

## Contribution toward a monograph of *Ramaria*. VI. the *Ramaria fennica* – *versatilis* complex

Ronald H. PETERSEN

Botany Department, University of Tennessee, Knoxville, TN 37916, USA

**Abstract.** – Keys and descriptions are furnished for taxa in *Ramaria* subg. *Laeticolorum* whose fruitbodies exhibit strong lilac, violet or purple coloration. Included are *R. fennica*, *R. versatilis*, *R. cedretorum*, and *R. asiatica*. *Ramaria purpurissima*, *R. himalayensis*, and *R. versatilis* var. *latisporum* are proposed as new, with new combinations *R. versatilis* var. *violaceibrunnea* and *R. purpurissima* var. *gigantea*. Nomenclators for all known epithets are provided.

### Introduction

Within *Ramaria* subg. *Laeticolorum* there are groups of taxa which, while quite well marked, are not well understood on a worldwide basis. Such a group comprises taxa with fruitbodies of predominant lilac, violet or purple coloration at least at the stipe apex or lower branches, but sometimes over the entire exposed portion of the fruitbody. It would appear that these taxa are distributed over at least the north temperate zone (plus Australia), with two rather cosmopolitan species in the northern hemisphere.

Unlike many species complexes within *Ramaria* subg. *Laeticolorum*, where microscopic characters are decisive in separation of taxa, in the complex summarized below microscopic features are rather uniform, and not of emphatic value in taxonomy. Instead, gross characters of the fruitbodies must be used, namely colors (and their combinations) and stature. Two general stature types can be identified: 1) stout, erect, sphaeropedunculate [e. g. *R. fennica*, *R. purpurissima* (both varieties)]; and 2) more gracile, usually geniculate fruitbodies with tapering stipes [e. g. *R. versatilis* (especially varieties *versatilis* and *latispora*), *R. himalayensis*]. Likewise, two general color schemes can be conceived: 1) violet upper stipe and/or lower branches, branches olive to ochraceous (e. g. *R. fennica*, *R. himalayensis*); and 2) upper stipe, branches and apices all violet to purple (e. g. *R. purpurissima* var. *purpurissima*, *R. versatilis*, *R. asiatica*). It is on these features that the key and taxon circumscriptions below are based.

Most difficulty has been found with the disposition of Sino-Indian taxa. The theses of SINGH (1977) and SHARDA (1983) are crucial, as well as the various papers on Indian clavarioid fungi, but

when dried specimens are the only source of firsthand information, results might not be all that could be desired. The last word on the Himalayan taxa, therefore, has yet to be written.

The major problem in unravelling such a group is availability of specimens from all areas of distribution, whether fresh specimens with adequate notes, or well-preserved material requiring even more complete documentation. Material from inside the Soviet Union and the People's Republic of China, for example, is almost missing from the world's sample, creating an enormous gap in distributional records as well as possible unproposed taxa. The account below includes analysis of specimens from Europe, northern Africa, North America, China and the Himalayas, with most of the specimens reported from North America, Europe and China having been collected fresh by me.

Not treated in this paper are species whose fruitbodies exhibit creamcolored, beige, or pallid buff branches with lilac or avellaneous tints only at the apices. Included in that group are *R. pallida* (SCHAEFF.) RICKEN, *R. subspinulosa* (COKER) CORNER, *R. fibulata* PET., and perhaps others.

The biochemistry of the purple pigments is not known at this time. All taxa which have been tested show a sensational color change from dull purple to bright peach-red in 25% KOH, probably a pH change reaction. Identical is the color change of the hymenium of *Gomphus clavatus* (PERS.: FR.) GRAY, which also exhibits a dull olive-grey pileus, quite similar to the color of upper parts of fruitbodies of *R. fennica*.

Several color charts and standards have been consulted, with colors reported as follows: colors in quotation marks are from RIDGWAY (1912); those reported alphanumerically (i.e. 4A7, 5A-C5-6) are from KORNERUP & WANSCHER (1967); those preceded by "S" (i.e. S250) are from SEGUY (1936); those preceded by NBS are from KELLY & JUDD (1965) and those preceded by "M&P" are from MAERZ & PAUL (1930). Other authors have used KLINCKSIECK but I have not seen that book. In reporting these colors, I have preceded the number by "K".

Abbreviations:  $E$  = spore length divided by width;  $E^m$  = mean  $E$ ;  $L^m$  = mean spore length;  $W^m$  = mean spore width. Macrochemical reagents are abbreviated as follows: ANO = aniline oil and water; ANW = alpha-naphthol in water; CRE = cresol in water; FCL = ferric chloride in water; FSW = ferrous sulphate in water; GUA = guaiac tincture; IKI = Melzer's reagent; KOH = 25% potassium hydroxide in water; NOH = 25% ammonium hydroxide in water; PHN = phenol in water; PYR = pyrogallol in water; SYR = syringaldehyde in water; TYR = L-tyrosinase in water. Recipes for these reagents can be found in MARR & STUNTZ (1973) and/or SINGER (1975).

### Key to the taxa of *Ramaria* subg. *Laeticolora* with purple or purplish fruitbodies

1. Upper stipe and branches beige, beige-cream, or pallid buff when young; apices with avellaneous or lilac tints (*R. pallida*, *R. subspinulosa*, *R. ibulata*, etc.) . . . . . not treated here

1. Upper stipe and/or branches purple, purple-drab or deep avellaneous when young; apices purple, avellaneous or mustard yellow ..... 2
2. Purplish colors restricted to the stipe apex and lower branches; upper fruitbody mustard yellow to dull ochraceous chartreuse when young, becoming smoky ochraceous with spore deposit ..... 3
2. All branches violet to purple when young, remaining so or becoming ochraceous, cinnamon, or dark olive color with spore deposit; apices violet or buffy olive when young ..... 4
3. Himalaya Mountains; spores  $11.5-14 \times 5-6.5 \mu\text{m}$  ( $L^m = 12.5 \mu\text{m}$ ); fruitbody stature gracile, often geniculate ..... 4. *R. himalayensis*
3. Europe, eastern North America; spores  $9-11.9 \times 4.3-5.4 \mu\text{m}$  ( $L^m = 10.4 \mu\text{m}$ ); fruitbody stature stout, erect, slender-sphaeropedunculate ..... 3. *R. fennica*
3. Fruitbodies purplish drab when young, becoming smoky drab, cinnamon, or dark olive in age; stipe discrete, tapering downward (up to  $4 \times 3 \text{ cm}$ ) ..... 5
4. Fruitbodies purple to reddish purple when young, remaining so or becoming ochraceous purple in age; stipe massive (up to  $6 \times 8 \text{ cm}$ ), rounded at base .... 9
5. Spore  $L^m = < 11 \mu\text{m}$  ..... 6
5. Spore  $L^m = 11.7 \mu\text{m}$  ( $9.7-13 \mu\text{m}$  long); fruitbodies up to  $21 \times 10 \text{ cm}$ , bulky; stipe slowly rubescent where bruised; Himalayas, western China ..... 1. *R. asiatica*
6. Apices buffy olive to tan when young; spore print "isabella color"; branches olivaceous drab when mature; western North America ..... 9. *R. versatilis* var. *violaceobrunnea*
6. Branches and apices lilac, purple to reddish tan when young; spore print "clay color"; branches cinnamon when mature ..... 7
7. Fruitbodies sphaeropedunculate in form; stipe thick, robust, erect; Sino-Himalaya; spores  $9.7-13.3 \times 4.7-6.1 \mu\text{m}$  ( $L^m = 11.2 \mu\text{m}$ ) ..... 6. *R. purpurissima* var. *gigantea*
7. Fruitbodies cylindrical-geniculate in form; stipe tapering, occasionally thick; Europe, eastern North America, Australia ..... 8
8. Spore  $W^m = > 5.5 \mu\text{m}$ ; Australia ..... 8. *R. versatilis* var. *latispora*
8. Spore  $W^m = < 5.2 \mu\text{m}$ ; Europe, eastern and western North America ..... 7. *R. versatilis* var. *versatilis*
9. Western North America (Idaho), under conifers; spores  $9-11.2 \times 4.7-5.2 \mu\text{m}$  ( $L^m = 10.3 \mu\text{m}$ ); stipe massive; branches short, numerous, bushy ..... *R. purpurissima* var. *purpurissima*
9. North Africa (Morocco), under *Cedrus*; spores  $10.4-13.3 \times 5.8-6.8 \mu\text{m}$  ( $L^m = 11.88 \mu\text{m}$ ); stipe large, rounded; branches long, erect, linear .. 2. *R. cedretorum*

### Enumeration of species

1. ***Ramaria asiatica*** (PETERSEN & ZANG) PETERSEN, *stat. nov.* – Figs. 1, 10

= *Ramaria violaceobrunnea* var. *asiatica* ZANG & PETERSEN (1986) . Acta Bot. Yunnan. 8: 291.

Illustration. – PETERSEN & ZANG (1986: figs. 8, 9).

Fruitbodies (Fig. 10) up to  $21 \times 10 \text{ cm}$ , repeatedly branched, obovate in profile. – Stipe single to falsely fasciculate, fleshy, solid, rounded at base, more or less equal, up to  $30 \times 20 \text{ mm}$ , tomentose to mycelial downward, white where protected, gradually pallid dull violaceous ("vinaceous drab") upward, commonly with areas of brown or tan ("cameo brown"); flesh white, dry, drying punky. –

Major branches 3–4, up to 1 cm thick below, fleshy, ascending, purplish tan (“army brown,” “Natal brown”), slowly buffy maroon (“ocher red”) where bruised. Branches in 3–6 ranks, terete, often obscurely rugulose, fleshy tan in color (“wood brown,” “tawny olive,” “saya brown”), “dark olive buff” with spore deposit; internodes diminishing gradually; axils rounded. – Apices slender, double-dichotomous, somewhat prolonged, concolorous with branches at all ages (“vinaceous drab” young; “dark olive buff” in age); branches bruising slowly brown. – Taste negligible to faintly astringent; odor weakly fragrant, aromatic.

Macrochemical reactions. – SYR = positive in spots; NOH, KOH = dark orange; FCL = deep green; ANW = capricious; HSO = yellow (dry); CRE, ANO, GUA, PHR, PHN, IKI = negative.

Tramal hyphae of stipe 3–7  $\mu\text{m}$  diam, hyaline, thin-walled, clamped, interwoven, easily collapsed; ampulliform clamps up to 14  $\mu\text{m}$  broad, ellipsoid, symmetrical, thin-walled, unornamented; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3.5–8  $\mu\text{m}$  diam, hyaline, clamped, hardly inflated, thin-walled, parallel, tightly packed; ampulliform clamps up to 12  $\mu\text{m}$  broad, not abrupt, somewhat thick-walled (wall up to 1.5  $\mu\text{m}$  thick), unornamented. – Subhymenium extensive, hyphal. – Hymenium thickening. – Basidia 50–58  $\times$  7–8  $\mu\text{m}$ , clavate, clamped, hyaline, contents scattered-multiguttulate, sterigmata 4, spindly, straight.

Spores (Fig. 1) 9.7–13.3  $\times$  5–6.1  $\mu\text{m}$  ( $E = 1.8$ –2.5;  $E^m = 2.13$ ;  $L^m = 11.7 \mu\text{m}$ ), ellipsoid, often with suprahilar depression, roughened in profile, yellowish; contents uni- to biguttulate, the guttulus dark, refringent, often lobed; wall up to 0.3  $\mu\text{m}$  thick; hilar appendix broad, without throat; ornamentation of complex meandering and anastomosing ridges and warts up to 0.3  $\mu\text{m}$  high.

Commentary. – When published (PETERSEN & ZANG, 1986), *R. violaceibrunnea* var. *asiatica* was compared briefly with “*R. fumigata* auct.” (= *R. versatilis* var *versatilis*). From it, var. *asiatica* differed in larger, bulkier fruitbodies and coarser, more anastomosing spore ornamentation. A later additional collection from northern Yunnan has confirmed these characters.

Examination of specimens from the western and eastern Himalayas indicate that the taxon extends through the mountains into Yunnan Province. This seems typical of the “Sino-Himalayan” pattern, but more material is needed before a valid judgement can be made.

SHARDA's photo (1983: pl. 69, fig. 5) and specimens 22317 (PAN, TENN) and 4584 (PAN, TENN) show rather bulky fruitbodies with thick stipes, not like the tapering stipes of other specimens cited below. Nonetheless, colors and microstructure agree with *R.*



*asiatica*, especially with PAN specimens with more gracile, tapering stipes, so I choose to treat them all as *R. asiatica*. PAN 22321 is evidently such a bulky fruitbody, but SHARDA's photo under this number (cited above) was furnished with his 22345 when sent to TENN, so I cannot be sure of which specimen is represented by it. Both specimens were cited under *R. fumigata*, however, and are contaxic.

The colors ascribed to this taxon by Indian authors are worth repeating, for they reinforce my disposition of PAN specimens. From RATTAN (1977: 154): "... extreme base ... white, terminal branches light greyish-purple to light greyish-ruby, basal branches slightly deeper concolorous with the terminal branches to reddish-violaceous to rather brownish towards the base, tips concolorous with the terminal branches; colors not changing by bruising." SHARDA (1983: 195) merely shortened the wording, but cited colors virtually identically.

SINGH's (1977: 151–154) description of *R. fennica* var. *violaceibrunnea* points toward *R. himalayensis*. My examination of his collection 12042 (PAN) confirms this. Fruitbody colors were described as follows: "... [stipe] part above the ground level – pale violet, basal branches pale violet or concolorous with the exposed portion of the stipe, while upper part of the branches pale yellowish-brown, terminal branches pale greyish-yellow, tips or apices concolorous with the terminal branches; colour of branches slowly turning brownish-red on bruising; colour of the tips turning brownish-red by withering; terminal branches sometimes having prominent greyish-violet stains ...". The stipe was described as "small, up to 2.3 cm long, fasciculate ...". All told, the slender stature of *R. himalayensis* fruitbodies is maintained in SINGH's description of *R. fennica* var. *violaceibrunnea*.

At the same time, SINGH gave some reasons why his concept differed from the original circumscription of the taxon (MARR & STUNTZ, 1973), including fruitbody colors and spore size.

Conversely, SHARDA's (1983) concept of *R. fennica* var. *violaceibrunnea* differed from SINGH's. Fruitbody colors, as rendered by SHARDA, were as follows: "... [stipe] part above the ground violet white, basal branches brownish grey, terminal branches reddish brown, tips concolorous with the terminal branches; colour of the branches turning brownish-red to dark brown by bruising." SHARDA's organism showed brownish grey to reddish brown branches and concolorous apices, while SINGH's exhibited yellowish brown to greyish yellow branches and concolorous apices. Examination of SHARDA's specimen indicates no significant differences from *R. asiatica*.

Specimens examined. — BHUTAN: Thimphu, 2. VIII. 1981, coll. SHARDA 22321 (PAN); Paro, D'Dzong, 9. VIII. 1981, coll. SHARDA 22350 (PAN, as *R. fennica* var. *violaceibrunnea*); Paro, Chailela, 29. IX. 1980, coll. SHARDA 22284 (PAN, as *R. fennica* var. *violaceibrunnea*). — CHINA: Yunnan, Szemao, 20. IX. 1983, 45674 (Holotype, TENN; isotype, HKAS); vic. Lijiang, 7. IX. 1986, 47312 (HKAS, TENN). — INDIA: Dalhousie, Lakkarmandi, 21. VIII. 1966, RATTAN 4584 (PAN; TENN 36990); Dalhousie, Jandi Ghat, 12. VIII. 1963, THIND 225 (TENN 36940); Simla, Glen, 22. IX. 1967, RATTAN 4624 (BPI); Same location, 28. VII. 1965, coll. KHARA, PAN 4502 (BPI); Dalhousie, Lovers Road, 27. VII. 1966, RATTAN 4564 (BPI); Sanasar, J. & K., 10. VIII. 1967, RATTAN 4614 (BPI).

2. *Ramaria cedretorum* (MAIRE) MALENÇON (1957). Bull. Soc. Mycol. France 73: 292

- ≡ *Clavariella cedretorum* MAIRE (1914). Bull. Soc. Mycol. France 30: 217, pl. IX.
- ≡ *Clavaria cedretorum* (MAIRE) SACCARDO (1925). Syll. Fung. 23: 488.
- ≡ *R. cedretorum* var. *eucedretorum* WERNER, Fung. Marocc. no. 586; *nom. illeg.*: cf. MALENÇON (1957). Bull. Soc. Mycol. France 73: 292.

Type (holotype, implicit). — ALGERIA: Atlas de Blida, Chreo, 26. XI. 1911, leg. MAIRE, "sous les Cedres", s. n., MPU.

Illustrations: MAIRE (1914): pl. 9, figs. 3, 25.

Fruitbodies 8–10 × 5–15 cm, broadly cylindric to broadly obpyriform in outline. — Stipe thick, irregular, short, fleshy, smooth, white; flesh not hygrophanous. — Branches more or less terete to somewhat compressed, slightly rugulose, more or less divaricate, entirely violet-lilac (K: 546–528D) when young, slowly becoming ochraceous with spore deposit; internodes long below, diminishing gradually; axils narrowly rounded. — Apices ending in 2–3 obtuse tubercles, concolorous with branches and remaining violet until maturity. — Odor negligible; taste faintly amarescent.

Macrochemical reactions: guaiac = positive.

Tramal hyphae of stipe 3–11 µm diam, hyaline, thin-walled, interwoven, probably clamped. Tramal hyphae of upper branches 4–9 µm, hyaline, thin-walled, clamped, parallel, free; inflated clamps and gloeoplerous hyphae not observed. — Basidia 60–70 × 7–9 µm, clavate, clamped; contents indiscernible, strongly cyanophilous; sterigmata (2)–4.

Spores 10.4–13 × 5.8–6.8 µm ( $E = 1.63$ – $2.12$ ;  $E^m = 1.85$ ;  $L^m = 11.88$  µm;  $W^m = 6.42$  µm), broadly ellipsoid, hardly flattened ad-axially, obscurely roughened in profile; contents now homogeneous to obscurely uniguttulate; wall up to 0.2 µm thick; hilar appendix prominent, protuberant, broad; ornamentation of many small iso-

lated warts and short, delicate ridges without apparently orientation, covering significant wall surface.

Commentary. – The type specimen was poisoned ( $\text{HgCl}_2$ ) in 1920, and hyphal details can no longer be seen accurately. A diligent search was necessary to ascertain the presence of clamp connections. The single fruitbody is in small fragments covered with mold, present before poisoning.

MALENÇON (1957) discussed at length the similarities and differences between *R. cedretorum* (as *R. cedretorum* var. *eucedretorum* WERNER) and *R. versatilis*. He concluded that the two were separate on the basis of spore dimensions (chiefly width and *E* values), probably fruitbody morphology, and surely tree association. This was in contradiction to the conclusion by PILÁT (1958), who considered *R. versatilis*, *R. fumigata*, and *R. cedretorum* (and their obligate synonyms) all as taxonomic synonyms. MALENÇON's analysis was the most complete to that time, but could not assess taxa not yet known.

Spores of this taxon are wider than measured by MAIRE, perhaps due to the action of dilute KOH after poisoning. The measurement given by MAIRE ( $9\text{--}12 \times 4.5\text{--}5 \mu\text{m}$ ) are virtually identical to those of *R. fennica* spores. The pronounced hilar appendix may be an artifact as well, for spores mounted in cotton blue stain do not exhibit it. Conversely, spores in cotton blue are usually collapsed to some degree, a feature not seen in dilute KOH.

MAIRE went to some lengths to compare and separate *Clavariella cedretorum* and *C. versatilis*, which he knew from France. In fact, he pictured fruitbodies of the two taxa, but failed to depict an entire fruitbody of *C. cedretorum*. He considered the two separable on at least two characters: 1) the stout stipe and bulky stature of *C. cedretorum* fruitbodies; and 2) the concolorous apices in *C. cedretorum*, contrasted to the paler violet tips in *C. versatilis*. Conversely, MAIRE did not italicize the following: "... se teintant à la fin d'ochrace par les dépôts de spores ..." when writing about the branches. MAIRE spent no effort in separating *C. cedretorum* from *R. fennica*, for the mustard yellow coloration of the latter bore little resemblance to the purple of *C. cedretorum*.

Spore ornamentation of many small warts and delicate short ridges is most similar to that of *R. violaceibrunnea* [MARR & STUNTZ, 1973; here considered as a variety of *R. versatilis*]. Type specimens of *R. fennica* (and its synonyms), and *R. asiatica* all show coarse ornamentation of large warts and anastomosing ridges.

Only one locality is mentioned in MAIRE's protologue. This locality appears on the label of the specimen cited above, and no other collection in herb. MAIRE at MPU was made before the date of publication of the description. I interpret the above specimen as an

implicit holotype, therefore. Two additional collections have been examined. One (MAIRE 3806) is authentic, the other (MALENÇON 5715) a general topotype (Table I).

These three specimens agree closely on  $E^m$  and  $W^m$ , the latter unusually large. MALENÇON'S collection, made in 1965, and poisoned subsequently, shows hyphal characters much more clearly than the other two. Clamps are abundant on basidia and tramal hyphae. Tramal hyphae of upper branches are 4–9  $\mu\text{m}$  diam, hyaline, thin-walled, more or less parallel. Basidia of all collections are strongly cyanophilous, but this may be an artifact of poisoning.

Spore data on specimens of *Ramaria cedretorum*

Specimen	Dimensions $\mu\text{m}$	$E$	$E^m$	$L^m$	$W^m$
Type	10.4–13.0 $\times$ 5.8–6.8	1.63–2.12	1.85	11.88	6.42
MAIRE 3806	11.5–13.7 $\times$ 6.1–7.6	1.67–2.24	1.92	12.37	6.57
MALENÇON 5715	10.8–14.0 $\times$ 5.8–6.5	1.67–2.17	1.97	12.17	6.19

Specimens examined. – ALGERIA: Atlas de Blida, Chreo, 26. IX. 1911, leg. MAIRE, s. n. (MPU – holotype); Ifrane (Moyen Atlas), 10. XI. 1965, coll. MALENÇON 5715 (MPU); Dra-Inquel, 22. X. 1919, leg. MAIRE, Champ. l'Afrique Nord 3806 (MPU); Atlas de Blida, 15. IV. 1914, leg. MAIRE, Mycoth. Bor. – Afrique 237 (BPI, NY).

3. *Ramaria fennica* (KARSTEN) RICKEN (1920) Vademecum f. Pilzfr., p. 264. – Figs. 2, 14

≡ *Clavaria fennica* KARSTEN (1868). Nat. Sellsk. faun. & Fl. Fenn. 9: 372.

≡ *Clavariella fennica* (KARSTEN) KARSTEN (1882). Hattsvampar, p. 184.

≡ *Clavaria fumigata* PECK (1879). Rep. N.Y. St. Mus. 31: 38.

≡ *Ramaria fumigata* (Pk.) CORNER (1950). Ann. Bot. Mem. 1: 591.

≡ *Clavaria testaceo-flava* var. *testaceoviridis* ATKINSON (1908). Ann. Mycol. 6: 58.

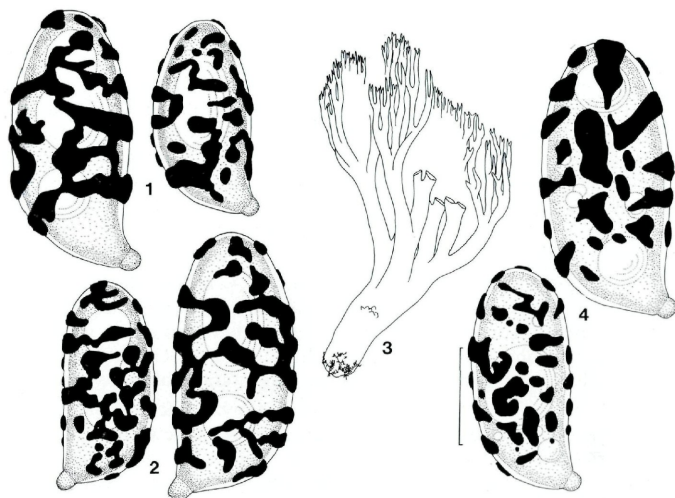
≡ *Clavaria testaceoviridis* (ATK.) DOTY (1944). Oregon St. Univ. St., p. ■

≡ *Ramaria testaceoviridis* (ATK.) CORNER (1959). Ann. Bot. Mem. 1: 631.

Illustrations. – COKER (1923): pl. 47 (not pl. 48).

Fruitbodies (Fig. 14) up to 10  $\times$  5 cm, broadly ellipsoid to vaguely obpyriform in outline. – Stipe single, large, up to 30  $\times$  25 mm, rounded below, smooth to minutely felted below, involving significant substrate, without aborted branchlets, off-white were protected, drab to pallid violaceous upward ("deep Quaker drab," "Quaker drab," "light vinaceous drab," "hair brown," "benzo brown," "drab"); flesh white, solid, dry, violaceous around worm channels. – Major branches 2–4, rebranching almost immedi-





Figs. 1-4: Spores and fruitbodies of *Ramaria* species: 1. Spores of *R. asiatica*, type specimen. - 2. Spores of *R. fennica*, TENN 36111. - 3, 4. *R. himalayensis*: 3. Fruitbody, PAN 22349, from SHARDA (1983: pl. 70, fig. 2). - 4. Spores, PAN 22326. - Standard bar = 5  $\mu$ m. Fruitbody not to scale.

ately, lobed in cross-section, concolorous with stipe below, upward concolorous with branches; branches in 4-6 ranks, more or less terete, at first somewhat browner than major branches ("Verona brown," "clay color," "wood brown") or paler ("ecru drab," "drab gray") than major branches, then more olivaceous with spore production ("tawny olive"); axils rounded; internodes all short, diminishing gradually at maturity; flesh white, hardly violaceous than outward; apices minutely double-dichotomous when young, expanding to digitate in age, dull olive yellow ("chamois," "honey yellow," "deep colonial buff") to yellow ("baryta yellow," "maize yellow") when young, mellowing toward tan with spore production ("tawny olive"). - Odor negligible or weak of anis-seed; taste mild, perhaps farinaceous.

Macrochemical reactions: FSW, FCL = weakly positive; KOH, NOH = browning on branch sections, bright peachy red on violaceous surfaces; PYR, ANO, ANW, TYR, PYR, IKI = negative; GUA, PHN = ambivalent; SYR = slowly, weakly positive.

Hyphae of stipe surface 2-3.5  $\mu$ m diam, thin-walled, clamped, tightly interwoven. - Tramal hyphae of stipe up to 8  $\mu$ m,

diam. hyaline, clamped, thin to slightly thick-walled (wall locally up to 1.5  $\mu\text{m}$  thick, usually uneven), loosely interwoven; septal inflations rare, unornamented, with wall no thicker than surrounding hyphae; gloeoplerous hyphae not observed. – Tramal hyphae of upper branches up to 8  $\mu\text{m}$  diam, hyaline, clamped, thin-walled, free, more or less parallel; septal inflations common, up to 13  $\mu\text{m}$  broad (usually less), locally thick-walled (wall very locally up to 2  $\mu\text{m}$  thick, usually less than 1  $\mu\text{m}$  thick), unornamented; gloeoplerous hyphae not observed. – Hymenium thickening. – Basidia 65–80  $\times$  9–10  $\mu\text{m}$ , clavate, clamped; contents homogeneous to minutely granular; sterigmata 4, apical, straight.

Spores (Fig. 2) 9–11.9  $\times$  4.3–5.4  $\mu\text{m}$  ( $E = 1.73$ –2.50;  $E^m = 2.14$ ;  $L^m = 10.41 \mu\text{m}$ ), cylindrical to pip-shaped, obviously roughened in profile, “ochraceous buff” in prints; contents ochraceous, with 1–2 darker inclusions; wall up to 0.2  $\mu\text{m}$  thick; hilar appendix gradual to very gradual; ornamentation of short ridges and isolated warts.

Commentary. – I have examined many collections of *R. fennica* from Europe and eastern North America, including the type specimens of *R. fennica* (PETERSEN, 1986), *R. testaceoviridis* (PETERSEN, 1975), and *R. fumigata* (PETERSEN & OLEXIA, 1967), all of which I consider synonymous. All diagnostic characters match, including: 1) dull violaceous major branches and olive upper parts; 2) presence of clamp connections; 3) coarsely ornamented spores; 4) KOH reaction to violaceous surfaces; and 5) fruiting under hardwood trees, especially oak and beech. Spore differences may be an artifact of the hymenial squash examined.

The tardy, weak positive reaction of stipe flesh in SYR is unusual, for most taxa react less equivocally. Eastern North American material of *R. versatilis* (usually identified as *R. fumigata*) shows no reaction in SYR.

COKER's (1923) treatment of *Clavaria fennica* drew from the literature as well as specimens. Apparently, fruitbodies with upper stipe/lower branches exhibiting purplish colors (COKER used “lilac” to describe the color) were placed under the name regardless of their stature or color of apices. At the writing of his book, he possessed the following specimens of *R. fennica* with notes (other specimens were available but COKER's notes and the specimens themselves are not adequate for modern identification): 486, 619, 620, 2857 and 2892. All were from Chapel Hill and all represent *R. fennica* as described above. Some bore notes about upper branch and/or branch tip color [i. e. “smoky yellowish brown” (486)]. Photographs of fruitbodies of numbers 486 and 2857 served as plates 46 and 47 of COKER's book, and examination of these specimens confirms that they represent *R. fennica*, even though plate 46 looks more like *R. versatilis*.

Conversely, in 1923, COKER had other specimens which did not agree in color or stature with the above. He noted them in his book (COKER, 1923: 136–137). Number 921 represents a striate-spored taxon, so must be disqualified along with COKER's note on color change of stipe flesh. Numbers 779 and 1282 are *R. versatilis*. COKER noted that branches and apices were lilac, just as the fruitbody base. Moreover, the fruitbodies show the more discrete, somewhat bulbous stipe shape typical of *R. versatilis*.

Despite these differences across the available specimens, COKER (1923) wrote a formal description which included: "... branches usually a pretty, rather light lilac when young, soon becoming a smoky gray or smoky cinnamon, the lilac tinge slowly disappearing except on the stem." In his commentary, he wrote: "our plants agree well with *C. fennica* as described by KARSTEN ... except that the tips of the branches ... are not yellow ..."

Specimens obtained after publication of COKER's book also represent at least three species. He was sent specimens from Alabama representing *R. fennica* and *R. versatilis*, extending the ranges of those two taxa, and *R. versatilis* var. *violaceibrunnea* came from the far west. All were placed in the herbarium under *Clavaria fennica*. Of the specimens I have examined, the most interesting is one of *R. bataillei* var. *americana* PET. collected in the North Carolina mountains at the same time and on the same spot as *R. versatilis*, both identified as *C. fennica*.

KHURANA's specimen under *R. fennica* var. *violaceibrunnea* (India, Kashmir, Gulmarg, 18. VIII. 1974, coll. KHURANA 12042; PAN, SUCO) is difficult to identify. I have not seen a complete fruitbody, but the fruitbody colors described by SINGH (1977) resemble those of *R. fennica*, and the photo (SINGH, 1977: pl. 57, fig. 3) shows several stocky fruitbodies with thick, erect stipes. Spore and hyphal characters are typical for the species complex. Only a "brownish-red" bruising reaction does not match the concept of *R. fennica* described above. The specimen may represent an Indo-Asian record of *R. fennica*, or might represent a species similar to *R. fibulata* PET. or *R. spinulosa* (PERS.: FR.) QUEL.

Specimens examined. — BELGIUM: Prov. Namur, Villers-sur-Lesse, 23. VIII. 1972, coll. DAMBLON 41320 (TENN). — CANADA: Nova Scotia: Cape Breton, Cheticamp River Trail, 7. IX. 1973, 38213 (TENN); Kentville, IX. 1953, coll. HARRISON 53–6 (DAOM), 31626 (TENN); Kentville, VII. 1930, coll. HARRISON 607 (DAOM, TENN 31623); Kentville, 12. IX. 1959, HARRISON 59–18 (DAOM, TENN 31573). — Ontario: Dorset, 15. IX. 1963, coll. LUCK 41496 (TRTC). — FINLAND: no location, "ad terras in Pineto," 9. VIII. 1866, herb. KARSTEN, s. n. (H – holotype); Mustiala, IX. 1892, misit KARSTEN (NY); Syrja, 18. VIII. 1889, herb. KARSTEN, s. n. (H); Syrja, 8. IX. 1892, herb.

KARSTEN, s. n. (H). — FRANCE: Champ. d'Allier, forêt le Château Charles, 28. IX. 1905, bois de hêtres, ex herb. BURT, BOURDOT 4677 (as *R. versatilis*, FH). — GERMANY: Brandenburg, 1918, leg. SYDOW, Mycoth. Germanica 1442 (MICH). — ITALY: Gocciadoro, near Trento, IX. 1904, leg. BRESADOLA, s. n. (NY). — THE NETHERLANDS: Leist, 19. X. 1967, coll. REIJNDERS 45051 (TENN). — UNITED STATES: *Alabama*: Robinsons Springs, 13. IX. 1942, BURKE "V" (NCU). — *Connecticut*: Redding, 18. VIII. 1902, coll. EARLE, det. COKER 493 (NY). — *Georgia*: Clarke Co., Univ. Georgia Bot. Gard., 25. VIII. 1978, coll. COOKE 55726, 44842 (TENN). — *Maine*: Cumberland, 12. VIII. 1986, coll. RISTIC, s. n. (TENN). — *Michigan*: vic. New Hudson, LaBadie Lake, 18. VIII. 1937, SMITH 7082 (NCU, MICH), 31221 (TENN); vic. Milford, Proud Lake, 23. VIII. 1937, coll. SMITH 31222 (TENN); New Hudson, LaBadie Lake, 18. VIII. 1937, SMITH 7082 (MICH). — *New York*: Delaware Co., vic. Oneonta, 21. IX. 1963, coll. & det. CAIN 41025 (TRTC); Tompkins Co., McGowan's Woods, 9. IX. 1900, leg. ATKINSON 5369 (2 – CUP); Varna, 21. VIII. 1902, leg. WHETZEL 14843 (CUP); east shore, Cayuga Lake, 1. VIII. 1902, leg. KAUFFMAN 13244 (CUP); Taughannock, 18. VIII. 1902, coll. WHETZEL 13584 (3 – CUP). — *North Carolina*: Macon Co.: Wayah Bald, 12. VIII. 1964, 26498 (TENN); Highlands, 1. IX. 1942, 14372 (TENN); Wayah Bald, VIII. 1064, 31471, 31472 (TENN); Norton Community, VIII. 1964, 31448, 31449 (TENN); Norton Community, 9. VIII. 1971, 36111 (TENN); Chattooga River Gorge, 15. VIII. 1961, 30744 (TENN); Norton Community, 13. VII. 1967, 32588 (TENN). Orange Co.: Chapel Hill, woods east of Schoolhouse, 3. X. 1912, coll. COBB & TOTTEN, COKER 486 (NCU); Chapel Hill, Battle's Park, 24. X. 1912, coll. COKER 619 (NCU); Chapel Hill, Battle's Park, 1. X. 1917, coll. COKER 2857 (NCU); Chapel Hill, woods south of athletic field, 9. X. 1917, coll. COKER 2892 (NCU); Chapel Hill, 30. VIII. 1918, COKER 3140 (NY); Transylvania Co., Pisgah National Forest: 31. VII. 1963, 30992 (TENN); VIII. 1964, 31251, 31298, 32882 (TENN); 12. VIII. 1971, no. 36139 (TENN); 31. VIII. 1963, 36323 (TENN); 14. VIII. 1963, 31054 (TENN); upper Toxaway River Gorge, 11. VIII. 1961, 30703 (TENN). Wake Co.: Lake John Natural Area, 19. IX. 1977, coll. Grand 42106 (TENN). — *Ohio*: Highland Co., The Seven Caves, 6. IX. 1933, coll. COOKE 2595, det. COKER (NY). — *South Carolina*: Oconee Co., 25. VIII. 1985, coll. METHVEN 46698 (TENN); Whitewater River Gorge, 9. VIII. 1961, 30696 (TENN). — *Tennessee*: Blount Co., Great Smoky Mountains National Park, Cades Cove: 25. VIII. 1945, ann. DOTY 17617 (TENN); 13. IX. 1940, 12924 (TENN); 9. VIII. 1965, 32862 (TENN); 7. VIII. 1965, 32858 (TENN); 12. VIII. ?, HESLER 32140 (TENN); 25. VIII. 1965, 32882 (TENN); 12. VIII. 1966, 32909 (TENN); 1. IX. 1965, 32901 (TENN); VIII. 1964, 27365 (TENN); Knox Co.: New Hopewell, 20. IX. 1949, ann. DOTY 19405 (TENN); New Hopewell, 29. IX. 1974,



HESLER 39760 (TENN); Sevier Co.: Great Smoky Mountains National Park, Mt. LeConte, VIII. 1964, 31351 (TENN).

4. *Ramaria himalayensis* PETERSEN sp. nov. — Figs. 3, 4

Basidiocarpa multiramosa, ad  $18 \times 7$  cm, crassi-sphaeropedunculata, geniculata. Bases ad  $4 \times 1.5$  cm, tenues, singulatae, sine ramulis abortivis, tactu non brunnescentia; caro alba, non-gelatinosa. Rami et ramuli violacei ad violaceo-avellanei deorsum, superne fusco-flavi. Apices tenues, cum ramulis concoloribus. Hyphae contextus fibulatae, tenuitunicatae. Basidia  $37-50 \mu\text{m}$  longa, clavata, fibulata. Sporae  $11.5-14 \times 5-6.5 \mu\text{m}$  ellipsoidae ad subcylindraceae, subcorrugatae. — BHUTAN: Motithang, Thimphu, 4. VIII. 81, coll. SHARDA 22326 (holotypus, PAN).

Fruitbodies (Fig. 3) up to  $18 \times 7$  cm, broadly comma-shaped in outline, gregarious to occasionally caespitose. — Stipe up to  $4 \times 1.5$  cm, single, bent to geniculate, without abortive branchlets, smooth, pruinose below, white to off-white where protected, "pale violet to violet white" (*teste* SHARDA) above substrate level, more or less terete, not changing color on bruising; flesh solid, white or whitish, not gelatinous or soapy, drying hard. Major branches 2–3, more or less terete, ascending but not erect, up to 4 mm thick, "greyish yellow to dull yellow" (*teste* SHARDA). — Branches in 3–5 ranks, slender, erect, concolorous with major branches, polychotomous below, dichotomous above; internodes long throughout, diminishing gradually upward; axils narrowly to broadly rounded. — Apices slender, awl-shaped to elongate, concolorous with branches. — Odor negligible, taste slightly bitter (*teste* SHARDA).

Stipe tramal hyphae  $4-8 \mu\text{m}$  diam, hyaline, thin-walled, clamped, interwoven, free; ampulliform clamps up to  $15 \mu\text{m}$  broad, thin-walled, symmetrical, unornamented; gloeoplerous hyphae occasional,  $4-6 \mu\text{m}$  diam, yellow-refrinct, frequently branched, not delimited by septa. — Tramal hyphae of upper branches  $3-5 \mu\text{m}$  diam, hyaline, thin-walled, clamped, tightly interwoven; ampulliform clamps up to  $12 \mu\text{m}$  broad, thin-walled asymmetrical to symmetrical, unornamented; gloeoplerous hyphae not observed. — Subhymenium rudimentary; hyphae  $2-3 \mu\text{m}$  diam, hyaline, thin-walled, clamped, tightly interwoven. — Hymenium thickening; basidia  $37-50 \times 8-9 \mu\text{m}$ , clavate, clamped; contents with scattered refringent guttules; sterigmata 4, spindly, curved.

Spores (Fig. 4)  $11.5-14 \times 5-6.5 \mu\text{m}$  ( $E = 1.94-2.5$ ;  $E^m = 2.18$ ;  $L^m = 12.47 \mu\text{m}$ ), ellipsoid to subcylindrical, obviously roughened in profile; contents uni- to multiguttulate, the guttules deep yellow, refringent, membrane-bound; wall up to  $0.5 \mu\text{m}$  thick; hilar appendix prominent, gradual; ornamentation of patches of cyanophilous material up to  $1 \mu\text{m}$  thick, without discernable orientation.

Commentary. — SHARDA's description of macroscopic characters (especially colors), combined with a representative photo, dia-

gnoses fruitbodies with: 1) slender, gracile, tapering stipe; 2) violet upper stipe and/or lowest branches (SHARDA's report of macrochemical reactions supports that the violet shades are naturally occurring pigments rather than vinescent spots around soil particles); 3) "greyish yellow to dull yellow" branches; and 4) apices concolorous with upper branches. Rather than the thick, stocky stature typical of fruitbodies of *R. fennica* from Europe and eastern North America, the Himalayan taxon shows gracile fruitbodies quite like those of *R. versatilis* (but with very different colors).

While SHARDA emphasized *Pinus* as a constituent of the forest where this species fruited, he consistently mentioned deciduous trees (no specific genera) as well. Thus it is difficult to conclude any specific mycorrhizal association for the species. *Ramaria fennica* in eastern North America seems associated with *Quercus*, although *Pinus* is usually also present. *Ramaria fennica* from Europe has been reported from under conifers, while *R. "fumigata"* (*R. versatilis* mihi) occurred under frondose woods.

In addition, spores of *R. himalayensis* are somewhat larger than those of *R. fennica*, approached only by those of *R. asiatica* and *R. cedretorum*. Ornamentation, while quite prominent and coarse, is similar to that seen in several other taxa of the complex.

*Ramaria himalayensis* seems to combine characters of fruitbody stature like that of *R. asiatica* and *R. versatilis* with colors approximating those of *R. fennica*. It is interesting to compare PECK's words about branch color in *Clavaria fumigata* (= *R. fennica*), "... smoky ochraceous ..." with SHARDA's on *R. fennica* (= *R. himalayensis*), "... greyish yellow to dull yellow ..."

Although SHARDA's (1983; pl. 24, figs. 5–8) illustrations include obviously ornamented ampulliform clamps, I have not observed such ornamentation. No specimen was cited with his drawing, however, and I may not have seen the appropriate specimen.

SHARDA's description and photo under *R. fumigata* (= *R. asiatica*) show apparently cespitose fruitbodies with massive stipes. Colors were described as follows: "... basal branches reddish-violaceous to rather brownish, terminal branches light greyish purple to light greyish ruby, tips concolorous with the terminal branches; colour not changing by bruising." These colors must be contrasted to the "greyish yellow to dull yellow" branches and concolorous tips of *R. himalayensis* (= *R. fennica* ss. SHARDA).

SHARDA described basidiospores of *R. fennica* (= *R. himalayensis*) as  $9.8\text{--}12.5\text{--}(13) \times 4\text{--}5\text{--}(5.5) \mu\text{m}$ ;  $L^m = 11.5 \mu\text{m}$ ;  $W^m = 4.8 \mu\text{m}$ . My measurements are somewhat larger ( $n = 30$ , for two specimens) for this taxon, although hardly so for *R. asiatica* (= *R. fumigata* ss SHARDA), where my  $L^m = 11.7 \mu\text{m}$ , while SHARDA's was  $11.2 \mu\text{m}$ .

Specimens examined (all as *R. fennica*). – BHUTAN: Thimphu, Motithang, 4. VIII. 81, coll. SHARDA 22326 (holotype, PAN); Paro, D'Dzong, 9. VIII. 81, coll. SHARDA 22349 (PAN). – INDIA: Meghalaya, Shillong, 21. IX. 79, coll. SHARDA 22130 (PAN).

5. *Ramaria purpurissima* PETERSEN & SCATES sp. nov. – Figs. 5, 15

Basidiocarpa multiramosa, ad  $14 \times 15$  cm, crasso-sphaeropedunculata ad crasso-obovata. Bases ad  $5 \times 9$  cm, crassae, singulatae, aliquando cum ramulis abortivis; tactu interdum brunnescentia; caro alba, non gelatinosa. Rami et ramuli purpurei deorsum et superne, breves, congesti. Apices crassi, purpurei. Hyphae contextus fibulatae, crassitunicatae. Basidia  $70-80 \mu\text{m}$  longa, clavata, fibulata. Sporae  $9-11.2 \times 4.7-5.2 \mu\text{m}$ , ellipsoidae subcorrugatae. – USA: Idaho, Panhandle Nat. Forest, vic. Hayden Lake, 29. IX. 77, coll. SCATES 6951 (holotypus, TENN 47011), isotypus in herb. SCATES.

Fruitbodies (Fig. 15) up to  $14 \times 15$  cm, nearly circular to very broadly obovate in outline. – Stipe up to  $5 \times 9$  cm, single, massive, rounded below, tapering gradually downward, involving very little substrate, with fine white tomentum in creases, otherwise smooth, off-white, occasionally with brunnescent areas appearing as substrate smudges; flesh white, solid, hard when dry, violaceous around grub holes. – Major branches 2–4, arising together, up to 3 cm thick, more or less terete, dull violaceous to dull purplish (NBS 233 – medium purple; “pale vinaceous drab”). – Branches in 3–6 ranks, rather crowded and abruptly arising from major branches, intensely violaceous to purple (“anthracene purple” 14E4, NBS 245 – grayish reddish purple), terete, crowded when young, short (up to 2 cm long) at maturity; axils rounded; internodes short throughout. – Apices cusped when young, dichotomous to double-dichotomous at maturity, minutely pointed, intensely purple (14D3, NBS 244 – pale reddish purple, NBS 245 – grayish reddish purple). – Odor and taste negligible.

Macrochemical reactions. – SYR, GUA = positive; KOH = red on purple parts; HSO = ruddy on purple parts (not yellow); PYR = weakly and slowly positive; TYR = negative.

Tramal hyphae of stipe  $3-11 \mu\text{m}$  diam, hyaline, thick-walled (wall up to  $2 \mu\text{m}$  thick), rigid, clamped, free interwoven; inflated clamps up to  $12 \mu\text{m}$  broad, not unusually thick-walled, unornamented; gloeoplerous hyphae not observed. – Tramal hyphae of upper branches  $3-9 \mu\text{m}$  diam, hyaline, thin-walled, clamped, locally adherent, parallel, tightly packed; inflated clamps occasional, thin-walled, unornamented; gloeoplerous hyphae as short, cudgel-shaped lengths delimited by one clamp, strongly cyanophilous. – Subhymenium extensive; hyphae  $2-3.5 \mu\text{m}$  diam, thin-walled, clamped,

hyaline, very tightly packed, interwoven, free. – Hymenium thickening. – Basidia  $70-80 \times 8-10 \mu\text{m}$ , clavate, attenuate below, clamped; contents homogeneous when young, minutely granular to multiguttulate at maturity; sterigmata 4, straight.

Spores (Fig. 5)  $9-11.2 \times 4.7-5.4 \mu\text{m}$  ( $E = 1.79-2.31$ ;  $E^m = 2.05$ ;  $L^m = 10.29 \mu\text{m}$ ), ellipsoid with adaxial bulge, conspicuously roughened in profile: contents uni- to several-guttulate, the guttules discrete, refringent, yellow-ochre; wall up to  $0.2 \mu\text{m}$  thick; hilar appendix prominent, broad, with moderate throat; ornamentation of complex low warts and short ridges, often in transverse orientation.

Commentary. – At present, this species is known only from northern Idaho, but assumedly also fruits in other places in western North America. Within the flora of the region it is extremely unique in its intense purple coloration which hardly changes during maturation. This retention of color seems due to sparse production of spores, resulting in little spore accumulation on the hymenium and therefore little diminution of purple color. While spores are common in hymenial squashes, they are not abundant as in such mounts of most taxa.

*Ramaria fennica* is easily separated from *R. purpurissima* by the immature dull chartreuse-ochre coloration of upper parts of the former. At present, the geographic ranges of the two species are not known to overlap, and *R. fennica* appears to fruit under broad-leaved trees.

Characters separating *R. purpurissima* from *R. versatilis* include stature (fruitbodies of the former are much larger, bulkier, with much more massive stipe), coloration (fruitbodies of *R. versatilis* are paler apically, and change to cinnamon with spore production), tramal hyphal differences (stipe tramal hyphae of *R. purpurissima* are heavily skeletalized, those of *R. versatilis* thin-walled), but spore dimensions are rather similar.

Separation of *R. purpurissima* from *R. cedretorum* is more difficult. *Ramaria purpurissima* produces smaller spores and seems consistently to exhibit strongly skeletalized generative stipe tramal hyphae. It has been found only under mixed coniferous forest (*Abies*, *Tsuga*, *Pseudotsuga*).

Specimens examined. – USA: Idaho: Panhandle Nat. Forest, vic. Hayden Lake, 29. IX. 1977, coll. SCATES 4649 (TENN); Kootenai Co., vic. Coeur d'Alene, 29. IX. 1984, coll. SCATES 45922 (TENN); Coeur d'Alene Co., V. 1986, coll. BARNHART 47028 (TENN); Coeur d'Alene Co., Birdhouse Hill, 12. XI. 1983, coll. SCATES 47011 (holotype – TENN); Coeur d'Alene Co., 3. X. 1982, 46993 (TENN); Coeur d'Alene Co., 29. IX. 1968, 34209 (TENN).



6. *Ramaria purpurissima* var. *gigantea* (THIND & ANAND) PETERSEN  
comb. nov. — Fig. 6

Basionym: *Ramaria fumigata* var. *gigantea* THIND & ANAND (1956): J. Indian Bot. Soc. 35: 98.

Illustrations. — THIND & ANAND (1956: pl. 5, fig. 2); SINGH (1977: pl. 8).

Fruitbodies up to  $21 \times 16$  cm, circular to flattened obovate in outline. — Stipe up to  $6 \times 5$  cm, large to massive, rounded, not involving significant substrate when picked, smooth, without abortive branchlets, off-white below, unchanging on bruising; flesh solid, moist but not slippery, compact, white. — Major branches 3–4, short, more or less terete, up to 1 cm thick, violet, lilac to reddish lilac; flesh white, fibrous. — Branches in 3–5 ranks, polychotomous, arising abruptly from upper surfaces of major branches, violet, lilac to reddish lilac when young, in age fuliginous-ochraceous with spore deposit, spreading slightly; internodes all short at first, lengthening by maturity and diminishing gradually upward; axils rounded. — Apices cusped when young, octuse by maturity, clustered, concolorous with branches, remaining violet to lilac into maturity. — Taste and odor negligible.

Macrochemical reactions on dried fruitbodies: KOH = “venetian red;” HSO = “maize yellow.”

Tramal hyphae of stipe 3–8  $\mu$ m diam, hyaline, clamped, thin-walled, tightly packed, locally adherent; inflated clamps up to 14  $\mu$ m broad, aliiform, thick-walled (wall up to 1  $\mu$ m thick), unornamented. — Tramal hyphae of upper branches 2.5–6  $\mu$ m diam, uninflated, hyaline, thin-walled, clamped, strictly parallel, locally adherent.

Spores (fig. 6)  $9.7\text{--}13.3 \times 4.7\text{--}6.1$   $\mu$ m ( $E = 1.93\text{--}2.47$ ;  $E^m = 2.14$ ;  $L^m = 11.16$   $\mu$ m;  $W^m = 5.21$   $\mu$ m), cylindrical to ellipsoid, adaxially flattened, conspicuously roughened in profile; contents 1–several-guttulate, the guttules refringent, deep ochre; wall up to 0.2  $\mu$ m thick; hilar appendix prominent, broad; ornamentation of small, discrete warts hardly anastomosing.

Commentary. — Size, color and stature of fruitbodies are very similar in the western North America taxon, *R. purpurissima*, and this taxon from the Himalayas. Both are purple to violet from the basal branches through the apices, both exhibit large to massive stipes and relatively crowded, short branches, and both form large fruitbodies.

When dealing with dried specimens and descriptions by other workers, convincing identification is often difficult. So it is with *R. purpurissima* var. *gigantea*.

THIND & ANAND (1956) separated *R. fumigata* var. *gigantea* from *R. fumigata* on several characters, the most important of which were

the following: 1) larger fruitbodies; 2) lack of rufescence; 3) guttulate spores; and 4) clamped hyphae. In my experience, *R. versatilis* [= *R. fumigata* auct. non (PECK) CORNER] does not exhibit rufescence (it does exhibit brunnescence), and produces clamp connections.

The concept of a clampless, rufescent *R. fumigata* can be traced through CORNER (1950: 591–592) to COKER (1923: 136–137). CORNER's mention "... flesh white (rufescent on bruising) ..." was probably taken from COKER's note of specimen 921 (see under *R. fennica* for more on this specimen). Of the tramal hyphae, COKER stated "... with no visible clamp connections." CORNER's rendition was "... hyphae ... (no clamps, COKER) ...", picked up by THIND & ANAND (1956) (with aid from CORNER, loc. cit., p. 101) as a separating character from their *R. fumigata* var. *gigantea*.

SINGH (1977: 157–158) cited spore measurements of *R. fumigata* var. *gigantea* as  $(10.5-12-15(-16.5) \times (4.5-5.5-6.0(-7.3) \mu\text{m})$  ( $L^m = 14.1 \mu\text{m}$ ;  $W^m = 6.2 \mu\text{m}$ ), even though THIND & ANAND (1956: 98) and THIND (1961: 70) had cited them as  $10.5-14 \times 4.2-6.3 \mu\text{m}$ , making SINGH's  $L^m$  and  $W^m$  impossible. Such a discrepancy should have arisen, therefore, from RATTAN's additional collections from Buthan (PAN 4703, 4705). My measurements from these are as follows:  $4703-9.7-12.6 \times 5.4-6.1 \mu\text{m}$  ( $L^m = 11.43 \mu\text{m}$ );  $4705-10.8-13.3 \times 5-6.1 \mu\text{m}$  ( $L^m = 12 \mu\text{m}$ ). I cannot detect, therefore, any significant difference in spore size between *R. asiatica* (which I interpret as representing *R. fumigata sensu* THIND & ANAND; see above) and *R. fumigata* var. *gigantea* (although I have not examined the type specimen, THIND & ANAND 34, PAN).

This spore size discrepancy between SINGH (1977) and THIND & ANAND (1956) casts doubt on SINGH's fruitbody description of *R. fumigata* var. *gigantea*. THIND & ANAND (1956: 99) stated: "... trunk ... violet colored throughout, color fading in over-mature specimens to fuliginous-ochraceous but the tips remain violet for a longer time ..." This conforms rather closely to the description (and specimens) of *R. purpurissima*.

THIND & ANAND (1956) described the fruitbody base as an "undifferentiated stubby basal part ... up to 5.8 cm broad." This suggests, perhaps, a taxon of subg. *Lentoramaria*, similar to *R. suecica*. Fruitbodies of KHURANA 4703 and 4705, however, show the stipe to be short, gnarled, tomentose to mycelial, but discrete rather than a basal felt or mat.

SHARDA's (1983) single collection under *R. cedretorum* has been split, and the fruitbody I have examined (PAN, TENN) seems to have a large, single stipe, in contrast to the tapering, usually geniculate stipe in *R. asiatica*. SINGH (1977; pl. 7, figs. 19, 20, 22) furnished drawings of the type specimen of *R. fumigata* var. *gigantea* (THIND & ANAND 34), which showed a fruitbody with large stipe and some

abortive branchlets, much as described by SHARDA under *R. cedretorum*. Moreover, THIND & ANAND's description of a large stipe in *R. fumigata* var. *gigantea* matches SHARDA's. SHARDA furnished no comparison or contrast of the specimen he identified as *R. cedretorum* with *R. fumigata* var. *gigantea*, so it is impossible to know what differences he perceived.

From her description and my macromorphological inspection of her specimen, I conclude that the collection WU (1986) cited under *R. cedretorum* is probably *R. purpurissima* var. *gigantea*. She cited colors as follows: upper stipe "vinaceous brown" (RIDGWAY, 1912); branches "vinaceous purple," with flesh "pale grayish vinaceous." Branches were short and crowded on a thick, erect stipe. Her specimen, from Yunnan Province, would extend the range of *R. purpurissima* var. *gigantea* in a predictable way.

Specimens examined. — BHUTAN: Thimphu, 9. VIII. 1981, coll. SHARDA 22345 (PAN, as *R. fumigata*; TENN 44254); Thimphu, Begana, 7. VIII. 1981, coll. SHARDA 22317 (PAN, as *R. fumigata*; TENN 44238); Thimphu, Begana, 7. VIII. 1981, coll. SHARDA 22339 (PAN, as *R. cedretorum*). — INDIA: Himal Pradesh, Simla, Glen, 31. VII. 1971, coll. KHURANA 4705 (PAN, as *R. fumigata* var. *gigantea*; BPI); Simla, Glen, 30. VII. 1971, coll. KHURANA 4703 (PAN, as *R. fumigata* var. *gigantea*; BPI).

7. *Ramaria versatilis* QUÉLET (var. *versatilis*) (1894): Assoc. France avanc. sci. 2: 489. — Figs. 7, 13

- ≡ *Clavariella versatilis* (QUÉL.) MAIRE (1914). Bull. Soc. Mycol. France 30: 218.
- ≡ *Clavaria versatilis* (QUÉL.) BOURDOT & GALZIN (1910). Bull. Soc. Mycol. France 26: 114.
- = *Clavaria fumigata* auct. non PECK; LEATHERS (1955): Clav. Michigan. — Ph.D. Dissertation, Univ. Michigan, ined.
- ≡ *Ramaria fumigata* auct. non (PECK) CORNER; SCHILD (1971): Fung. Rar. Icon. Color. 5: 33–40.
- = *Clavaria fennica* auct. non KARSTEN; COKER (1923): Clav. U.S. & Canada, p. 135 (pro parte).

[= *Clavaria lilacinipes* Peck; nom. herb., teste COKER]

[= *Ramaria fuscoviolacea* Petersen; nom. herb.]

[= *Ramaria fennica* f. *violacea* SCHILD (1971): Icon. Fung. Rar., nom. nud.]

Type (neotype, des. mihi). — France: Loire-et-Cher, Mundou-bleau, X. 1910, misit LEGUE, ex. herb. BOUDIER, s. n., PC.

Illustrations. — MAIRE (1914: pl. 9, fig. 1); COKER [1923: pl. 48 (as *Clavaria fennica*; not pl. 47)].

Fruitbodies (fig. 13) up to 15 × 8 cm, obovate to obpyriform in outline. — Stipe up to 7 × 4 cm stout, single, often expanded or subbulbous, discrete, hardly rhizomorphic, often dimpled, white below substrate level (and often above), sometimes faintly brunnes-

cent in creases, dull violaceous above ("vinaceous drab," "sorghum brown," "benzo brown," M&P 56J5), especially when young, but usually at all ages and even when dried, or white throughout, with violaceous colors appearing on major branches; flesh white, rarely with violaceous tints around grub holes, soft and punky when fresh, and then with a somewhat leathery rind, chalky when dried and then easily penetrated, but harder outward. – Major branches 2–5, stout, arising together, up to 1.5 cm thick, white to violaceous below, violaceous above when young ("army brown," "benzo brown," "deep Quaker drab," "wood brown," "anthracene purple"), but becoming cinnamon above coincident with maturing spores, usually remaining violaceous below the maturing hymenium even when dried; primary internodes up to 2.5 cm long; branches violaceous when young, becoming cinnamon with maturing spores ("buffy brown," "buckthorn brown," "clay color," "tawny olive," S43, S72, S104, M&P 13BC6), terete; axils broadly acute to rounded. – Apices violaceous when young ("tilluel buff," "vinaceous buff," "dark slate purple," "light vinaceous drab," "light brownish drab," "light purple drab"), becoming cinnamon with maturing spores ("clay color") but retaining violaceous tints well into old age. – Odor not recorded, taste faintly bitter or faintly acrid.

Macrochemical reactions. – FCL = slate green; KOH = negative on branch sections or leaching copper red, copper red, "carnelian red," "venetian red" on purple surfaces; ANW = weakly positive; NOH = cherry red on cut ends; GUA = negative on branch sections, positive on stipe surface; SYR = slowly positive; ANO = cinereous grey; IKI, PHN, PYR, TYR = negative.

Tramal hyphae of stipe 3–11  $\mu\text{m}$  diam., thin- to thick-walled (wall up to 1  $\mu\text{m}$  thick), hyaline, clamped, loosely packed, interwoven; swollen clamps common, thick-walled, ornamented; gloeopleurous hyphae not observed. – Tramal hyphae of upper branches 3–9  $\mu\text{m}$  diam., thin-walled, hyaline, clamped, tightly packed, parallel, free. – Hymenium thickening. – Basidia 44–50  $\times$  9–9.5  $\mu\text{m}$ , clavate, clamped; contents homogeneous when young, granular when mature; sterigmata 4, slender, incurved but hardly divergent.

Spores (fig. 7) (9.0)9.5–12(13)  $\times$  4.4–5.2(5.6)  $\mu\text{m}$  ( $E = 1.81$ –2.66;  $E^m = 2.12$ ;  $L^m = 10.5 \mu\text{m}$ ), ellipsoid to subovoid, somewhat flattened adaxially, convex abaxially, roughened in profile, "clay color" in prints; contents uni- to multiguttulate, the guttules refringent under phase contrast, dark ochraceous; wall up to 0.2  $\mu\text{m}$  thick; hilar appendix prominent, thin-walled, broad; ornamentation of small, non-anastomosing, scattered, low, strongly cyanophilous warts.

Commentary. – CORNER (1950) agreed with COKER (1923) that *Clavaria fumigata* was synonymous with *Ramaria versatilis*, but in recombining the former in *Ramaria* neglected the prior combination.





Figs. 5–9: Spores of *Ramaria* taxa: 5. *R. purpurissima*. – 6. *R. purpurissima* var. *gigantea*. – 7. *R. versatilis*. – 8. *R. versatilis* var. *latispora*. – 9. *R. versatilis* var. *violaceibrunnea*. – Standard bar = 5  $\mu$ m.

This helped perpetuate the incorrect combination *Ramaria fumigata* (Pk.) CORNER.

Microscopically, it is difficult to distinguish *R. fennica* from *R. versatilis*. Spores are approximately the same dimensions, and basidia and tramal hyphae are similar. Spore ornamentation is coarser in *R. fennica*, but it is necessary to stain spores with aniline blue to see this. The two species can be separated rather easily on macroscopic characters, however. In *R. versatilis*, upper branches are violaceous when young, and turn cinnamon to olive with maturing spores, while in *R. fennica*, upper branches are dull yellow-green when young, becoming dull ochraceous olive with maturing spores. Fruit-body stipes in *R. versatilis* are discrete, rounded below, and often subbulbous while those of *R. fennica* are stout but tapering, and often beset with mycelium. These stature differences can be seen even in dried material (when whole fruitbodies are present). In addition, *R. fennica* fruits under hardwood trees, especially oak and beech, while *R. versatilis* seems to prefer conifers or mixed forests.

The two common North Temperate taxa of *Ramaria* with purple tints on the lower branches have seen a tortured taxonomic and nomenclatural past. Because these colors are unique in the subge-

nus, and because both taxa can fruit under broad-leaved trees, it must be expected that they would be described several times, and that epithets would be recombined as the list of synonymy indicates.

Typical fruitbodies from western North America seem to produce large, bulky stipes with short branches. Fruitbodies of the same species from eastern North America and Europe seem to exhibit a better developed branch system, and smaller stipe (viz. SCHILD, 1971, for the best illustration). Based on this discrepancy I used the herbarium name *Ramaria gomphoides* for the western North American taxon, in reference to the color of the hymenium in *Gomphus clavatus*. This herbarium name applies both to var. *versatilis* and var. *violaceibrunnea* in the Pacific Northwest.

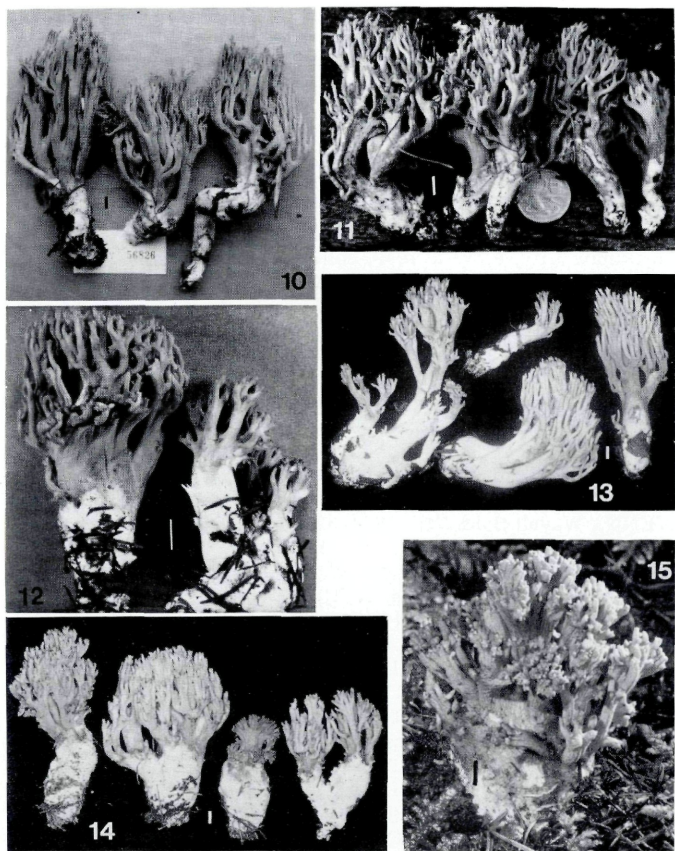
On the other hand, *R. fumigata* (PECK) CORNER has been used by several authors for a taxon in eastern North America and Europe, which I find identical to *R. versatilis* var. *versatilis*. While these two taxa (*R. fennica* and *R. fumigata* ss. auct.) are distinct, examination of PECK's type of *Clavaria fumigata* showed it to be conspecific with *R. fennica* (PETERSEN & OLEXIA, 1967). This synonymy left *R. fumigata* ss. auct. without a valid name. For it, I used the nomen herbariorum *R. fuscoviolacea*, but recently (PETERSEN & ZANG, 1986) I proposed an elevation of MARR's variety to species rank as *R. violaceibrunnea*. This new status allowed description of *R. violaceibrunnea* var. *asiatica* PETERSEN from China and India. Below, var. *violaceibrunnea* has been transferred to *R. versatilis*, and var. *asiatica* has been proposed at species rank above.

SHARDA (1983) described an organism under "*Ramaria* sp. IV," fruitbodies of which were marked by "... greyish red to light brownish ..." branches and "... pale yellow tips; slightly bitter taste; slightly inflated, clamped hyphae; negative macrochemical tests;" and somewhat large spores. The small fragment at SUCO SHARDA 22003 bears spores  $11.9-14.8 \times 5.8-6.8 \mu\text{m}$  ( $E = 1.89-2.28$ ;  $E^m = 2.06$ ,  $L^m = 12.9 \mu\text{m}$ ), which are coarsely warted. These match almost exactly those of *R. cedretorum*, but fruitbody colors and negative macrochemical reactions are different from the latter species. I cannot identify the organism from the fragment at SUCO, but it is not any taxon treated here.

A case could be made for the use of *Ramaria rufo-violacea* (BARLA) QUEL. for the taxon here treated as *R. versatilis*. I interpret that epithet as representing a species of *Clavulina*, however, and I reject the epithet as a *Ramaria* (see under Nomen Rejiciendum).

For a discussion of COKER's treatment of specimens of *R. versatilis*, see *R. fennica*.

Specimens examined. — CANADA: Nova Scotia: Kentville, 4. IX. 1938, coll. HARRISON 940 (DAOM), 32106 (TENN). — FRANCE: Vosges, IX. 1910, misit MAIRE, ex herb. BOUDIER, s.n. (PC); Loire-et



Figs. 10–15: Fruitbodies of *Ramaria* taxa: 10. *R. asiatica*. – 11. *R. versatilis* var. *latispora*. – 12. *R. versatilis* var. *violaceibrunnea*. – 13. *R. versatilis*. – 14. *R. fennica*. – 15. *R. purpurissima*. – Standard bars = 1 cm.

Cher, Mondoubleau, X. 1910, leg. LEGUE, ex herb. BOUDIER, s.n. (PC – neotype of *R. versatilis*); Meurthe-et-Moselle, Herrimenil, bois Bareth, 11. IX. 1910, sous *Fagus*, *Carpinus*, *Quercus*, leg. MAIRE, s.n. (MPU); forêt de Fontainebleau, 19. X. 1934, sous *Quercus*, *Fagus*, leg. MAIRE, s.n. (MPU); Dept. de l'Allier, forêt de Château Charles, X.

1910. leg. BOURDOT 7477, ex herb BRESADOLA (BPI); same location, 28. IX. 1905, coll. BOURDOT 4677 (FH). – ITALY: vic. Trento, 20. IX. 1972, 36806 (TENN). – SPAIN: Catalonia, Solises, 24. X. 1933, in quercetis, leg. MAIRE, s.n. (MPU). – UNITED STATES: *Alabama*: location unknown, 23. VIII. 1942, coll. BURKE "T" (as *C. fennica*, NCU). – *Florida*: vic. Gainesville, 21. VIII. 1958, coll. THIERS 5375 (SFSU). – *Georgia*: Chattooga River, near Monroe Camp, 7. VIII. 1942, coll. COKER 12918 (as *C. fennica*, NCU). – *Maryland*: Takoma Lake, 31. VIII. 1919, coll. KAUFFMAN 811 (as *C. fennica*, det. COKER) (MICH). – *Michigan*: Newaygo Co., 7. VIII. 1967, coll. THIERS 20444 (SFSU); Mackinaw City, 4. VIII. 1949, coll. SMITH 32849 (as *C. fumigata*) (MICH). – *New York*: Otsego Co., vic. Oneonta, 21. VIII. 69, coll. MARR, s.n. (SUCCO). – *North Carolina*: Jackson Co.: Rt. 64, vic. Cashiers, VIII. 1964, 31310, 31314 (TENN); Macon Co.: Whitewater River Gorge, VIII. 1964, 31447 (TENN); Cliffside Lake, 17. VII. 1984, coll. WOLFE 45723 (TENN); Horse Cove, VIII. 1964, 31446, 32865 (TENN); Coweeta Hydrol. Lab., VIII. 1964, 32864 (TENN); vic. Cashiers, 18. VII. 1963, 32890 (TENN); Coweeta Hydrol. Lab., 29. VII. 1967, 32672 (TENN); Highlands, Bear Pen Mt., VIII. 1964, 32860 (TENN); Highlands, Bear Pen Mt., 15. VIII. 1943, coll. COKER 13472 (as *C. fennica*, NCU); Miller Cemetery Rd., 31. VII. 1963, 32857 (TENN); Wayah Bald, VIII. 1964, 32898 (TENN); Macon Co., Highlands, vic. Ravenel Lake, 1. IX. 1943, coll. COKER 13573 (as *C. fennica*, NCU); Highlands, old Wright place, 31. VII. 1940, coll. COKER 11905 (as *C. fennica*, NCU); Rt. 64, 17. VII. 1963, 30903 (TENN). Orange Co.: Chapel Hill, University Lake, 20. X. 1945, coll. COKER 14011 (as *C. fennica*, NCU); Chapel Hill, 17. IX. 1913, coll. COKER 779 (NCU). Chapel Hill, "Meeting of Waters," 17. IX. 1913, COKER 779 (as *C. fennica*, NCU); Transylvania Co., Pisgah National Forest: VIII. 1964, 31252 (TENN); Black Mt. Trail, 15. VII. 1985, 46733 (TENN). – *South Carolina*: Oconee Co.: Whitewater River Gorge, 8. IX. 1961, 30690 (TENN). – *Tennessee*: Blount Co., Great Smoky Mountains National Park: Ekanetlee Trail, 15. IX. 1965, 32786 (TENN); Ekanetlee Rd., 26. IX. 1965, 32824 (TENN); Cades Cove, VIII. 1964, 27488 (TENN), Cades Cove, 22. VIII. 66, 32083 (TENN); Cades Cove, 28. IX. 1965, coll. OLEXIA 31778 (TENN). Sevier Co.: Great Smoky Mountains National Park, Roaring Fork Nature Trail, 3. VIII. 1985, 46755 (TENN).

8. *Ramaria versatilis* var. *latispora* PETERSEN var. nov. – Fig. 8, 11

Ut varietas typica, sed: 1) apices roseo-violacei ad roseo-alutacei; 2) sporae 9.4–12.2 × 5.0–6.5 µm; et 3) in Australia fructificans.

Type. – AUSTRALIA: Brisbane Mountain Range, vic. Beremboke, 18. VI. 1977, coll. Weste & RHP (VIC–5), TENN 47328, holotype.



Fruitbodies (Fig. 11) up to  $14 \times 6.5$  cm, sphaeropedunculate to commashaped in outline. Stipe up to  $3 \times 2$  cm, single (sometimes cespitose in 2's or 3's), often which a tangle of slender, fragile, white rhizomorphs at base, often somewhat bulbous at base, rounded or gnarled below, smooth, off-white where protected, dull lavender drab above; flesh solid, off-white, not gelatinous or slippery. — Major branches few, ascending, terete, concolorous with branches. — Branches in 3–7 ranks, ascending, dichotomous above, terete, bright lavender (“deep dull lavender,” *teste* Fawcett), to dull lavender (“vinaceous drab,” “dark vinaceous drab”), becoming more tan with spore production; axils rounded; internodes diminishing gradually upward. Apices finely divided, double-dichotomous, ruddy tan (“sorghum brown,” “army brown”) to ochraceous (*teste* Watling). All parts slowly brunnescent (“cinnamon buff,” “clay color”) where bruised. — Odor and taste not recorded.

Macrochemical reactions. — FCL, GUA = positive; KOH = “Etruscan red,” “testaceous” on purple surfaces; ANO, ANW, PYR, IKI = negative.

Stipe tramal hyphae  $3\text{--}11\text{ }\mu\text{m}$  diam., thin- to thick-walled (wall up to  $1\text{ }\mu\text{m}$  thick), hyaline, clamped, loosely interwoven, free; ampulliform septa up to  $13\text{ }\mu\text{m}$  broad, thick-walled (wall up to  $1.5\text{ }\mu\text{m}$  thick), asymmetrical, ornamented; gloeoplerous hyphae not observed. — Tramal hyphae of upper branches  $3\text{--}11\text{ }\mu\text{m}$  diam., hyaline, thin-walled, clamped, parallel, free; ampulliform septa up to  $13\text{ }\mu\text{m}$  broad, asymmetrical, thick-walled (wall up to  $0.5\text{ }\mu\text{m}$  thick), unornamented; gloeoplerous hyphae not observed. — Subhymenium extensive; hyphae  $1.5\text{--}2.0\text{ }\mu\text{m}$  diam, hyaline, clamped, thin-walled, tightly interwoven to pseudoparenchymatous. Hymenium thickening; basidia  $62\text{--}70 \times 9\text{--}10\text{ }\mu\text{m}$ , clavate, clamped; contents multiguttulate to multigranular at maturity; sterigmata 4, stout, curved.

Spores (Fig. 8)  $9.4\text{--}12.2$  ( $-13$ )  $\times 5\text{--}6.5\text{ }\mu\text{m}$  ( $E = 1.56\text{--}2.25$ ;  $E^m = 1.86$ ;  $L^m = 10.67$ ;  $W^m = 5.78\text{ }\mu\text{m}$ ), ellipsoid, conspicuously roughened in profile; contents deep ochraceous, often with one dark, delimited guttule; wall up to  $0.3\text{ }\mu\text{m}$  thick; hilar appendix curved, prominent; ornamentation of large scattered warts and some lobate ridges.

Commentary. — FAWCETT (1939) described a fungus from Australia which she identified as *Clavaria fennica*. Fruitbodies were described as lavender (“deep dull lavender” of RIDGWAY) or dull purple (becoming “vinaceous drab” in age). Such sensational colors would seem improbable, and I have made two collections in Victoria which were considerably more subdued (branches “dark vinaceous drab” to “vinaceous drab” when fresh, apices with a reddish blush — “sorghum brown” to “army brown” — lower parts brunnescent to “cinnamon buff” or “clay color” where bruised or chafed). In my

collections a typical KOH reaction was noted (to "testaceous" or "Etruscan red" on purple areas). Spore measurements on my collections [ $9.4\text{--}11.5$  ( $-13.0$ )  $\times$   $5\text{--}6.1$   $\mu\text{m}$  ( $E = 1.65\text{--}2.25$ ;  $E^m = 1.9$ ;  $L^m = 10.6$   $\mu\text{m}$ )] show the wide spores reported by FAWCETT ( $10.3\text{--}11.1$   $\times$   $4.5\text{--}5.8$   $\mu\text{m}$ ). Indeed, these width measurements hardly overlap those of the taxon from other geographic regions (see above), with concomitantly lower  $E$  and  $E^m$  values. With such spore differences coupled with the reddish hue of branch apices, and geographic disjunction, it seemed wise to segregate an additional taxon (at infraspecific rank), but I have been reluctant to do so based on only a few dried collections with meager notes. Now, two WATLING collections confirm the situation, together with examination of many collections of *R. versatilis* from Europe and North America, and I am persuaded to propose a separate variety for the Australian taxon.

Specimens examined. — AUSTRALIA: Capital Territory: Blue Range Block, Cotter Dam, 25. IV. 1974, WATLING 10606 (E). Victoria: Gembrook, vic. Melbourne, 11. V. 1982, WATLING 14830 (E); Brisbane Mountain Range, vic. Beremboke, 18. VI. 1977, coll. WESTE & RHP, VIC-5 (TENN 47328, holotype) road to Yea, 12. VI. 1977, coll. WESTE, SWART & RHP, VIC-13 TENN 47317).

9. *Ramaria versatilis* var. ***violaceibrunnea*** (MARR & STUNTZ) PETERSEN comb. nov. — Figs. 9, 12

≡ *Ramaria fennica* var. *violaceibrunnea* MARR & STUNTZ (1973). Biblioth. Mycol. 38: 78.

≡ *Ramaria violaceibrunnea* (MARR & STUNTZ) PETERSEN (1986). Acta Bot. Yunnan. 8: 293.

Type (holotype). — USA; Washington, Mason Co., Mason Lake;

1. XI. 1966, coll. MARR 512 [n. v.], SUCCO.

Illustrations. — MARR & STUNTZ (1973: pl. 4, figs. 21, 22, pl. 20, fig. 80).

Fruitbodies up to  $13 \times 6$  cm, narrowly ellipsoid, truncate-ovate to sphaeropedunculate in outline. — Stipe up to  $40 \times 30$  mm, single, rounded at base, mycelial to rooting with many ropy, white rhizomorphs, smooth, not glabrous, brunnescent in creases (but not over surface or upon bruising), solid, upward pallid grey-violet ("vinaceous drab," "dark vinaceous brown," "light grayish vinaceous"); flesh white, solid, moist but not gelatinous or slippery, homogeneous, drying punky, somewhat friable. — Major branches 2–4, more or less terete, concolorous to branches above. Branches in 3–5 ranks, terete, avellaneous to purple in youth ("anthracene purple," "avellaneous," "drab"), darkening with spore production to smoky olivaceous shades ("buffy brown," "deep olive buff," "light brownish olive"); axils narrowly rounded; internodes diminishing

gradually at maturity. – Apices double-dichotomous in youth, lengthening by maturity to digitate, buffy olive (“buffy olive,” “light brownish olive”), darkening age (“dark olive buff,” “citrine drab,” “buffy brown”). – Odor sometimes weakly fragrant, taste negligible.

Macrochemical reactions. – FSW, FSA, FCL = strongly positive; KOH = bright peach red (“grenadine,” fading to “rufous”); SYR = capricious; IKI, CRE, ANO, ANW, PYR, PHN, GUA = negative.

Tramal hyphae of stipe 4–10  $\mu\text{m}$  diam, hyaline, thin- to thick-walled (wall up to 0.5  $\mu\text{m}$  thick), conspicuously clamped, free, interwoven; ampulliform swellings at clamps, up to 14  $\mu\text{m}$  broad, thin- to thick-walled (wall up to 0.5  $\mu\text{m}$  thick), unornamented to scarcely and delicately ornamented; gloeoplerous hyphae not observed. – Tramal hyphae of upper branches 4–10  $\mu\text{m}$  diam., hyaline, thin-walled, conspicuously clamped, free, interwoven; ampulliform swellings and gloeoplerous hyphae not observed. – Subhymenium rudimentary, densely interwoven. – Hymenium thickening. – Basidia 50–60  $\times$  7–9  $\mu\text{m}$ , clavate, clamped; contents homogeneous; weakly cyanophilous; sterigmata 4, straight, spindly.

Spores (Fig. 9) 9–13  $\times$  4.3–5.4  $\mu\text{m}$  ( $E = 1.8$ –2.57;  $E^m = 2.13$ ;  $L^m = 10.42 \mu\text{m}$ ), ellipsoid to ovate, flattened adaxially, obscurely roughened in profile; contents homogeneous to obscurely uniguttulate, the guttules dark, hardly refringent; wall up to 0.2  $\mu\text{m}$  thick; hilar appendix eccentric, broad, with no throat; ornamentation of many small, isolated cyanophilous warts up to 0.1  $\mu\text{m}$  high, without discernable orientation.

Commentary. – MARR (in MARR & STUNTZ, 1973) furnished a detailed description of *R. fennica* var. *violaceibrunnea*, to which my observations agree totally. MARR and I collected the holotype together, and an isotype is at TENN. The TENN portion was not properly dried, and the SUCO portion is much better preserved.

Recently, MARR (1985, pers. comm.) suggested that there was a cline from typical cinnamon brown coloration of mature fruitbodies of *R. violaceibrunnea* to a somewhat olivaceous cast reminiscent of *R. fennica*. In western collections I also noticed this tendency, with west coast fruitbodies producing spores “deep olive buff” to “isabella color” in prints, unlike the more cinnamon colors of the typical variety. All of the fruitbodies gathered showed purple to lilac branches, however, not the colors and stature of *R. fennica* from Europe or eastern North America. Indeed, I have not seen fruitbodies of *R. fennica* in western North America. Only *R. versatilis* (vars. *violaceibrunnea* and *versatilis*) seem to represent the complex there.

Specimens examined. — CANADA: *British Columbia*: Sheep Lake, 3. X. 1966, 31959 (TENN). — UNITED STATES: *California*: Del Norte Co., Jedediah Smith Redwoods State Park, 11. XI. 1967, 33219, 33277 (TENN); same location, 16. XI. 1985, coll. LARGENT & RHP 46732 (TENN); same location, 13. XII. 1969, coll. THIERS, 24512 (SFSU); Del Norte Co., Smith River, 30. XI. 1937, coll. SMITH 9256 (as *C. fennica*) (MICH); Mendocino Co., Mendocino, 14. XI. 1967, 33274 (TENN); Mendocino Co., Mendocino, 23. XI. 1985, coll. SAYLOR & RHP 46710, 46713 (TENN). — *Idaho*: Bonner Co., Coolin, 16. IX. 1968, 33898 (TENN); Bonner Co., Priest River, 19. IX. 1968, 33967 (TENN); Bonner Co., Priest Lake, 27. IX. 1968, 34176 (TENN); Bonner Co., Upper Priest Lake, 21. IX. 1968, 34030 (TENN); Bonner Co., Hughes Meadows, 19. IX. 1968, 33917 (TENN); Bonner Co., Priest River, 25. IX. 1968, 34102 (TENN). — *Oregon*: Cave Junction, 29. XI. 1937, coll. SMITH, ex MICH 5269 (MICH, NCU, TENN 31218). — *Washington*: Mt. Rainier Nat. Park, Lower Tahoma Creek, 14. X. 1970, 34864 (TENN); Location unknown, Puget Sound 18–20. X. 1968, 34464 (TENN); Mason Co., Mason Lake, 1. XI. 1967, coll. MARR & RHP, Marr M-843, RHP 2887, TENN 33137.

### Nomen Rejiciendum

*Clavaria rufo-violacea* BARLA (1859). Champ. Prov. Nice, p. 87, pl. 41, figs. 3–13

≡ *Ramaria rufo-violacea* (BARLA) QUELET (1888). Flore Mycol. pl. 465.

Type (neotype, des. mihi). — FRANCE: Bois de la Frania, 3. X. 1886, s. n., NICE.

Three specimens under the name *Clavaria rufo-violacea* reside at NICE in BARLA's *Herbarium Mycologicum, Fungi Exsiccati precipue alpium maritimarum* (vol. 42, genera 83, *Clavaria*, and 84, *Calocera*). All were collected in the 1880's and therefore cannot be candidates for holotype or lectotype status.

Specimen 1: "*Clavaria rufo-violacea*, Locat.?, 1882." A slender, branched fruitbody. Annotated by E. SCHILD, 7. XII. 1979, as *Ramaria spinulosa*. I support that identification.

Specimen 2: "*Clavaria rufa?*, *violacea?*, Lagastet, 26. Nov. 1889." A stocky fruitbody, sectioned longitudinally, of some member of subg. *Laeticolorum*. Annotated by E. SCHILD, 7. XII. 1979, as *R. fennica*. Hyphae, spores and fruitbody stature support this identification. Assumption of fruitbody color from the epithet(s) applied would also lead one to *R. fennica* or *R. versatilis*.

Specimen 3: "*Clavaria rufo-violacea* BARLA, Bois de la Frania, 3. X. 1886." Three fruitbodies with slender stipes and inflated, rugose upper parts. Annotated by E. SCHILD, 7. XII. 1979, as *Clavulina amethystina*, and by an anonymous source on the specimen reverse



with the same identification (as *Clavaria amethystina*), crossed out and replaced by "*rufo violacea* BARLA". Hyphae, spores and basidia support generic placement in *Clavulina*.

BARLA's circumscription comprises two disparate ideas. One can be ascertained through the following: "... ses branches prennant naissance sur un pedicule blanc et aminci... Les branches sont flexueuses, arrondies, cylindriques ou un peu aplaties, et parfois rugueuses ou ondulées à leur surface... la couleur en est violette, tirant plus ou moins sur le gris ou le bleu cendre. Leur surface est comme saupoudrée d'une légère poussière pruinuse bleuâtre, et la sommet des rameaux est coloré d'une teinte jaune ou rousse... La chair est très blanche, ferme, cassante, filandreuse et agréable au gout; elle a fort peu d'odeur." When all this is added to the lovely, accurate aquarelle of fruitbodies (pl. 41, figs. 3-13), there can be little doubt that the organism is a dull violaceous *Clavulina*."

BARLA, however, also included the following: "Les sporules sont allongées et d'un brun roussâtre." On the aquarelle, two such spores are shown, accurate even to the roughened wall, all typical of *Ramaria* spores. One is left, therefore, with an identification choice for the epithet between a *Clavulina* based on several written characters and an excellent painting, or a *Ramaria* based on spores.

DONK (1933: 23, 110) drew the same conclusion, but did not establish a positive identification. CORNER (1950: 619) included the taxon under *Ramaria*, but while citing BARLA's plate, probably did not see it. COKER (1923:135) placed BARLA's epithet in synonymy under *Clavaria fennica* but with a question mark and no discussion.

If BARLA's epithet is used in *Ramaria*, it predates combinations of *R. fennica* and *R. versatilis* (1920 and 1894 respectively), so it is important to anchor its identity. I have chosen to use fruitbody characters included in BARLA's circumscription and plate, and have designated the 1886 specimen as neotype, thus preserving the priority of the other two *Ramaria* combinations. Concomitantly, there is no combination of BARLA's epithet in *Clavulina*, so all previous combinations in that genus would retain their priority even if BARLA's epithet were recombined.

### Acknowledgements

I am indebted to E. SCHILD for his advice on these taxa. He painstakingly examined several pertinent specimens and furnished his spore data, measurements, and taxonomic conclusions in personal communications. I am grateful to Mrs. Katherine SCATES-BARNHART for alerting me to *R. purpurissima*, and for allowing me to collect specimens with her. She was aware that the taxon was new (in the American flora), and provided several specimens and descriptive details otherwise unavailable. This project was supported, in part, by National Science Foundation grant BSR-83-03783.

## Bibliography

- COKER, W. C. (1923). The Clavarias of the United States and Canada. – Chapel Hill, 209 p.
- CORNER, E. J. H. (1950). A monograph of *Clavaria* and allied genera. – Ann. Bot. Mem. 1: 740 p.
- DONK, M. A. (1933). Revision der Niederländischen Homobasidiomycetes – Aphyllophorales. II. – Mededeel. Bot. Mus. Rijksuniv. Utrecht 9: 278 p.
- FAWCETT, S. G. M. (1939). Studies on the Australian Clavariaceae, Part II. – Proc. Roy. Soc. Victoria 51 (n. s.): 265–280.
- KELLY, K. L. (1965). ISCC–NBS color-name charts with centroid colors. Standard sample no. 2106. – Nat. Bur. Standards Circ. 553, Supple., Washington, D.C.
- MAERZ, A. J. & M. R. PAUL (1930). Dictionary of color. – McGraw Hill Co., N.Y., 207 p. + 56 pls.
- MALENÇON, G. (1957). Prodrome d'une flore mycologique du Moyen Atlas. IV. – Bull. Soc. Mycol. France 73: 289–330.
- MARR, C. D. & D. E. STUNTZ (1973). *Ramaria* in western Washington. – Biblioth. Mycol. 38: 232 p.
- PETERSEN, R. H. (1968). Type studies on clavarioid fungi. I. – Nova Hedwigia 14: 407–414.
- (1975). *Ramaria* subgenus *Lentoramaria*, with emphasis on North American taxa. – Biblioth. Mycol. 43: 161 p.
- & P. D. OLEXIA (1967). Type studies in the clavarioid fungi. I. The taxa described by Charles Horton PECK. – Mycologia 59: 767–802.
- & M. ZANG (1986). New or interesting clavarioid fungi from Yunnan, China. – Acta Bot. Yunnan. 8: 281–294.
- PILÁT, A. (1985). Übersicht der Europäischen Clavariaceen unter besonderer Berücksichtigung der tschechoslowakischen Arten. – Sbor. Narod. Mus. Praha 14: 129–225.
- RIDGWAY, R. (1912). Color standards and color nomenclature. – Washington, D.C. Publ. Priv., 43 p. + 53 pls.
- SCHILD, E. (1971). Clavariales. – Fungorum Rar. Icones Color. 5: 44 p.
- SHARDA, R. M. (1983). Studies on the clavarioid fungi of eastern Himalayas and adjoining hills. – Ph. D. Thesis, Panjab Univ., 432 p.
- SINGER, R. (1975). The Agaricales in Modern Taxonomy. – J. Cramer, 912 p.
- SINGH, I. P. (1977). Studies on clavarioid fungi of India. – Ph. d. Thesis, Panjab Univ., 487 p.
- THIND, K. S. (1961). The Clavariaceae of India. – Indian Counc. Agric. Res., 197 p.
- & G. P. S. ANAND (1956). The Clavariaceae of the Mussoorie Hills. I. – J. Indian Bot. Soc. 35: 92–102.

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 1987/1988

Band/Volume: [40](#)

Autor(en)/Author(s): Petersen Ronald H.

Artikel/Article: [Contribution toward a monograph of Ramaria. VI. the Ramaria fennica - versatilis complex. 197-226](#)