

## New Species of *Ramalina* (Ascomycotina, Ramalinaceae) from the Hawaiian Islands

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*Ramalina reptans* and *R. subrotunda* from the Hawaiian Islands are described as new to science. They are endemic to the islands.

**Key words:** Hawaiian Islands, lichens, *Ramalina*, taxonomy.

Members of the genus *Ramalina* are among the most prominent macrolichens throughout the Hawaiian Islands. Magnusson and Zahlbruckner (1944) and Magnusson (1956) in their studies on Hawaiian lichens in European herbaria reported 39 species, 17 of which were endemic. Further review of their treatment and substantial additional collections in the islands indicated a need to revise the genus using modern taxonomic characters, particularly the chemistry and inner structures of the thallus (Kashiwadani 1986, 1987, Kashiwadani and Kalb 1993, Kashiwadani and Nash 1994). In the course of reviewing extensive collections by the authors from the islands as well as borrowed material from BM, H, LD, S, UPS and W, we have found two apparently undescribed species. We give the names *R. reptans* and *R. subrotunda* to these new taxa and provide descriptions herein.

*Ramalina reptans*, a saxicolous species on lava, has a unique creeping thallus and often forms radiating colonies. This unique habit within the Ramalinaceae is found only on

rocks in windy locations along the coast. *R. subrotunda* is a corticolous species which is readily distinguished from other species of the genus by its fan-shaped lobes and narrow holdfast. There are two chemical races of this species.

### Methods

The specimens were collected mainly by the authors during their lichenological field works in 1997–1999. The secondary products were detected by thin layer chromatography (TLC) using amended procedures of Culberson and Johnson (1982). Anatomical variation within the thallus and apothecia was studied using sections cut by hand with a razor blade. They were mounted in lactophenol-cotton blue solution and the anatomy and spores were examined with standard light microscopic procedures.

### Results and Discussion

*Ramalina reptans* Kashiw., C.W.Sm. & K.H.Moon, sp. nov. [Fig. 1]

Thallus ut in *Ramalina umbilicatae* sed



Fig. 1. *Ramalina reptans* Kashiw., C.W.Sm. & K.H.Moon (holotype), scale = 2 mm.

lobis repentibus et sorediis destitus differt. Acidum usnicum et acidum salazinicum continentibus.

Type: U.S.A. Hawaii. Molokai Island. Molokai District: Pohakuloa Pt., ca 1 km NE of Waialua. On exposed rock along coast; elevation about 10 m, H. Kashiwadani 39973—holotype in BISH and isotype in TNS.

Thallus saxicolous, up to 2 cm long, loosely attached to the substrate by scattered hapters, sparingly branched, forming radiate rosettes. Branches more or less dorsiventral, attached, solid, creeping on the substrate, plane, up to 1.5 mm wide; upper surface yellowish green, without soredia or isidia; lower surface pale to ochre yellow, with scattered hapters. Pseudocyphellae ellipsoid, plane to more or less convex, common on upper surfaces, sparse or lacking on the lower surface.

Thallus 150–200  $\mu\text{m}$  thick; cortex distinct, composed of 2–3 layers of thin-walled cells, 18–20  $\mu\text{m}$  thick; chondroid layer smooth to moderately cracked, discontinuous, up to 100  $\mu\text{m}$  thick; medulla dense. Apothecia laminal or subterminal, up to 1.5 mm in diam.; margin entire; disc flat to convex; thalline exciple smooth, usually with pseudocyphellae; hymenium 40–45  $\mu\text{m}$  hypothecium 20–30  $\mu\text{m}$  thick; ascospores shortly fusiform, 8–12  $\times$  3.5–4  $\mu\text{m}$ ; pycnospores rod-shaped, 3–4  $\times$  0.5  $\mu\text{m}$ .

Chemistry: usnic and salazinic acids.

*Ramalina reptans* is characterized by its: 1) saxicolous habit; 2) sparingly branched dorsiventral lobes forming radiating thallus which are attached to the substrate by scattered hapters; 3) absence of soredia or isidia; 4) the smooth to weakly cracked chondroid layer; 4) the shortly fusiform spores of 8–

12 × 3.5–4 µm in size; and, 5) presence of salazinic. *Ramalina reptans* resembles *R. umbilicata*, also from Hawaii. However, it can be distinguished from the latter by the creeping lobes without soredia. In the latter species, the lobes are upright and bear granular soralia.

At present, *Ramalina reptans* is known only from Lanai, Maui, Molokai, and Oahu islands where it grows on rocks (lava) along the coast.

Specimens examined. **Lanai Island.** Lahaina District: 7 km NNE of Lanai city along Koele-Koeomuku Trail, on rocks, 160 m alt., May 26, 1999, H. Kashiwadani 41840 (TNS). **Maui Island.** Lahaina District: Punalau Pt., Honokohau, on rock, 50 m alt., June 14, 1998, H. Kashiwadani (40949, BISH, TNS) & K.-H. Moon; Kanounou Point, along R 340, on rocks along the coast, 50 m alt., June 22, 1998, H. Kashiwadani (41168 & 41169, BISH, TNS) & K.-H. Moon. **Molokai Island.** Molokai District: Ca. 1 km SE of Halawa. On rock along Highway R450, 150 m alt., November 2, 1997, November 5, 1997, H. Kashiwadani 40011b (TNS); E shore of Kalaupapa Peninsula. On rock, 10 m alt., November 8, 1997, Y. Ohmura 4271 (BISH, TNS); Pohakuloa Pt., ca. 1 km NE of Waialua. On exposed rock along coast, 10 m alt., November 2, 1997, H. Kashiwadani 39965 ,

39968, 39978 & 39979 (BISH, TNS). **Oahu Island.** Honolulu District: Makapuu Point. On exposed rocks, 70–145 m alt., October 16, 1997, H. Kashiwadani 39681 & 39685 (BISH, TNS); Makapuu Point. On exposed rocks, 80 m alt., October 16, 1997, Y. Ohmura 3873 (BISH, TNS). Waianae District: Ca. 2 km E of Kaena. On rocks (lava), 30 m alt., June 23, 1999, H. Kashiwadani 42151 & 42156 (BISH, TNS).

***Ramalina subrotunda*** Kashiw., C.W.Sm. & K.H.Moon, sp. nov. [Figs. 2a, 2b]

Thallus ut in *Ramalina palmiformis* sed apotheciis marginalibus, sporis minoribus (usque ad 14 µm longibus) et acidum divaricaticum vel acidum homosekikaicum et acidum sekikaicum continentibus differt.

Type: U.S.A. Hawaii. Hawaii Island, South Kohara District: Koaia Tree Sanctuary, 400 m N of Puu Kawaiwai (20° 03'N, 155°44'W), on bark of *Acacia koaia*, elevation 960–1000 m, June 10, 1999, H. Kashiwadani 42028–Holotype in BISH, isotype in TNS.

Chemistry (TLC): usnic acid, divaricatic acid and 4'-O-demethyldivaricatic acid.

Thallus corticolous, greenish yellow, ro-

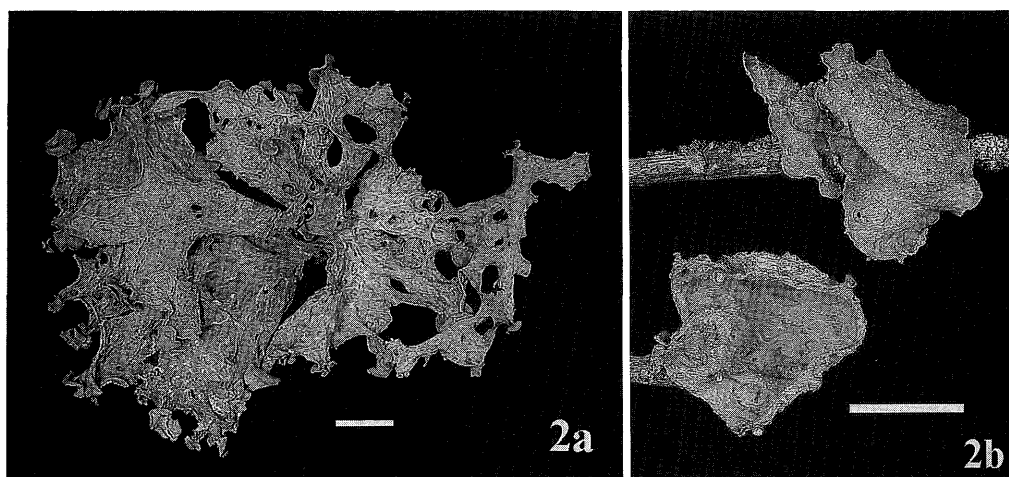


Fig. 2. *Ramalina subrotunda* Kashiw., C.W.Sm. & K.H.Moon, a) specimen with sparingly branched lobes and marginal apothecia (holotype), b) a specimen with monophyllous lobes (C.W.Smith 950530002), scale bar = 1 cm.

sette-like or sparingly branched from a narrow holdfast. Branches solid, plane, up to 3 (–5) cm broad; surface reticulately ridged on both sides, without isidia or soredia; pseudocyphellae laminal, scattered, more or less depressed. Thallus irregularly thickened 160–640  $\mu\text{m}$  thick; cortex indistinct, 8–10  $\mu\text{m}$  thick; chondroid layer scattered, smooth, irregularly thickened, 20–240  $\mu\text{m}$  thick. Apothecia common, marginal or laminal in aged branches, up to 7 (–10) mm in diam.; disc plane, becoming convex; thalloid exciple entire, rarely pseudocyphellate; hymenium 40–45  $\mu\text{m}$  thick; hypothecium, 10–15  $\mu\text{m}$  thick; proper exciple 12–15  $\mu\text{m}$  thick; ascospores short fusiform, straight or slightly curved,  $10\text{--}14 \times 4\text{--}5 \mu\text{m}$ . Pycnidia not seen.

*Ramalina subrotunda* is characterized by: 1) the corticolous habit; 2) the fan-shaped monophyllous or sparingly branched lobes with reticulate ridges on both surfaces; 3) the absence of soredia or isidia; 4) the discontinuous chondroid layer without cracks; 4) the shortly fusiform spores; and, 5) the presence of homosekikaic and sekikaic acids or divaricatic acids.

*Ramalina subrotunda* differs from the most known species of *Ramalina* in having round and sparingly branched lobes with more or less reticulate upper and lower surfaces and in producing marginal apothecia. It superficially resembles *R. palmiformis*, a species reported from Mexico. However, it can be easily distinguished from the latter by the marginal apothecia with smaller ascospores (up to 14  $\mu\text{m}$  long), and the presence of divaricatic or homosekikaic and sekikaic acids as major chemical substances; *R. palmiformis* has submarginal apothecia with larger ascospores (15–17  $\mu\text{m}$  long) and produces boninic acid as a major chemical substance.

This new species might be confused with *R. mollis* Krog & Østh., a species reported from the Canary Islands, which differs in the

absence of pseudocyphellae on lobes and in producing bourgeanic acid. It also resembles *R. sinensis* Jatta, a species widely distributed in the Northern Hemisphere. However, the latter is distinguished by the presence of anastomosing ridges with decorticate interstices towards the holdfast and by the absence of depsides.

Two chemical races, a divaricatic acid containing race (Race 1) and a homosekikaic and sekikaic acids containing race (Race 2) are recognized for the Hawaiian material. They are indistinguishable morphologically and appear to be sympatric in the present area, though the divaricatic acid race is apparently more common.

It grows on twigs of trees in rather exposed condition at elevations between 600 to 1000 m. One collection was made on *Cocos nucifera* trunks in the parking lot of a supermarket in Lihue, Kauai Island at elevation 100 m.

Specimens examined. (Race 1) **Hawaii Island.** North Kohala District: Road from Waimea to Hawi, on bark of *Acacia koa*, 1000 m alt, August 25, 1994, C. W. Smith 940825 (BISH, TNS); the same locality, on bark of *Casuarina equisetifolia*, 1000 m alt, May 30, 1995, C.W. Smith 950530002 (BISH, TNS); 2 km SSW of Puuanahulu, along Mamalahoa Hwy. On bark of *Metrosideros polymorpha*, 600 m alt, June 9, 1999, H. Kashiwadani 41999 (BISH, TNS). South Kohala District: 1 km NW of Puu Loa, along Kohala Mountain Rd. On bark of *Casuarina equisetifolia*, 1060 m alt., June 10, 1999, H. Kashiwadani 42031 & 42032 (TNS); 8 miles NW of Waiaka, along Kohala Mountain Rd. On *Casuarina equisetifolia*, 1030 m alt., June 13, 1999, H. Kashiwadani 42064 (BISH, TNS); 9–10 miles NW of Waiaka, along Kohala Mountain Rd. On *Casuarina equisetifolia*, elevation 1080 m, June 13, 1999, H. Kashiwadani 42073 (BISH, TNS); the same locality with the type, K.-H. Moon 3884 (BISH, TNS). **Molokai Island.** Molokai District: Kupaia, ca. 3 km W of Kamoku Flats. On bark of *Acacia* sp., 660 m alt., November 12, 1997, H. Kashiwadani 40292 (BISH, TNS).

(Race 2) **Kauai Island.** Lihue District: Lihue, on bark of *Cocos nucifera*, 100 m, October 24, 1997, H. Kashiwadani 39815 (BISH, TNS). Waimea District: along Kukui Trail, Kukui. On bark of *Eucalyptus* sp., 500–850 m alt, October 23, 1997, H. Kashiwadani

39786 (TNS). **Maui Island**. Hana District: Auwahi. On bark, 600 m alt, June 23, 1998, H. Kashiwadani (41200b, BISH, TNS) & K.H.Moon.

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柏谷博之<sup>a</sup>, C. W. スミス<sup>b</sup>, 文 光喜<sup>c</sup>: ハワイ諸島産カラタチゴケ属の2新種

筆者等が採集したハワイ諸島産のカラタチゴケ属を分類学的に精査した結果, *Ramalina reptans* と *R. subrotunda* の2新種を記載した. いずれもハワイ諸島特産種である. *R. reptans* は海岸の溶岩上に生育し, 地衣類全体で基物に付着するという本属としては特異な地衣体を形成する. 本種は, ハワイから記載された *R. umbilicata* に似ているが, 地衣体の形状と粉芽を欠く点で区別される. *R. subrotunda* は樹皮上に生育し, 扇子状に広がり,

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表裏両面共に網目状の凹凸を持つ地衣体を形成する. 本種はメキシコから報告された *R. palmiformis* に似ているが, 子器が地衣体の縁に形成され, 子嚢胞子の長さが14  $\mu\text{m}$  以下と小さく, 地衣成分としてセッカ酸かディバリカート酸を持つ点で区別できる.

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