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The lichen genus *Graphis* (Graphidaceae) in Everglades National Park (Florida)

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Abstract. In this paper we reassess 482 collections of the lichen genus *Graphis* from Everglades National Park using the recent world key of Lücking and co-workers as the principal reference. We report a total of 31 species present in the Park. Of these, three species, *Graphis brittoniae, G. elevata and G. hinnulea*, are described as new to science. In addition, the following eleven species are newly reported from North America: *Graphis analoga* Nyl., *G. cincta* (Pers.) Aptroot, *G. chlorotica* A. Massal., *G. crebra* Vain., *G. dendrogramma* Nyl., *G. filiformis* Adaw. & Makhija, *G. furcata* Fée, *G. modesta* Zahlbr., *G. neoelongata* Zenker, *G. renschiana* (Müll. Arg.) Stizenb. and *G. supracola* A. W. Archer. Each species is described and discussed based upon Park collections. Notes concerning some species previously known from North America are also included where new or interesting information can be added to the literature. Conversely, species well documented elsewhere where we have nothing to add are excluded from that section. *Graphis chlorotica*, also new to North America but collected from outside the Park, is treated here since the key would be incomplete with its omission. Photos of all 32 species are provided including the degree of excipular carbonization. A key is provided for all species of *Graphis* known to occur in Florida.

Keywords. Mycoflora, Ostropales, taxonomy, North America.

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As with most wide-ranging lichen genera containing a large number of species, the taxonomy of *Graphis* Adans. prior to 2002 was badly in need of review. When the family Graphidaceae was revised (Staiger 2002) the genus *Graphis* was redefined, ultimately causing most *Graphina* species to be merged into it while splitting of other members into various genera (*Platythecium*, *Fissurina*, *Carbacanthographis*, *Anomomorpha*, etc.). The task of realigning North American *Graphis* collections with Staiger's generic concepts was taken up by several authors (Lendemer 2007, 2010; Lendemer & Knudsen 2008; Lendemer & Yahr 2004; Tripp et al. 2010). However, still left undone was the revision of specific names within *Graphis,* the largest genus within the family. A worldwide analysis of the genus considered many described species to be stenotypic or exhibiting little variation, and yet to have been described several times, leading to various synonymization of names (Lücking et al. 2009). Consequently, as many as six names were synonymized, bringing the genus to about 330 species. Under this revised current treatment nearly 28% of *Graphis* have ranges that extend into both hemispheres and many are now

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regarded as pantropical. Based on this revision, we reevaluated the South Florida Natural Resources Center (FNPS) collection of 181 *Graphis* vouchers and added 300 plus more during a 2½ year span from 2008–2010.

The Everglades National Park is a flat expanse of roughly 640,000 hectares (1.6 million acres) dominating the southern terminus of mainland Florida whose natural elevation does not exceed 3 meters above sea level. It lies wholly within a subtropical life zone as strictly defined by Tomlinson (1980). In Holdridge's life zone classifications the tree islands and forests of the Park could perhaps best be considered Tropical Wet Forest (Holdridge 1947; Holdridge et al. 1971). Although the Park is the country's third largest national park (excluding Alaskan parks), much of it is occupied by seasonally or permanently inundated graminoid prairies, which are largely incapable of supporting a lichen flora. Tree-dominated communities account for only 13–14% (88,000 hectares; 220,000 acres) of the Park's total area (Welch & Madden 1999). These can be subdivided into pine, cypress and mangrove forests plus a variety of broad leaf tree islands locally known as hammocks and bayheads. Mangrove forests are often tidally flooded or inundated by summer rainfall while cypress domes and strands normally have superficial water year round at least in the central parts. The pine forests of the Park are maintained by wild fires or prescribed burns. The time span between burns rarely allows significant lichen formation although neither fire consumes 100% of the vegetation. Occasional trees or rocks escaping at least one burn cycle in this habitat can host lichen colonization but overall the pine forests of the Park are lichen poor. Rock outcroppings throughout the Park are exclusively limestone either inorganic or biogenic and may be under water during the summer rain season. Due to all of the above, over 85% of lichen collections from the Park are corticolous, lignicolous or foliicolous. Of these, by far the largest represented genus, in terms of species richness, is *Graphis.* Considering the subtropical nature of the Park, it is no surprise that its *Graphis* collections more closely resemble other parts of the tropical/subtropical world than the rest of the continent to the north. This has also been demonstrated by a recent lichen inventory of nearby Fakahatchee Strand State Preserve (Lücking et al. 2011).

Until 2006 the lichen flora of the Park had been largely ignored. The possible reasons for this are abundant. The Park is very remote and has only one drivable road often requiring collectors to wade to collection sites or to cross treacherous pineland to reach upland hammocks. The abundance of poisonous snakes, alligators, toxic plants, biting insects, heat, humidity and lack of shade all may be additional reasons as well as the strict permitting process to collect within the Park. Furthermore, until recently tropical and subtropical zones of the world were thought to be incapable of harboring abundant lichen populations when compared to temperate or subboreal climates (Lücking et al. 2011). Although recent or ongoing lichen inventories in Costa Rica, Florida (U.S.A.), Mexico, Peru and Venezuela challenge this preconception, the belief might have caused the area to be overlooked as a worthwhile lichen habitat.

Materials and Methods

All collections were made by the authors from Everglades National Park except where noted and were examined using standard stereoscopic and light microscope techniques. Sections were taken from lirellae occupying the center of the thallus. All measurements given for Park lichens were made by computer using Leica software and rounded to the nearest micron. In the accompanying key, measurements of species not collected by us were taken from reference material. A 10% KOH solution was used to detect and verify the presence of anthraquinones. A 1% Lugol's solution was occasionally used to increase contrast for photographic purposes. Images were taken with a Leica DFC295 camera mounted on a DM750 Leica trinocular microscope and captured with Leica Application Suite V3.6.0 software. The software's automatic setting was employed and may have enhanced some of the images. No additional enhancement was used unless noted. The chemistry of all 32 species occurring in the Park was verified by TLC following Orange et al. (2001) using system C in a ratio of 170:30 toluene to acetic acid. All collections were made by the authors and will be deposited at the South Florida Collections Management Center (FNPS).

The degree of carbonization of the exciple is an essential taxonomic character in *Graphis.* With conventional methods we occasionally found it difficult to separate lateral from complete carbonization in certain species. Lücking et al. (2009) recommended inspecting sections at high power under a dissecting microscope against a white background. This method is sufficient in the majority of cases. With the more difficult determinations as mentioned above, we viewed sections at 100× using dark field illumination. The increased contrast provided by this method leaves little doubt as to the degree of carbonization.

Although the keys presented in Lücking et al. (2009) are invaluable identification tools, we occasionally found them cumbersome to use where the collection's characters were unclear, e.g. striate versus entire labia. Collections that failed to key in one group had to be keyed over again in another. To facilitate such problems we created a filterable Excel database with the data imported from the aforementioned worldwide keys and other sources. This allowed us to shift between characters in mid key without having to start over. The results from the Lücking keys and the database matched in every instance when compared. Even so, unusual identifications returned by the program were run through the above keys for verification.

Results

Thirty one species of *Graphis* were collected from Everglades National Park, including nine species new to North America and three species described as new to science (in bold): ***G. analoga* Nyl.**, *G. anfractuosa* (Eschw.) Eschw., *G. antillarum* Vainio, ***G. brittoniae* F.Seavey & J.Seavey *sp. nov.***, *G. caesiella* Vainio, *G. chromothecia* R.C.Harris, ***G. cincta* (Pers.) Aptroot**, ***G. crebra* Vainio**, *G. cupei* Vain. ex Lücking, ***G. dendrogramma* Nyl.**, *G. desquamescens* (Fée) Zahlbr., ***G. elevata* F.Seavey & J.Seavey *sp. nov.***, ***G. filiformis* Adaw. & Makhija**, ***G. furcata* Fée**, *G. haleana* R.C.Harris, *G. handelii* Zahlbr., ***G. hinnulea* F.Seavey & J.Seavey *sp. nov.***, *G. intricata* Fée, *G. leptocarpa* Fée, *G. librata* C. Knight, *G. lineola* Ach., *G. lucifica* R.C.Harris, ***G. modesta* Zahlbr.**, ***G. neoelongata* Lücking**, *G. pinicola* Zahlbr., ***G. renschiana* (Müll. Arg.) Stizenb.**, *G. stellata* Cáceres & Lücking, *G. subamylcea* Zahlbr., ***G. supracola* A.W.Archer**, *G. tenella* Ach., *G. xylophaga* (R.C.Harris) Lendemer.

Graphis chlorotica A. Massal. is hereby reported as new to North America based on a collection from west central Florida. The species is included in our treatment since the accompanying key encompasses all of Florida and its exclusion would make the key incomplete.

The New Species

Graphis brittoniae F.Seavey & J.Seavey *sp. nov.*
Figs. 1A & E

Mycobank #: 563631

Sicut Graphis desquamescens sed ascosporis maioribus et 10–15 loculis differt.

Type: U.S.A. florida. Miami–Dade Co.: South of Blue Shanty Canal, Everglades National Park. 25° 41″N 80° 38″W. Habitat: In moderate shade within a small mixed group of *Taxodium distichum, Ilex cassine* and *Chrysobalanus icaco.* Surface water present most of the year. Collected on bark of *Annona glabra. F. Seavey & J. Seavey 2852E* (Holotype: fnps).

Diagnosis. Thallus: Pale to medium gray, corticate, smooth, cortex and algal layer ecrystallate, medulla with scattered large oxalate crystals. Lirellae black, epruinose, erumpent to sessile, lacking a thalline margin, 1–3(4) × 0.18–0.21 mm, usually abundant, slightly to extremely flexuous, sparsely branched; labia entire; disc closed; exciple completely carbonized; hymenium inspersed; epihymenium pale brown with scattered brown crystals, KOH−; ascospores 8 per ascus, hyaline, 38–66 × 8–11 µm, 10–15 celled, often with short rounded appendages at both ends, fragile, broken examples are common.

Chemistry. Norstictic acid.

Etymology. Named in honor of Elizabeth Gertrude Knight Britton (1858–1934), botanist, bryologist, explorer and lichen collector in early 20th century Florida.

Distribution and habitat. *Graphis brittoniae* can be found in all habitats throughout the Park from the bark of a wide variety of trees excluding rough barked mature mahogany (*Sweitenia mahagoni*) and

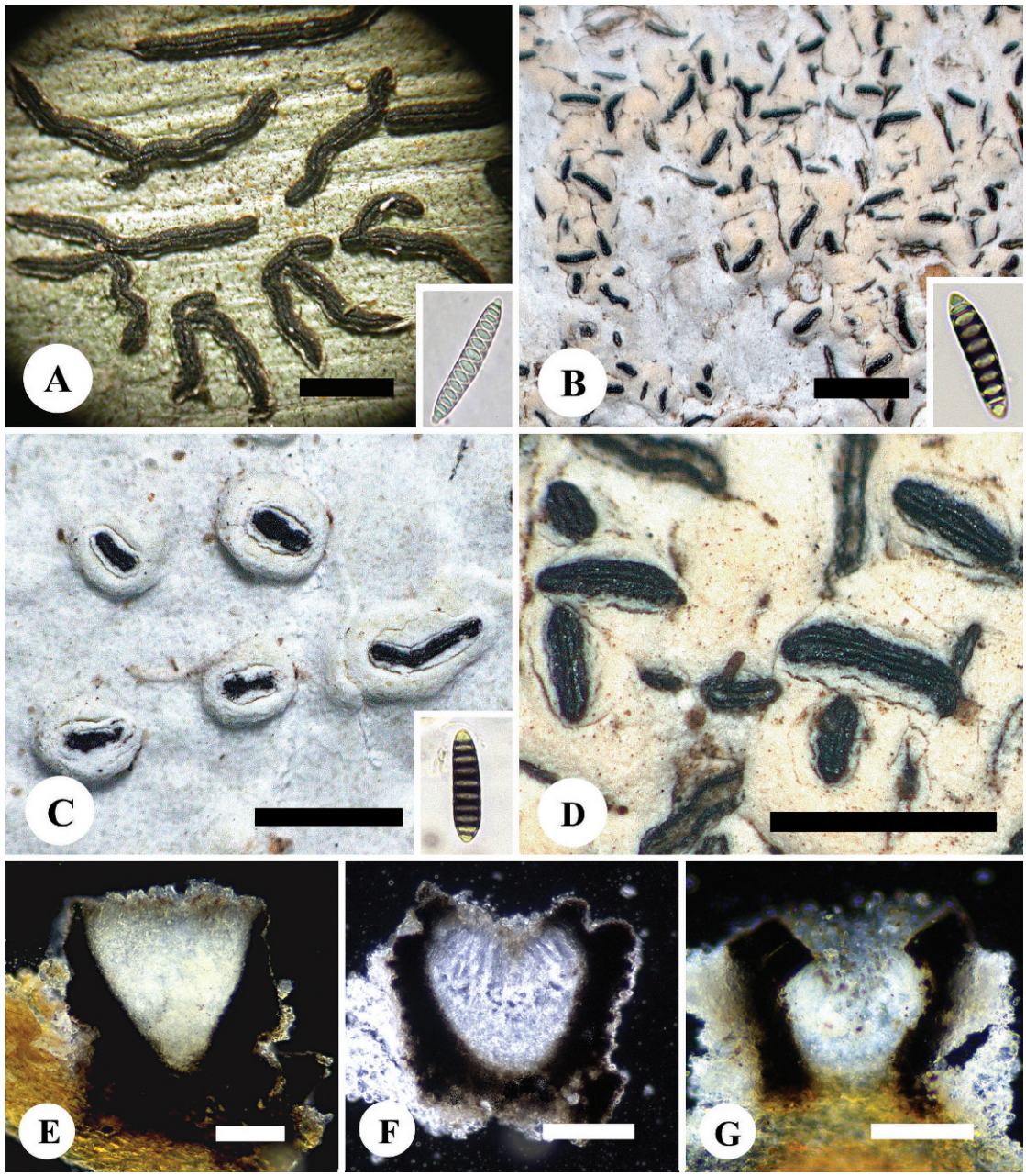

Figure 1. New *Graphis* species from Florida (all holotypes). **A.** *G. brittoniae*. **B.** *G. hinnulea*. **C.** *G. elevata*. **D.** *G. hinnulea* (lirellae with striate labia). **E.** *G. brittoniae* (completly carbonized exciple usually thick at the base). **F.** *G. hinnulea* (completely carbonized exciple typically thin at the base). **G.** *G. elevata* (laterally carbonized exciple). Scales: A–D = 1mm; E–G = 100 µm.

live oak (*Quercus virginiana*). We have also collected it from Miccosukee tribal lands north of the Park.

Discussion. *Graphis brittoniae* is widely dispersed throughout the Park and a component of all ecological niches. It contains norstictic acid and can be recognized by its *Opegrapha*-like lirellae lacking a thalline margin, an entire labia, closed discs, inspersed hymenium and medium size ascospores. Superficially and chemically it is very similar to *G. desquamescens* but that species has considerably shorter ascospores, which are 6–10 locular (see discussion under that species). Other similar species having an inspersed

hymenium and a completely carbonized exciple are *G. anfractuosa* and *G. cupei* but both contain no substances. Among the other known *Graphis* of the World containing norstictic acid and lacking a thalline margin, only *G. inspersolongula* Aptroot of the East Indies shares the traits of inspersed hymenium, completely carbonized exciple and transversely septate ascospores with *G. brittoniae*. However, that species has large ascospores (75–100 µm) and striate labia. *G. brittoniae* is quite probably the same as *Graphis* sp. 23509 of Harris (1995). Although Harris mentioned the lirellae of that species as mostly immersed, they may have been in the erumpent stage.

Additional specimens examined (all at FNPS). Miami–Dade Co.: Two km south of Nine Mile Pond, twigs of unknown dead tree, 629E. Pa-hay-okee Hammock, bark of *Taxodium distichum*, *F. Seavey & J. Seavey 1307E*. Sissal Hammock, bark of *Magnolia virginiana, F. Seavey & J. Seavey 1481E*. Dewhurst Hammock, bark of *Conocarpus erectus, F. Seavey & J. Seavey 1842E*. Long Pine Key Extension Road, bark of *Ilex cassine, F. Seavey & J. Seavey 4636E*.

Graphis hinnulea F.Seavey & J.Seavey *sp. nov.* **Figs. 1B, D & F**

Mycobank #: 563632

Thallus corticatus, albidus ad hinnuleus, planus aut undulatus. Lirellae immersae, brevissimae, 0.3–0.7 mm longae, cum 1 ad 4 immersae in pseudostromae. Labiae striatae. Discus clausus. Ascosporis 33–40 × 7–8 µm, 7–9 septatis. Acidum norsticticum et sticticum continens.

TYPE: U.S.A. FLORIDA. Miami–Dade Co.: Pinelands of Everglades National Park near Osteen Hammock. 25° 24″N 80° 38″W. Habitat: Upland fire adapted *Pinus elliottii* dominated community with associated temperate shrub species. Collected on bark of *Lysiloma latisiliquum, F. Seavey & J. Seavey 3890E* (Holotype: FNPS).

Diagnosis. Thallus circular, 2–3 cm broad, white to pale brown, corticate, smooth to uneven. Lirellae black, epruinose, erumpent, short, straight to occasionally bent, rarely branched, 0.3–0.7(0.9) × 0.14–0.18 mm, arranged in pale brown pseudostromata-like tissue, with lateral thalline margin; labia becoming striate; disc closed. Exciple completely carbonized; hymenium inspersed; epihymenium pale brown. Ascospores 8 per ascus, 33–40 × 7–8 µm, 8–10 celled.

Chemistry. Norstictic and stictic acids.

Distribution and habitat. The collection sites are widely dispersed within open pinelands. *Graphis hinnulea* so far has only been found on isolated smooth bark trees in nearly full sun.

Etymology. After the fawn color of the fertile sections of the thallus.

Discussion. *Graphis hinnulea* is known from two locations within the pineland forests of Everglades National Park. Infertile parts of the thallus are smooth and white but lirellae are aggregated in confluent wart-like pseudostromatic pale brown tissue. In our observations lichens with white thalli and high concentrations of norstictic acid may appear pale brown when exposed to full sun or after herbarium storage, e.g. *Platygramme pachnodes*. In our lab we have also demonstrated via TLC that occasionally norstictic acid will become slightly to significantly more concentrated around the lirellae, e.g in *G. librata* and *G. intricata*. When first encountered we suspected that phenomena was the cause of the fawn colored areas of this collection. However, equal weights of both the white and fawn parts of the thallus (to ± .01 g.) failed to show any significant differences by TLC.

Within *Graphis* the presence of pseudostromata is rare. We are able to locate only one other species, *G. hyphosa* Staiger, for which it has previously been reported. That species has a non-inspersed hymenium and contains no substances. In our collections about 20% of the lirellae, all located near the center of the thallus, are striate while peripheral lirellae are entire. We interpret this as having striate labia. Both collections have the same dual acid chemistry.

Additional specimens examined. Miami–Dade Co.: Open pinelands between Junk and Wright Hammocks, bark of *Ilex cassine, F. Seavey & J. Seavey 4881E* (FNPS).

Graphis elevata F.Seavey & J.Seavey *sp. nov.* **Figs. 1C & G**

Mycobank #: 563633

Similis G. lineola sed lirellis minoribus, 0.1–0.3 mm longis, immersis solitariis in pseudostromae elevatae differt.

TYPE: U.S.A. FLORIDA. Miami–Dade Co.: Lott Hammock within Everglades National Park. 25° 24″N 80° 42″W. Habitat: In near full sun among pioneer tree species along margin of pineland hammock. Collected on bark of *Lysiloma latisiliquum*, *F. Seavey & J. Seavey 4665E* (Holotype: FNPS).

Diagnosis. Thallus white, corticate over non-fertile zones, smooth. Lirellae black, epruinose, immersed, short 0.3–0.7 × 0.10–0.14 mm, unbranched, solitary within distinctly elevated pseudostromata-like ecorticate structures; labia entire; disc closed. Exciple laterally carbonized; hymenium inspersed; epihymenium clear with a few scattered brown crystals in section, KOH −. Ascospores 8 per ascus, 30–45 × 8–10 µm, 10–12 celled.

Chemistry. No substances. However, one collection showed a trace of norstictic acid.

Distribution and habitat. *Graphis elevata* is widely distributed throughout the 1800 hectare (4500 acres) pineland forests of the Park. As in the case of *G. hinnulea*, it has been found only on lone smooth bark trees.

Etymology. Refers to the distinctly elevated pseudostromatic tissue in which the lirellae form.

Discussion. *Graphis elevata* is known from several collections both from open pinelands and hammocks within pinelands of the Park. All collections to date have been made on the smooth bark of Wild Tamarind (*Lysiloma latisiliquum*). Excipular carbonization, hymenium inspersion, labia type, spore size and septation are similar to *G. lineola.* However, the lirellae of *G. elevata* are always solitarily immersed in severely raised ecorticate pseudostroma-like tissue consisting of a thick layer of medullary fungal tissue mixed with scattered crystals. The algal layer within the pseudostroma is present but much thinner than within the thallus at large. Thallus tissue not associated with these structures is generally corticate although some small ecorticate patches can be found. But close inspection of the ecorticate areas show these to be primordia in various stages of elevation.

Additional specimens examined (all FNPS). Miami-Dade Co.: Open pinelands near Osteen Hammock, bark of *Lysiloma latisiliquum, F. Seavey & J. Seavey 4908E.* Along pineland fireroad near Fairchild Hammock, bark of *Lysiloma latisiliquum, F. Seavey & J. Seavey 4802E.* Open pineland at edge of Rattlesnake Hammock, bark of *Lysiloma latisiliquum, F. Seavey & J. Seavey 4777E.* Open pineland between Osteen and Rattlesnake Hammock, bark of *Lysiloma latisiliquum*, *F. Seavey & J. Seavey 4452E.*

New Records for North America and notes on other selected species

Descriptions are based on Park collections (FNPS). All collections are corticolous and made by the authors from Everglades National Park, Florida, U.S.A. except where noted. For type locations and synonymy, refer to Lücking et al. (2009).

Graphis analoga Nyl. **Figs. 2A & 7A**

Diagnosis. Thallus corticate, smooth, pale gray. Lirellae epruinose, prominent with a lateral to more commonly basal thalline margin, 1–4 mm long, highly flexuous, partly branched, often abundant. Labia entire. Disc closed. Excipulum laterally carbonized, the carbonization well separated at the base. Hymenium not inspersed. Ascospores hyaline, muriform, 23–30 × 9–11 µm, 6–8 × 2–3, 8/ascus.

Chemistry. Norstictic acid.

Discussion. Due to the large range expansion we viewed this identification skeptically but can find no reason to negate it. Lücking et al. (2009) assign this species to the *hossei* morphotype and our collection matches that well. In the Everglades' two collections, the lirellae are abundant but rarely more than once or twice branched. Reports of *Graphis analoga* having richly branched lirellae may have been misidentifications ascribed to *G. renschiana* another small muriform spored *Graphis* also containing norstictic acid. The use of these two names as well as *G. gracilis* has been confused until clarified by Lücking et al. (2009). *Graphis renschiana* can be separated from *G. analoga* by its lateral thalline margin and less prominent but considerably longer (*deserpens* morphotype), more richly branched lirellae (**Fig. 6A**). The collection site for *G. analoga* consists of a landscaped parking lot with several planted mahogany trees. The second collection site is highly visited and as such only one collection suitable for curation was obtained.

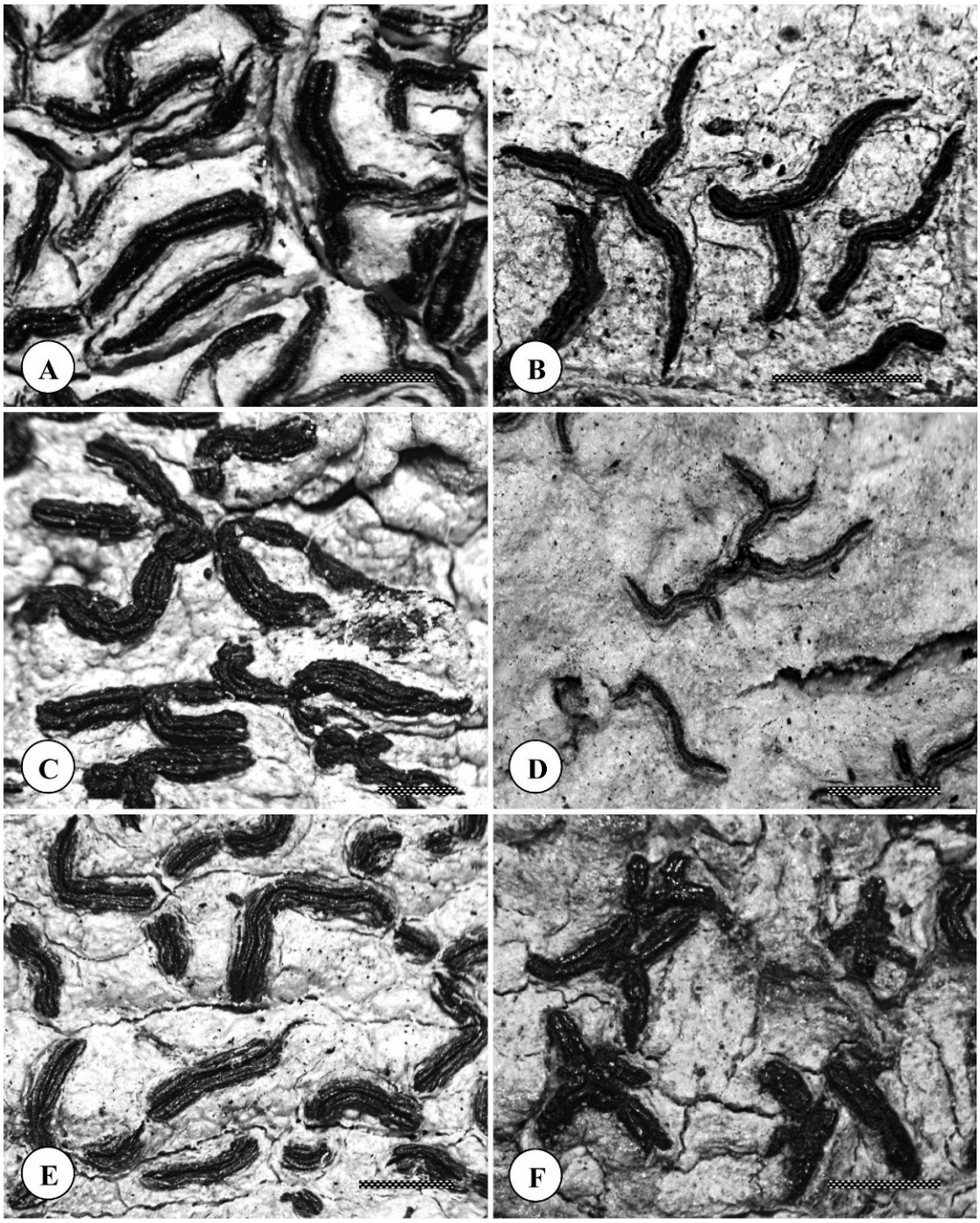

Figure 2. Habit of *Graphis* species from Florida. **A.** *G. analoga.* **B.** *G. anfractuosa.* **C.** *G. antillarum.* **D.** *G. caesiella.* **E.** *G. chlorotica.* **F.** *G.chromothecia.* Scale: 1 mm.

However, most trees have visually similar entities and subsequent minute collections from each of these confirmed the presence of *G. analoga* on at least four other trees.

Specimens examined (all FNPS). Miami-Dade Co.: Road margin leading to Mahogany Hammock, *Swietenia mahagoni,* 746E. Mahogany Hammock parking area, *Swietenia mahagoni, F. Seavey & J. Seavey 2404E.*

Graphis antillarum Vain. **Figs. 2C & 7C**

In one of our collections the excipular carbonization varies from distinctly apical to nearly lateral on the same thallus. We have chosen to show the most extreme example of the latter (**Fig. 7C**). That thin section was obtained from the collection shown in **Fig. 2C**. The only other laterally carbonized, muriform spored *Graphis* with striate margins and containing norstictic acid is *G. neoelongata* (**Fig. 5E**), a *dichotoma* morph quite dissimilar from *G. antillarum* (*tenella* morph).

Graphis caesiella Vain. **Figs. 2D & 7D**

Harris (1990, 1995) reported the chemistry of *Graphis caesiella* s. lat. as containing either stictic acid or protocetraric acid. However, *G. caesiella* s. str. contains norstictic acid. The specimens viewed by Harris may have been *G. dendrogramma* (stictic acid) and *G. supracola* (protocetraric acid), both similar pruinose species. Although Hale (1968) recognized these three metabolites occurred independently in *G. caesiella* collections from the West Indies, Mexico and Florida, he apparently considered them as chemotypes of the same species as he did not make new combinations from them. However, following Lücking et al. (2009) we recognize these as three separate species with *G. dendrogramma* and *G. supracola* being new additions to the North American checklist. Also see discussion under *G. supracola.*

Graphis chlorotica A. Massal **Figs. 2E & 7E**

Diagnosis. Thallus shiny gray, thick, verruculose, indurated. Lirellae epruinose, erumpent with lateral thalline margin, short to slightly elongate, flexuous, sparsely branched. Labia striate. Disc closed. Exciple carbonized apically. Hymenium not inspersed. Ascospores hyaline, 28–45 × 9–11 µm, 10–13 celled. 4–8/ascus but usually less than 8.

Chemistry. No compounds detected.

Discussion. This collection is included here for informational purposes as it was collected in Manatee County well up the west coast of Florida and not in the Park. The type is from the Eastern Paleotropics but collections have been made from Costa Rica and it seems likely to occur in the West Indies as well. *Graphis chlorotica* (*tenella* morph) can be misidentified as *G. proserpens* Vainio but the latter has longer, usually well branched lirellae and an absent or basal thalline margin (*striatula* morph).

Specimen examined (FNPS). Manatee Co.: Along Palma Sola Creek, *Calistemon viminalis F. Seavey & J. Seavey 1236ST.*

Graphis cincta (Pers.) Aptroot **Figs. 3A & 7G**

Diagnosis. Thallus white, smooth, corticate. Lirellae epruinose, erumpent with lateral thalline margin, short to elongate, straight to curved, unbranched to sparsely branched. Labia entire. Disc closed. Excipulum carbonized laterally (see discussion). Hymenium inspersed. Ascospores hyaline, 27–45 × 7–10 µm, 8–10(12) celled. 8/ascus.

Chemistry. Norstictic acid.

Discussion. We had previously assigned this to *Graphis tenellula* Vain., a species known from the West Indies. This has now been included in *G. cincta* (an older name), which as such is now pantropical. One collection assigned to this species from outside the Park had an excipulum structure which was nearly completely carbonized. Although Lücking et al. (2009) describe the thalline margin as basal to lateral, we have observed only the latter. Superficially *G. cincta* is quite similar to *G. librata, G. lineola* or *G. leptocarpa* but can be separated from all three by the inspersed hymenium and the presence of norstictic acid. A very common taxon in the Park had formerly been assigned to *Graphis* sp. Britton 664 following the key in Harris (1995). It has short, more or less straight, unbranched lirellae rarely more than 1.5 mm long but otherwise is identical to *G. cincta.* Additionally, although shorter on average, the length of Britton 664 overlaps with the lower end of the range scale of *G. cincta* (Archer 2001, 2009, see above) and, therefore, we believe these to be conspecific and thus assign *G.* sp. Britton 664 to *G. cincta.*

Specimens examined (all FNPS). Monroe Co.: Cape Sable, *F. Seavey & J. Seavey 1513E.* Murray Key, *Rhizophora mangle, F. Seavey & J. Seavey 3733E & 3647E.* Cape Sable, *Piscidia piscipula, F. Seavey & J. Seavey 3881E.* One km west of Rowdy Bend, *Conocarpus erectus F. Seavey & J. Seavey 3006E.* Miami–Dade Co.: North margin of West Lake, *Rhizophora mangle, F. Seavey & J. Seavey 774E.* Madeira Ditches, *Sabal palmetto, F. Seavey & J. Seavey 1264E.* Fire road near Osteen Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 4183E.*

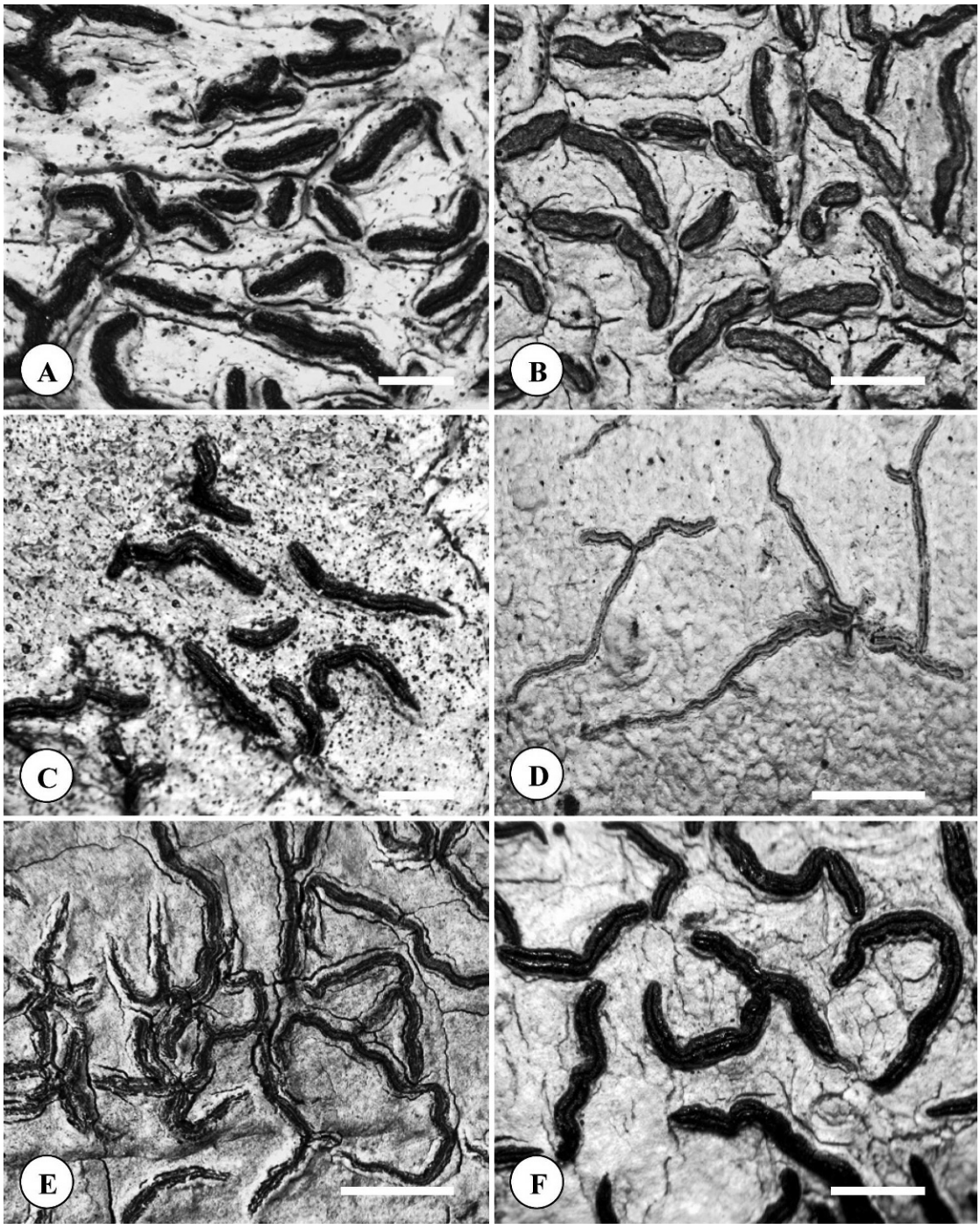

Figure 3. Habit of *Graphis* species from Florida. **A**. *G. cincta.* **B.** *G. crebra.* **C.** *G. cupei.* **D.** *G. dendrogramma* (formerly *G. ceylanica*) **E.** *G. dendrogramma* **F.** *G. desquamescens* Scale: 1mm.

Along Old Ingraham Highway near Coe cypress dome, *Metopium toxiferum, F. Seavey & J. Seavey 4583E.* Elliott Key, Biscayne National Park, *Swietenia mahagoni, F. Seavey & J. Seavey 3960B.* Southwest bank of West Lake, *Rhizophora mangle, F. Seavey & J. Seavey 2448E.* 2.2 km west of Dan Beard Center, *Acer rubrum, F. Seavey & J. Seavey 4434E.*

Graphis crebra Vain. **Figs. 3B & 7**H

Diagnosis. Thallus corticate, dull to somewhat shiny, pale gray. Lirellae erumpent with lateral thalline margin, short, unbranched to rarely once branched, straight to slightly curved. Labia entire. Disc becoming exposed very early, with a distinct white pruina. Excipulum laterally carbonized. Hymenium inspersed. Ascospores hyaline, 29–33 × 8–9 µm, 9–12 celled, 8/ascus.

Chemistry. Norstictic acid.

Discussion. In the Neotropics *Graphis crebra* is known from Guadeloupe, St. Helena and the Galapagos. All of our collections have been from close proximity to the seashore. Among the similar accepted species by Lücking et al. (2009), *G. streimannii* of Australia has considerably larger spores with longer, more branched lirellae. *Graphis cincta* lacks open pruinose discs while the exposed discs of *G. handelii* lack pruinosity.

Specimens examined (all FNPS). Monroe Co.: Northwest Cape Sable, *Piscidia piscipula,* 455E. Murray Key, *Conocarpus erectus, F. Seavey & J. Seavey 3679E.* Miami–Dade Co.: Elliott Key, Biscayne National Park, *Pithecelobium keyense, F. Seavey & J. Seavey 4507B.* Wright Hammock, *F. Seavey & J. Seavey 4262E.*

Graphis dendrogramma Nyl. **Figs. 3D, E & 7J**

Diagnosis. Thallus corticate, matte, bluish-gray to pale gray. Lirellae white pruinose, immersed, occasionally barely erumpent, with lateral thalline margin, elongate to very long, richly to irregularly branched. Labia entire. Disc closed. Exciple carbonized laterally. Hymenium not inspersed. Ascospores hyaline, 20–45 × 6–8 µm, 8–12 celled, 8/ascus.

Chemistry. Stictic acid complex.

Discussion. As now defined by Lücking et al. (2009), *Graphis dendrogramma* incorporates several previously autonomous species of both the *caesiella* and *dendrogramma* morphotypes. In the Park both the *caesiella* morphotype (formerly *G. ceylanica* Zahlbr. **Fig. 3**D) and the *dendrogramma* morphotype (**Fig. 3**E) have been found. In Everglades material the former has longer ascospores (30–45 µm), wandering, irregularly branched lirellae and a white thallus while the ascospores of the latter average 20–30 µm with very long and richly branched lirellae. The thallus usually has a bluish tint. Both contain stictic acid as the sole metabolite. Although we have not seen the holotype, there seems to be substantial reason to keep *G. ceylanica* as a separate entity based on Everglades material due to the ascospore size difference, different morphotypes and thallus color.

Specimens examined (all FNPS). Monroe Co.: Abandoned roadbed near Rowdy Bend, *Pisonia aculeata, F. Seavey & J. Seavey 928E.* Bear Lake trailhead, *Bursera simaruba, F. Seavey & J. Seavey 3169E.* Bear Lake Mounds, *Eugenia axillaris, F. Seavey & J. Seavey 3385E* & *3551E.* Coot Bay Hammock, *Erythrina herbacea, F. Seavey & J. Seavey 4098E.* Miami–Dade Co.: Deer Hammock, unknown dead tree, *F. Seavey & J. Seavey 3510E.* Deer Hammock, *Ocotea coriacea, F. Seavey & J. Seavey 3534E.* Mahogany Hammock, *Ficus aurea, F. Seavey & J. Seavey 3795E* & *3796E.* Elliott Key, Biscayne National Park, *Swietenia mahagoni, F. Seavey & J. Seavey 4043B.* Collier Co.: Sandfly Key, *Krugiodendron ferreum, F. Seavey & J. Seavey 5001E.*

Graphis desquamescens (Fée) Zahlbr. **Figs. 3F & 7**K

Discussion. In the literature there seems to be little agreement regarding ascospore length of this species. They are variously given as 23–35 µm (Wirth & Hale 1978), 25–50 µm (Lücking et al. 2009), 18–25 µm (Harris 1995). Lücking et al. (2011) mention the lectotype ascospores measure 25–35 µm. All Park collections fall within a range of 23–38 (–45) µm and are 6–9 (–10) locular.

Graphis filiformis Adaw. & Makhija **Figs. 4A & 7L**

Diagnosis. Thallus corticate, matte, pale gray. Lirellae erumpent with lateral thalline margin, slender, very long, richly to radially branched, flexuous. Labia entire, rarely a few exhibiting slight striation. Disc closed. Exciple laterally carbonized. Hymenium not inspersed. Ascospores hyaline, 22–32 × 8–10 µm, 6–7 celled, 8/ascus.

Chemistry. Norstictic acid.

Discussion. *Graphis filiformis* was recently (Adawadkar & Makhija 2007) described from India

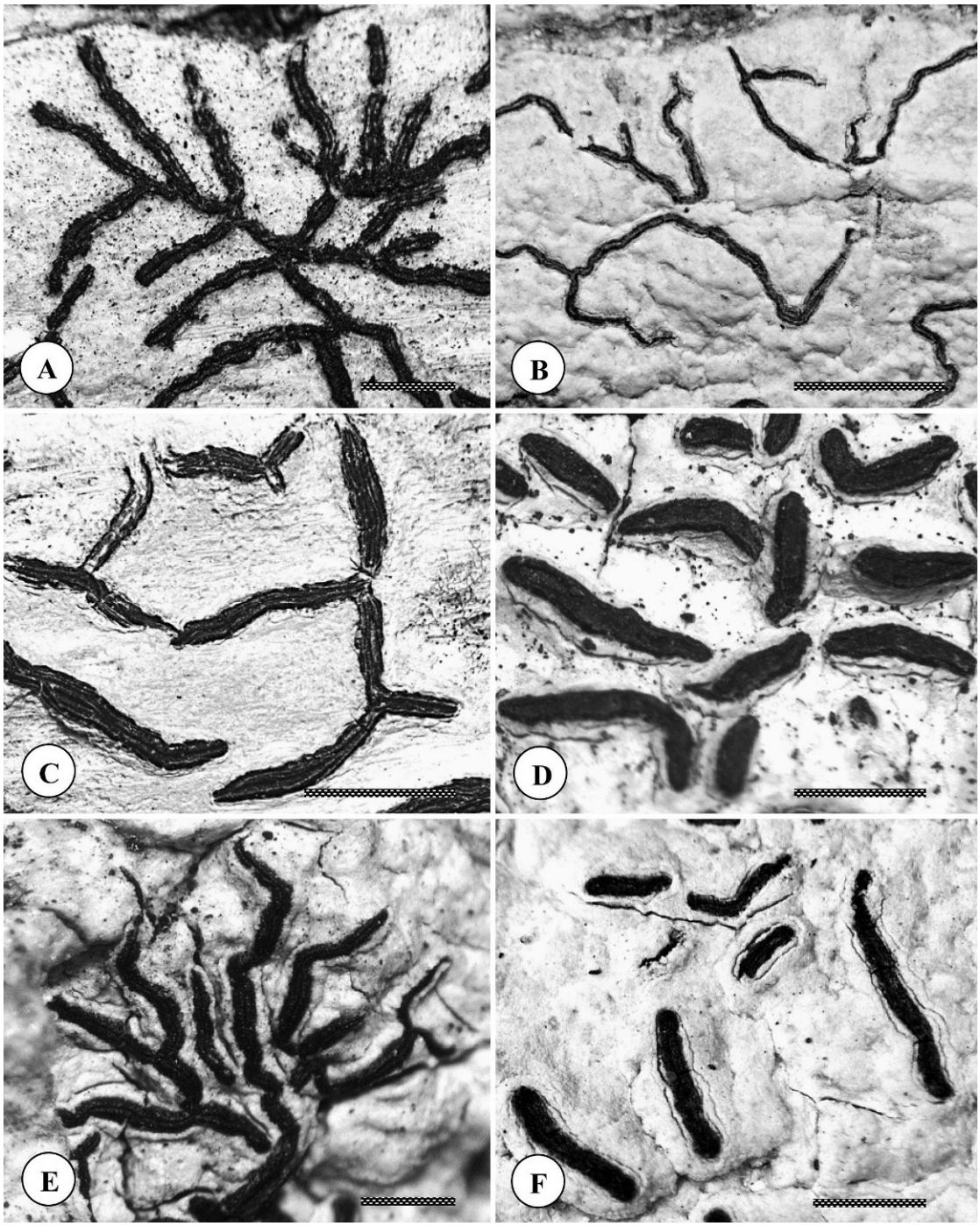

Figure 4. Habit of *Graphis* species from Florida. **A.** *G. filiformis* **B.** *G. furcata* **C.** *G. haleana.* **D.** *G. handelii.* **E.** *G. intricata.* **F.** *G. leptocarpa.* Scale: 1 mm.

and as far as we know the record from Florida is the first published account of it in the Western Hemisphere. The similar *G. librata* differs from this taxon only in the length and branching traits of the lirellae (see Lücking et al. 2008 for a discussion of these related species). In *G. filiformis* the lirellae are very long and richly to radially branched while those of *G. librata* are short and irregularly branched. Both

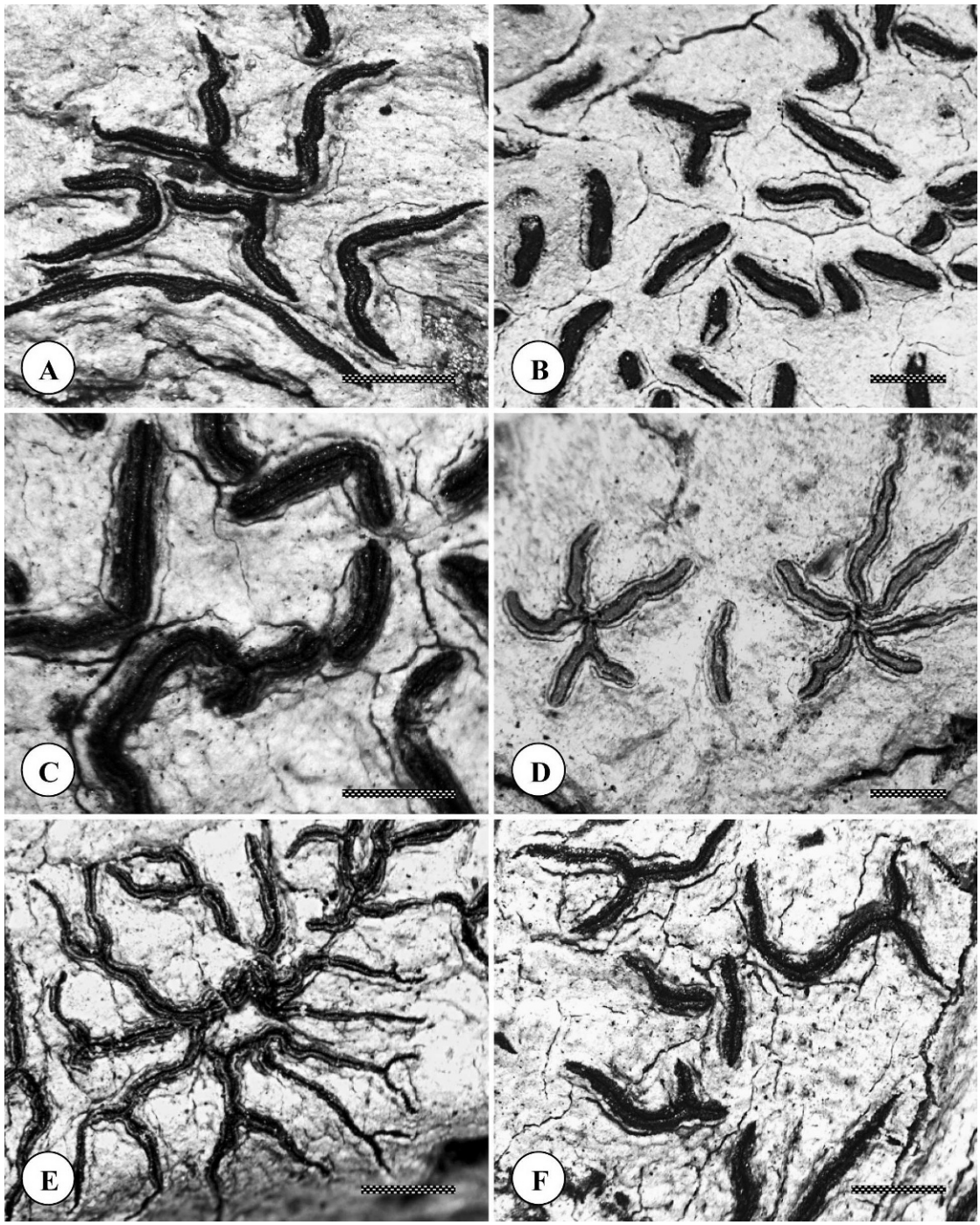

Figure 5. Habit of *Graphis* species from Florida. **A.** *G. librata.* **B.** *G. lineola.* **C.** *G. lucifica.* **D.** *G. modesta.* **E.** *G. neoelongata.* **F.** *G. pinicola.* Scale: 1 mm.

are epruinose. *G. dendrogramma* (*dendrogramma* morph) often has similar radially branching lirellae but contains stictic acid and the lirellae are pruinose. *G. caesiella* also contains norstictic acid but has shorter less branched lirellae that also are pruinose.

Specimens examined (all FNPS). Miami-Dade Co.: Dwarf Cypress Forest, *Taxodium ascendens, F.*

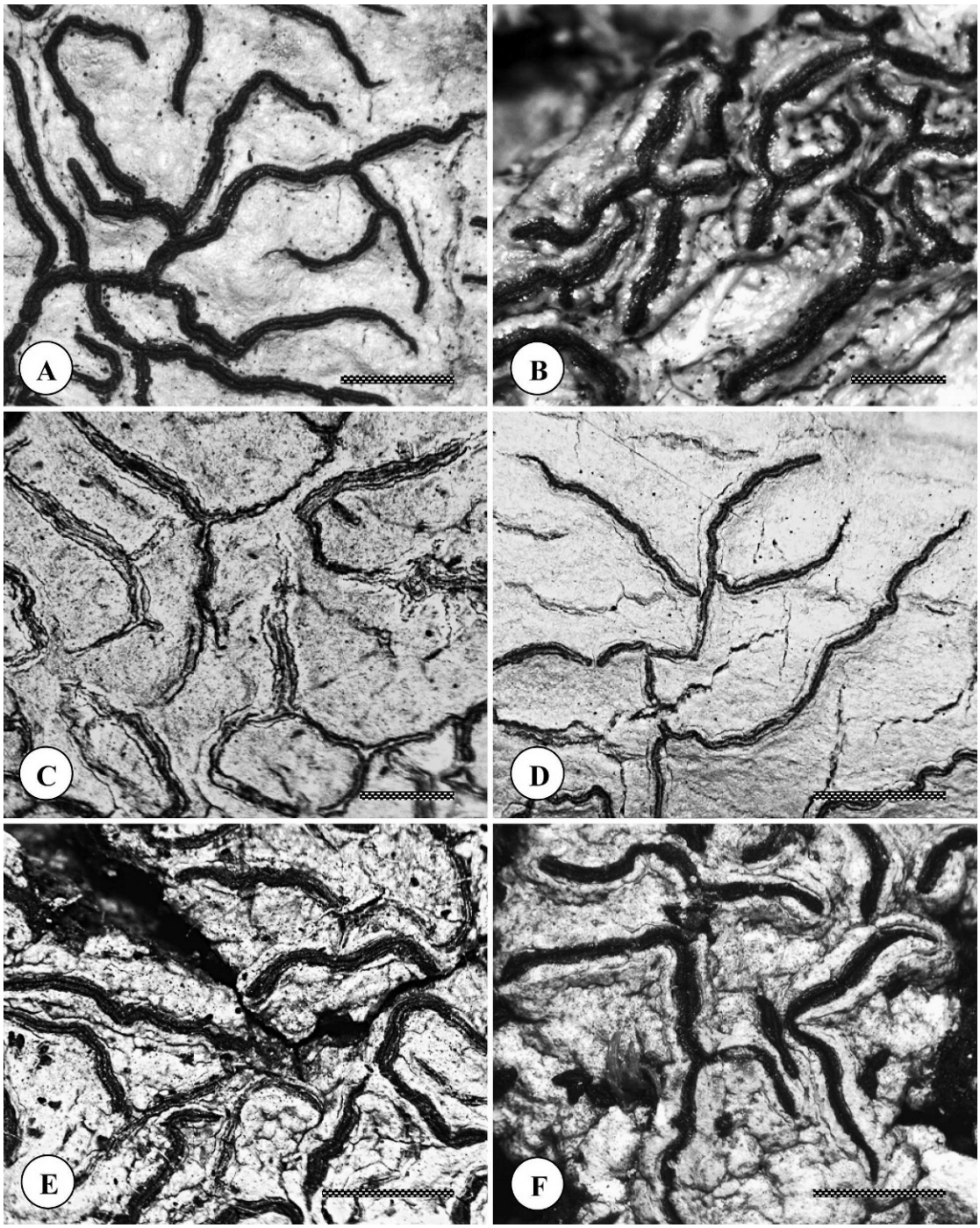

Figure 6. Habit of *Graphis* species from Florida. **A.** *Graphis renchiana* **B.** *G. stellata* **C.** *G. subamylacea* **D.** *G. supracola* **E.** *G. tenella* **F.** *G. xylophaga.* **Scale** 1 mm.

Seavey & J. Seavey 3547E. Mahogany Hammock, *Calyptranthes zuzygium, F. Seavey & J. Seavey 2406E.* Along fire road leading to Osteen Hammock. *Lysiloma latisiliquum, F. Seavey & J. Seavey 4608E.*

Graphis furcata Fée **Figs. 4B & 8A**

Diagnosis. Thallus white to bluish-white, usually mostly ecorticate, loose and appearing granular.

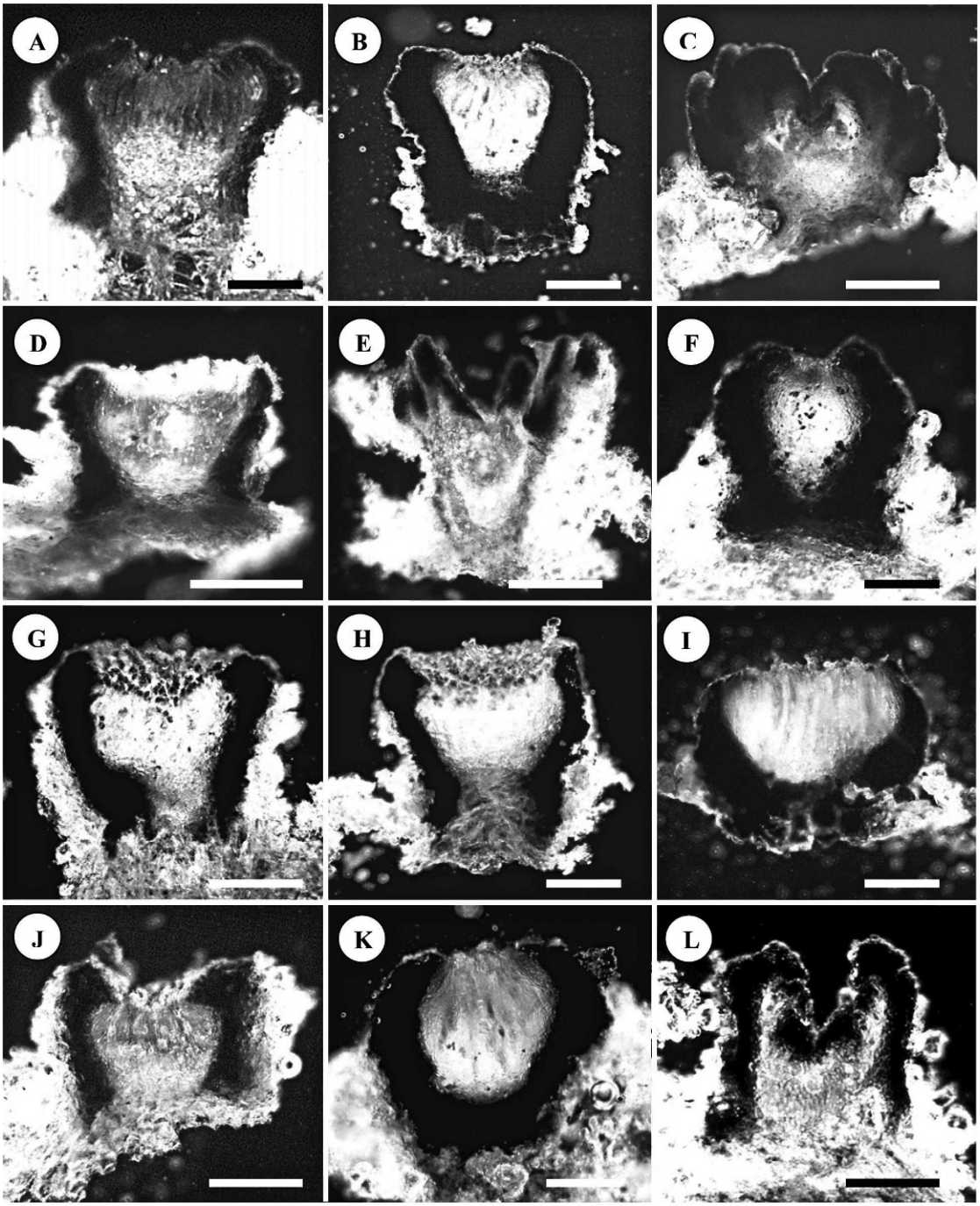

Figure 7. Habit of *Graphis* species from Florida. **A.** *G. analoga.* **B.** *G. anfractuosa.* **C.** *G. antillarum.* **D.** *G. caesiella.* **E.** *G. chlorotica.* **F.** *G. chromothecia.* **G.** *G. cincta.* **H.** *G. crebra.* **I.** *G. cupei.* **J.** *G. dendrogramma.* **K.** *G. desquamescens.* **L.** *G. filiformis.* Scale: 100 μm.

Lirellae thinly white pruinose, erumpent with lateral thalline margin, slender, elongate, normally once branched, undulate and flexuous. Labia entire. Disc closed. Hymenium not inspersed. Ascospores hyaline, 20–32 × 5–9 μm, 6–10 celled, 8/ascus.

Chemistry. No compounds detected.

Discussion. *Graphis furcata* is part of the taxonomically challenging *G. scripta* group, an assemblage of 15–20 species. Within that group only *G. scripta* and *G. furcata* have a clear hymenium,

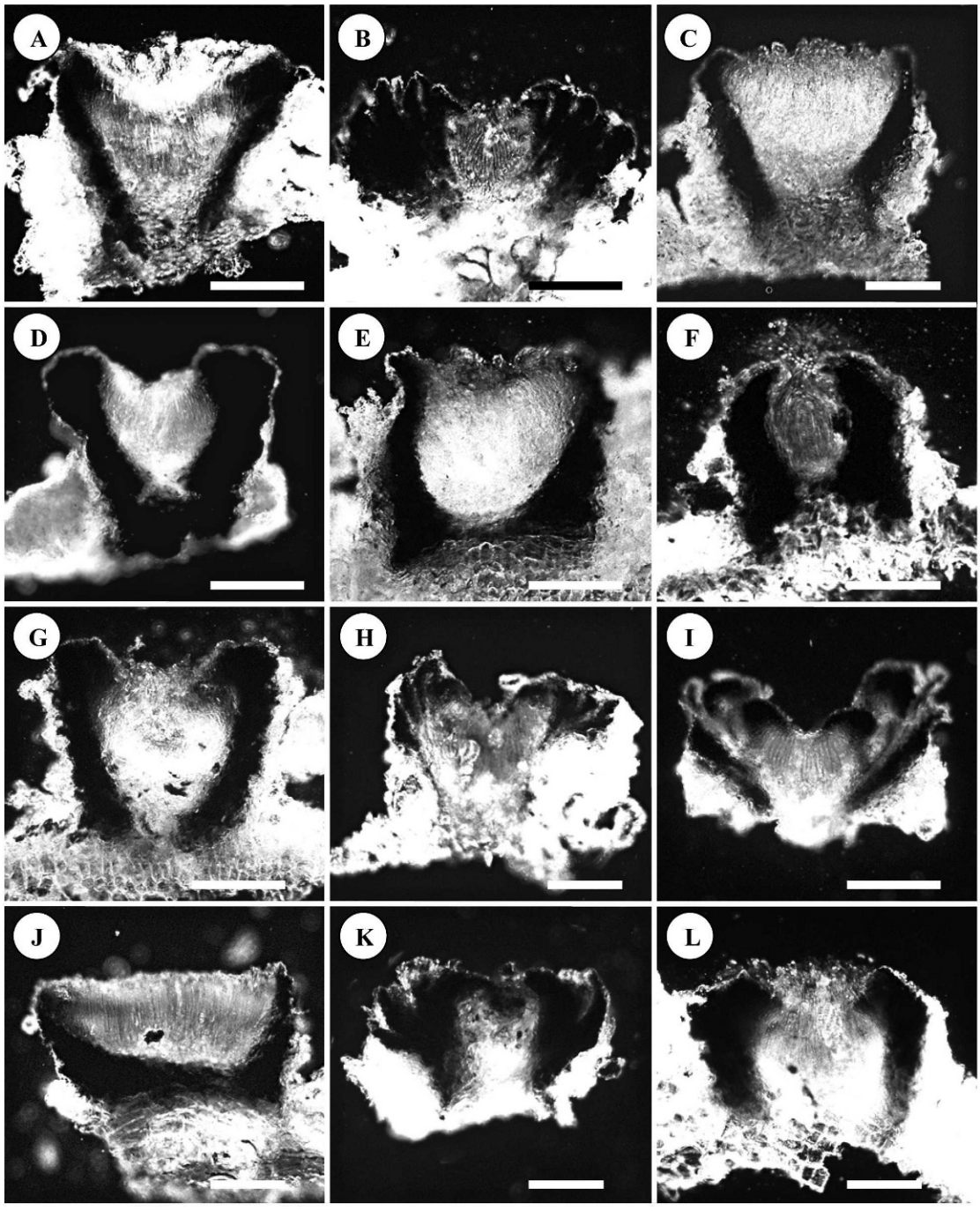

Figure 8. Habit of *Graphis* species from Florida. **A.** *G. furcata.* **B.** *G. haleana.* **C.** *G. handelii.* **D.** *G. intricata.* **E.** *G. leptocarpa.* **F.** *G. librata.* **G.** *G. lineloa.* **H.** *G. lucifica* (anomalis apically carbonized section). **I.** *G. lucifica* (laterally carbonized). **J.** *G. modesta.* **K.** *G. neoelongata.* **L.** *G. pinicola.* Scale 100 μm.

pruinose lirellae and lack chemistry. In South Florida as in other tropical/subtropical zones *G. furcata* has commonly been misidentified as *G. scripta*, a species considered to be nontropical. However, the latter taxon has exposed discs and broader lirellae that lack the waviness exhibited by *G. furcata.* In addition, all collections of *G. furcata* from the Park are essentially ecorticate unlike *G. scripta.* For a more complete

discussion of the *G. scripta* group see Lücking et al. (2009).

Specimens examined (all FNPS). Miami–Dade Co.: North of Ficus Pond, *Magnolia virginiana, F. Seavey & J. Seavey 2919E.* Fran Young Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 3083E.* Fran Young Hammock, *Persea borbonica, F. Seavey & J. Seavey 3126E.* Fairchild Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 3691E.* Fire road near Osteen Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 3825E.* Fire road near Fairchild Hammock, *F. Seavey & J. Seavey 4136E.* Edge of Rattlesnake Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 4927E.*

Graphis leptocarpa Fée **Figs. 4F & 8E**

Graphis leptocarpa is a common pantropical species widespread throughout most of the West Indies and into Florida. However, of nearly 500 *Graphis* collections only two have been identified as *G. leptocarpa.* Additionally, the collections made contain norstictic acid as well as stictic acid, the latter being the normal metabolite associated with the species. In all other ways the voucher specimen agrees exactly with *G. leptocarpa.* Harris (1990, 1995) reported both chemicals for that species but we can find no other reference of norstictic acid being associated with it. Possibly the species reaches its northern limit in South Florida as evidenced by the paucity of collections. Harris (1995) listed it only for Miami-Dade County at the southern tip of the peninsula.

Graphis lucifica R.C.Harris **Figs. 5C, 8H & I**

Treatments of this species describe the exciple as being laterally carbonized (Lücking et al. 2008; Lücking et al. 2009). However, in our collections of *G. lucifica* we find this not to be totally reliable. The exciple from lirellae on the same thallus can be both laterally and apically carbonized (**Figs, 8H & I**). In one case we found both degrees of carbonization within the same lirella.

Graphis modesta Zahlbr. **Figs. 5D & 8J**

Diagnosis. Thallus white to grayish-white, matte, corticate. Lirellae erumpent with lateral thalline margin, usually radially to stellately branched. Labia entire, thin. Disc exposed and white pruinose. Exciple completely carbonized. Hymenium clear. Ascospores hyaline, 20–28 × 6–8 µm, 6–8 celled, 8/ascus.

Chemistry. Stictic acid complex.

Discussion. Previously known only from the Paleotropics, *Graphis modesta* is another *G. scripta* morph (open pruinose discs, labia entire, lateral thalline margin, small ascospores) separated from others in that group by its completely carbonized exciple and the presence of stictic acid. Among other open-disc species, *G. handelii* has shorter less branched non-pruinose lirellae, an inspersed hymenium and contains norstictic acid. *Graphis crebra* has a laterally carbonized exciple, contains norstictic acid and is rarely branched.

Specimens examined (all FNPS). Miami-Dade Co.: One mile south of Pa-hay-okee, *Taxodium distichum, F. Seavey & J. Seavey 2631E.* Fairchild Hammock, *Schinus terebinthifolius, F. Seavey & J. Seavey 3900E.* Monroe Co.: Abandoned trail between Rowdy Bend and Buttonwood Canal, *Pisonia aculeata, F. Seavey & J. Seavey 930E.*

Graphis neoelongata Lücking **Figs. 5E & 8K**

Diagnosis. Thallus pale brownish-gray, corticate, matte to slightly shiny. Lirellae epruinose, immersed to erumpent with lateral thalline margin, richly branched, usually stellate. Labia striate at least in central part of lirellae. Disc closed. Exciple laterally carbonized. Hymenium not inspersed. Ascospores hyaline, muriform, 27–33 × 12–14 µm, 6–8 × 3–4 celled, 4/ascus.

Chemistry. Norstictic acid, trace stictic acid.

Discussion. *G. neoelongata* (*dichotoma* morph) is described as having both norstictic and stictic acids. Our one collection has only a trace of the latter. However, all other laterally carbonized, muriform spored *Graphis* with striate margins contain no substances or lack the long radiate branching characteristic of *G. filiformis.* Our observation of the species having 4 spored asci should be viewed lightly as only the one collection has been investigated.

Specimen examined (FNPS). Miami–Dade Co.: Mosier Hammock, *Taxodium distichum, F. Seavey & J. Seavey 2248E.*

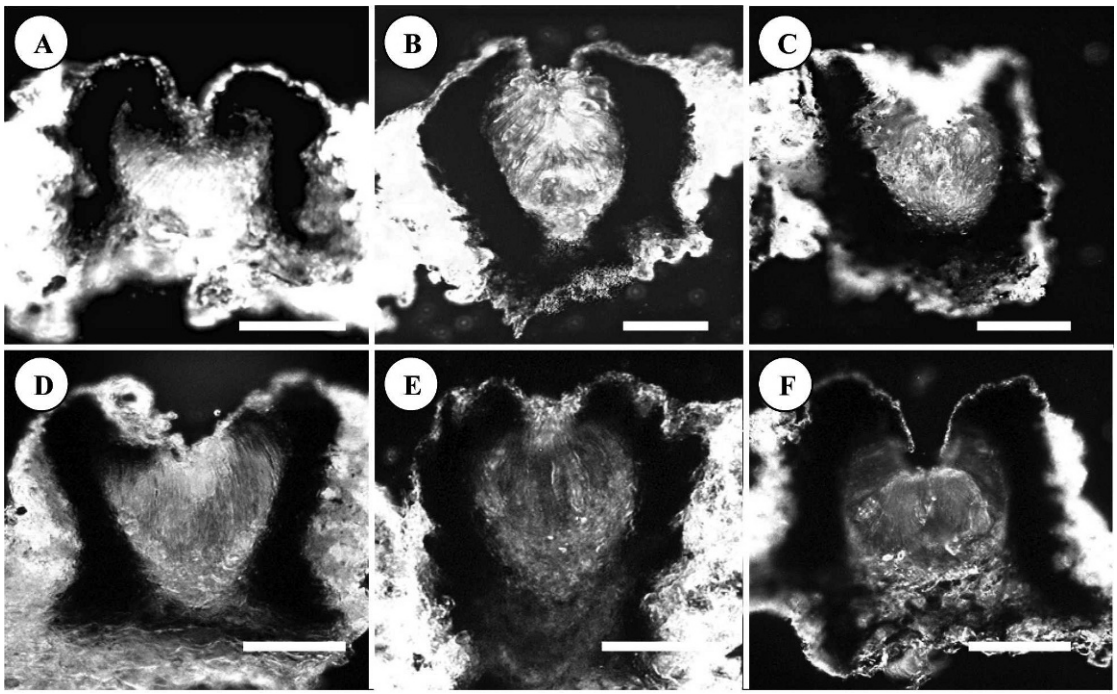

Figure 9. Habit of *Graphis* species from Florida. **A.** *G. renschiana.* **B.** *G. subamylacea.* **C.** *G. stellata.* **D.** *G. supracola.* **E.** *G. tenella.* **F.** *G. xylophaga.* Scale 100 μm.

Graphis pinicola Zahlbr. **Figs. 5F & 8L**

Diagnosis. Thallus white, matte, corticate. Lirellae erumpent, often quite prominent, short to moderately long, curved, only slightly flexuous, occasionally once branched, with lateral thalline margin. Labia entire. Disc closed. Labia and disc epruinose. Exciple laterally carbonized. Hymenium clear. Ascospores hyaline, 28–40 × 7–8 μm, 9–10 celled, 8/ascus.

Chemistry. No substances detected.

Discussion. Lendemer (2010) recently reported the probable presence of this species in North America from collections identified as *Graphis pavoniana* at NY. However, the spore sizes he obtained straddled two similar species, *G. pinicola* and *G. elongata* Zenker. In the Park *G. elongata* has not yet been found but *G. pinicola* is known from the southern end of the Park and along the west coast of Florida near Manisota Beach. The species may be overlooked due to its close resemblance to the common *G. lineola,* a species differing only in its inspersed hymenia. *G. pinicola* is also superficially similar to *G. librata,* another common species in the Park and throughout most of Florida. These can be reliably separated by their chemistry, the latter having norstictic acid. Although previously reported, we include *G. pinicola* here for informational purposes.

Specimens examined (all FNPS). Manatee Co.: 300 meters east of Manisota Beach, *Chrysobalanus icaco, F. Seavey & J. Seavey 1826ST*. Monroe Co. Bear Lake Mounds, *Erythrina herbacea, F. Seavey & J. Seavey 3549E.*

Graphis renschiana (Müll. Arg.) Stizenb. **Figs. 6A & 9A**

Diagnosis. Thallus most commonly white to pale gray but occasionally with a bluish-gray tint, corticate, moderately shiny. Lirellae erumpent, slender, epruinose with lateral thalline margin, long, sinuous, partly branched to more often richly branched. Labia entire. Disc closed. Exciple laterally carbonized. Hymenium clear. Ascospores hyaline, muriform, 23–38 × 10–15 μm, 6–8 × 2–3, 2–6/ascus.

Chemistry. Norstictic acid.

Discussion. *Graphis deserpens*, recently found in South Florida, shares the same morphotype with *G. renschiana*, but contains stictic acid. Two other

muriform spored species from the Paleotropics, *G. norstictica* and *G. borealis*, resemble the pantropical *G. renschiana* and have the same chemistry. However, each has larger ascospores and broader, less branched lirellae. *Graphis analoga* also has the same chemistry and spore type but the lirellaee are considerably shorter, less branched and have a basal or absent thalline margin.

Specimens examined (all FNPS). Miami–Dade Co.: Mahogany Hammock, *Swietenia mahagoni, F. Seavey & J. Seavey 746E.* Abandoned roadbed Old Ingraham Highway, *Metopium toxiferum, F. Seavey & J. Seavey 2042E.* Old Ingraham Highway near Madeira Ditches, *Sabal palmetto, F. Seavey & J. Seavey 2510E.* Dwarf Cypress Forest, *Taxodium ascendens, F. Seavey & J. Seavey 3513E.* Monroe Co. Clive Key, *Maytenus phyllanthoides, F. Seavey & J. Seavey 3840E.*

Graphis supracola A. W. Archer **Figs. 6D & 9**D

Diagnosis. Thallus pale gray to bluish-gray, thin and occasionally partly ecorticate, matte. Lirellae thin, white pruinose, immersed to erumpent with lateral thalline margin, long sinuous, loosely branched to occasionally stellate. Labia entire. Disc closed. Exciple carbonized laterally or occasionally nearly completely. Hymenium clear. Ascospores hyaline, 25–42 × 6–9 µm, 7–10 celled, 8/ascus.

Chemistry. Protocetraric acid.

Discussion. The Australian holotype of *Graphis supracola* features short to only moderately elongate lirellae, which are sparsely branched. However, Lücking et al. (2009) also accepted a Brazilian collection (*G. scripta* var. *candida* Zahlbr. nom. inval., not published) as *G. supracola.* Our collections are a close visual match to the Brazilian entity but not to the holotype. As mentioned by Lücking et al. (2009), protocetraric acid is an uncommon metabolite within the genus and, as far as we know, no other species of *Graphis* currently known from the Western Hemisphere contains it. *Graphis supracola* is very similar to both the *caesiella* and *dendrogramma* morphs of *G. dendrogramma* and chemistry is the most reliable method of separating them. *G. caesiella* also has immersed to erumpent, white pruinose lirellae but the lirellae are shorter, broader and normally less flexuous. It also contains norstictic rather than protocetraric acid.

Specimens examined (all FNPS). Miami–Dade Co.: Unnamed hammock 2 kilometers west of Mahogany Hammock, *Bursera simaruba, F. Seavey & J. Seavey 2316E.* Deer Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 3207E.* Unnamed hammock 3 kilometers west of Dan Beard Center, *Rapanea punctata, F. Seavey & J. Seavey 3211E.* Robertson Hammock, *Ocotea coriacea, F. Seavey & J. Seavey 3255E.* Dewhurst Hammock, *Drypetes diversifolia, F. Seavey & J. Seavey 3381E.* Fire road near Osteen Hammock, *Lysiloma latisiliquum, F. Seavey & J. Seavey 3709E.* Mahogany Hammock, *Ficus aurea, F. Seavey & J. Seavey 3816E.* Monroe Co.: Coot Bay Hammock, *Erythrina herbacea, F. Seavey & J. Seavey 3938E.* Cape Sable, *Conocarpus erectus, F. Seavey & J. Seavey 1504E.* Bear Lake trailhead, *Eugenia axillaris, F. Seavey & J. Seavey 3168E.* Hammock north of Bear Lake canoe dock, *Metopium toxiferum, F. Seavey & J. Seavey 3531E.* Seaside hammock 100 meters west of Buttonwood Canal, *Hippomane mancinella, F. Seavey & J. Seavey 3652E.*

Key to *Graphis* recorded for Florida

1a. Exciple apically carbonized 2
1b. Exciple laterally or completely carbonized 7
2a. Labia entire, disc closed, pruinose, hymenium clear, ascospores 20–40 × 6–10 µm, 5–9 septate ..... *G. xanthospora*
2b. Labia striate 3
3a. Ascospores muriform 4
3b. Ascospores transversely septate 5
4a. Containing norstictic acid, ascospores 30–60 × 17–25 µm, 2–8 per ascus ..... *G. antillarum*
4b. Containing no substances, ascospores 25–45 × 15–25 µm, 1–2(4) per ascus ..... *G. disserpens*
5a. Ascospores small, 35–45 × 7–10 µm, lirellae erumpent with lateral thalline margin ..... *G. chlorotica*
5b. Ascospores medium, 40–60 × 9–13 µm, thalline margin absent or complete 6
6a. Thallus yellowish-green, lirellae prominent, thalline margin absent, ascospores 50–60 × 9–12 µm, 9–15 septate ..... *G. caribica*
6b. Thallus grayish-white, lirellae erumpent, thalline margin lateral to complete, ascospores 40–60 × 9–13 µm, 9–13 septate ..... *G. appendiculata*
7a. Exciple laterally carbonized 8
7b. Exciple completely carbonized 32
8a. Labia striate 9
8b. Labia entire 14
9a. Thallus UV+ yellow, containing lichexanthone 10
9b. Thallus UV−, lichexanthone lacking 11

10a. Lirellae elongate, partly branched, ascospores 20–30 × 7–10 µm, 6–8 septate ..... *G. lucifica*
10b. Lirellae short, rarely branched, ascospores 40–70 × 7–12 µm, 8–15 septate ..... *G. haleana*
11a. Ascospores muriform to submuriform 12
11b. Ascospores transversely septate 13
12a. Ascospores muriform, 25–40 × 12–14 µm, lirellae long, stellately branched, immersed, containing norstictic acid and traces of stictic acid ..... *G. neoelongata*
12b. Ascospores submuriform, 20–35 × 10–15 µm, containing norstictic acid, labia striate encrusted with anthraquinone crystals, KOH+ purple/red ..... *G. tamiamiensis*
13a. Lirellae prominent, thalline margin absent, ascospores 30–65 × 7–12 µm, 9–15 septate ..... *G. striatula*
13b. Lirellae erumpent with lateral thalline margin, ascospores 15–30 × 6–8 µm, 5–9 septate ..... *G. tenella*
14a. Hymenium inspersed 15
14b. Hymenium clear 21
15a. Containing norstictic or stictic acid 16
15b. Containing no substances 19
16a. Containing stictic acid, lirellae short, rarely branched, ascospores 20–40 × 6–8 µm ..... *G. leptocarpa*
16b. Containing norstictic acid 17
17a. Disc exposed, lirellae erumpent with lateral thalline margin 18
17b. Disc closed, lirellae erumpent with basal to lateral thalline margin, ascospores 25–40 × 6–8 µm ..... *G. cincta*
18a. Disc pruinose (*scripta* morph) ..... *G. crebra*
18b. Disc epruinose (*handelii* morph) ..... *G. handelii*
19a. Lirellae 0.3–0.7 mm long, straight, unbranched, immersed singly in distinctly raised pseudostroma, ascospores 30–45 × 8–10 µm, 9–11 septate ..... *G. elevata*
19b. Lirellae 1–3 mm long, erumpent not in raised pseudostroma 20
20a. Ascospores 20–40 × 6–8 µm, 7–9 septate ..... *G. lineola*
20b. Ascospores 40–55 × 8–12 µm, 11–17 septate ..... *G. intermedians*
21a. Ascospores muriform 22
21b. Ascospores transversely septate 24
22a. Containing norstictic acid, ascospores 4–8 per ascus ... 23
22b. Containing no substances, ascospores 60–90 × 20–25 µm, 1–2 per ascus ..... *G. xylophaga*
23a. Lirellae short to elongate 1–4 mm long, sparsely branched, prominent, thalline margin basal or absent ..... *G. analoga*
23b. Lirellae long 1–8 mm long, richly branched, erumpent with lateral thalline margin ..... *G. renschiana*
24a. Disc exposed 25
24b. Disc closed 26
25a. Disc with orange crystals, KOH+ purple, ascospores 23–30 × 6–7 µm, 5–7 septate ..... *G. inversa*
25b. Disc with white pruina, KOH−, ascospores 30–40 × 7–9 µm, 7–10 septate, extreme northern Florida only .... *G. scripta*
26a. Thallus with no substances, ascospores 20–40 × 7–12 µm 27
26b. Thallus with norstictic, stictic or protocetraric acid 28
27a. Thallus mostly ecorticate, lirellae thin, elongate, 1–5 mm long, thinly white pruinose ..... *G. furcata*
27b. Thallus corticate, lirellae thicker and shorter, 1.0–3.5 mm long, epruinose ..... *G. pinicola*
28a. Thallus with protocetraric acid, lirellae long, partly branched, pruinose ..... *G. supracola*
28b. Thallus with norstictic or stictic acid, thalline margin lateral 29
29a. Thallus with stictic acid, lirellae long, partly branched to stellate, immersed, pruinose, ascospores 20–40 × 6–8 µm ..... *G. dendrogramma*
29b. Thallus with norstictic acid 30
30a. Lirellae up to 3(4) mm long, sparsely to partly branched, pruinose or not 31
30b. Lirellae up to 10 mm long, partly to richly branched, labia and disc epruinose, ascospores 20–30 × 5–8 µm, 5–9 septate ..... *G. filiformis*
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**Graphis oshioi* was recently reported for South Florida (Lücking et al. 2011). It differs from all of the above species by having an uncarbonized exciple contrary to the genus characteristics sensu Staiger. Molecular data suggests it falls within the confines of *Graphis* (Rivas Plata et al. 2011). But at the time of this writing the data and manuscript regarding this were in press and the specifics of this are unclear to us. Currently it seems more logical to keep the species segregated until the data are formally published and the genus redefined to accommodate this and similar collections. In addition to the uncarbonized exciple, *G. oshioi* has a complete thalline margin, entire labia, prominent lirellae, transversely septate ascospores, 30 × 7 µm and contains norstictic acid.

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