

## *Punctelia eganii*, a new species in the *P. rudecta* group with a novel secondary compound for the genus

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**ABSTRACT.** – *Punctelia eganii*, a lichen species from southeastern North America, is described as new to science. This species is known from a single locality in Alabama, U.S.A., and is morphologically identical to *P. rudecta*, differing in the production of lichexanthone, a secondary compound previously unknown in the genus. The use of secondary chemistry in the species-level taxonomy of *Punctelia* is discussed.

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### INTRODUCTION

The genus *Punctelia* Krog represents a distinctive group of parmelioid species distinguished by having small pseudocyphellae ('punctae') in the upper cortex (Krog 1982). The genus has recently been shown to exhibit a greater degree of alpha-diversity in eastern North America than previously reported (Lendemer & Hodkinson 2010, Wilhelm & Ladd 1987). Species in the genus are distinguished by a combination of characters including underside color, secondary chemistry, presence/absence of scrobiculae on the upper surface, and diaspore-type (Lendemer & Hodkinson 2010). A population that is morphologically identical to *P. rudecta* (Ach.) Krog, but has an alternative secondary chemistry was recently discovered and is described here as *P. eganii*. This represents the first reported occurrence of lichexanthone in the genus *Punctelia*.

### MATERIALS AND METHODS

Specimens were studied dry using a Bausch & Lomb StereoZoom 7 dissecting microscope and subjected to chemical analysis using standard spot tests (reagents are abbreviated following Brodo et al. (2001)) and Thin Layer Chromatography (TLC). TLC was carried out by R.S. Egan at OMA following Culberson & Kristinsson (1970). Images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. The illustration was prepared using Adobe Photoshop. Due to the limited material available, measurements are expressed simply as ranges of observed values.

### THE NEW SPECIES

***Punctelia eganii* Hodkinson & Lendemer sp. nov.**

Mycobank #561203.

**PLATE 1 (PAGE 36).**

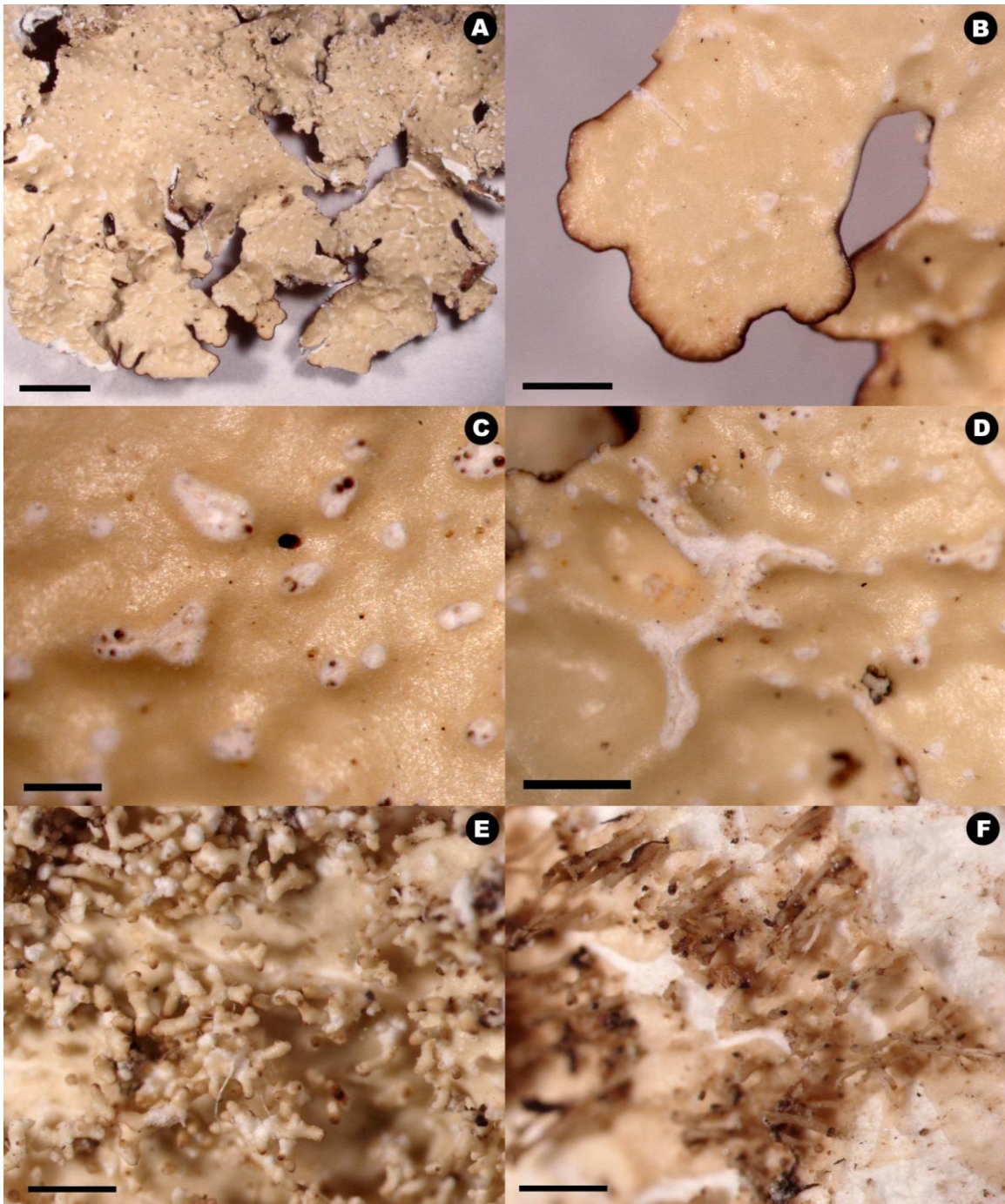
Sicut *Punctelia rudecta* sed lichexanthonum continens.

**TYPE: U.S.A. ALABAMA. MONROE CO.:** Haines Island Park, forest trail near boat ramp, public recreation area operated by the U.S. Army Corps of Engineers, 20 mi N of Monroeville, along the Alabama River, 50 ft. elev., beech-*Magnolia* forest, 31.vii.2003, on bark, *R.S. Egan 16197-A* (NY, holotype).

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**Figure 1.** *Punctelia eganii* (all from holotype). A, macromorphology of the thallus (scale = 2.0 mm). B, detail of lobe tip (scale = 0.5 mm). C-D, pseudocyphellae (scale = 0.25 mm). E, isidia (scale = 0.5 mm). F, rhizines (scale = 0.5 mm).

DESCRIPTION – *Thallus* foliose, lobate, isidiate; lobes irregularly branched, 1.0-2.5 mm wide, adnate to loosely adnate (?), continuous to overlapping laterally, apices round, margins plane to somewhat upturned and often with a narrow brown band; upper surface continuous, glabrous, epruinose with some shallow poorly defined ridges, lacking scrobiculae; isidia abundant, corticate, simple and cylindrical to abundantly branched and coralloid, brown tipped, laminal and arising from both the pseudocyphellae and cracks in the thallus cortex; 0.2-0.5 mm tall; maculae absent; pseudocyphellae white, laminal, circular and punctiform, sometimes becoming sublinear, variable in size (~0.1-0.3 mm in diameter); medulla white, lacking pigments; lower surface pale brown to white, glabrous, smooth; rhizines sparse not forming a tomentum, concolorous with the underside or slightly darker brown, simple or occasionally branched, 0.3-0.8(>1.0) mm in length; apothecia unknown; pycnidia unknown.

CHEMISTRY – Atranorin (? low concentration in the cortex and not detected with TLC; see Culberson and Culberson (1956)), lichexanthone (restricted to the pseudocyphellae); lecanoric acid (medulla).

Spot tests: cortex K-, C-, KC-, P-, UV-; pseudocyphellae K-, C+ red, KC+ red, P-, UV+ bright yellow; medulla, K-, C+ red, KC+ red, P-, UV-.

ETYMOLOGY – The species is named after Robert S. Egan, who collected the type specimen and brought its unusual chemistry to our attention.

ECOLOGY AND DISTRIBUTION – So far, only a single population has been discovered on bark in a beech-*Magnolia* forest in the coastal plain of southern Alabama. The natural landscape of the region in which the type locality is situated has been subjected to considerable anthropogenic change (Drummond & Loveland 2010). Remaining natural habitats largely exist as isolated fragments of variable size amid a dense mosaic of agriculture and urbanization. In light of the above, it is possible that *Punctelia eganii* was once more common but is now rare or even extirpated. It is equally probable that the species has been overlooked by collectors because of its morphological and chemical similarity to the ubiquitous *P. rudecta*. A search of all material from southeastern North America filed as *P. rudecta* at DUKE and NY failed to reveal any additional collections of *P. eganii*.

COMPARISON WITH OTHER SPECIES OF *PUNCTELIA* – *Punctelia eganii* is seemingly indistinguishable from *P. rudecta* based on morphology alone. Both species have a pale lower surface, lecanoric acid in the medulla, and abundant, corticate, cylindrical isidia. However, the striking fluorescence of the pseudocyphellae of *P. eganii* under UV light allows the two entities to be readily distinguished. Both *P. eganii* and *P. rudecta* may sometimes be confused with *P. missouriensis* G.Wilh. & Ladd or *P. punctilla* (Hale) Krog, but these species are readily distinguished by their diaspores. Both *P. missouriensis* and *P. punctilla* produce ecorticate, squamiform soredia, structures that can be misinterpreted as isidia (Wilhelm & Ladd 1987, Egan & Aptroot 2004, Lendemer & Hodkinson 2010).

## DISCUSSION

As is noted above, the species described here represents the first reported occurrence of lichexanthone in the genus *Punctelia*. Although this substance is known from other parmelioid genera, particularly *Hypotrachyna* (Vainio) Hale (Hale 1975, Sipman et al. 2009) and *Parmotrema* A. Massal. (Spielmann 2009), its occurrence is not widespread in the family. Whereas species of *Hypotrachyna* produce lichexanthone in the cortex, species of *Parmotrema*, such as *P. ultraluscens* (Krog) Hale, produce this compound in the medulla. The occurrence of this compound in the medulla of *Punctelia eganii* indicates that this phenomenon may be more widespread in parmelioid lichens than previously recognized.

Some lichenologists may question the value of formally describing *Punctelia eganii* from a population that is effectively a chemical variant of the much more common *P. rudecta*. This criticism is reasonable in the absence of independent molecular sequence data. However, the inclusion of *P. eganii* in *P. rudecta* would require a significant expansion of the circumscription of the latter species. Specifically, it would require allowing for the existence of a chemotype that produces a secondary compound that is both otherwise unknown in the genus and is biosequentially distinct from the other compounds present in *P. rudecta*. With regard to taxonomic convention, broadening the circumscription of *P. rudecta* in this manner would significantly violate current species concepts in the parmelioid lichens as a whole, where differences in secondary chemistry are regarded as characters that warrant separation at the species rank. Although it

remains possible that *P. eganii* merely represents a chemotype of *P. rudecta*, we put forth the more probable hypothesis that it represents a distinct taxon that has previously been overlooked.

At present, the utility of chemical characters in circumscribing monophyletic parmelioid taxa at species rank remains largely untested by molecular methods. The few studies that have been produced provide conflicting results. For instance, Lendemer and Hodkinson (2010) found differences in secondary chemistry to be strongly correlated with other characters, making them useful in circumscribing species in *Punctelia* (i.e., *P. borreeri* (Sm.) Krog and *P. subrudecta* s.l.). Conversely, Leavitt et al. (2011) concluded that, although there were chemical trends in some species of *Xanthoparmelia* Hale, these did not correlate absolutely with clades reconstructed through analyses of molecular sequence data.

Studies of lichens outside of the family Parmeliaceae provide similarly conflicting results. Some studies have found examples where chemical characters correlate with molecular characters (Lendemer & Hodkinson 2009, Lücking et al. 2008), while others have documented cases where chemically distinct populations represent variants of a single taxon (Vondrák et al. 2010). Based on the differing outcomes encountered in studies of different taxa, it is almost certain that the utility of chemical characters in circumscribing monophyletic entities is variable and they cannot *a priori* be used or ignored. Indeed, the results obtained by Lendemer and Hodkinson (2009) best summarize the situation: in examining closely related species of *Cladonia*, we found that chemical characters sometimes correlated with other sets of characters, while at other times they did not. As such, we advocated a case-by-case approach in which the status of chemotypes is evaluated on an individual basis.

#### ACKNOWLEDGEMENTS

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#### LITERATURE CITED

- Brodo, I.M., S.D. Sharnoff and S. Sharnoff. 2001. Lichens of North America. New Haven & London: Yale University Press.
- Culberson, W.L. and C.F. Culberson. 1956. The systematic of the *Parmelia dubia* group in North America. American Journal of Botany, 43: 678-687.
- Culberson, C.F. and H. Kristinsson. 1970. A standardized method for the identification of lichen products. Journal of Chromatography, 46: 85-93.
- Drummond, M.A. and T.R. Loveland. 2010. Land-use pressure and a transition to forest-cover loss in the eastern United States. Bioscience, 60: 286-298.
- Egan, R.S. and A. Aptroot. 2004. *Punctelia*. In T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries and F. Bungartz eds. Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Tempe, Arizona: Lichens Unlimited, Arizona State University. pp.431-436.
- Hale, M.E. Jr. 1975. A revision of the lichen genus *Hypotrachyna* (Parmeliaceae) in tropical America. Smithsonian Contrib. Bot., 25: 1-73.
- Krog, H. 1982. *Punctelia*, a new lichen genus in the Parmeliaceae. Nordic Journal of Botany, 2: 287-292.
- Leavitt, S.D., L. Johnson, and L.L. St. Clair. 2011. Species delimitation and evolution in morphologically and chemically diverse communities of the lichen-forming genus *Xanthoparmelia* (Parmeliaceae, Ascomycota) in western North America. Am. J. Bot., 98: 175-188.
- Lendemer, J.C., and B.P. Hodkinson. 2009. The wisdom of fools: new molecular and morphological insights into the North American apodetiate species of *Cladonia*. Opuscula Philolichenum, 7: 79-100.
- Lendemer, J.C. and B.P. Hodkinson. 2010. A new perspective on *Punctelia subrudecta* in North America: previously-rejected morphological characters corroborate molecular phylogenetic evidence and provide insight into an old problem. The Lichenologist, 42: 405-421.
- Lücking, R., R. del Prado, H.T. Lumbsch, S. Will-Wolf, A. Aptroot, H.J.M. Sipman, L. Umana and J.L. Chaves. 2008. Phylogenetic patterns of morphological and chemical characters and reproductive mode in the *Heterodermia obscurata* group in Costa Rica. Systematics and Biodiversity, 6: 31-41.
- Sipman, H.J.M., J.A. Elix and T.H. Nash III. 2009. *Hypotrachyna* (Parmeliaceae, Lichenized Fungi). Flora Neotropica Monograph 104. The New York Botanical Garden Press, Bronx. 176 pp.
- Spielmann, A.A. 2009. Estudos taxonômicos em *Parmotrema* s.l. (Parmeliaceae, Ascomycota liquenizados) com ácido salazínico. Instituto de Botânica da Secretaria de Estado do Meio Ambiente, São Paulo. 152 pp.
- Vondrák J., J. Aoun, M. Sogaard, U. Søchting and U. Arup. 2010. *Caloplaca phlogina*, a lichen with two facies; an example of infraspecific variability resulting in the description of a redundant species. The Lichenologist, 42: 685-692.
- Wilhelm, G. and D. Ladd. 1987. *Punctelia perreticulata*, a distinct lichen species. Mycotaxon, 28: 249-250.