New species and new records in the lichen genus *Rinodina* (Physciaceae) from India

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ABSTRACT: A new species, *Rinodina indica* Vishal Kumar, R. Ngangom & Nayaka is described from India. It is characterized by ochraceous, areolate, blastidiate thallus with brown, 1-septate *Teichophila*-type ascospores. Eight additional species of the genus viz., *R. archaea* (Ach.) Arnold, *R. dolichospora* Malme, *R. mniaroeiza* (Nyl.) Arnold, *R. obnascens* (Nyl.) H. Olivier, *R. oleae* Bagl., *R. plana* H. Magn., *R. pyrina* (Ach.) Arnold and *R. trevisanii* (Hepp) Körb., are reported for the first time from India. Detailed description, illustration and distribution for new species and new records are provided. A key to all species of *Rinodina* presently known from India is also provided.

KEY WORDS: Biodiversity, Caliciales, lichenized fungi, *Rinodina* herrei, *Rinodina indica*, revision, taxonomy.

INTRODUCTION

The genus *Rinodina* (Ach.) Gray is a cosmopolitan, polyphyletic genus belonging to order Caliciales, family Physciaceae and comprises about 300 species (Wijayawardene et al., 2020). The genus is characterized by crustose to sub-squamulose, rarely lobate or squamulose thallus, *lecanorine* or rarely *lecidine*-type of apothecia with brown to black discs, a hyaline hymenium, a brown, red-brown or rarely blue-grey epiphylum, clavate asci, brown, 1-septate (rarely 3-septate) to sub-muriform ascospores with well-developed septa and variously thickened walls (Mayrhofer and Moberg, 2002; Sheard, 2004, 2010).

The genus has been systematically studied in Australia, New Zealand (e.g., Mayrhofer, 1983; Mayrhofer et al., 1999; Kaschik, 2006), Europe (e.g., Mayrhofer and Poelt, 1979; Mayrhofer, 1984; Giralt, 2001; Mayrhofer and Moberg, 2002) and North America (e.g., Sheard, 2004, 2010, 2018). However, less attention has been paid to the revision of the genus in Asia (e.g., Mayrhofer 1984; Kondratyuk et al., 2013, 2016; Joshi et al., 2013; Aptroot and Moon, 2014; Sheard et al., 2017; Zheng and Ren, 2020) and South Africa (e.g., Matzer and Mayrhofer, 1996; Mayrhofer et al., 2014).

The genus *Rinodina* is a common and wide-spread genus in India, however it has hitherto not been critically studied for taxonomic diversity and geographical distribution. Awasthi (1991) mentioned the occurrence of nine species from India. Mayrhofer et al. (2001) synonymized *R. megaspora* (D.D. Awasthi & M.R. Agarwal) D.D. Awasthi, a species described from India with *Rinodina intermedia* Bagl. Sheikh et al. (2006) reported two species of *Rinodina* from Jammu and Kashmir as new to India. Singh and Sinha (2010) in their checklist of Indian lichens enumerated the 11 species of *Rinodina* from India. During the ongoing revisionary study of the genus from India several interesting specimens were encountered, one of it is described as new to science while eight species as new distributional records to the country. In present state of knowledge, the genus *Rinodina* in India is represented by 20 species.

MATERIALS AND METHODS

The present study is based on lichen specimens lodged in the herbarium of the CSIR-National Botanical Research Institute, Lucknow (LWG) and fresh collections. The morphological observations of specimens were made using a stereo-zoom microscope (Leica S8APO) and anatomy of ascomatal structures were observed under compound microscope (Leica DM2500), both equipped with camera and image analysis software. The fine hand-cut sections of ascomata were mounted in water and squashed to release the ascospores for detailed study. All the measurements were taken in water mounts and only mature ascospores were considered. The colour spot tests were carried out using routine reagents - potassium hydroxide (K), calcium hypochlorite (C) and para-phenylenediamine (P). The secondary metabolites were detected through thin-layer chromatography (TLC) following Orange et al. (2001) in solvent system C, and illustrations of Sheard (2010) were followed for the nomenclature of ascospore types (Fig. 1).

TAXONOMIC TREATMENT

*Rinodina indica* Vishal Kumar, R. Ngangom & Nayaka, sp. nov.

**Type:** India, Uttar Pradesh, Bhadohi district, Lakhansenpur, 30 km. after Varanasi towards Bhadohi, N 25°21’18.9’’ E 82°42’29.3’’, elev. 105 m, on bark of
Fig. 2. *Rinodina indica*. A. thallus with habitat; B. thallus and apothecia showing blastidia; C. vertical section of apothecium; D. immature ascospores in ascus & E. mature ascospores. Scale bars: A = 5 mm; B = 1 mm; C = 5 µm; D & E = 20 µm.


**Mycobank no.:** MB#838885

**Diagnosis:** *Rinodina indica* is similar to *R. herrei* H. Magn., but differs in having persistent thalline margin and smaller ascospores of size 11.5–19 × 5.5–8.5 µm.

**Description:** Thallus crustose, 2.5 cm across, ochraceous to brown, areolate, areoles 0.6–1.8 mm wide, thick, slightly raised, blastidiate, blastidia arising from areole margins, occasionally cortex breaking at tips, margin determinate. Prothallus absent. Apothecia lecanorine, immersed to erumpent, 1–4 apothecia per areole, narrowly attached to broadly attached, becoming contiguous, 0.5–1 mm in diam., disc dark brown to black, plane to slightly convex, margin concolourous with thallus, persistent, 80–100 µm thick, frequently becoming blastidiate. Apothecial cortex 12–18 µm thick. Epihymenium light to dark brown, 12–16 µm, crystals absent. Proper exciple light brown, 12–25 µm thick, thalline exciple 55–75 µm across with green algal cells. Hymenium hyaline, 35–55 µm high. Paraphyses simple, not conglutinate, 1.5–2.0 µm thick, apical cell swollen, pigmented at tips. Hypothecium slightly yellowish, 90–140 µm high. Asci clavate, 8-spored, 40–55 × 14–18 µm. Ascospores brown, 1–septate, *Teichophila*-type, (11.5–) 13.0–16.0(–19.0) × (5.5–) 6.0–7.5(–8.5) µm, average l/w ratio 1.7–2.6 µm, ontogeny of Type B, spore walls not ornamented, torus not observed. Pycnidia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –, UV–; TLC: No lichen substance detected.

**Etymology:** The epithet *indica* refers to the country India from where the new species is being reported.

**Remarks:** The new species is characterized by its corticolous habitat, ochraceous to brown, areolate thallus, presence of blastidia on thallus and apothecial margins, *Teichophila*-type of ascospores with smooth outer walls and lack of lichen compounds. It does not resemble with any *Rinodina* species known from the country. It is close to *R. herrei* H. Magn., a corticolous species endemic to North America (Sheard, 2010) by lacking chemistry and blastidia developing occasionally on areole margins, but easily gets distinguished by ascospore size and ontogeny. The lumina in immature ascospores of *R. indica* are *Physcia*-type, which becomes *Teichophila*-type at maturity. Whereas in case of *R. herrei* immature ascospores
Thallus crustose, brownish grey, thick, areolate to rimose-areolate, becoming continuous, minutely verrucose, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, dense, broadly attached, becoming contiguous, 0.2–0.6 mm in diam., disc dark brown to black, plane, rarely slightly convex, margin concolourous with thallus. Apothecial cortex 10–18 µm. Proper exciple hyaline, 7–15 µm wide, thalline exciple 93–110 µm with green algal cells. Hymenium 85–102 µm, hyaline. Paraphyses conglutinate, 1.0–2.5 µm thick. Hypothecium hyaline, 34–50 µm. Asci clavate, 8-spored. Ascospores brown, 1-septate, ellipsoidal, broadly lumened, Physcia-type, 14.0–22.0 × 6.0–10.0 µm. Pyenia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** The species was found growing on bark of conifer tree in temperate Himalayan region in Himachal Pradesh state at an elevation of 2250 m. Earlier the species was reported from British Columbia, Southern California, Arizona, Europe, Siberia and Scandinavia (Sheard, 2010).

**Remarks:** Rinodina archaea is usually confused with *R. trevisanii* (Hepp) Körb. due to the presence of Physcia-type of ascospores, but the later species differs by having persistent rimose thallus and smaller ascospores of size 17.5–18.5 × 8.5–9.5 µm (Sheard, 2010).

**Specimen examined:** INDIA, Himachal Pradesh, Kullu district, Parvati river valley, just above Pulga rest house, elev. 2250 m, on conifer tree trunk, 19 June 1975, D.D. Awasthi & K. Dange 75133 (LWG-LWU).

**NEW RECORDS**

*Rinodina archaea* (Ach.) Arnold, Flora, Regensburg 64: 195 (1881) **Fig. 3A**

Parmelia sophodes var. archaea Ach. Methodus Lichenum (Stockholmiae): 156 (1803).

Thallus crustose, light grey, thick, continuous to rimose-areolate, becoming sub-squamulose, glossy, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, scattered, broadly attached, sometimes contiguous, 0.4–0.8 mm in diam., disc dark brown to black, plane, margin concolourous with thallus. Apothecial cortex indistinct. Ephydrium dark red-brown, 8–15 µm. Proper exciple hyaline, 7–15 µm wide,
Rinodina mniaroeiza (Nyl.) Arnold, Flora, Regensburg 53(30–31): 469 (1871) [1870]  

**Remarks:** Rinodina mniaroeiza is being reported from the mountainous region of Western Himalayan state Himachal Pradesh at an elevation of 3200 m where it was found growing on soil. Earlier, its occurrence was reported from Norway, Sweden, Greenland, Finland, North America (Mayrhofer and Moberg, 2002) and Nepal (Awasthi, 1991).

**Remarks:** Rinodina mniaroeiza is close to *R. turfacea* (Wahlen.) Körb. in having large ascospores of *Physcia*-type and similar habitat but the latter species differs in having plane to concave disc and persistent thalline margin with crystals of sphaerophorin (Sheard, 2010).

**Specimen examined:** INDIA, Himachal Pradesh, Lahul Spiti district, Lahul Valley, Chhatree, elev. 3200 m, on soil along the river, 03 August 2002, Upreti & Divakar 02-000050/B (LWG).


Thallus crustose, lichenicolous, saxicolous, dark brownish, areolate, areoles 0.4–0.7 mm wide, margin indeterminate, prothallus absent, dark brown consoredia present, arising from areole margins. Apothecia lecanorine, 0.3–0.75 mm in diam., narrowly attached, scattered, rarely contiguous, disc brown to black, plane, thalline margin entire, concolourous with thallus. Ephymenium dark brown 12–15 µm high. Proper exciple hyaline, 24–35 µm wide, thalline exciple 65–80 µm wide. Hymenium dark 65–80 µm high, not inspersed. Paraphyses not conglutinate. Ascospores ellipsoidal, 45–70 µm high. Asci clavate, 8-spored. Ascosporae brown to dark brown, ellipsoidal, 1-septate, Milvina-type, 13.5–16.0 × 7.0–9.5 µm, with well-developed torus. Pycnidia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** This species is being reported from the temperate Central Himalayan region in Uttarakhand state, where it was found growing on crustose, saxicolous *Aspicilia* sp. at an elevation of 2611 m. Previously its occurrence was reported from North America, California, France (Sheard, 2010), Spain (Giralt, 2001), Switzerland (Mayrhofer, 1984), Bulgaria (Mayrhofer et al. 2005) and Sweden (Nordin, 2004).

**Remarks:** The spore size of Indian specimen is slightly smaller as compared to descriptions of the species from North America and Iberian Peninsula. *Rinodina obnascens* resembles with *R. milvina* (Wahlen.) Th. Fr. in its lichenicolous habitat, ascospore size and type, but differs in external morphology and having dark brownish consoredia (Sheard, 2010).

**Specimen examined:** INDIA, Uttarakhand, North-West Himalayas, district Almora, on rock, 1970, *D.D. Awasthi & K.P. Singh* 71/281 (LWG-LWU); Nilgiri Hills, Emerald road near Muthorai, on bark of tree, 01 December 1973, K.P. Singh 73.494 (LWG-LWU).

**Rinodina mniaroeiza** (Nyl.) Arnold, Flora, Regensburg 53(30–31): 469 (1871) [1870]  
Fig. 3C

Thallus crustose, sub-squamulose, light greyish, areolate, continuous, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, 0.5–1.5 mm in diam., frequent, broadly attached, disc black, plane, thalline margin entire, concolourous with thallus. Epihymenium red-brown, 10–15 µm high. Hypothecium hyaline, 70–85 µm high. Asci clavate, 8-spored. Ascosporae brown to dark brown, ellipsoidal, 1-septate, Milvina-type, 13.5–16.0 × 7.0–9.5 µm, with well-developed torus. Pycnidia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** This species is being reported from the North-eastern state, Arunachal Pradesh, where it was found growing on bark at an elevation of 700 m. Its occurrence has been reported from Australia (Mayrhofer et al., 1999), Brazil and south-western Europe (Giralt et al., 2009), Russia (Kotlov, 2008, Sheard et al., 2017) and USA (Sheard, 2010; Lendemer et al., 2013, 2014).

**Remarks:** Rinodina dolichospora does not resemble any other Rinodina species reported so far from the country. However, it is close to *R. tenuis* Müll. Arg., in ascospore type and size but the latter species possess pannarin which is lacking in *R. dolichospora*. It also shows some similarities with *R. ascosciscana* (Tuck.) Tuck. in thallus characteristics but the latter species has radially cracked apothecial margins and larger ascospores ([(22.5–)30.0–32.0(–39.5) × (10.5–)13.5–14.5(–17.5) µm] of Physcia-type (Sheard 2010).

**Specimens examined:** INDIA, Arunachal Pradesh, Dibang valley district, Roing, Deopani, elev. 700 m, on bark, 01 June 1984, D.K. Upreti & B.C. Upreti L81720 (LWG); Tamil Nadu, Nilgiri Hills, Ootacamund, Botanic Garden,7000 feet, on bark of conifer tree, 05 January 1971, D.D. Awasthi & K.P. Singh 71/281 (LWG-LWU); Nilgiri Hills, Emerald road near Muthorai, on bark of tree, 01 December 1973, K.P. Singh 73.494 (LWG-LWU).

**Rinodina mniaroeiza** (Nyl.) Arnold, Flora, Regensburg 53(30–31): 469 (1871) [1870]  

Thallus crustose to sub-squamulose, light greyish, areolate, continuous, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, 0.5–1.5 mm in diam., frequent, broadly attached, disc brown dark, convex, thalline margin concolourous with thallus, often excluding. Apothecial cortex indistinct. Ephymenium red-brown, 10–15 µm high. Proper exciple hyaline, 10–25 µm wide, thalline exciple 70–110 µm wide. Hymenium hyaline, 80–110 µm high, not inspersed. Paraphyses not conglutinate, 2.0–3.5 µm thick. Hypothecium hyaline to slightly yellowish, 45–70 µm high. Asci clavate, 8-spored. Ascosporae brown, 1-septate, Physcia-type, 24.5–32.0 × 10.0–14.0 µm. Pycnidia not seen.

**Chemistry:** Thallus K+ yellow, C –, KC –, PD + faint yellow; TLC: atranorin.

**Habitat & distribution:** Rinodina mniaroeiza is being reported from the mountainous region of Western Himalayan state Himachal Pradesh at an elevation of 3200 m where it was found growing on soil. Earlier, its occurrence was reported from Norway, Sweden, Greenland, Finland, North America (Mayrhofer and Moberg, 2002) and Nepal (Awasthi, 1991).

**Remarks:** Rinodina mniaroeiza is close to *R. turfacea* (Wahlen.) Körb. in having large ascospores of *Physcia*-type and similar habitat but the latter species differs in having plane to concave disc and persistent thalline margin with crystals of sphaerophorin (Sheard, 2010).

**Specimen examined:** INDIA, Himachal Pradesh, Lahul Spiti district, Lahul Valley, Chhatree, elev. 3200 m, on soil along the river, 03 August 2002, Upreti & Divakar 02-000050/B (LWG).

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** Rinodina oleae is being reported from the coastal areas of arid region in Gujarat state, where it was growing on the bark of tree at an elevation of 74 m. Earlier, it was reported from Western North America (Alaska, California), Nevada (Sheard, 2010), Europe (Giralt, 2001), China (Ren and Zheng, 2020), Japan and Russia (Sheard et al., 2017) and South Korea (Joshi et al., 2013).

**Remarks:** Rinodina oleae is close to R. gennarii Bagl. in thallus characteristics and lacking chemistry, but the latter species differs in having primarily saxicolous habitat and more broadly ellipsoid ascospores (Sheard, 2010).

**Specimen examined:** INDIA, Gujarat, Kutch district, Lakhpat taluka, near Kutch cement factory, N23°48ʹ00.2ʹʹ, elev. 74 m, on bark, 4 June 2014. K.K. Ingle, S. Nayaka & team (LWG).

Thallus crustose, greyish-white, verrucose, becoming areolate, margin indeterminate, delimited by a prothallus of light brown colour, vegetative propagules absent. Apothecia frequent, lecanorine, broadly to narrowly attached, becoming contiguous, 0.3–0.6 mm in diam., disc dark brown, plane to concave, margin concolourous with thallus. Epihymenium pale-brown, 08–15 μm. Proper exciple hyaline, 7–15 μm wide, thalline exciple 80–105 μm with green algal cells. Apothecial cortex absent. Epihymenium hyaline, 56–90 μm, hyaline, not inspersed. Paraphyses simple, unbranched, not conglutinate, 2.0–2.5 μm thick. Hypothecium hyaline, 20–30 μm pale-yellowish brown to hyaline. Ascii clavate, 8-spored. Ascospores brown, 1-septate, ellipsoidal, Physcia-type, 18.5–24.5 × 10–13.5 μm. Pyenia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** The species was found growing on the bark of tree in the temperate region of Western Himalayan state, Himachal Pradesh at an elevation of 2850 m. Previously its occurrence has been reported from Spain, Mediterranean region (Giralt, 2001) and Central Europe (Ropin and Mayrhofer, 1993; and Nadyeina et al., 2010).

**Remarks:** Rinodina plana resembles R. exigua (Ach.) in lacking chemistry and ascospore type, but latter species differs in having atranorin and smaller ascospores (15.0–17.0 × 7.0–8.5 μm). It also resembles R. septentrionalis Malme in having atranorin and smaller ascospores type, but latter species gets distinguished with smaller ascospores (13.5–16–17–19.5) × (6.5–7.5–8.0–9.5) μm (Sheard, 2010).

**Specimens examined:** INDIA, Himachal Pradesh, Kullu district, Parvati river valley, above Pulga rest house, elev. 2850 m, on tree trunk, 20 June 1975. D.D. Awasthi & K. Dange 75239D (LWG-LWU), 75236D (LWG-LWU).

*Rinodina pyrina* (Ach.) Arnold, Flora 64: 196 (1881)

Thallus crustose, whitish grey to brownish, plane, continuous to rimose, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, 0.2–0.4 mm in diam., broadly attached, frequent, scattered to contiguous, disc dark brown to black, plane, sometimes becoming convex, thalline margin concolourous with thallus, persistent to becoming excluded. Apothecial cortex absent. Epihymenium pale brown, 08–15 μm high. Proper exciple hyaline, 10–20 μm wide, thalline exciple 70–95 μm wide. Hymenium hyaline, 65–80 μm high. Paraphyses not conglutinate, simple, 2.0–2.5 μm thick. Hypothecium hyaline to slightly yellowish, 35–45 μm high. Asci clavate, 8-spored. Ascospores pale brown, 1-septate, Physconia-type, 12.0–16.0 × 5.0–8.0 μm. Pyenia not seen.

**Chemistry:** Thallus K –, C –, KC –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** The species was found growing on the bark of tree in the temperate region of Western Himalyan state, Himachal Pradesh at an elevation of 2850 m. Earlier, it was reported from Australasia, British Isles, Norway, Sweden, Finland, North America, northern Africa, central and southern Europe (Mayrhofer and Moberg, 2002), Taiwan (Aptroot et al., 2003), Japan (Kurokawa and Kashiwadani, 2006) South Korea (Joshi et al. 2013) and China (Ren and Zheng, 2020).

**Remarks:** Rinodina pyrina is close to R. orculata Poelt & M. Steiner in thallus and ascospore characteristics but the latter species differs in having Physcia-Physconia-type ascospores and dark brown epihymenium (Giralt, 2001). It can also be mistaken with R. imshaugi Sheard for its Physconia-type similar ascospores however ascospores in R. imshaugi are significantly larger in size (12.5–15.5–16.5(–19) × (6.0–)7.0–8.5(–9.5) μm (Sheard, 2010).

**Specimens examined:** INDIA, Himachal Pradesh, Kullu district, Parvati river valley, above Pulga rest house, elev. 2850 m, on tree trunk, 20 June 1975. D.D. Awasthi & K. Dange 75239D (LWG-LWU), 75236D (LWG-LWU).

*Rinodina trevisanii* (Hepp) Körb., Parerga Lichenol. (Breslau) 1: 70 (1859) [1865]

Thallus K –, C –, PD –; TLC: No lichen substance detected.

**Habitat & distribution:** The species was found growing on the bark of tree in the temperate Himalayan region in Himachal Pradesh state at an elevation of 2850 m. Previously its occurrence has been reported from Spain, Mediterranean region (Giralt, 2001) and Central Europe (Ropin and Mayrhofer, 1993; and Nadyeina et al., 2010).

**Remarks:** Rinodina trevisanii resembles R. exigua (Ach.) in having atranorin and smaller ascospores (15.0–17.0 × 7.0–8.5 μm). It also resembles R. septentrionalis Malme in lacking chemistry and ascospore type, but latter species gets distinguished with smaller ascospores (13.5–16–17–19.5) × (6.5–7.5–8.0–9.5) μm (Sheard, 2010).

**Specimens examined:** INDIA, Himachal Pradesh, Kullu district, Parvati river valley, above Pulga rest house, elev. 2850 m, on tree trunk, 20 June 1975. D.D. Awasthi & K. Dange 75239D (LWG-LWU), 75236D (LWG-LWU).

*Psora trevisanii* Hepp, Flecht. Europ.: no. 80 (1853).
Fig. 3. A. *Rinodina archaea* with rimose-areolate thallus and dense apothecia; B. Sub-squamulose thallus of *Rinodina dolichospora* with apothecia; C. Thallus of *Rinodina mniaroeiza* with sub-squamules and apothecia. D. *Rinodina obnascens* with apothecia and consoredia; E. Thallus and apothecia of *Rinodina oleae*; F. Thallus of *Rinodina plana* with apothecia; G. *Rinodina pyrina* with apothecia; & H. *Rinodina trevisanii* with plane-rimose thallus and scattered apothecia. (Scale bars: A - H = 0.5 mm)
Thallus crustose, greenish to pale grey, continuous to rimose, surface plane, margin indeterminate, vegetative propagules and prothallus absent. Apothecia lecanorine, scattered, broadly attached, 0.3–0.7 mm in diam., disc dark brown to black, frequently convex, thalline margin concolourous with thallus, entire, becoming excluded. Apothecial cortex indistinct. Epiphyllumium brown to yellowish brown, 10–12 µm high. Proper exciple light brown 10–20 µm wide, thalline exciple 40–80 µm wide. Hymenium hyaline, not inspersed, 40–50 µm high. Paraphyses conglutinate, simple, unbranched, 2–2.5 µm thick. Hypothecium hyaline, 30–60 µm high. Ascii clavate, 8-spored. Ascospores brown, 1-septate, 14.0–22.0 × 6.0–10.0 µm, thallus inconspicuous, brownish grey to dark brown, continuous, plane, apothecia 0.5–0.8 mm in diam. ....... R. conradii Körb. 7b. Ascospores submuriform at maturity, 24–39 × 13–18 µm, thallus light brown to ochraceous, continuous, plane to rugose with small marginal lobes, apothecia 0.8–1.5 mm in diam. ...... R. intermedia Bagl. 8a. Thallus with vegetative propagules ......................... 9 8b. Thallus lacking vegetative propagules ...................... 10 9a. Epiphyllumium blue-grey, K+ violet, areoles with marginal consoredia, ascospores Dirinaria-type, 16.0–22.0 ×10.0–12.0 µm ..... 20b. Ascospores submuriform, light brown to ochraceous, continuous, plane to rugose with small marginal lobes, apothecia 0.8–1.5 mm in diam. ...... .......... R. colombina (Ach.) Th. Fr. 9b. Epiphyllumium brownish, K–, areoles with frequent blastidia, ascospores Teichophila-type 11.5–19 × 5.5–8.5 µm ................. R. indica Vishal Kumar, R. Ngangom & Nayaka 10a. Ascospores Pachyphora-type ................................ 11 10b. Ascospores otherwise .................................... 12 11a. Ascospores 19.0–35.0 × 14.0–17.0 µm, thallus light grey, areolate, becoming sub-squamulose ............ R. dolichospora Malme 11b. Ascospores 14.0–22.0 × 8.0–11.0 µm, thallus ocheraceous, continuous to rimose .... R. intrusa (Nyl.) Malme 12a. Ascospores Milvina-type, 13.0–16.0 × 7.0–8.0 µm, thallus brown, continuous to areolate, apothecia up to 1 mm in diam. ....... R. sophodes (Ach.) A. Massal. 12b. Ascospores otherwise .................................. 13 13a. Ascospores Physcia or Physconia-type ............... 14 13b. Ascospores otherwise .................................... 16 14a. Ascospores Physcia-type .............................. 15 14b. Ascospores Physconia-type .......................... 16 15a. Ascospores 15.0–17.0 × 7.0–8.5 µm, thallus K+, light to dark grey, areolate, apothecia 0.3–0.8 mm in diam. ..... R. exigua (Ach.) Gray 15b. Ascospores 18.5–24.5 × 10.0–13.5 µm, thallus K-, greyish-white, verrucose, becoming areolate, apothecia 0.3–0.6 mm in diam. ....... R. plana H. Magn. 16a. Ascospores 12.0–16.0 × 5.0–8.0 µm, thallus whitish brown, continuous to rimose, apothecia 0.2–0.4 mm in diam. ....... R. pyrina (Ach.) Arnold 16b. Ascospores larger ...................................... 17 17a. Ascospores 14.0–22.0 × 6.0–10.0 µm, thallus brownish grey, rimose-areolate, apothecia 0.2–0.6 mm in diam. ....... R. archaea (Ach.) Arnold 17b. Ascospores 15.0–18.0 × 6.0–8.0 µm, thallus greenish to pale grey, continuous to rimose, apothecia 0.3–0.7 mm in diam. .......... R. trevisanii (Ach.) Arnold 18a. Ascospores Beltraminia-type, 13.0–17.0 × 7.0–8.0 µm, thallus dark brown, continuous, apothecia 0.1–0.3 mm in diam. .......... R. mackenziei Räsänen 18b. Ascospores Dirinaria-type, 12.5–17.0 × 6.0–8.5 µm, thallus dark brown to greyish brown, apothecia 0.3–0.6 mm in diam. ....... R. oleae Bagl. 19a. Ascospores 3-septate or submuriform ................. 20 19b. Ascospores 1-septate .................................. 21 20a. Ascospores consistently 3-septate, 20.0–32.0 × 10.0–12.0 µm, thallus inconspicuous, brownish grey to dark brown, continuous, plane, apothecia 0.5–0.8 mm in diam. ...... .......... R. conradii Körb. 20b. Ascospores submuriform, light brown to ochraceous, continuous, plane to rugose with small marginal lobes, apothecia 0.8–1.5 mm in diam. ....... R. intermedia Bagl 21a. Apothecial cortex well developed, sphaerophorin present, thallus K+, ashy white to brownish grey, areolate, apothecia 1–1.5 mm in diam., ascospores 1-septate Physcia-type, 26–35 × 11.0–14.0 µm .......... R. turfaeae (Wahlenb.) Körb. 21b. Apothecial cortex indistinct, sphaerophorin absent, thallus K+ yellow, light grey, sub-squamulose, apothecia up to 1.5 mm in diam., ascospores Physcia-type 24.5–32.0 × 10.0–14.0 µm .......... R. mniaroeiza (Nyl.) Arnold. ACKNOWLEDGMENTS

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