

BUELLIA IN NORTH AND CENTRAL FLORIDA  
OR  
THE VIRTUES AND REWARDS OF COLLECTING

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This work continues a line of thought and to some extent is derived from my two articles in the previous number of Evansia. It is intended to reinforce the idea that lichen collecting is needed due to our very real, perhaps even colossal, ignorance of the lichens of North America. I will use as an exemplar Mr. Edward Wheeler of Nalcrest, Florida, who began collecting and sending me lichens about two years ago. The prime requisites of a good collector seem to me to be the ability to see differences, serendipity and persistence. That Mr. Wheeler possesses serendipity is amply evident from his discovery of Gyalideopsis vainioi, a new species of Buellia and several additional species in other groups which are also probably new to science. His "stick to it" quality is shown by the fact that when he heard about the Gyalideopsis, he went out, not entirely sure what he was looking for, and collected a large amount of material with dark apothecia. He did indeed recollect a half dozen more thalli of the Gyalideopsis, but more relevant here, also a large amount of Buellia. Thinking that this would make good exchange material, I began to sort it. I soon realised that several taxa were present and conceived the idea that some ecological information might be derivable from this material. It is very rarely that such a large, essentially random sample is collected. In higher organisms it is generally accepted that only one species of a genus is going to be found in a given niche. This does not seem to apply to fungi, including lichens, as is shown below. The collections consisted of lengths of twig ca. 2-15 cm long and ca. 0.5-2 cm thick. Presumably such a piece represents a single niche. There were three collections all from Fedhaven, Polk County, mostly on Myrica cerifera. Six taxa of Buellia were present, bahiana (8-spored), bahiana (12-16-spored), curtisii, modesta (including oily hymenium and non-oily hymenium forms), punctata and stillingiana. The polysporous form of Buellia bahiana was kept separate just to get some feel of how it related to the 8-spored form. The first collection (82 thalli) yielded 40% curtisii, 38% bahiana(8), 11% modesta, 8% bahiana(12-16) and 2% stillingiana; the second (23 thalli) 52% bahiana(8), 26% bahiana(12-16), 17% curtisii and 4% modesta and the third (65 thalli), 56% bahiana(8), 28% modesta, 9% bahiana(12-16), 5% curtisii and 2% punctata. In the three collections there were a total of 47 pieces of twig, one had four of the above taxa, 9 had three taxa, 18 had two taxa and 19 had only one, i.e., 59% of the samples had more than one species of Buellia occupying the same niche. All the Buellia species found, except B. punctata, contain norstictic acid. This raises the question: Does norstictic acid provide some advantage in this niche? Thus another virtue of collecting is that it can provide stimuli to lichen ecology and biology.

Another major virtue is that collections, both large and small, such as Mr. Wheeler's encourage taxonomic revision, if only to find a pigeonhole in the herbarium for them. The remainder of this paper is such a working revision of Buellia in North and Central Florida. As a matter of deliberate policy I have not attempted to examine all type specimens. This is a work of a few weeks for a small region based on a



small number of specimens. In recent years it has become all too common for those working on small regional floras to identify their specimens by borrowing the types. I, as a sometime monographer, find this extremely unfortunate. There are several types at Geneva which have been completely "used up", destroyed without the characters needed for their understanding being recorded. Such names then end up as nomina inquirenda or excluded species. Major herbaria should give more consideration to conservation of scanty type specimens.

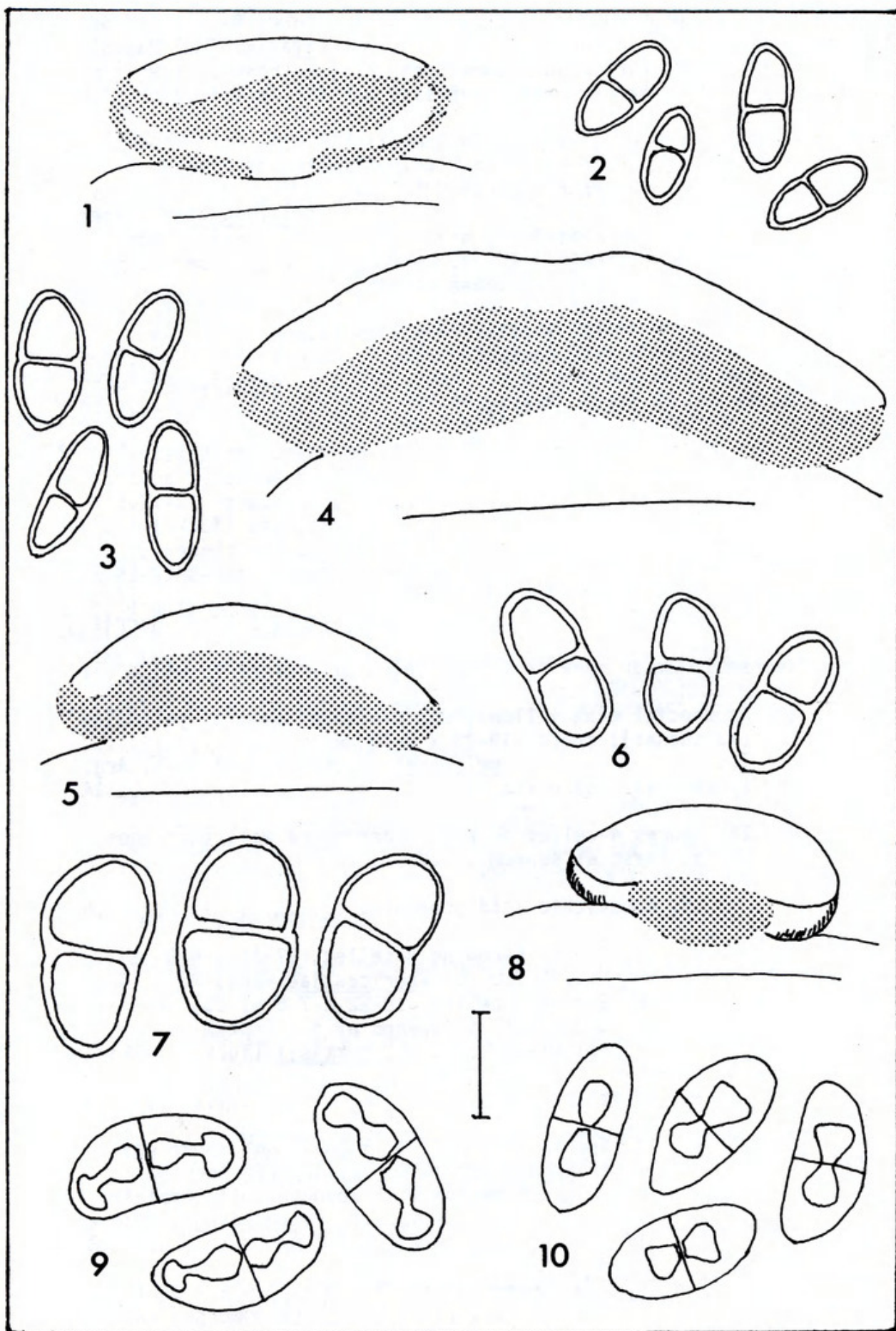
Most of our knowledge of Buellia in Florida is from Imshaug's unpublished thesis (1951) and his work on the West Indian species (1955). A few changes were included in the first North American lichen checklist (Hale & Culberson, 1956). Most of the information in the keys and discussion below is original but some is shamelessly borrowed from Imshaug (1951, 1955) and to a lesser extent from Aptroot (1987). They should be consulted to fill in the picture. I have also decided to validate one of Imshaug's nomina nuda. Three species which may be better placed in Rinodina are included due to lack of algae in the exciple and consequent possible confusion with Buellia. I realize that what follows leaves many questions unanswered but it is presented on the old philosophic principle that something is better than nothing.

#### KEY TO BUELLIA IN NORTH AND CENTRAL FLORIDA

1. Thallus with citrine yellow soredia (KC+ orange) in punctiform to diffuse, confluent soralia; spore wall strongly ornamented; spores 16-19 x 9-11.5 um ..... wheeleri R. C. Harris
1. Thallus not sorediate ..... 2
2. Thallus P+ orange-red (fumarprotocetraric acid); spores 13.5-16.5 x 6.5-7.5 um ..... rubifaciens R. C. Harris
2. Thallus P- or P+ yellow (norstictic or baeomycesic acid) ..... 3
3. Spores more than 8 in the ascus ..... 4
4. Hymenium with abundant oil droplets; spores 12-16 in the ascus; upper hymenium K+ purplish ..... bahiana Malme
4. Hymenium without oil droplets; spores 24-32 in the ascus; upper hymenium K- ..... polyspora (Willey in Tuck.) Vainio
3. Spores 8 in the ascus ..... 5
5. Spores 15 um or less in length and mostly 5 um or less in width ..... 6
6. Thallus containing a bright red pigment; spores 8.5-12 x 4-5.5 um ..... coccinea (Fée) Aptroot
6. Thallus unpigmented ..... 7
7. Hymenium with abundant oil droplets; spores 9-13 x 4-5 um ..... rappii Imshaug ined.
7. Hymenium without oil droplets ..... 8
8. Exciple with strongly differentiated colorless layer (fig. 1); spores 9-12.5 x 4-5 um ..... amphidexia Imshaug ex R. C. Harris
8. Exciple at most paler brown within ..... 9



9. Lichen substances lacking; spores 9-16 x 6-7  $\mu$ m ..... punctata (Hoffm.) Massal. 10
9. Lichen substances present (xanthonic, atranorin, baeomycesic, barbatic, norstictic acids) 10
10. Atranorin and norstictic acid or atranorin only; exciple paler within; disk naked; spores 10-15 x 5-7  $\mu$ m ..... stillingiana Steiner
10. Containing other substances; exciple not paler within, concolorous with hypothecium; disk pruinose or not ..... 11
11. Thallus P+ yellow (baeomycesic and squamatic acids); spores 9-13 x 4-5.5  $\mu$ m ..... caloosensis Tuck.
11. Thallus P- ..... 12
12. Thallus KC- or weakly orangish (lichexanthone and barbatic acid); disk not pruinose; spores 10-12.5 x 4-5.5  $\mu$ m .... catasema (Tuck.) Tuck.
12. Thallus KC+ orange (xanthonic); disk white pruinose; spores 12-15 x 4.5-6  $\mu$ m ..... pachnidisca R. C. Harris
5. Spores 15  $\mu$ m or more in length and 5  $\mu$ m or more in width 12
13. Apothecial disk yellow-green pruinose; thallus yellowish (xanthonic); spores 19-28 x 8-10  $\mu$ m ..... melanochlora (Krempelh.) Müll. Arg.
13. Apothecial disk naked ..... 14
14. Spores 4-celled or with inner spore wall thickened, at least at septum ..... 15
15. Norstictic acid present ..... 16
16. Spores becoming 4-celled, 17-21 x 6-8  $\mu$ m ... lauricassiae (Fée) Müll. Arg.
16. Spores 2-celled, 18-22 x 7-8.5(-10)  $\mu$ m; spore wall thickened at the septum as in Caloplaca ..... curtisii (Tuck.) Imshaug
15. Norstictic acid absent ..... 17
17. Spores large, 32-41 x 13-20  $\mu$ m; spore wall thickened partially cutting off terminal cells; hymenium with abundant oil droplets ..... rinodinospora Riddle
17. Spores less than 20 x 10  $\mu$ m ..... 18
18. Spores as in fig. 9, 17-19 x 7-9  $\mu$ m ... cf. placodiomorpha Vainio
18. Spores of Pachysporaria-type (fig. 10), 15-19 x 7-8  $\mu$ m ..... Rinodina sp.





14. Spores 2-celled, thin walled ..... 19
19. Norstictic acid absent; spore wall strongly ornamented; spores 14-20 x 8-11 um ..... leucomela Imshaug
19. Norstictic acid present; spore wall weakly ornamented ..... 20
20. Hymenium without oil droplets or with oil droplets only in the upper part; exciple paler within; spores 16-23 x 6-9 um ..... modesta (Krempelh.) Müll. Arg.
20. Hymenium with abundant oil droplets throughout; exciple concolorous with hypothecium; spores 14-22 x 6-8 um ..... 21
21. Hymenium greenish above, K+ purplish ... bahiana Malme
21. Hymenium brownish above, K- ..... curatellae Malme

Note: In the descriptions below the underlined figure in the spore sizes is the mean. The Florida distributions include specimens cited by Imshaug (1951), if no problems exist, and those verified by me from FLAS and NY with a few from MICH and are indicated only by a list of counties at the end of the description or discussion.

Buellia amphidexia Imshaug ex R. C. Harris, sp. nov.

Buellia amphidextra Tuck., Syn. N. Amer. lich. 2: 131. 1888, nom. nud.; Buellia amphidexia Imshaug in Hale & Culb., Castanea 21: 78. 1956, nom. nud.

Buellia sporis minoribus, 9-11.2-12.5 x 4-4.6-5 um et excipulo interne strato hyalino distincto. Type. Florida, Wilson 55 (FH, holotype, chosen by Imshaug; NY-Higginson, isotype).

Thallus pale gray, continuous to granular areolate, containing atranorin. Apothecia to 0.7 mm, plane with slightly raised margin. Exciple with a distinct colorless layer (fig. 1). Spores 9-11.2-12.5 x 4-4.5-5 um (fig. 2). Levy, Marion and Seminole.

This species recognized by Imshaug in his thesis but never validated seems easily recognizable and not uncommon in northern Florida and was reported by Imshaug from Alabama. Among the small spored species it is easily recognized by the sharply defined colorless layer in the exciple.

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Figs. 1-10. Apothecial cross-sections and spores of Buellia and Rinodina. 1-2. B. amphidexia (isotype, NY). 3-4. B. pachnidisca (holotype, FLAS). 5-6. B. rubifaciens (holotype, NY). 7-8. B. wheeleri (holotype, NY). 9. B. cf. placodiomorpha (Sarasota County, McFarlin 195, FLAS).

10. Rinodina sp. (Polk County, Wheeler, NY). Scale bar = 10 um for spores, 150 um for apothecia.



Buellia bahiana Malme

Reported from Florida by Imshaug (1955), it is locally common. The polysporous form has not been noted before but does not seem to be worthy of nomenclatural recognition. However, Buellia pleiotera Malme may be a name for it but I have not seen the type. It apparently has the same range as the 8-spored form and as noted above grows intermingled with it. 8/ascus: Alachua, Dade, Franklin, Polk, Seminole, Wakulla. 12-16/ascus: Columbia, Polk, Seminole.

Buellia caloosensis Tuck.

The application of this name is uncertain as I have not examined the type. Most of the material named by Imshaug is B. catasema but also includes this taxon with baeomycesic and squamatic acids and B. pachnidisca. I have adopted it here to avoid describing yet another taxon, possibly unnecessarily. Its chemistry is distinctive and possibly relates it to B. catasema as barbatic, baeomycesic and squamatic acids shift around rather freely. I have verified a specimen from Texas as well as from the Caloosa River and Duval County.

Buellia catasema (Tuck.) Tuck.

Aptroot (1987) as well as Imshaug (1955) unite this taxon with B. coccinea. However, in view of the chemical differences I feel that they should be kept separate pending study of additional material. Buellia catasema contains lichexanthone and barbatic acid while Buellia coccinea contains a xanthone (probably xanthonones), a trace of an unknown and the red pigment (chiodectonic acid according to Aptroot, 1987). The thallus may be more finely granular in B. catasema. All Florida collections examined were on Sabal palmetto except one possibly on Quercus: Duval, Lake, Marion, Seminole.

Buellia coccinea (Fée) Aptroot

Immediately distinguishable by the bright red medullary pigment. See B. catasema for separation from that species. Dade, Liberty.

Buellia curatellae Malme

Treated by Imshaug (1951) as B. conspirans (Nyl.) Vainio but replaced by B. curatellae in Hale and Culberson (1956). It differs from B. bahiana in lacking K+ purplish epithecium and possibly in spore type. I am not convinced that the two are distinct. This is another area where further study is needed. Alachua, Columbia, Duval, Monroe, Seminole.

Buellia curtisii (Tuck.) Imshaug

Imshaug's concept included at least two taxa but I restrict it here to the one with spores with a isthmus more or less as in Caloplaca, exciple pale internally and containing atranorin and norstictic acid. Although widely reported I suspect it is confined to the southern Coastal Plain. In addition to Florida I have verified specimens from Alabama and South Carolina. Columbia, Duval, Franklin, Polk, Seminole.

Buellia lauricassiae (Fée) Müll. Arg.

This is immediately recognizable due to the 4-celled spores and production of norstictic acid. Dade, Palm Beach, Seminole.

Buellia leucomela Imshaug

Buellia langloisii Imshaug in Hale & Culb., Castanea 21: 101. 1956, nom. nud.

The strong ornamentation, broad spores and lack of chemistry define



this taxon which is apparently more common in Louisiana than Florida. Often on Taxodium but also Melia and Quercus, Duval, Nassau, Polk.

Buellia melanochlora (Krempelh.) Müll. Arg.

It was reported from Florida by Imshaug (1955) but I have not verified any specimen. I suspect it may not be in North or Central Florida but is more southern.

Buellia modesta (Krempelh.) Müll. Arg.

I am using a broad concept here for material previously included in B. curtisii but which lacks any spore wall thickening. Most of the material lacks oil droplets in the hymenium but a few have oil in the upper part. Imshaug (1955) also included such specimens in B. modesta and some West Indian specimens annotated by him have oil droplets only in the base of the hymenium. Aptroot (1987) gives the spore size as 15-18(-20) x 6-8(-10)  $\mu$ m. A Brazilian specimen at NY has spores 16-17.2-19 x 6-6.6-7  $\mu$ m. Florida material has spores 16-19.2-23 x 6-7.3-9  $\mu$ m. Thus the spores in our material seem a little larger than in South American material. It is separated from B. stillingiana by larger, more pointed spores but the separation is sometimes difficult. Buellia modesta may also differ from B. curtisii and B. stillingiana in lacking atranorin, but only a very few specimens have been analyzed. Clearly this complex requires additional work. I have no idea how far north this taxon is distributed as I have not tried to revise anything but Florida specimens. Alachua, Polk, Seminole.

Buellia pachnidisca R. C. Harris, sp. nov.

Buellia disco apotheciorum albobruinoso, sporis minoribus, 12-13.7-15 x 4.5-5.3-6  $\mu$ m, et thallo KC+ aurantiaco. Type. Florida. Seminole County: Sanford, on cypress [Taxodium], 8 Aug 1930, Rapp (FLAS, F30564, holotype; NY, isotype).

Thallus whitish to gray, more or less continuous to granular areolate, K-, C-, KC+ orange (3-4 xantheses). Apothecia to 1.0 mm, plane with slightly raised margin; disk weakly whitish pruinose; exciple brown, confluent and concolorous with the hypothecium (fig. 4); clumps of colorless prismatic crystals forming in exciple in KOH. Spores 12-13.7-15 x 4.5-5.3-6  $\mu$ m (fig. 3); spore wall weakly ornamented.

All the tropical taxa with white pruinose apothecia have much larger spores. The epithet is derived from pachne, the Greek equivalent of Latin pruina, frost. Two of the three known collections are on Taxodium. Franklin, Seminole.

Buellia cf. placodiomorpha Vainio

This name is used with hesitation. The spores (fig. 9) do not quite match Imshaug's (1955) stylized drawing, the spore size is a little large and I have seen no comparative material. It probably belongs in Rinodina s. lat. but Mayrhofer has not illustrated this spore type. The external appearance and apothecial anatomy are indistinguishable from B. punctata suggesting that apothecial characters are highly conservative. Sarasota.

Buellia polyspora (Willey in Tuck.) Vainio

Widespread in eastern North America and reported by Aptroot (1987) from Guyana, this species is weedy and probably fast growing and short-lived as one collection is on Baccharis. Alachua, Duval, Lake, Levy, Seminole.



Buellia punctata (Hoffm.) Massal.

Weedy and widespread, this species probably reaches its southern limit in Central Florida. Duval, Polk, Seminole, Volusia.

Buellia rappii Imshaug in Hale & Culb., nom. nud.

Castanea 21: 78. 1956.

I have only seen one very small specimen which fits Imshaug's (1951) description. Without study of more ample material I do not care to validate the name. It is distinct among the small spored taxa by its oily hymenium. Duval, Seminole.

Buellia rinodinospora Riddle

Buellia callispora sensu Imshaug

Mayrhofer (1984) treated this group in Rinodina and neotropical material may be called R. dissa (Stirton) Mayrh. as Aptroot (1987) has done. However, Mayrhofer considered them distinct and I agree that the spore sizes of Australian and neotropical specimens are different although I do not see the difference in spore ornamentation he mentions. Both populations contain atranorin and diploicin, although one Florida collection contains only atranorin. The oldest name in this group in the neotropics is Karschia fraudans Starbäck, but the spore size given in the original description is too small. Therefore, I have fallen back on the next available name which was described as having spores 36-50 x 15-20  $\mu$ m. Mayrhofer is apparently "purifying" Buellia by transferring all species which do not have the Buellia spore type to Rinodina. I am in no position to fault this as I have done something very similar in a forthcoming paper on the Pyrenulaceae. However, I will leave it to others to transfer the species, probably best assigned to a new genus, to Rinodina.

Buellia rubifaciens R. C. Harris, sp. nov.

Buelliae catasemae similis sed sporis latioribus, 13.5-14.9-16.5 x 6.5-7.1-7.5  $\mu$ m, hymenio oleoso et thallo acidum fumarprotocetraricum continenti. Type: Florida. Franklin County: Hardwoods along Owl Creek, Hickory Landing Recreation Area, ca. 2 mi S of Sumatra, 23 May 1976, Harris 11277 (NY, holotype).

Thallus whitish, granular areolate, becoming crowded and more or less continuous in the center, K-, C-, P+ orange-red (fumarprotocetraric acid). Apothecia to ca. 0.6 mm, plane to slightly swollen with slightly raised margin; exciple concolorous with hypothecium or slightly paler within (fig. 5); hymenium with numerous oil droplets. Spores 13.5-14.9-16.5 x 6.5-7.1-7.5  $\mu$ m (fig. 6).

Buellia rubifaciens, named for its reaction with paraphenylendiamine, is known only from the type collection. The only other species that I know with fumarprotocetraric acid is B. dialyta (Nyl.) Tuck., which has much larger spores. The type collection also contains material of B. pachnidisca.

Buellia stillingiana Steiner

This species is easier to recognize in old herbarium specimens in which the hymenium has turned yellowish and large bipyramidal colorless crystals have developed in the exciple. This would seem to separate it from the closely related B. modesta. Recent collections must be named by the smaller spores with more rounded ends. I have included a number of specimens which contain only atranorin. My intuition is that they may merit nomenclatural recognition but I do not have the time to



investigate further. The Dade County collections are phytogeographically disturbing as I would not have predicted it so far south. Norstictic acid: Dade, Duval, Lake, Polk, Seminole. Atranorin: Clay, Dade, Duval, Levy.

Buellia wheeleri R. C. Harris, sp. nov.

Species distincta sorediis citrinis, KC+ aurantiacis et sporis mediocribus, 16-17.8-19 x 9-10-11.5  $\mu$ m. Type: Florida. Polk County: Bok Tower Gardens, on fallen rotting oak in scrub, 27 Jun 1988, Wheeler (NY, holotype).

Thallus whitish, rimose, with citrine yellow soredia in initially punctiform soralia which enlarge and fuse to form large sorediate patches; soredia KC+ orange (xanthone, possibly arthothelin). Apothecia to ca. 0.5 mm, slightly swollen; margin not raised; outer exciple darker; inner exciple occasionally yellowish; hypothecium light brown (fig. 8). Spores 16-17.8-19 x 9-10-11.5  $\mu$ m (fig. 7); spore wall strongly granular ornamented.

Sorediate species are rare in Buellia. The combination of yellow, KC+ orange soredia and rather large, ornamented spores is very distinctive. The spore type suggests a relationship to B. leucomela. Preliminary chromatography suggests that the xanthone responsible for the KC reaction is arthothelin which is known to occur in the genus. Buellia wheeleri is known only from the type collection. It is worthy of note that Bok Tower Gardens, where it was collected, is dedicated to preserving the sand scrub habitat (Garden 12(1): 20-23. 1988) in which Mr. Wheeler has been turning up many interesting lichens and about which so little is known lichenologically.

Rinodina sp.

This is known from a single thallus collected by Mr. Wheeler in Polk County. Although the apothecial margin lacks algae, it is pale and together with the spore type (fig. 10) suggests placement in Rinodina.

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