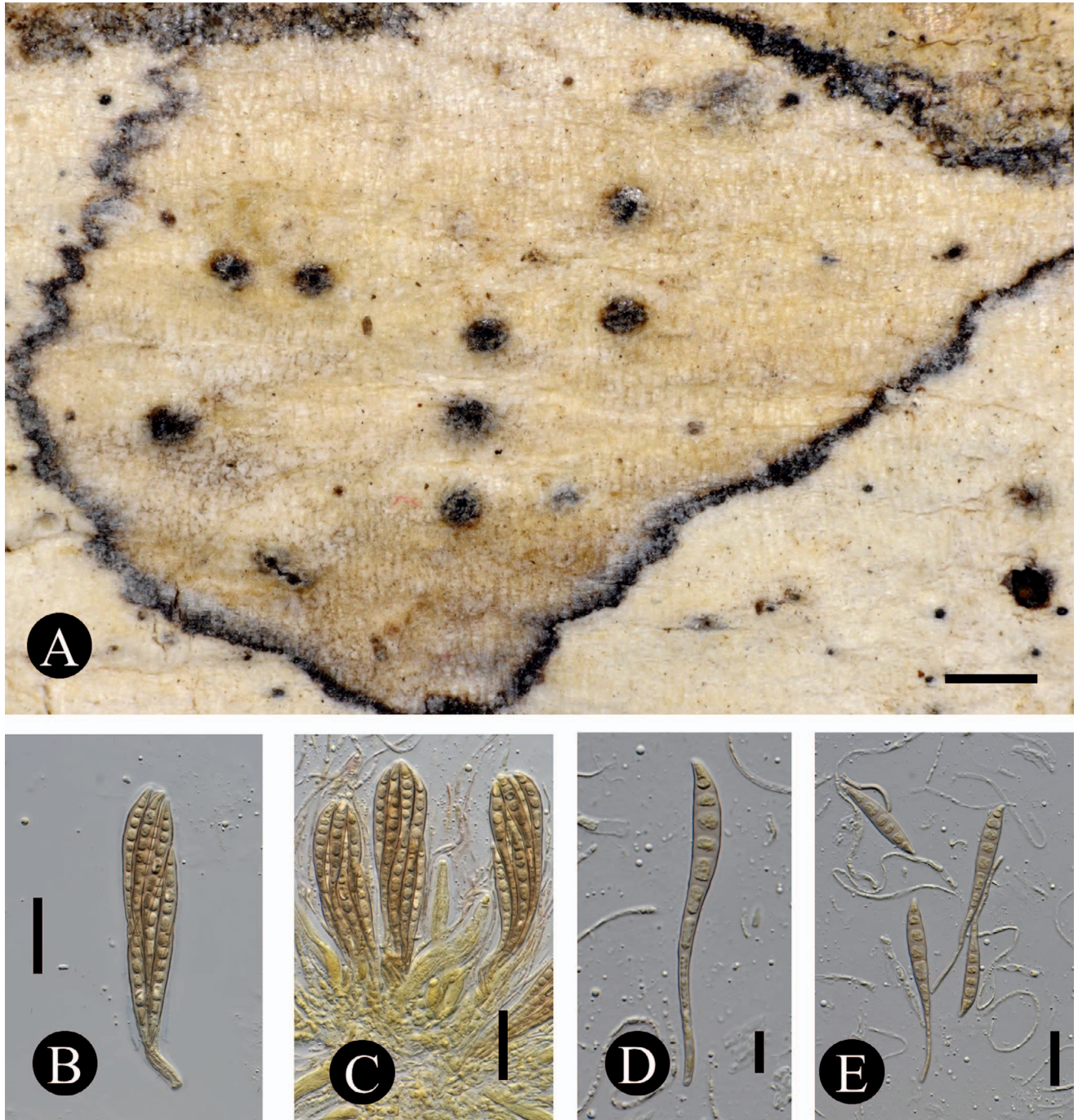


Figure 1. *Pyrenula clavatispora* (holotype). A. Habitus. B–C. Asci. D–E. Ascospores with tails. Bar = 1 mm in A, Bar = 20 µm in B–C & E, Bar = 10 µm in D.

TYPE: U.S.A. FLORIDA: Charlotte Co., on Fla. Rt. 775 near Buck Creek south of Grove City. Dry wooded area with pine and palmetto, mangroves along margin of creek 1 January 1976, R.S. *Common* 3747A (holotype: MSC; isotype: ABL).

Description. Thallus corticate, smooth, continuous, rather thin, cream, without pseudocyphellae,

surrounded by a black prothallus line. Algae trentepohlioid. Ascomata perithecioid, erumpent, 0.3–0.5 mm diam., black, conical with flattened tips, single, largely covered by a thallus layer. Wall carbonized all around. Ostioles exposed, usually black, apical, flat. Hamathecium hyaline, densely interspersed with oil droplets, in IKI partly reddish, in

IKI after pretreatment with KOH clearly blue. Asci clavate, with 8 ascospores, $77\text{--}95 \times 16\text{--}22.5 \mu\text{m}$. Ascospores brown, 7–12-distoseptate, narrowly clavate, without constrictions, $50\text{--}65(\text{--}70) \times 4\text{--}5 \mu\text{m}$, lower end attenuated, tail-like, but septate. Pycnidia not observed.

Chemistry. Thallus UV-negative; no substances detected.

Notes. This is one of the few *Pyrenula* species with long, multiseptate ascospores. This species was probably already keyed out in Harris (1995: 106), based on a specimen from Collier County, but not named or described. That specimen, which we have not examined, differed from our specimens only in that the IKI reaction was said to be negative. Since the visibility of reddish iodine reactions of this type are dependent on the iodine concentration used (Common 1991) and in any case easily overlooked, we believe the Harris specimen is almost certainly conspecific with ours. The Harris specimen, like ours, was collected in a coastal habitat along the Gulf Coast of Southern Florida. The similar *P. flagellata* H. Harada (Harada 1993) differs by the more slender ascospore tail which has no septa; in *P. subcylindrica* Jagadeesh & Upreti (Jagadeesh et al. 2005) the ascospores are also 7–11-septate and $42\text{--}72 \times 4.5\text{--}6.5 \mu\text{m}$, but not clearly clavate; in *P. cylindrica* Kashiw. (Kashiwadani 1989) the ascospores are 10–17-septate, but measure only $45\text{--}60 \times 4\text{--}6 \mu\text{m}$ and the ends are rounded; in *P. filiformis* Aptroot (Aptroot 2014) the ascospores are 11–17-septate, slender fusiform to slightly clavate, $75\text{--}90 \times 4.5\text{--}6.5 \mu\text{m}$, with both ends pointed, but not attenuated into a long tail.

Additional specimen examined. U.S.A. FLORIDA: Charlotte Co., on Fla. Rt. 775 near Buck Creek south of Grove City. Dry wooded area with pine and palmetto, mangroves along margin of creek, 1 January 1976, R.S. Common 3746T (MSC, ABL, FLAS).

KEY TO SPECIES OF PYRENULA WITH ASCOSPORES (INCLUDING APPENDAGES) OVER 4 TIMES AS LONG AS WIDE

1. Ostioles pointing in various directions, mostly eccentric to lateral 2
1. Ostioles apical or rarely eccentric and then all pointing in the same direction..... 4
2. Ascospores 5-septate, $42\text{--}55 \mu\text{m}$ long; Neotropical (Colombia, Florida) *Pyrenula pleiomeria* (Nyl.) Zahlbr. 4
2. Ascospores 9–15-septate 3
3. Ascospores 9–13-septate, $65\text{--}90 \times 17\text{--}22 \mu\text{m}$ ascospores single; Brazil *Pyrenula fusispora* (Malme) Aptroot 3
3. Ascospores 11–15-septate, $50\text{--}70 \times 4.5\text{--}6 \mu\text{m}$, ascospores with 5–15 fused ostioles; Japan *Pyrenula tokyensis* (Müll. Arg.) H. Harada 3

4. Ascospores all 3-septate, without tails; Brazil *Pyrenula fusoluminata* Aptroot 4
4. Ascospores at least partly with more than 3 septa, or with 3 septa and long tails at one or both ends, seemingly more than 3-septate 5
5. Ascospores at least seemingly 4–6(–7)-septate 6
5. Ascospores 7–17-septate 9
6. Ascospores with one or two tails 7
6. Ascospore without tails, at most pointed 8
7. Ascospores with tails at both ends; Australia *Pyrenula bicuspidata* Müll. Arg. 7
7. Ascospores with a long tail at one end; Pacific (Solomon Islands) *Pyrenula mastigophora* Aptroot 8
8. Hamathecium interspersed with oil globules; thallus UV+ yellow, with lichexanthone; Brazil *Pyrenula musaespora* Aptroot & M. Cáceres 8
8. Hamathecium not interspersed; thallus UV-negative; Neotropical... *Pyrenula melanophthalma* (Mont.) Trevis. 9
9. Ascospores with a long tail without septa at the lower end; Pacific (Mariana Islands) (here the temperate fungal genus *Rebentischia* keys out) *Pyrenula flagellata* H. Harada 9
9. Ascospores without tails (here the common fungal genus *Navicella* keys out, characterized by elongate ostioles) 10
10. Ascospores (5–)7-septate 11
10. Ascospores 7–17-septate 12
11. Ascospores $30\text{--}38 \mu\text{m}$ long; Pantropical *Pyrenula montagnei* Müll. Arg. 11
11. Ascospores $53\text{--}70 \mu\text{m}$ long; Australasia (New Zealand), also Neotropical? *Pyrenula moniliformis* (C. Knight) Müll. Arg. 12
12. Ascospores 12–17-septate 13
12. Ascospores 7–11-septate 14
13. Ascospores $45\text{--}60 \mu\text{m}$ long; Ryukyu Islands, Japan *Pyrenula cylindrica* Kashiw. 13
13. Ascospores $75\text{--}90 \mu\text{m}$ long; Pacific (New Caledonia and Campbell Island) *Pyrenula filiformis* Aptroot 14
14. Ascospores clavate; Florida *Pyrenula clavatispora* Common & Aptroot 14
14. Ascospores not clavate; India *Pyrenula subcylindrica* Jagadeesh Ram & Upreti 14

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