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The genus *Ramaria* in the Eastern Himalayas: Subgenera *Ramaria*, *Echinoramaria* and *Lentoramaria*

K S THIND and R M SHARDA
Department of Botany, Panjab University, Chandigarh 160014, India

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Abstract. In this paper an account of 12 taxa of the genus *Ramaria* (Fr) Bonorden collected from various localities in the eastern Himalayas and adjoining hills is given. Of the taxa included *R. rubella* var *himalaica* is described as new; *R. rubrievanescens*, *R. rubripermanens*, *R. botrytis*, *R. strasseri* and *R. flaccida* var *longiramosa* are now records for the Himalayas; while *R. clarobrunnea*, *R. flaccida*, *R. pusilla*, *R. concolor* and *R. apiculata* are the first records of their occurrence in the eastern Himalayas.

Keywords. *Ramaria*; taxonomy; eastern Himalayas.

1. Introduction

Fungal forays conducted by the authors during the years 1978–1981 revealed luxuriant growth of clavarioid fungi in the eastern Himalayas. Most of the collections made pertained to the species of genus *Ramaria*. This paper gives an illustrated account of 12 taxa of the genus, of which one is described as new, five are new records for the Himalayas and five are the first records of their occurrence in the eastern Himalayas.

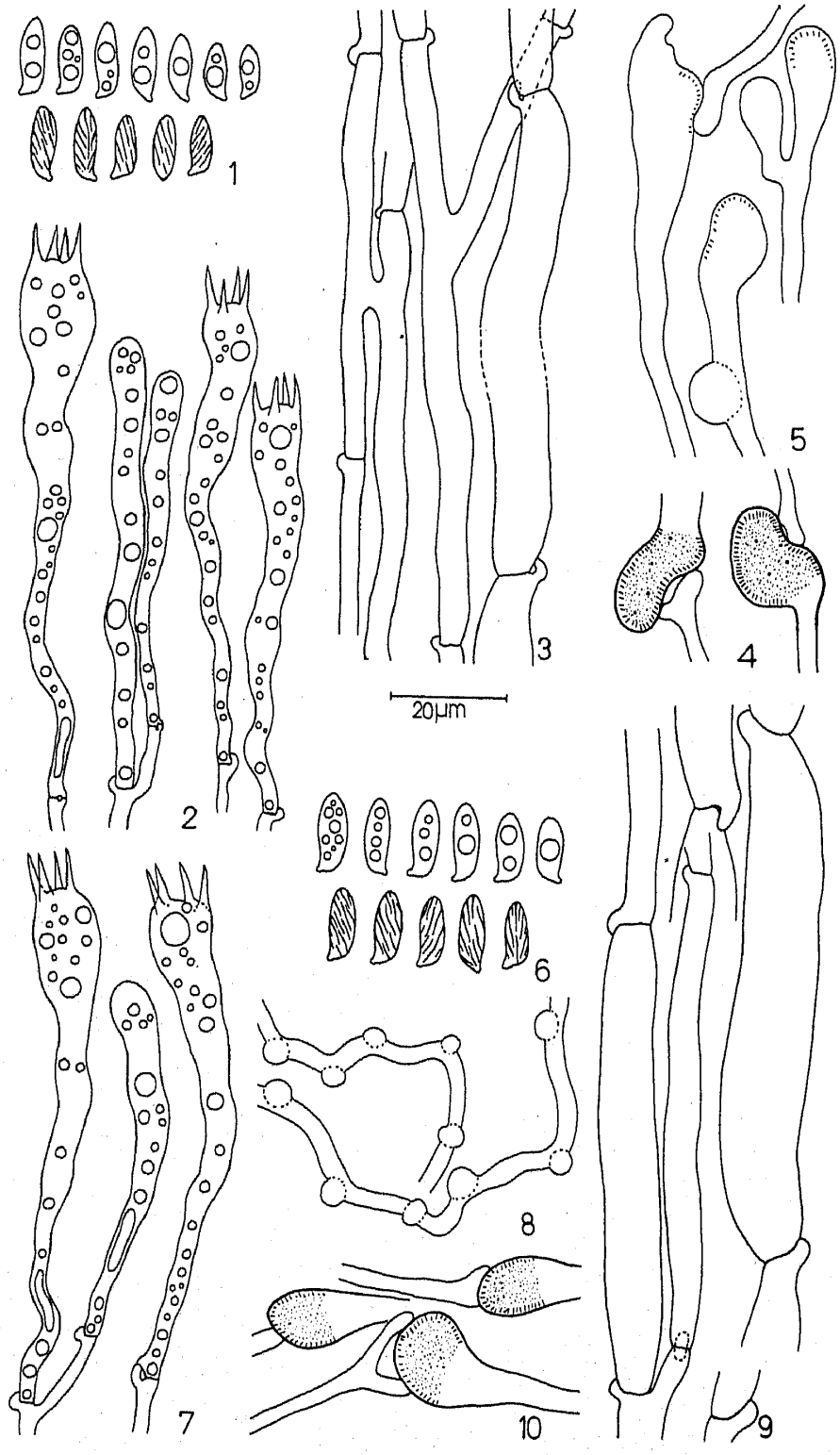
Ramaria is the largest genus of clavarioid fungi and the modern trend is to treat it under several subgenera. The species described in this paper belong to the subgenera *Ramaria*, *Echinoramaria* and *Lentoramaria*. The materials of all the taxa have been deposited at the Herbarium, Department of Botany, Panjab University, Chandigarh, (PAN) and at some noted foreign herbaria as indicated. The abbreviations used for herbaria follow Holmgren and Keuken (1974) and the colour standards are according to Kornerup and Wanscher (1967).

2. Subgenus: *Ramaria*

2.1 *Ramaria rubrievanescens* Marr & Stuntz, Biblthca mycol. **38**: 41. 1973. (figures 1–5)

Fruit-bodies up to 15 × 9 cm, massive, fleshy, gregarious or scattered, cream-coloured, turning brown to brownish red on bruising; trunk absent; branching polychotomous throughout, lower branches thick, becoming narrower upward; axils lunate; tips subacute to obtuse, mostly in pairs, pink but fading later on; flesh white; taste and smell not distinctive.

Hyphal system monomitic; hyphae upto 11(−13·5) μm wide, clamped, thin-walled, acyanophilous; ampullaeform swellings prominently ornamented; gloeoplerous hyphae abundant, up to 5 μm wide, simple to sparsely branched, inflated near the septa, thin-walled, cyanophilous. Basidia 70–91 × 9·5–11 μm, clavate, clamped,



Figures 1–10. *R. rubrievanescens.* **1.** Basidiospores. **2.** Basidia. **3.** Context-hyphae. **4.** Ampullaeform swellings. **5.** Gloeoplerous hyphae. *R. rubripermanens.* **6.** Basidiospores. **7.** Basidia. **8.** Gloeoplerous hyphae. **9.** Context-hyphae. **10.** Ampullaeform swellings.

guttulate, 4-spored, weakly cyanophilous; sterigmata upto 7 μm long. Basidiospores 9–11(–12·5) × 3·5–4·5(–5) μm, cylindric-ellipsoid, uni- to multiguttulate; wall thin to slightly thickened, cyanophilous, striated; apiculus up to 1 μm long.

Specimens examined: R. M. Sharda 22279 (PAN), on soil under mixed forest, Nawephu, Thimphu, Bhutan, September 26, 1980; R. M. Sharda 22322 (PAN), on soil under mixed forest, Begana, Thimphu, Bhutan, August 2, 1981; R. M. Sharda 22348 (PAN), on soil under broad-leaved forest, Chankaphug, Thimphu, Bhutan, August 9, 1981.

The eastern Himalayan collections resemble closely with those of Dalhousie in the north-western Himalayas made by Khurana (1977). This species is closely allied to *R. rubripermanens* but differs in having cream colour of the fruit-bodies turning brown to brownish red on bruising and pink tips fading later on.

2.2 *Ramaria rubripermanens* Marr & Stuntz, Biblthca mycol. **38**: 43. 1973 (figures 6–10)

Fruit-bodies up to 13 × 14 cm, massive, fleshy-watery, gregarious or scattered; pinkish white, unchanging on bruising; trunk up to 4 × 3 cm, white, branches polychotomous, up to 1·5 cm wide at the base, becoming thinner and longer above; axils wide open; tips acute to subacute, in pairs or clustered, pink, not fading later on; flesh concolorous with the fruit-body surface; taste and smell not distinctive.

Hyphal system monomitic; hyphae up to 12·5(–16) μm wide, clamped, thin to slightly thick-walled, acyanophilous; ampullaeform swellings prominently ornamented; gloeoplerous hyphae rare, up to 3·5 μm wide, simple or branched, with abundant localized swellings imparting beaded appearance, thin-walled, cyanophilous. Basidia up to 80 × 10·5 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 7 μm long. Basidiospores 10·5–12(–13) × 4–4·5(–5) μm, ellipsoid, uni- to multiguttulate; wall thin to slightly thickened, cyanophilous, spirally striated; apiculus up to 0·8 μm long.

Specimens examined: R. M. Sharda 22280 (PAN), on soil under mixed forest, Nawephu, Thimphu, Bhutan, September 26, 1980; R. M. Sharda 22319 (PAN), on soil under mixed forest, Begana, Thimphu, Bhutan, August 2, 1981; R. M. Sharda 22347 (PAN), on soil under mixed forest, Chankaphug, Thimphu, Bhutan, August 9, 1981.

Khurana (1977) made a number of collections of this species from Dalhousie and Simla hills in the north-western Himalayas which closely resemble the eastern Himalayan collections made by us. The species is marked by pinkish white fruit-bodies having clearly pink tips not fading later on and non-bruising nature.

2.3 *Ramaria botrytis* (Pers.: Fr.) Ricken, Vademecum. 253. 1918 (figures 11–13)

Fruit-bodies up to 12 × 13·5 cm, nearly as broad as tall, massive, fleshy-fibrous, gregarious or scattered closely, rarely in groups of 2 or 3, light yellow at the base and flesh-coloured to reddish or vinous upward, unchanging on bruising; trunk indistinct to distinct, up to 2·5 × 2 cm, somewhat stubby, dull yellow; branches polychotomous, lower branches up to 1 cm thick, stout, becoming shorter and congested upward, smooth or faintly rugulose; axils narrow; tips subacute to obtuse, minute, pluridigitate, pale red to pastel red or vinous; flesh white; taste not distinctive; smell pleasant, edible.

Hyphal system monomitic; hyphae up to 11 μm wide, clamped, thin-walled,

acyanophilous; ampullaeform swellings conspicuously ornamented; gloeoplerous hyphae not observed. Basidia up to 70 × 10·5 μm clavate, guttulate, clamped, 4-spored; sterigmata up to 7 μm long. Basidiospores 12–15 (– 16·5) × 4–4·5 (– 5) μm, cylindric-ellipsoid, uni- to multiguttulate; wall thin, cyanophilous, striated; apiculus up to 1·2 μm long.

Specimens examined: R. M. Sharda 22373 (PAN), on soil under mixed forest, Chankaphug, Thimphu, Bhutan, August 16, 1981; R. M. Sharda 22467 (PAN), on soil under broad-leaved forest, Shergaon, West Kameng, Arunachal Pradesh, September 8, 1981; R. M. Sharda 22470 (PAN), on soil under mixed woods, 15 km (Rupa-Shergaon road), West Kameng, Arunachal Pradesh, September 9, 1981.

All the eastern Himalayan collections are quite typical of the species and agree well with the description given by Corner (1950, 1970) and Marr and Stuntz (1973).

2.4 *Ramaria strasseri* (Bres) Corner, Ann. Bot. Mem. **1**: 622. 1950 (figures 14–18)

Fruit-bodies up to 17 × 10 cm, massive, fleshy, occurring singly, light yellow to greyish orange at the base, pale yellow to tan above, unchanging on bruising; trunk up to 7·5 × 3·5 cm, massive, thick, white; branches polychotomous below and dichotomous above, basal branches up to 1 cm thick, becoming thinner and elongated upward; axils U-shaped; tips subacute to obtuse, bifid to multifid, light brown with vinaceous cast, turning dark-brown after drying; flesh white, soft, fibrous; taste bitter; smell not distinctive.

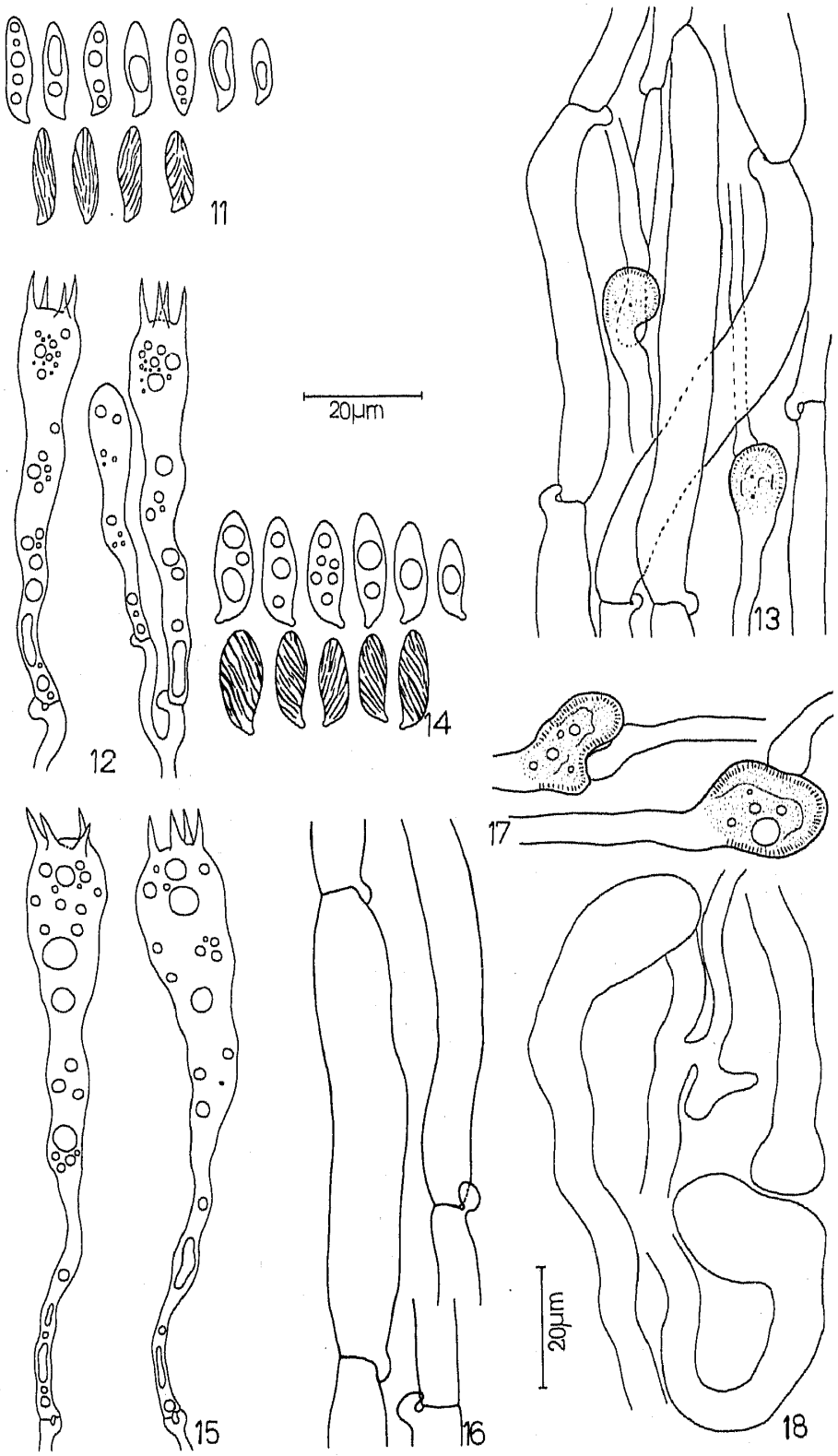
Hyphal system monomitic; hyphae up to 13·5 μm wide, clamped, wall slightly thickened; acyanophilous; ampullaeform swellings prominently ornamented; gloeoplerous hyphae common, up to 7 μm wide, inflated near the septa, thin-walled, cyanophilous. Basidia up to 95 × 14 μm, long clavate, multiguttulate, weakly cyanophilous, clamped, 4-spored; sterigmata up to 8·5 μm long. Basidiospores 14–16 (– 17·5) × 4·5–6·5 (– 7·0) μm, subcylindric to cylindric-ellipsoid, uni- to multiguttulate; wall moderately thickened, cyanophilous, spirally striated; apiculus up to 1·5 μm long.

Specimens examined: R. M. Sharda 22267 (PAN), on soil under coniferous forest, Chankaphug, Thimphu, Bhutan, September 23, 1980; R. M. Sharda 22278 (PAN), on soil under mixed forest, Nasephu, Thimphu, Bhutan, September 26, 1980.

Both the eastern Himalayan collections from Bhutan agree well with the concept of this species as given by Corner (1950) and Marr and Stuntz (1973). Characteristics that distinguish *R. strasseri* from the related species are pale yellow to light tan, massive fruit-bodies, bitter taste and prominently striated, large basidiospores.

2.5 *Ramaria clarobrunnea* Corner, Thind & Anand, Trans. Br. Mycol. Soc. **39**: 478. 1956 (figures 19–24)

Fruit-bodies up to 16 × 12 cm, massive, fleshy-watery, gregarious to scattered closely, orange white to pale orange, to light brown, unchanging on bruising; trunk up to 3 × 3 cm, thick, smooth, white to pallid white; branches polychotomous below, dichotomous above, profuse, lower branches thick, becoming thinner and shorter upward; axils narrow; tips blunt, concolorous with the fruit-body surface; flesh paler concolorous with the surface; taste and smell not distinctive.



Figures 11–18. *R. botrytis.* **11.** Basidiospores. **12.** Basidia. **13.** Context-hyphae and ampulaeform swellings. *R. strasseri.* **14.** Basidiospores. **15.** Basidia. **16.** Context-hyphae. **17.** Ampullaeform swellings. **18.** Gloeoplerous hyphae.

Hyphal system monomitic; hyphae up to 12 μm wide, clamped, wall slightly thickened, acyanophilous; ampullaeform swellings conspicuously ornamented; gloeoplerous hyphae of two types: (i) short, unbranched, granular or soapy gloeoplerous hyphae marked by a main stem up to 6 μm wide from which are given out numerous small, narrow, usually simple branches; (ii) long, sparsely branched, non-granular or non-soapy gloeoplerous hyphae up to 8 μm wide, swollen near the septa, thin-walled, cyanophilous. Basidia 70–92 × 10–13 μm, long clavate, guttulate, clamped, 4-spored; sterigmata up to 7·5 μm long. Basidiospores 8·5 – 11·0 (– 12·0) × 3·5 – 4·0 (– 5·0) μm, ellipsoid, uni- to multi-guttulate; wall thin to slightly thickened, cyanophilous, spirally striated; apiculus up to 1 μm long.

Specimens examined: R. M. Sharda 22113 (PAN), on soil under predominantly *Pinus kesiya* forest, Elephant falls, Shillong, Meghalaya, September 18, 1979; R. M. Sharda 22283 (PAN), on soil under mixed forest, Chailala, Paro, Bhutan, September 29, 1980.

This species was described by Corner *et al* (1956) on the basis of a single collection from Mussoorie (U.P.). Corner (1970) also included a collection from Panama under this species. During his various visits to different collecting sites in the north-western Himalayas, including the type locality, Khurana (1977) did not encounter this species there again.

In the eastern Himalayas, the species was collected twice from widely separated localities in shillong and Bhutan. Both these collections resemble well the holotype at PAN examined by Khurana (1977) and by us in having pale orange to light brown, massive fruit bodies, well developed gloeoplerous hyphal system (two types of gloeoplerous hyphae) and striated basidiospores.

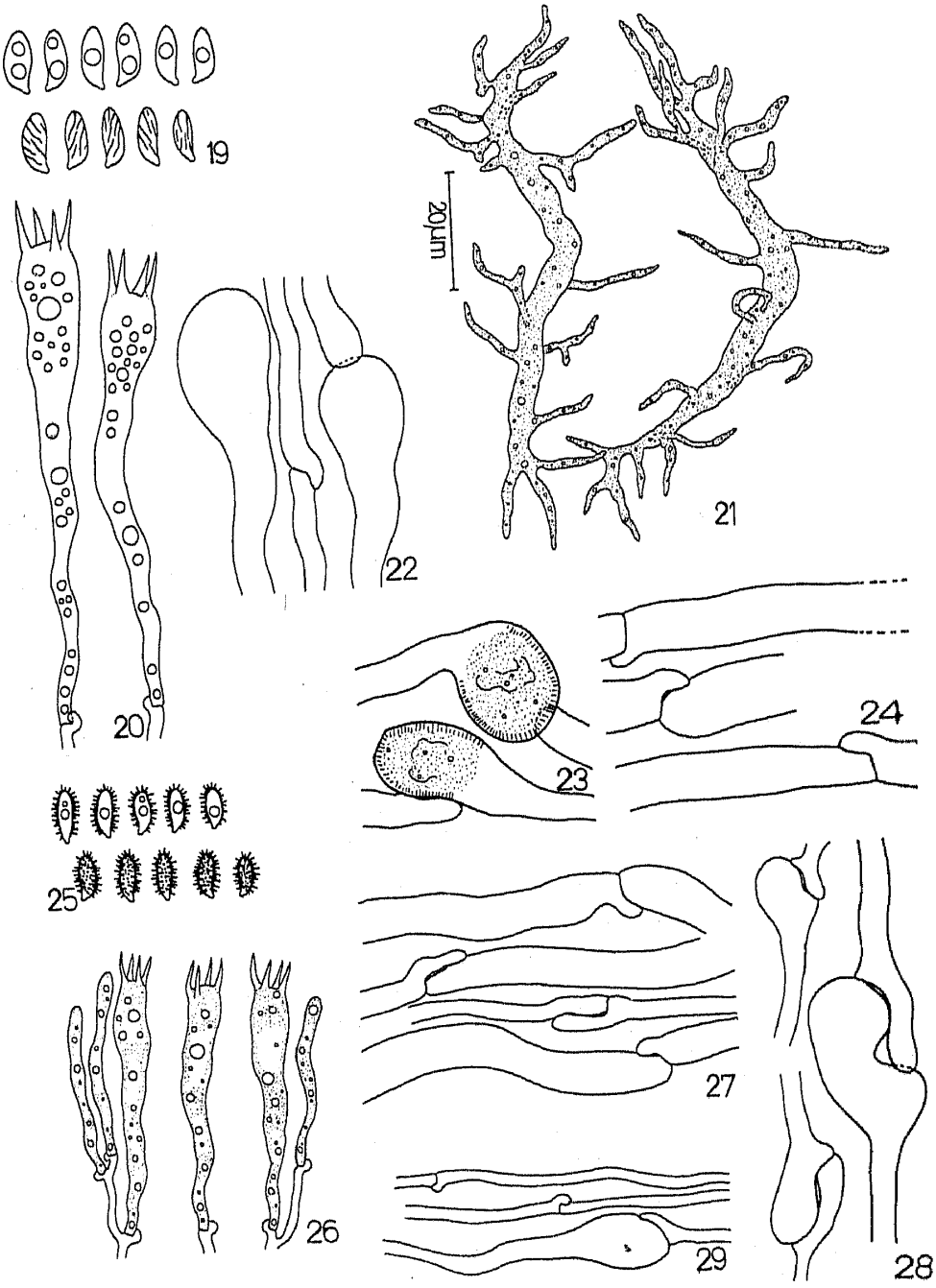
3. Subgenus—*Echinoramaria* Corner, Beih. Nova Hedwigia 33: 238–239. 1970.

3.1 *Ramaria flaccida* (Fr) Ricken, Vademecum. 254. 1918.

Fruit-bodies up to 8 cm long and 3·5 cm broad, medium to small sized, fleshy when fresh, drying brittle, solitary, gregarious; yellowish brown to brown; trunk indistinct to distinct, up to 2 cm long and 0·3 cm broad, slender; branches dichotomous, slender, profuse, lower branches up to 0·2 cm wide, smooth, becoming narrower and shorter upward, sometimes ultimate branches fused with one another, axils U-shaped; tips acute, minute, dichotomous or in unequal pairs, brown; flesh white to lighter concolorous; taste and smell not distinctive.

Hyphal system monomitic; hyphae up to 11 (– 12·5) μm wide, clamped, thin-walled, acyanophilous; ampullaeform swellings abundant, smooth; hyphae of the rhizomorphs up to 3·5 μm wide, not inflated, clamped, thin-walled; ampullaeform swellings present, smooth. Basidia up to 50 × 6·5 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 4·5 μm long. Basidiospores 4·0–7·0 × 3–3·5 (– 4·0) μm, ellipsoidal, uniguttulate; wall thin, cyanophilous, echinulate, spines up to 0·7 μm long; apiculus minute.

Specimens examined: R. M. Sharda 22286 (PAN), on humus and needle duff under mixed forest, 9 km (Haa-Chuzom road), Haa, Bhutan, October 1, 1980; R. M. Sharda 22293 (PAN), on humicolous soil or bark duff under broad-leaved forest, Dam site forests, Chimakothi, Bhutan, July 27, 1981; R. M. Sharda 22298 (PAN), on humus under angiospermous forest, forests near Dam site, Chimakothi, Bhutan, July 28,



Figures 19–29. *R. clarobrunnea.* **19.** Basidiospores. **20.** Basidia. **21.** Acanthodendroid gloeoplerous hyphae. **22.** Normal gloeoplerous hyphae. **23.** Ampullaeform swellings. **24.** Context-hyphae. *R. flaccida* var. *longiramosa.* **25.** Basidiospores. **26.** Basidia. **27.** Context-hyphae. **28.** Smooth ampullaeform swellings. **29.** Hyphae of the rhizomorphs.

1981; R. M. Sharda 22311 (PAN), on humus under broad-leaved forest, Bunakha, Bhutan, July 29, 1981.

In India, this species was first recorded by Thind and Anand (1956) from Mussoorie hills (U.P.). Subsequently, Thind (1961) and Khurana (1977) cited a number of collections from different localities in the north-western Himalayas indicating its common occurrence in that area.

As discussed by Corner (1950, 1970), and Thind (1961) it is quite a variable species, however, all the eastern Himalayan collections fall within the specific limits of this species. It is marked by small to medium size of the fruit-bodies (usually 4–8 cm long), greyish yellow to finally brown colour, non-bruising nature, and small, minutely echinulate basidiospores.

3.2 *Ramaria flaccida* var *longiramosa* Corner, Beih. Nova Hedwigia **33**: 250, 1970 (figures 25–29)

Fruit-bodies up to 16 × 5 cm, fleshy-coriaceous, brittle after drying, gregarious or scattered closely, with abundant mycelial hyphae at the base; yellow to olive brown, unchanging on bruising; trunk up to 4 × 0·5 cm, slender, most part buried in the needle duff, white or light yellow; branches polychotomous below and dichotomous above, long, slender, smooth, axils broad; tips acute, dichotomous, light yellow; flesh dull white; taste and smell not distinctive.

Hyphal system monomitic; context-hyphae up to 10 μm wide, clamped, thin-walled, acyanophilous; ampullaeform swellings present, smooth; mycelial hyphae up to 3 μm wide, not inflated, clamped, thin-walled, ampullaeform swellings occur, smooth; gloeoplerous hyphae not observed. Basidia 35–45 × 5–6 μm, clavate, granular-guttulate, clamped, 4-spored; sterigmata up to 4·5 μm long. Basidiospores 5·5–7 (−8) × 3–4 μm, ellipsoid to pip-shaped, uniguttulate; thin to slightly thick-walled, cyanophilous, echinulate, spines dense, up to 1 μm long; apiculus up to 0·8 μm long.

Specimen examined: R. M. Sharda 22088 (PAN, SUCO), on needle duff under *Cryptomeria japonica* forest, Dhotrey, Darjeeling, West Bengal, September 10, 1979.

This taxon was described by Corner (1970) on the basis of a collection from Pangarango, Java. The fungus was not collected again after that and this is the second report to its occurrence in the world. Evidently, it is rare in its distribution.

The eastern Himalayan collection from Dhotrey (Darjeeling) fits well in the circumscription of the variety as given by Corner (1970). Microscopically, it cannot be separated from *R. flaccida* var *flaccida* but for the larger size of the fruit-bodies (up to 16 cm high).

3.3 *Ramaria sikkimia* Rattan & Khurana, Biblthca mycol. **66**: 18. 1978.

Fruit-bodies up to 7 × 3 cm, small-sized, fleshy to fleshy-coriaceous, gregarious or scattered closely, brown, unchanging on bruising; trunk up to 2·5 × 0·6 cm, slender, pallid white; branches profuse, polychotomous below, dichotomous above, basal branches parallel, long, slender, becoming thinner and shorter upward, smooth, axils U-shaped; tips subacute to obtuse, paler concolorous to yellow; flesh light brown; taste and smell not distinctive.

Hyphal system monomitic; hyphae up to 8·5 μm wide, clamped, wall thin to slightly

thickened, acyanophilous; ampullaeform swellings not ornamented; gloeoplerous hyphae fairly common, up to 3 μm wide, simple or forked, swollen near the septa, thin-walled, cyanophilous. Basidia 40–52 × 7–8·5 μm, clavate, clamped, 3(2–4) spored; sterigmata up to 8 μm long. Basidiospores up to 6·5–8·5 (–9) × 4·5–5·5 (–6·2) μm, broadly ellipsoid to subglobose, to lacrimiform, uniguttulate; wall up to 1·2 μm thick, cyanophilous, prominently echinulate, spines up to 1·5 μm long; apiculus up to 1·5 μm long.

Specimens examined: R. M. Sharda 22072 (PAN, TENN), on soil under angiospermous forest, Takdah Cantt., Darjeeling, West Bengal, August 31, 1979; R. M. Sharda 22487 (PAN), on soil under broad-leaved forest, 3 km (Jamiri-Buragaon road), West Kameng. Arunachal Pradesh, September 13, 1981.

This species was described by Rattan and Khurana (1978) on the basis of a single collection from Manebhanjang, Darjeeling hills. During our search for the clavarioid fungi of the eastern Himalayas, we encountered this species in Darjeeling (West Bengal) and Jamiri (Arunachal Pradesh). Both these collections conform well with the holotype and its description as given by Rattan and Khurana (1978). However, the fruit-bodies are smaller (up to 7 × 3 cm) than that of the holotype (up to 17 × 5·5 cm) and appear to represent young fruit-bodies of this species. Therefore, more collections are needed to find out the exact range of variation of *R. sikkimia*. The underlining features of this species are the brown colour of the fruit-bodies with yellowish tips; unchanging flesh; predominantly 3-spored basidia, and broadly ellipsoid to subglobose to lacrimiform, prominently thick-walled, strongly echinulate basidiospores.

3.4 *Ramaria pusilla* (Peck) Corner, Ann. Bot. mem. **1**: 617. 1950

Fruit-bodies up to 7 × 3·5 cm, small-sized, fleshy-coriaceous, occurring singly, gregarious, arising from white mycelium, cream yellow to yellow ochraceous; colour changing to brownish on bruising; trunk up to 2 × 0·5 cm, white to dull white; branching profuse, polychotomous below, dichotomous above, ascending, parallel, axils narrow or U-shaped; tips acute, minute, concolorous with the fruit-body surface; flesh white; taste and smell not distinctive.

Hyphal system monomitic; hyphae up to 10·5 μm wide, clamped, wall thin, acyanophilous, ampullaeform swellings smooth; hyphae of the rhizomorphs up to 3 μm wide, not inflated, clamped, thin-walled; ampullaeform swellings present, smooth; gloeoplerous hyphae not observed. Basidia up to 45 × 6 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 4·5 μm long. Basidiospores 4·5–6 (–6·5) × 2·5–3 (–3·5) μm, ellipsoid or pip-shaped, uniguttulate, wall thin, cyanophilous echinulate, spines short, up to 0·5 μm long, apiculus up to 0·5 μm long.

Specimens examined: R. M. Sharda 22221 (PAN), on soil or bark-duff under predominantly *C. japonica* forest, Palmajuha, Darjeeling, West Bengal, August 30, 1980; R. M. Sharda 22255 (PAN), on leaf mold under broad-leaved forest, Uetselpong, Thimphu, Bhutan, September 21, 1980; R. M. Sharda 22333 (PAN), on bark-duff or soil under broad-leaved forest, Uetselpong, Thimphu, Bhutan, August 5, 1981; R. M. Sharda 22372 (PAN), on bark-duff under predominantly pine forest, Wagdiphodrang-Thimphu road forests, Bhutan, August 14, 1981.

R. pusilla was first recorded in India by Thind and Dev (1957) on the basis of two collections from Mussoorie (U.P.). Khurana (1977) added two more collections from

Pahalgam (J & K). The species appears to be of wide occurrence in the Himalayas.

The eastern Himalayan collections show variations with regard to habitat, bruising reaction and colour of the fruit-bodies. Collection numbers 22255 and 22333 were found growing in humus under angiospermous forest, whereas the other two collections were found under coniferous forests. In collection number 22221, colour of the branches is yellow-ochraceous to honey yellow to oak brown, whereas collection numbers 22372 and 22333 are pale yellow to greyish yellow or creamish yellow in colour. Collection number 22221 develops dark-red coloration on bruising, whereas the other collections turn brownish on bruising. These variations, however, do not warrant distinction into separate taxa and all these collections have been treated under *R. pusilla*. Unifying characters which serve to recognise these collections as one taxon are the usually small fruit-bodies arising from basal mycelial mat; yellowish to dull yellowish colour of the branches; vinescent bruising reaction; and small, 4·5–6 × 2·5–3 (−3·5) μm, ellipsoid or pip-shaped, minutely echinulate basidiospores.

4. Subgenus: *Lentoramaria* Corner, Beih. Nova Hedwigia 33: 239. 1970

4.1 *Ramaria rubella* (Schaeffer per Krombholz) Petersen, Am. J. Bot. **61**: 746. 1974.

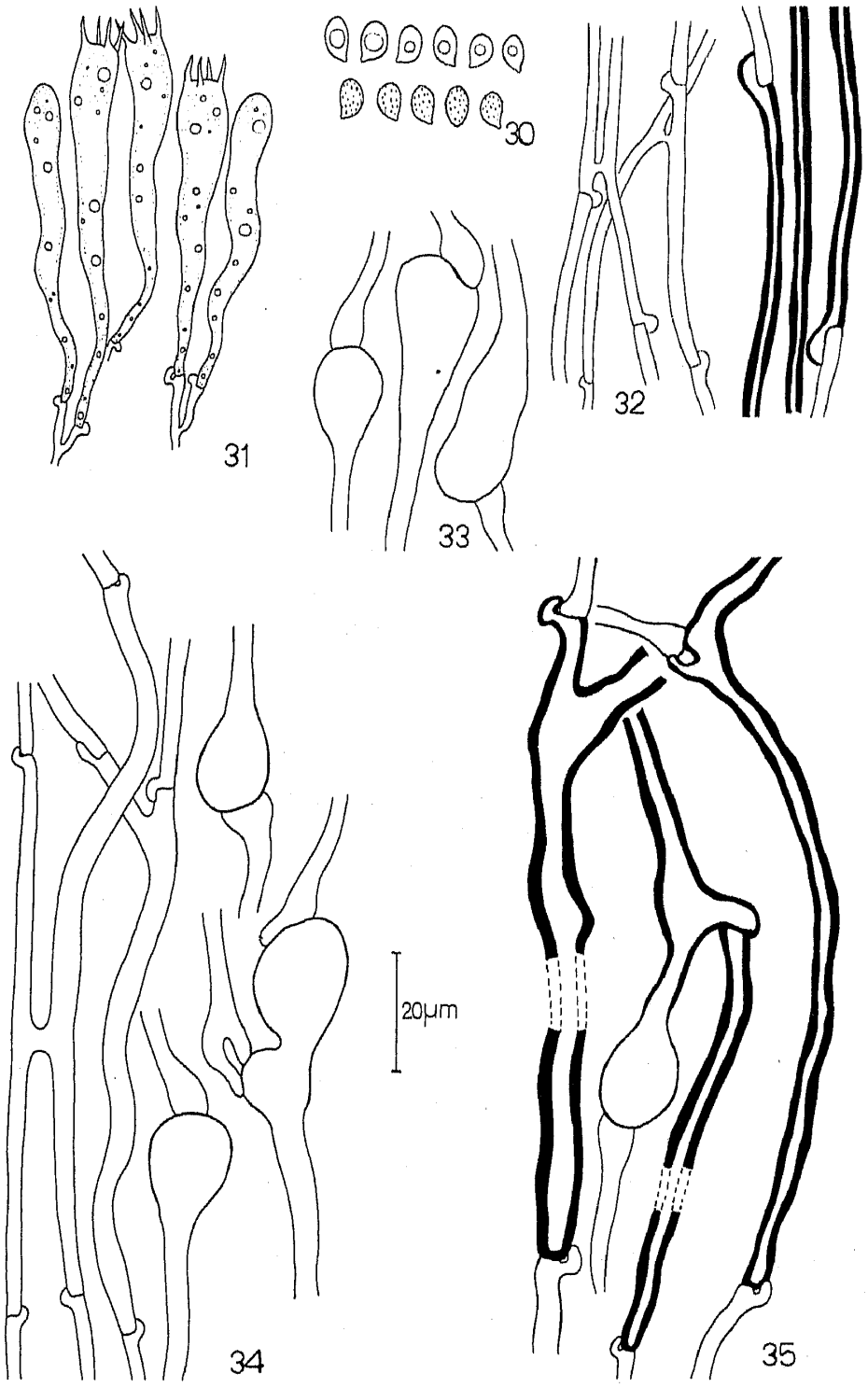
var *himalaica* Thind & Sharda, var. nov. (figures 30–35)

Fructus corpora ad 6 × 3·5 cm, lignicolus, ramificatus, caesnes ad carnem colorem et albi vertices. Truncus indistinctus ad distinctum. Systematicus hyphalus monomiticus cum intercalare cellae sclerificatae in contextu. Basidiospores 5–6·5 (−7) × 3–4 (−4·5) μm, exigua ellipotata ad ovoidatum, verruculosam.

Typus: In ligno tabo et acuus dufftus sub mixto silvae, Uetselpong, Thimphu, Bhutan, Aug. 5, 1981; Leg. R. M. Sharda 22332 (holotypus, PAN).

Fruit-bodies up to 6 × 3·5 cm, fleshy-tough, solitary gregarious, arising from white rhizomorphs; greyish orange or flesh coloured, unchanging on bruising; trunk indistinct to distinct, up to 1·5 × 0·4 cm, smooth, whitish; branching profuse, lax type, polychotomous below, dichotomous above, internodes in the basal branches up to 2 mm thick, long, slender, becoming thinner and shorter upward, axils U-shaped; tips acute, single or dichotomous, white; flesh whitish concolorous; taste and smell not distinctive.

Hyphal system monomitic both in rhizomorphs and fruit-body context; hyphae of the context of three types: (a) generative hyphae, up to 6 μm wide, clamped, thin-walled, acyanophilous; ampullaeform swellings present, smooth; (b) skeletalized generative hyphae, up to 7 μm wide, thick-walled, clamped, arising and ending in clamp connections, rarely ending blindly; and (c) intercalary sclerified cells, up to 8 μm wide, thick-walled, wall up to 1·2 μm thick, originating and ending with a clamp; hyphae of the rhizomorphs quickly turning pink when put in 10 % KOH, two types of hyphae are present; (a) generative hyphae, up to 3 μm wide, not inflated, clamped, thin-walled, branched, ampullaeform swellings smooth; (b) sclerified generative hyphae, up to 3·5 μm wide, thick-walled, wall up to 0·8 μm thick, originating and ending in a clamp. Basidia up to 59 × 8·5 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 5 μm long. Basidiospores 5–6·5 (−7) × 3–4 (−4·5) μm, short ellipsoid to ovoid, uniguttulate; thin-walled, verruculose, warts minute, cyanophilous; apiculus up to 0·7 μm long.



Figures 30–35. *R. rubella* var. *himalaica*. **30.** Basidiospores. **31.** Basidia. **32.** Hyphae of the rhizomorphs: generative hyphae and sclerified hyphae. **33.** Smooth ampullaeform swellings of the rhizomorphs. **34.** Generative hyphae and smooth ampullaeform swellings of the context-hyphae. **35.** Intercalary sclerified cells of the context.

Specimen examined: R. M. Sharda 22332 (PAN), on rotten wood and needle duff under mixed forest, Uetselpong, Thimphu Bhutan, August 5, 1981.

This variety is marked by having greyish orange to flesh coloured fruit-bodies, measuring up to 6 × 3·5 cm; rhizomorphic hyphae quickly turning pink in 10 % KOH; monomitic hyphal system with sclerified cells in the context; and short ellipsoid to ovoid, minutely warted, 5–6·5 (−7) × 3–4 (−4·5) μm basidiospores. In the similar change in colour of the rhizomorphic hyphae, in 10 % KOH, it resembles *R. rubella* var *rubella* closely. However, the latter variety differs in its ruddy colour of the fruit-bodies, measuring up to 10 cm high; absence of sclerified cells in the context and slightly larger basidiospores measuring 6·3–9·5 × 4·1–5·5 μm (fide Petersen 1975).

4.2 *Ramaria concolor* (Corner) Petersen, Biblthca mycol. **43**: 54. 1975.

Fruit-bodies up to 8 × 6 cm, fleshy to fleshy tough, solitary, gregarious, arising from white, mycelial felt; flesh coloured to pinkish yellow above and ochraceous brown below, unchanging on bruising; trunk indistinct to distinct, up to 1 × 0·6 cm, smooth, white; branching profuse, polychotomous, internodes of lower branches up to 3 mm wide, stout, smooth, becoming narrower and shorter upward; axils U-shaped or broad; tips acute or subacute, single or in pairs, concolorous with the upper branches; flesh whitish concolorous; taste and smell not distinctive.

Hyphae of the context monomitic; three types of hyphae are present, (a) generative hyphae, up to 4 μm wide, clamped, thin-walled; (b) sclerified generative hyphae, up to 8·5 μm wide, clamped, wall up to 1·2 μm thick, composing major part of the context; (c) intercalary sclerified segments, up to 6·5 μm wide, thick-walled, wall up to 1 μm thick, arising and ending with a clamp; hyphae of the rhizomorphs dimitic; generative hyphae up to 3 μm wide, not inflated, clamped, thin-walled, branched, ampullaeform swellings present, smooth; skeletal hyphae up to 3 μm wide, long celled, aseptate, thick-walled, arising with a clamp and ending blindly. Basidia up to 53 × 9 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 5·5 μm long. Basidiospores 8·5 × 4·2 μm; 7·5–9 (−10) × 3·5–4·5 μm, ellipsoid to elongate ellipsoid, uni- to biguttulate; wall slightly thickened, obscurely ornamented, cyanophilous; apiculus up to 1 μm long.

Specimen examined: R. M. Sharda 22417 (PAN), on wood under broad-leaved forest, 10 km (Bomdila-Munna road), West Kameng, Arunachal Pradesh, August 29, 1981.

In India, this species was first recorded by Thind and Anand (1956) as '*R. stricta* var. *concolor*' on the basis of a collection from Mussoorie (U.P.). Petersen (1975) raised this to the rank of a species because it lacks yellow tips. *R. stricta* is marked by the possession of yellow tips. Khurana (1977) also referred to Mussoorie collection to *R. concolor*.

The only eastern Himalayan collection from Arunachal Pradesh fits well the circumscription of this species as given by Petersen (1975) and Khurana (1977). It is marked by flesh coloured to pinkish brown fruit-bodies with concolorous tips; lignicolous habit; dimitic rhizomorphic hyphae; and obscurely warted, ellipsoid basidiospores.

4.3 *Ramaria apiculata* (Fr.) Donk, Meded. bot. Mus. Herb. Rijks-Univ. Utrech. **9**: 105. 1933.

Fruit-bodies up to 10 × 5·5 cm, coriaceous to fleshy-coriaceous, slender, solitary,

gregarious or closely scattered, arising from white, distinct rhizomorphs; greyish orange to brownish orange, or light violaceous brown at maturity, yellowish brown in the axils of lower branches, colour translucent on bruising; trunk indistinct or very small, up to 1 cm long and 5 mm broad, smooth, concolorous with the fruit-body surface; branching profuse, polychotomous, ascending, internodes long and up to 3 mm wide in the lower branches, shorter and thinner in the subsequent branches, axils U-shaped; tips minute, acute, in pairs or clustered, pale orange or concolorous with the branches; flesh paler concolorous or white; taste slightly bitter; smell not distinctive.

Hyphal system monomitic; context hyphae up to 10·5 μm wide, inflated, clamped, sparsely branched, think-walled, wall up to 1·5 μm thick, acyanophilous; ampullaeform swellings present, prominently ornamented; hyphae of the rhizomorphs of two types; (a) generative hyphae, up to 3 μm wide, clamped, branched, thin-walled, ampullaeform swellings present, ornamented; (b) skeletalized generative hyphae up to 4 μm wide, clamped, thick-walled, wall up to 0·8 μm thick. Basidia up to 60 × 9 μm, clavate, guttulate, clamped, 4-spored; sterigmata up to 6·5 μm long. Basidiospores 8·5 × 4 μm; 7–9 (–9·5) × 3–4 (–4·5) μm, ellipsoid, uni- to biguttulate; thin to slightly thick-walled, verruculose, warts prominent, cyanophilous; apiculus up to 1 μm long.

Specimens examined: R. M. Sharda 22331 (PAN), on wood under broad-leaved forest, Uetselpong, Thimphu, Bhutan, August 5, 1981; R. M. Sharda 22353 (PAN), on decayed wood under mixed forest, D'Dzong, Paro, Bhutan, August 9, 1981.

This species was first recorded by Thind (1961) on the basis of four collections from Simla hills (H.P.). Subsequent collections made by other workers and Khurana (1977) from different localities in the north-western Himalayas indicate its common occurrence under the *Cedrus deodara* forests of this region.

Both the eastern Himalayan collections made under the angiospermous or mixed forests in Bhutan, agree well their north-western Himalayan counterparts. The species is marked by slender fruit-bodies with ascending branches; greyish orange, brownish orange or light violaceous brown fruit-bodies with paler concolorous tips; monomitic hyphal construction with prominently thick-walled hyphae; and verruculose basidiospores.

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