

Reexamination of *Odontia sacchari*, *O. saccharicola*, and *Corticium granulare*

KAREN K. NAKASONE

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Type specimens of three corticioid taxa described by E.A. Burt are reexamined. In 1917, Burt described two new species of *Odontia*, *O. sacchari* and *O. saccharicola*, on sugar cane from Cuba and Puerto Rico. *Odontia sacchari* is similar to the ubiquitous *Hyphoderma setigerum* (Fr.) Donk except for basidia that are consistently two-sterigmate and basidiospores that are slightly larger. The new combination *Hyphoderma saccharum* (Burt) Nakasone is proposed. *Odontia saccharicola* is morphologically similar to *Resinicium bicolor* (Fr.) Parmasto but differs in lacking clamp connections and producing smaller basidiospores. The new combination *Resinicium saccharicola* (Burt) Nakasone is proposed. *Corticium granulare* Burt, on herbaceous stems from Hawaii, is conspecific with *Odontia saccharicola*. Descriptions and illustrations of the *H. saccharum* and *R. saccharicola* are provided. In addition, a cultural description of *R. saccharicola* is presented.

Key words: Cuba, cultural description, Hawaii, *Himantia stellifera*, *Hyphoderma setigerum*, Puerto Rico, *Resinicium*, sugar cane

Karen K. Nakasone, Center for Forest Mycology Research, USDA Forest Service, Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398, U.S.A

Introduction

In 1917, Burt described *Odontia sacchari* Burt and *Odontia saccharicola* Burt on dead and dying leaf sheaths at the base of sugar cane stalks from Cuba and Puerto Rico (Burt 1917). Gilbertson (1964) studied the type specimens but was unable to assign the species to any known taxa. From Hawaii, Burt (1923) described *Corticium granulare* Burt that was placed in synonymy under *Resinicium bicolor* (Fr.) Parmasto by Liberta (1969). Later, Wu (1990) reported that *C. granulare* possessed simple-septate generative hyphae and proposed the combination *R. granulare*. In this study, the type specimens of *O. sacchari*, *O. saccharicola*, and *C. granulare* were reexamined.

Methods

Freehand sections and squash mounts of basidiomes were examined microscopically in 2% (w/v) KOH and 1% (w/v) aqueous phloxine or Melzer's reagent (Hawksworth et

al. 1995). Drawings of microscopic features were aided with a camera lucida attachment on an Olympus BH2 compound microscope. Color descriptions were taken from Korerup and Wanscher (1978) and herbarium designations from Holmgren et al. (1990). All cultures are of polysporous origin and are on deposit at the Center for Forest Mycology Research (CFMR). Cultures were grown on 1.5% (w/v) Difco malt extract agar (MEA), 0.5% (w/v) gallic acid agar (GAA), and 0.5% (w/v) tannic acid agar (TAA) in the dark at 25°C (Davidson et al. 1938). Cultures were checked at weekly intervals. Key patterns describing 2-wk-old cultures are based on the system of Davidson et al. (1942), and species codes describing 6-wk-old cultures are based on the system of Nobles (1965) as revised and expanded by Nakasone (1990).

Description of species

Hyphoderma saccharum (Burt) Nakasone, comb. nov. – Figs. 1–2

≡ *Odontia sacchari* Burt, *Annals Missouri Bot. Gard.* 4: 233. 1917.

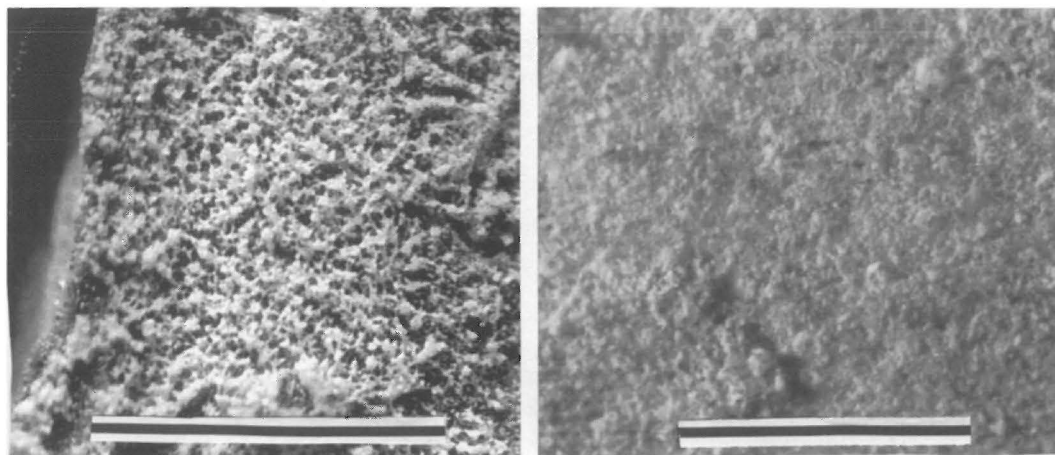


Fig. 1 (left) and Fig. 2 (right). Microscopic elements of *Hyphoderma setigerum* var. *sacchari*. – Fig. 1. From holotype specimen (*W.T. Howe*, 24.VII.1905): a. septate cystidia, b. basidia, c. basidiospores. – Fig. 2. From isotype specimen (*BPI*: US0266029): a. septate cystidia, b. basidia, c. basidiospores.

Basidiomes effused, up to 60×50 mm, tuberculate, thin, up to $150 \mu\text{m}$ thick between the tubercles, membranous, continuous, off white to pale yellow (4A3); hymenial surface of small tubercles or warts, up to $100 \mu\text{m}$ high, with fibrillose apices; however, in most specimens these bristly projections are broken off; margin indeterminate, gradually thinning out. *Hyphal system* monomitic with regularly nodose-septate hyphae. Tubercles with multi-celled, nodose-septate, smooth or encrusted cystidia originating from the subiculum and penetrating through the apex, sometimes also with embedded, simple, clavate structures (possibly young cystidia). Subiculum up to $120 \mu\text{m}$ thick, consisting of moderately dense tissue of more or less vertically intertwined hyphae; subicular hyphae $3\text{--}7 \mu\text{m}$ diam, nodose-septate, moderately branched, sometimes forming H-connections, walls hyaline, thin to thick, up to $1 \mu\text{m}$ thick, smooth. Subhymenium difficult to differentiate from subiculum because there is no change in the density of the tissue or branching patterns of the hyphae; subhymenial hyphae $2\text{--}4.5 \mu\text{m}$ diam, nodose-septate, moderately branched, walls hyaline, thin to slightly thickened, smooth. *Hymenium* composed of cystidia and basidia. Cystidia cylindrical with a slightly enlarged, rounded apex, up to $175 \times 11 \mu\text{m}$, tapering to $2 \mu\text{m}$ diam at base, with a basal clamp, nonseptate or typically with several septa and clamp connections, walls at apex usually thin, thickening to-

ward the base, hyaline, smooth or lightly to heavily encrusted with coarse, hyaline crystals. *Basidia* narrowly cylindrical, constricted, often slightly enlarged above the base, $24\text{--}33 \times 4.5\text{--}7 \mu\text{m}$, with a basal clamp connection, 2-sterigmate; walls thin, hyaline, smooth. *Basidiospores* cylindrical, $(10.5\text{--})11\text{--}13 \times (4.5\text{--})5\text{--}5.5\text{--}(5.8) \mu\text{m}$, walls hyaline, thin to slightly thick, up to $0.7 \mu\text{m}$, smooth, negative in Melzer's reagent.

Habitat: On dead and decaying leaf sheaths at the base of sugar cane.

Distribution: Cuba, Puerto Rico.

Type specimen examined: Cuba, on dead sheath bases of sugar cane, 24.VII.1905 *W.T. Howe* (FH, holotype of *Odontia sacchari*).

Specimens examined: **Puerto Rico**. Rio Piedras, on leaves of *Saccharum officinarum* L., 17.VII.1916 *J. A. Stevenson* 5628, ut *Odontia sacchari* (paratypes – *BPI*: US0266026, US0266027, US0266029); 25.VII.1912 *J. R. Johnston* 4509, ut *Odontia sacchari* (paratype – *BPI*: US0266022); 26.VII.1915 *J. A. Stevenson* 2908, ut *Odontia sacchari* (paratype – *BPI*: US0266025); Central Juncos, III.1916 *J. A. Stevenson*, ut *Odontia saccharicola* (*BPI*: US0266041).

Remarks: *Hyphoderma saccharum* is an uncommon saprophyte growing on dead and dying leaf sheaths at the base of sugar cane stalks in Puerto Rico and Cuba. Except for the two-sterigmate basidia and slightly larger basidiospores, *H. saccharum* is indistinguishable from *Hyphoderma setigerum* (Fr.) Donk. In *H. setigerum*, the basidiospores are slightly shorter, $7\text{--}10\text{--}(13)$

$\times 3-4.5(-6) \mu\text{m}$ than in *H. saccharum*. The protruding septate cystidia, typical of *H. setigerum*, are often broken off in the type and paratype specimens of *H. saccharum*, and only the basal remnants of the cystidia can be found embedded in the subiculum. Two additional paratypes cited by Burt (1917), *J. A. Stevenson 6358* (BPI: US0266923 and US0266924) are *Hyphodontia microspora* J. Erikss. & Hjortstam.

Resinicium saccharicola (Burt) Nakasone, comb. nov. – Figs. 3–4

≡ *Odontia saccharicola* Burt, Ann. Missouri Bot. Gard. 4: 235. 1917.

= *Corticium granulare* Burt, Annals Missouri Bot. Gard. 10: 187. 1923.

≡ *Resinicium granulare* (Burt) Sheng H. Wu, Acta Bot. Fennica 142: 35. 1990.

Basidiomata effused, thin, 25–45 μm thick, smooth to finely farinaceous or grandinoid, finely porose between the aculei, soft to subceraceous, white to yellowish grey (4B2), not cracking, not reacting to KOH; aculei conical, 40–80 \times 30–50 μm (Wu 1990), 5–10 aculei per mm, single, with terminal hyphae protruding through apex;

margins indeterminate, gradually thinning out, closely attached to substrate, not cordonic.

Hyphal system monomitic with simple-septate generative hyphae and rare clamp connections. Aculei composed of a trama of parallel subicular hyphae enclosed by thin subhymenial and hymenial layers and cystidioles protruding through apex; cystidioles cylindrical, obclavate or sicyoid, 20–45 \times 2–5 μm , tapering to 1.5–2.2 μm diam at base, simple-septate, walls hyaline, thin, smooth, gradually tapering to apex. Subiculum thin, up to 25 μm thick, hyphae agglutinated, difficult to separate; subicular hyphae 2.5–3.5 μm diam, simple-septate, agglutinated, walls hyaline, thin, smooth; sometimes with small asterocystidia, these 2–4 μm long exclusive of stellate crystal clusters. Subhymenium thin, up to 15 μm thick, difficult to separate individual elements, hyphae often fragmented, not as dense as subiculum; subhymenial hyphae 1.5–3.5 μm diam, frequently branched, vertically arranged, short-celled, walls thin, hyaline, smooth. *Hymenium* up to 45 μm thick, a palisade of basidia, cystidioles, halocystidia and asterocystidia. Cystidioles cylindrical to narrowly obclavate, 22–45 \times 2–5 μm , taper-

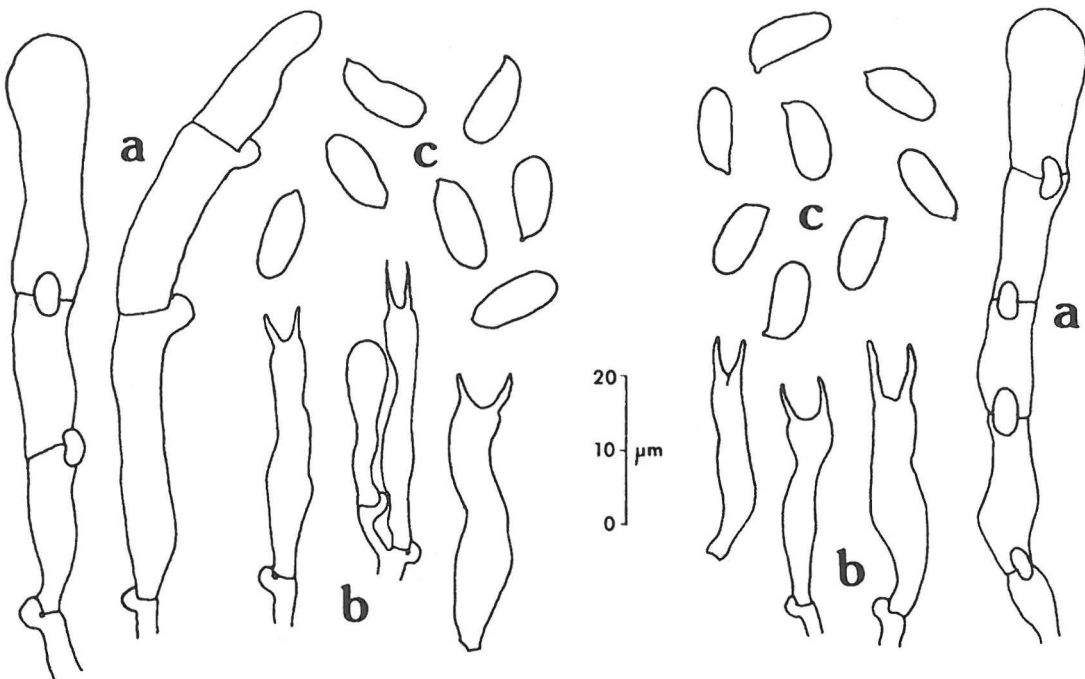


Fig. 3. Hymenial surfaces of dried basidiomata. – Left: *Corticium granulare* (FL. Stevens 381, holotype specimen); right: *Resinicium saccharicola* (FP-102841). Bar equals 1 mm.

ing to 1.5–2 μm diam at base, basal clamp not observed, rare, walls thin, hyaline, smooth. Cystidia of two types: (1) halocystidia short cylindrical, obclavate, or ribiform, 8–17 \times 3–7 μm (exclusive of apical bulb), tapering to 1.5–2.2 μm diam at base, simple-septate at base, walls hyaline, thin, smooth, apical bulb 5–9 μm diam and enclosed by a larger vesicle, 8–22 μm diam, empty or filled with small, refractive, yellow globules, walls thin, hyaline, smooth; (2) asterocystidia clavate to obclavate with an acute or bulbous apex, 10–15 \times 2–4 μm , tapering to 1 μm diam at base, simple-septate at base, walls hyaline, thin, smooth, apex capped by a stellate cluster of hya-

line crystals, 5–11 μm diam, sometimes developing on subcicular hyphae. *Basidia* short cylindrical with a median constriction, 11–20(–23) \times 4–7 μm , tapering to 1.5–2.5 μm diam at base, simple-septate at base, 4-sterigmate, sterigmata up to 4 μm long, walls hyaline, thin, smooth. *Basidiospores* ellipsoid, 4.5–6(–7) \times (3–) 3.5–4(–4.5) μm ; walls thin, hyaline, smooth, negative in Melzer's reagent.

Habitat: On sugar cane, grasses, ferns, herbaceous stems.

Distribution: Puerto Rico, Costa Rica (Hjortstam & Melo 1997), Taiwan, Hawaii.

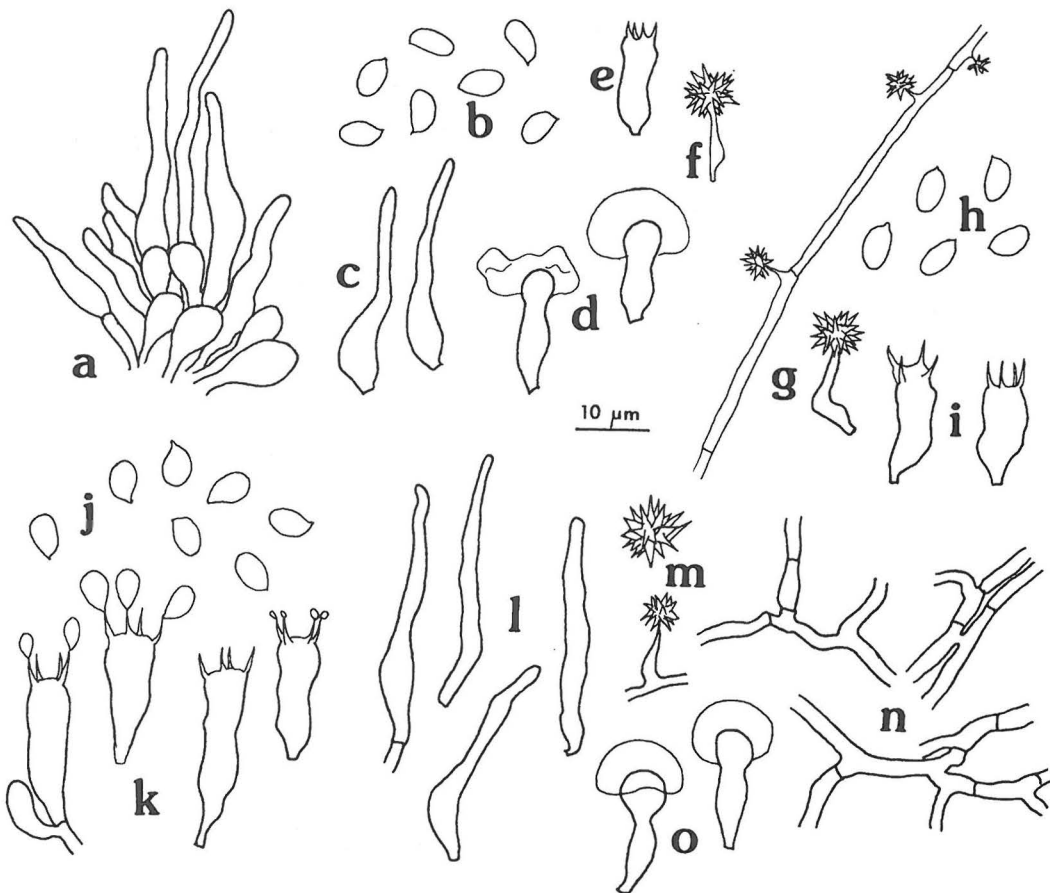


Fig. 4. Microscopic elements of *Resinicium saccharicola*. – a. apex of an aculeus, b. basidiospores, c. cystidioles from aculeus apices, d. halocystidia, e. basidium, f. asterocystidium (drawn from holotype specimen US0266038); – g. asterocystidia, h. basidiospores, i. basidia (from paratype specimen US0266035); – j. basidiospores, k. basidia, l. cystidioles from aculeus apices, m. asterocystidia, n. generative hyphae from subiculum, o. halocystidia (from FP-102841).

Type specimens examined: Puerto Rico. Rio Piedras, on *Saccharum officinarum*, 5.X.1915 J. A. Stevenson (holotype of *Odontia saccharicola*: FH, isotype: BPI – US0266038). Hawaiian Islands, on dead herbaceous stems, F. L. Stevens 381 (holotype of *Corticium granulare*: FH, isotype: BPI – US0281318).

Specimens examined: Puerto Rico. Rio Piedras, on *S. officinarum*, 1.1916 J. A. Stevenson, 2657a, ut *Odontia saccharicola* (paratype – BPI: US0266035); on living stalk of *S. officinarum*, 1.1915 J. R. Johnston 2657, ut *Odontia saccharicola* (paratype – BPI: US0266033 and US0266034); on *Paspalum* sp., 12.II.1917 J. A. Stevenson 6213, ut *Odontia saccharicola*, (paratype – BPI: US0266031); on *S. officinarum*, 16.XII.1915 J. A. Stevenson 3614 (paratype – BPI: US0266037). Rio Grande Municipio, Caribbean National Forest, El Yunque Recreation Area, Mt. Britton Trail, 750–900 m, on attached leaf petiole of *Prestoea montana* (R.Grah.) Nicholas, 21.VI.1996 K. K. Nakasone FP102841 and FP102843 (CFMR); Luquillo Mts., El Yunque Recreation Area, Big Tree Trail, 500 m, on lower petiole of living palm, 18.VI.1996 K. K. Nakasone FP102754 (CFMR). Taiwan. Taoyan, Sanhsia, 280 m, on culm of Poaceae, 9.IX.1988 S. H. Wu 880909–21, ut *Resinicium granulare* (H); Nantou, Hsitou, 23°40' N, 120°47' E, alt. 1,200 m, on culm of *Miscanthus floridulus*, 26.XI.1996 S. H. Wu 9611–4, ut *Resinicium granulare* (TNM).

Cultural description: Growth on MEA (29–) 35–55 mm diam at 1 wk, (56–)85–90+ mm diam at 2 wk. Mats at 2 wk mostly appressed, thin, subfelty with scattered raised, downy areas; margins even to slightly bayed, appressed, thin, subfelty; no odor at 2 and 4 wk; unchanged or slightly at 2 wk, bleached by 4 wk. Oxidase reactions on GAA and TAA strong (++++), stain, rarely –, no growth at 1 and 2 wk.

Marginal hyphae 1.5–5.5(–9) µm diam, simple-septate with scattered single clamps on wider hyphae, sparingly branched, often branching opposite clamps or immediately below septa, walls thin, hyaline, smooth. Aerial hyphae 1–4.5 µm diam, simple-septate, sparingly to moderately branched, often developing H-connections, walls thin, hyaline, smooth, on narrower hyphae with numerous, short, lateral pegs that bear astero-cystidia, also with halocystidia. Submerged hyphae similar to aerial hyphae except lacking astero-cystidia and halocystidia, occasionally with globose hyphal swellings, 9–14 µm diam, intercalary, scattered or absent. Halocystidia sphaeropedunculate, with a cylindrical stalk 4–15 × 2–3 µm, apical bulb 4–15 µm diam, usually staining dark pink in phloxine, often apical bulb enclosed by a fragile vesicle up to 20 µm diam, empty or filled with refractive, oil-like materials, walls thin, hyaline, smooth; scattered in aerial

mat at 2 and 4 wk. Astero-cystidia usually formed on short pegs developed on narrow aerial hyphae, with stellate crystalline clusters 3–25 µm diam, abundant in aerial mat at 2 and 4 wk.

Key codes: A-P-I-10-16, A-P-I-1-10-16, A-P-M-10-16, A-P-M-1-10-16, A-O-M-10-16, A-O-M-1-10-16.

Species codes: 2.5.13.(26).28.32.36.40.42.43.50.54.

Remarks: The presence of halocystidia and astero-cystidia indicates that *Resinicium saccharicola* is closely related to *R. bicolor*. The broader basidiospores and simple-septate hyphae distinguish *R. saccharicola* from *R. bicolor*. The hyphae in the basidiomata and cultures are primarily simple-septate, but single clamp connections were occasionally observed. Many old specimens of *R. saccharicola* appear to lack basidiospores. Similarly, the halocystidia can be difficult to observe because they are easily destroyed when preparing microscopic slides.

Comparative study of the types of *Corticium granulare* and *O. saccharicola* demonstrated that they are conspecific. Occasional single clamp connections were observed in the type of *C. granulare*. Dennis (1970) reported *O. saccharicola* from Venezuela; however, the taxon described is not conspecific to *R. saccharicola*. Other descriptions and illustrations of *R. saccharicola* are published by Hjortstam and Melo (1997) and Wu (1990) as *R. granulare*.

Himantia stellifera J. R. Johnst., a sterile species, has been suggested to be the teleomorph of *O. saccharicola* (Johnston & Stevenson 1917). Examination of the holotype (BPI: US0455264) and paratype specimens (BPI: US0455266, US0455267) of *H. stellifera* reveals a sterile fungus with well-developed, fragile cordons (Johnston & Stevenson 1917, plate XIX, Fig. 2), simple-septate generative hyphae, abundant astero-cystidia, and scattered halocystidia. In the original description, the hyphae are described as having clamp connections; however, this is erroneous because the hyphae are simple-septate. *Resinicium saccharicola* is simple-septate but lacks cordons. Therefore, I am doubtful that it is the teleomorph of *H. stellifera*. Other paratype collections of *H. stellifera* (BPI: US0455260, US0455261, US0455262, US0455263) lack cordons and may not be conspecific with the holotype. These specimens may be sterile specimens of *R. saccharicola*. Comparison of DNA se-

quences of *H. stellifera* and *R. saccharicola* may resolve the conspecificity of these taxa.

Stevenson (1975) and Farr et al. (1989) state that *O. sacchari* is the teleomorph of *Himantia stellifera*. These reports are incorrect, for *O. sacchari* is conspecific with *Hyphoderma saccharum*, as discussed above, and lacks halocystidia and asterocystidia.

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