

CONTRIBUTIONS TOWARD A MONOGRAPH OF RAMARIA — VIII
Some taxa sheltered under the name *Ramaria flava*

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Several *Ramaria* taxa with yellow fruitbodies have been sheltered under the epithet *R. flava* in Europe. Redescriptions are furnished for *Ramaria flava*, *R. flavescens*, *R. lutea*, *R. rasilispora* var. *scatesiana*, and *R. schildii*. *Ramaria brunneicontusa*, *R. flavicingula*, *R. obtusissima* var. *scandinavica*, *R. pallido-saponaria*, and *R. vittadinii* are proposed as new. Keys are offered for worldwide taxa of *Ramaria* subg. *Laeticolora* with smooth spores and to taxa with fruitbodies exhibiting a yellow color band at stipe apex.

Some years ago (Petersen, 1974) a species description was furnished for *Ramaria flava* (and some other classic species concepts) and herbarium specimens cited, including a representative specimen. This made possible a comparison of taxa with similar diagnoses to what I considered the probable true concept. Since that time, Schild (1977, 1978, 1982a, b, 1983a, b) has published on *Ramaria* subg. *Laeticolora* from Europe, including proposals of several new taxa, and Maas Geesteranus (1976) has provided a handbook for the Netherlands' clavarioid fungi. My awareness has also increased, thanks to examination of additional European collections as well as other worldwide experience.

In one short collecting period in 1972, I was introduced to the *Ramaria* flora in Switzerland, northern Italy, and northern Bavaria. Two papers (Petersen, 1974, 1976) resulted directly from those collections. Other material was gathered in Sweden in 1970, and Prof. J. A. Nannfeldt sent me a small lot in 1972. In all this material, it was obvious that several European taxa were sheltered under the name *Ramaria flava*. It is the purpose of this paper to comment on some of these.

It is clear that various seminal European mycologists (Fries, Persoon, Bresadola, etc.) considered *Clavaria (Ramaria) flava* to be quite variable in color and stature (cf. Petersen, 1974, 1976, for more on this idea). With modern equipment and narrower limits on character breadth, it is possible to cleave several taxa from this assemblage.

No pretense is made here that all appropriate taxa from Europe are covered. For this reason, no key is provided to taxa with yellow fruitbodies from that area. The paper does intend, however, to alert European collectors to the several taxa which are casually called *R. flava*, in hopes that more accurate notes, photos and other documentation will result.

In the text below the following abbreviations are used: FSW = ferric sulphate in water; FCL = ferric chloride in water; GUA = guaiac tincture; PYR = pyrogallol acid in water; PHN = phenol; ANO = aniline oil mixed with water; ANW = alpha naphthol in water; KOH = potassium hydroxide in water; NOH = ammonium hydroxide in water; SYR = syringaldehyde

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Figs. 1, 2. *Ramaria brunneicontusa*. — 1. Fruitbody, TENN 36811. — 2. Spores, TENN 36848.
 Figs. 3, 4. *Ramaria flavicingula*. — 3. Fruitbody, TENN 36832. — 4. Spores, TENN 36889. Standard bars = 4 cm for fruitbodies, 5 μ m for spores.

in water; TYR = l-tyrosine in water; IKI = Melzer's reagent; PD = p-phenylenediamine. Recipes for these reagents may be found in Marr & Stuntz (1973) and Marr (1968). Colors in quotation marks are from Ridgway (1912), those with alpha-numeric citations are from Séguy (1936).

***Ramaria brunneicontusa* R. Petersen, *spec. nov.* — Figs. 1–2**

Basidiocarpi multiramosi, ad 13 \times 8 cm, obtriangulati ad sphaeropedunculati. Basi ad 3 \times 3.5 cm, singulati, sine ramuli abortivi; contusi brunnescenti; caro albo, non-gelatinoso. Rami et ramuli flavi ad ochraceo-flavi. Apices tenui, flavi. Odor fragrantis; sapor fabaceus. Hyphae contextualis fibulatae, crassitunicatae (tunica ad 0.5 μ m lata). Basidia 60–70 μ m longa, clavata, fibulata. Sporae 13.0–16.6 \times 4.7–6.1 μ m, tenui-ellipsoidae, subcorrugatae.

Typus: Helvetia, Steinback, 29.IX.72 (TENN no. 36848).

Fruitbodies (Fig. 1) up to 13 \times 8 cm, broadly obtriangular to second-obtriangular in outline when young, becoming sphaeropedunculate to fan-shaped by maturity. Stipe single, up to 3 \times 3.5 cm, broadly conical, tapering sharply to a narrowly rounded base, without abortive branchlets, or producing small, dwarf abortive branchlets, off-white, easily brunnescent where bruised or chaffed, smooth above, pruinose below, involving significant substrate below when picked; flesh solid, off-white, moist but not gelatinous or slippery, drying soft, friable, easily pierced. Major branches 3–several, divergent, crowded, hardly terete, con-

colourous with branches. Branches in 3–6 ranks, divergent-ascending, irregularly dichotomous throughout, yellow when young and fresh (S. 229, 230, 258), mellowing to more ochraceous shades by maturity, easily brunnescent where rubbed; internodes diminishing gradually upward; axils narrowly rounded. Apices pluridentate, expanded, terraced when young, often inflating by maturity, concolorous with branches when fresh (S. 258), fading somewhat by maturity (S. 229), sometimes becoming a reddish vinaceous color where bruised or confined. All parts occasionally suffusing a watery vinaceous color around soil particles or where broken. Odor mild of nitro-benzol; taste mildly fabaceous.

Macrochemical reactions: FSW, FCL, FSA = positive; NOH = pink vinaceous; KOH = copper color; GUA = slowly, light blue; ANO, PYR = negative.

Tramal hyphae of upper branches 3–22 μm diam., hyaline, thin- to thick-walled (wall rarely up to 0.5 μm thick), inflated more inward, parallel, free, frequently clamped; ampulliform septa not observed; gloeoplerous hyphae 1.5–3 μm diam., yellow-refringent, as short lengths of non-septate hyphae, tortuous. Subhymenium extensive, pseudoparenchymatous. Hymenium thickening; basidia 60–70 \times 8–10 μm , clavate, clamped; contents homogeneous or with scattered small granules; sterigmata 4, long, delicate, curved.

Spores (Fig. 2) 13.0–16.6 \times 4.7–6.1(–6.7) μm ($\underline{E} = 2.25\text{--}3.00$; $\underline{E}^m = 2.77$; $\underline{L}^m = 14.06$ μm), narrowly ellipsoid, often with adaxial swelling and prominent struma, conspicuously roughened in profile; contents homogeneous or with 1–several dark inclusions; wall up to 0.2 μm thick; hilar appendix curved, not conspicuous; ornamentation of scattered small, low warts or short anastomosed ridges.

Fruitbody shape, color and odor are all reminiscent of *R. flavo-brunnescens* var. *aromatica* Marr & Stuntz (1973: 85). Fruitbodies of that taxon are more delicately branched, however, with common abortive branchlets on the stipe. Spores of *R. flavo-brunnescens* var. *aromatica* are significantly smaller (9–12 \times 3–5 μm ; $\underline{L}^m = 10.4$ μm , *teste* Marr & Stuntz) than those of *R. brunneicontusa*.

Two bruising reactions are produced on fruitbodies of *R. brunneicontusa*. One, more obvious, is the brunnescent reaction of stipe and branch surface where rubbed or bruised, shared by many taxa. The second, more subtle and not easily observed (and noted only on TENN 36811), is the vinaceous reaction when the hymenium or stipe derm is broken. The color blush appears rapidly at the point of rupture, then slowly suffuses up to one millimeter away from the break. The reaction seems most pronounced at fruitbody surfaces, but can be seen, although weaker, on broken flesh. This color change, perhaps an oxidation reaction, may be similar to the color change of branch apices where touched or confined.

The two Maas Geesteranus specimens furnish the only notes on habitat. Both were found in forests of *Picea* at 1200 m altitude, with various understory plants.

SPECIMENS EXAMINED. — SWITZERLAND: vic. Brienz, 17.IX.1972, Dreiländertagung coll. (TENN no. 36811); vic. Einsiedeln, 27.IX.1972, misit Schwegler (TENN no. 36841); Steinback, 29.IX.1972, misit Furrer-Ziogas (holotype, TENN no. 36848); Kanton Luzern, Sorenberg, Hirsegg, 2.IX.1970, *Maas Geesteranus* 15357, 15358 (L).

Ramaria flava (Schaeff.: Fr.) Quél.

Ramaria flava (Schaeff.: Fr.) Quél. 1888. Fl. mycol., p. 466 = *Clavaria flava* Schaeff.: Fr. 1821. Syst. mycol. 1: 467 = *Clavaria flava* Schaeff. 1774. Fung. Bavar., Index 118 (pl. 175).

Fruitbodies up to 14 × 8 cm, broadly obovoid or obpyriform in outline. Stipe up to 4 × 3 cm, large to medium sized (not massive), single, smooth, without abortive branchlets, broadly conical, off-white below substrate level, not rooting, unchanging or weakly brunnescent where handled, pale clear lemon yellow (S. 229, 'maize yellow') above substrate; flesh white, solid, uniform to mottled, not gelatinous. Major branches few, concolorous with stipe apex, more or less terete. Branches in 3–6 ranks, terete, when young upward gradually becoming somewhat more intensely yellow (S. 258); in age mellowing to buffy yellow ('warm buff,' 'pale orange yellow'); flesh very pale yellow ('ivory yellow'), often tinged with pallid fleshy cinnamon ('light pinkish cinnamon'); internodes diminishing gradually upward; axils rounded to narrowly rounded. Apices short when young, at maturity dentate to minutely pronged, rounded, clear yellow ('buff yellow') to clear ochre-yellow (S. 258, 'mustard yellow'), at maturity somewhat elongated, dichotomous to trichotomous, concolorous with mature branches (S. 229). Odor mild, of rubber; taste faintly fabaceous or of cauliflower.

Macrochemical reactions: FSW, FSA, FCL, GUA, ANW = positive; PYR = weakly positive; ANO = negative to weakly positive; KOH, NOH = negative.

Stipe tramal hyphae 4–25 µm diam., hyaline, thin- to thick-walled (wall up to 0.5 µm thick locally), tortuous, densely interwoven, not adherent or agglutinated, occasionally clamped; ampulliform clamps rare to abundant (in various collections), up to 20 µm broad, thin-walled, with gross stalactitiform ornamentation; gloeoplerous hyphae not observed. Stipe surface hyphae 3–9 µm diam., thin-walled, more or less parallel, mostly clamped. Tramal hyphae of upper branches 3–14 µm diam., hyaline, thin- to thick-walled (wall occasionally up to 0.5 µm thick), occasionally clamped, parallel, locally adherent in some specimens; interhyphal crystalline deposits occasional, hyaline, amorphous. Hymenium thickening; basidia 65–70 × 12 µm, clavate, clamped, often sinuate to geniculate; contents granular to homogeneous when young, at maturity with scattered refringent guttules, weakly cyanophilous; sterigmata 4, straight, stout, subperipheral.

Spores (Petersen, 1974: fig. 4) (9.7–)10.7–14.8 × 4.3–5.9 µm (\bar{E} = 1.94–3.00; E^m = 2.36; L^m = 11.9 µm), subcylindrical to somewhat tapering distally, minutely roughened in profile; contents uni- to multiguttulate, with acyanophilous, refringent guttules; wall up to 0.3 µm thick; hilar appendix eccentric, papillate, prominent; ornamentation strongly cyanophilous, of very small, scattered warts and narrow meandering ridges with no apparent orientation.

The addition of data from specimens listed below allows broadening of spore dimension ranges as well as reducing spore L^m a full micrometer.

Two of the three Swedish specimens (TENN 35061, 35063) showed pallid salmon tints in the upper branch flesh, not noted previously for this species. While additional data on this character are needed from continental European specimens, the character must be added to the species description. In this regard, the Swedish specimens resemble *R. rubricarnata* Marr & Stuntz (1973: 113) from western North America, especially a vernal variety (var. *elongata* Petersen & Scates, 1988), in which the branches are yellow and the flesh pallid salmon. That species (all varieties) is also macrochemically active, bears clamped hyphae, and shows mottled stipe flesh. If the Swedish material listed below can be considered non-conspecific with *R. flava*, then it is surely quite similar to *R. rubricarnata*. *Ramaria flavigelatinosa* var. *carnisalmonea* Marr & Stuntz (1973: 83) also exhibits pink-salmon branch flesh and yellow hymenium. That taxon, however, produces gelatinous stipe flesh, lacks clamp connections, and is macrochemically relatively inert.

For more on nomenclatural synonymy and history of the species taxonomically, see Petersen (1974). Although I have not seen a more appropriate specimen of *R. flava* than that originally cited as representative specimen, in this case I prefer to retain it as a 'representative specimen' rather than as neotype. This will allow designation of a well-documented, freshly collected specimen from toptype ground as neotype.

ADDITIONAL SPECIMENS EXAMINED. — SWEDEN: Berthåga, 3.IX.1970, *N. Lundquist & R. Petersen* (TENN nos. 35061, 35063); Östergötland, Gryt parish, 23.IX.1972, *J.A. Nannfeldt 22658* (TENN no. 37781).

Ramaria flavescens (Schaeff.) R. Petersen

Ramaria flavescens (Schaeff.) R. Petersen. 1974. *Amer. J. Bot.* 61: 740. = *Clavaria flavescens* Schaeff. 1774. *Fung. Bavar., Index*: 120 (pl. 285).

Fruitbodies up to 10 × 7 cm, obpyriform to sphaeropedunculate in outline. Stipe up to 5 × 3 cm, single, stout, pruinose to tomentose downward, involving significant substrate when picked, white below substrate level, cream-colored above, with common clusters of abortive branchlets; flesh white, marbled to minutely watery-mottled. Major branches several, white, cream or alutaceous below, within a few millimeters becoming pale bleached salmon (S. 199, 'light ochraceous salmon') when young, fading later to duller shades (S. 200). Branches in 3–6 ranks, concolorous with upper major branches; flesh pinkish salmon, paler than hymenium. Apices pale clear yellow in ultimate 2 mm (S. 226/227, 'buff yellow,' 'baryta yellow'), quickly paler to concolorous with branches. Odor negligible; taste mildly fabaceous.

Macrochemical reactions: FSW, FSA, FCL, GUA, ANW = positive; KOH = yellow; ANO, PYR = negative (positive on Swedish material).

Stipe tramal hyphae 4.4–8.4 µm diam., hyaline, thin- to thick-walled (wall up to 1.5 µm thick), locally adherent, clamped; agglutinating substance commonly observed as sheets of interhyphal material; ampulliform clamps and gloeoplerous hyphae not observed. Stipe surface hyphae as stipe tramal hyphae, covered with a tomentum of narrow (1.5–2.2 µm diam.), hyaline, thin-walled, long-celled, stiff, clamped hyphae. Tramal hyphae of upper branches 4.4–13.3 µm diam., thin-walled, hyaline, parallel, clamped, free; gloeoplerous hyphae not observed. Hymenium thickening; basidia 53 × 9.6–11.8 µm, clavate, not apically bulbous, clamped; contents multiguttulate when mature; guttules most numerous at base when young, gradually filling more of the basidial lumen, pale yellow in mass, refringent; sterigmata 4, straight, spindly.

Spores (Petersen, 1974: fig. 1) (9.4–)10.4–12.5 × 4.3–5.9 µm (\bar{E} = 2.00–2.38; \bar{E}^m = 2.24; \bar{L}^m = 11.2 µm), ellipsoid, roughened in profile; contents weakly cyanophilous, several-guttulate, the guttules refringent; wall up to 0.3 µm thick; hilar appendix eccentric, not prominent, papillate; ornamentation strongly cyanophilous, of low coarse warts and delicate meandering ridges covering significant wall areas.

The three Swedish collections listed below furnish some additional data toward a species description. Colors match those of the collections reported earlier, and macrochemical reactions are more accurate. With this additional, consistent material, I feel safe in proposing that the collection previously cited (Petersen, 1974) as representative specimen (Deutsche Bundes Republik, vic. Regensburg, 17.IX.1972, no. 36864, TENN) now be declared the neotype.

ADDITIONAL SPECIMENS EXAMINED. — SWEDEN: location unknown, 1970, *J.A. Nannfeldt 21-417* (no. 35090 TENN), *21-418* (TENN no. 35078) (both as *R. flava*); Östergötland, Gryt, 1970, *J.A. Nannfeldt 21-384b, 21-351* (TENN no. 36508).

***Ramaria flavicingula* R. Petersen, *sp. nov.* — Figs. 3, 4**

Basidiocarpi multiramosi, ad 14 × 8 cm, sphaeropedunculati ad depresso-ovati. Basi ad 6 × 4 cm, crassi, singulati, laevi ad cum ramuli abortivi, flavo-aurei superne; contusi non- ad brunnescenti infirmi; caro albo, non-gelatinoso. Rami flavo-aurei deorsum pallido salmonei superne; ramuli pallido salmonicolor. Apices crassi aurantei ad aureo-aurantei. Odor fragranti infirmi; sapor nullo. Hyphae contextualis fibulatae, crassi-tunicatae. Basidia 50–65 µm longa, clavata, fibulata. Sporae 10.1–11.2 × 4.3–5.0 µm, ellipsoidae ad subcylindricae, subcorrugatae.

Typus: Helvetia, Einsiedeln, 28.IX.72 (TENN no. 36832).

Fruitbodies (Fig. 3) up to 14 × 8 cm, sphaeropedunculate, circular, to depressed-obovate in outline. Stipe up to 6 × 4 cm, single, bluntly cylindrical to broadly rounded, smooth, occasionally with 1–2 abortive branchlets, white or whitish below substrate level, yellow to golden yellow above (S. 226, 228, 242), not brunnescent to weakly watery brunnescent where handled; flesh white, solid, moist but not gelatinous or slippery when cut, not mottled or marbled, not discoloring. Major branches several, short, terete outward, concolorous with stipe apex downward, upward concolorous with branches. Branches in 3–6 ranks, generally short, more or less terete, elongating only in age, varying from orange (S. 211) to pallid salmon-flesh (S. 199); flesh often somewhat more salmon than hymenium; internodes all short until maturity, diminishing gradually upward; axils narrowly rounded to acute when young, rounded at maturity. Apices bluntly digitate to molar-like when young, digitate at maturity, varying in color from intense orange (S. 196, but brighter and more vivid, near 'cadmium orange' or 'orange') to rich golden yellow (S. 227, 258). Odor mildly aromatic, of nitro-benzol; taste weakly sweet to negligible.

Macrochemical reactions: FSW, FSA, FCL, GUA, PYR = positive; ANO = negative to slowly weakly positive; KOH = negative.

Stipe tramal hyphae 3–14 µm diam., hyaline, thin- (rarely) to thick-walled (wall normally up to 1.2 µm thick), often appearing irregularly banded or mottled, occasionally clamped, not adherent or agglutinated, tightly interwoven; ampulliform septa up to 15 µm broad, asymmetrical, thick-walled (wall up to 1.5 µm thick), with gross stalactiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3–12 µm diam., hyaline, thin- to thick-walled (wall locally up to 0.5 µm thick, especially at septa), parallel, tightly packed, occasionally clamped; ampulliform swellings up to 14 µm broad, aliiform, thick-walled (wall up to 1 µm thick), unornamented; gloeoplerous hyphae not observed. Subhymenium rudimentary; hyphae 1.5–2.5 µm diam., clamped, tightly interwoven. Hymenium thickening; basidia 50–65 × 8–9 µm, clavate, clamped; contents weakly cyanophilous, opalescent; sterigmata 4, delicate, curved.

Spores (Fig. 4) 10.1–11.2 × 4.3–5.0 µm ($\bar{E} = 2.07-2.50$; $\bar{E}^m = 2.30$; $\bar{L}^m = 10.61$ µm), ellipsoid to subcylindrical, conspicuously roughened in profile; contents with 1–3 yellow-refringent guttules; wall up to 0.2 µm thick; hilar appendix curved, not prominent; ornamentation of scattered small warts and/or short anastomosing ridges apparently without orientation.

This taxon may be what Schild (1982b) called *R. sandaracina* (ut 'sandracina') Marr & Stuntz (1973: 114). For the American taxon (presumably var. *sandaracina*) Schild summar-

ized fruitbody colors as '... unten scheinbar bleibend gelb, zitrongelb, aufwärts bis zu den Spitzen intensiv orange.'

Schild reported colors for two of his collections. Swiss fruitbodies were as follows: '... die Aeste jungerer Pilze sehr blass orangegelb mit einem Hauch lachsrosa oder blass lachsfarbig, mit zunehmenden Wachstum oft noch intensiver (ähnlich Seguy 199, aber leuchtender) die Spitzen waren anfänglich meist gelblich, wurden aber bald den Aesten gleichfarbig.' The Italian fruitbodies were as follows: '... die Aeste zuerst bis obenaus gleichfarbig primelgelb, dann mehr aprikosengelb (nahe S. 229) wurden aber mit zunehmenden Wachstum (oder auch nach längerer Lagerung) bis obenaus blass orangerosa-lachsfarbig.'

In my copy of Schild's publication (reprint, *misit* Schild), Schild has changed his opinion on this taxon, apparently wishing to describe it as new. He has furnished the provisional name *Ramaria flavosalmonicolor*, but the comparison above still holds.

Marr & Stuntz (1973) drew attention to var. *sandaracina* versus var. *euosma*, with differed (in part) by the yellow apices of the latter versus the orange apices of the former. Both varieties, however, were marked by the yellow upper stipe/lowest branches against the salmon or salmon orange middle and upper branches. This yellow color band, acknowledged by Schild for American material, was not reported for his European collections. In this, Schild's description does not match the American taxa nor my European collections described above.

Spores dimensions reported by Schild [(6-)6.4-9.6 × 3.2-4.5(-4.8) μm] match well those reported by Marr & Stuntz (for var. *sandaracina*, 6.5-9 × 3.5-4.5, $\underline{L}^m = 8.1$ μm; for var. *euosma*, 7-10 × 3.5-4 μm, $\underline{L}^m = 8.6$ μm), but all these reported spores are too small for the taxon described above.

Ramaria sandaracina was diagnosed (Marr & Stuntz, 1973), in part, by a tendency of fruitbody stipe flesh to gelatinize. This was not as noticeable in var. *sandaracina* as in var. *euosma*. Schild mentioned such a character when he wrote of his European material: 'Fleisch ... im Strunk deutlich wasserig marmoriert ...' Stipe flesh in *R. flavicingula* does not gelatinize.

From all of this, I conclude (without examination of Schild's collections) that Schild's specimens are quite similar to *R. sandaracina* (especially var. *euosma*, with yellow apices), but lack the yellow color band on the lower branches and/or upper stipe. The collections listed below do not match the descriptions by Schild (yellow color band, spores too large) nor that by Marr & Stuntz (spores too large, non-gelatinizing stipe flesh).

Superficially very similar to *R. flavicingula* is *R. aurea*, for which the collections below were originally taken. Fruitbody stature and colors, and spore dimensions are quite close [for representative specimen (Petersen, 1974): 11-13 × 4.8-5.9 μm, $\underline{L}^m = 11.2$ μm]. The two are immediately separable, however, for *R. aurea* septa are clampless.

The species epithet combines *flava* (yellow) + *cingula* (girdle or belt).

SPECIMENS EXAMINED. — ITALY: vic. Trento, 20.IX.1972, coll. Gruppo G. Bresadola (TENN no. 36889). — SWITZERLAND: Grosser Runn, vic. Einsiedeln, 28.IX.1972, *misit* Furrer-Ziogas, with notes and diapositive (holotype, TENN no. 36832); vic. Einsiedeln, 30.IX.1972 (TENN no. 36890).

To facilitate identification of taxa with conspicuous yellow color band, I offer the following key to the taxa known by me. Other already described taxa may be missing simply because I have not examined material nor deduced this character from written descriptions.

KEY TO THE TAXA IN RAMARIA SUBG. LAETICOLORA WITH FRUITBODIES
EXHIBITING YELLOW COLOR BAND ON UPPER STIPE

- 1a. Stipes compound, fasciculate; stipe flesh subgelatinous; branches hollow; branches and apices salmon to orange; spores $7-10 \times 3.5-5 \mu\text{m}$ ($\underline{L}^m = 8.3 \mu\text{m}$); western North America
R. sandaricina var. *chondrobasis* Marr & Stuntz
- b. Stipe single, fleshy 2
- 2a. Basidia clampless 3
- b. Basidia clamped 6
- 3a. Stipe flesh subgelatinous; some apices yellow; spores $9-11.2 \times 4.7-6.1 \mu\text{m}$ ($\overline{L}^m = 1.91$; $\underline{L}^m = 10.1 \mu\text{m}$); western North America *R. verlotensis* Marr & Stuntz
- b. Stipe flesh not subgelatinous 4
- 4a. Europe 5
- b. Interior China (?upper Michigan); spores $10-13.7 \times 4.3-5.8 \mu\text{m}$ ($\underline{L}^m = 11.6 \mu\text{m}$)
R. 'linearis', nom. prov.
- 5a. Stipe massive, with abortive branchlets; all colors pallid; spores $11.2-14 \times 5-6 \mu\text{m}$ ($\underline{L}^m = 12.5 \mu\text{m}$)
R. vittadinii R. Petersen
- b. Stipe modest to large, smooth; colors vivid; spores $11-13 \times 4.8-6 \mu\text{m}$ ($\underline{L}^m = 11.2 \mu\text{m}$)
R. aurea (Schaeff.: Fr.) Quéf.
- 6a. Stipe flesh gelatinous to subgelatinous 7
- b. Stipe flesh not gelatinous or subgelatinous 9
- 7a. Apices intense orange to orange; spores $6.5-9 \times 3.5-4.5 \mu\text{m}$ ($\underline{L}^m = 8.1 \mu\text{m}$); western North America
R. sandaracina var. *sandaracina* Marr & Stuntz
- b. Apices yellow to golden yellow 8
- 8a. Malaya; branches apricot pink; upper stipe and apices yellow; spores $8.3-11.5 \times 4.7-5.5 \mu\text{m}$ ($\underline{L}^m = 10.1 \mu\text{m}$) *R. subgelatinosa* Corner
- b. Western North America; branches orange; upper stipe and apices bright yellow; spores $6.5-9 \times 3.5-4.5 \mu\text{m}$ ($\underline{L}^m = 8.1 \mu\text{m}$) *R. sandaracina* var. *eosma* Marr & Stuntz
- 9a. Stipe small (usually less than 3×2 cm) 10
- b. Stipe large to massive 11
- 10a. Branches pastel salmon; apices cream colored; stipe flesh amyloid; spores $8.3-11.2 \times 4.3-5.0 \mu\text{m}$ ($\underline{L}^m = 9.8 \mu\text{m}$); interior China *R. 'linearioides', nom. prov.*
- b. Branches and apices yellow; lower axils and stipe surface golden yellow; spores $8.6-10.4 \times 4-4.3 \mu\text{m}$ ($\underline{L}^m = 9.6 \mu\text{m}$); vernal; eastern North America *R. 'duoflavicolor', nom. prov.*
- 11a. Spore $\underline{L}^m = > 13 \mu\text{m}$ 12
- b. Spore $\underline{L}^m = < 11.5 \mu\text{m}$ 13
- 12a. China; stipe attenuate, rooting; spores $12.6-16 \times 5-6 \mu\text{m}$ ($\underline{L}^m = 14.2 \mu\text{m}$), distinctly guttulate
R. distinctissima 'var. *distinctissima*', *nom. prov.*
- b. Western North America; stipe bluntly rounded; spores $12.6-16.3 \times 4.8-6.3 \mu\text{m}$ ($\underline{L}^m = 13.7 \mu\text{m}$), indistinctly guttulate *R. distinctissima* var. *americana*
- 13a. Europe; stipe bluntly rounded; spores $10.1-11.2 \times 4.3-5.0 \mu\text{m}$ ($\underline{L}^m = 10.6 \mu\text{m}$)
R. flavicingula R. Petersen
- b. Western North America; vernal; branches pallid salmon; branch flesh bright salmon; stipe flesh amyloid; spores $10.4-12.2 \times 4-5 \mu\text{m}$ ($\underline{L}^m = 11.1 \mu\text{m}$) *R. rubricarnata* var. *verna* R. Petersen & Scates

Ramaria European taxon I

Fruitbodies up to 17×9 cm, ellipsoid, sphaeropedunculate, or broadly comma-shaped in outline. Stipe single, up to 7×4 cm, smooth or with common clusters of abortive branchlets, pruinose and involving significant substrate below, tapering downward evenly to a point, off-white below, upward abruptly concolorous with major branches, weakly to moderately brunnescent; abortive branchlets white where protected, concolorous with upper stipe where exposed; flesh white, moist but not gelatinous or slippery, without discoloration. Major branches 2-5, hardly terete, somewhat divergent, 'ochraceous buff' below, some-

what paler above. Branches in 3–7 ranks, curved-ascending, more or less terete, sometimes rugulose and irregularly inflated, yellow-buff ('warm buff') to yellow (S. 244, 259, 260); internodes diminishing gradually upward; axils rounded. Apices ochraceous yellow to greenish yellow ('mustard yellow,' 'amber yellow,' S. 242, 258) fading slightly by maturity (S. 241, 259), sometimes suffusing a ruddy blush where bruised or confined, or perhaps after frost, either: 1) blunt, molar-like, almost minutely turbinate; or 2) irregularly inflated, subpistillariform, rugulose. Odor mild of nitro-benzol or fabaceous; taste negligible, fabaceous or pungent.

Macrochemical reactions: FSW, FSA, FCL = positive; GUA = slowly blue; KOH = liquid leaching yellow; NOH = liquid leaching peach color; ANO, PYR = negative.

Stipe tramal hyphae 3.5–15 μm diam., hyaline, thick-walled (wall 0.5–3 μm thick, often occluding cell lumen, and then hyphae yellow-refrangent), not adherent, tightly interwoven; ampulliform swellings up to 20 μm broad, variously shaped from aliform to grossly asymmetrically tibiiform, thick-walled (wall up to 1 μm thick), with extensive, delicate stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3–14 μm diam., hyaline, thin-walled (septum walls occasionally up to 0.5 μm thick), somewhat inflated inward, clamped, free to locally weakly adherent; intercellular material moderately cyanophilous, appearing as abundant amorphous patches; ampulliform clamps up to 13 μm broad, thin-walled, unornamented; gloeoplerous hyphae 1.5–2.5 μm diam., tortuous, yellow-refrangent, as short lengths of non-septate hyphae sometimes ending at an inflated septum. Subhymenium extensive, pseudoparenchymatous. Hymenium thickening; basidia 50–70 \times 8–10 μm , clavate, clamped; contents homogeneous; sterigmata 4, long, delicate, curved.

Spores 11.2–16.2 \times 4.0–5.4 μm (\bar{E} = 2.32–3.23; \bar{E}^m = 2.69; \bar{L}^m = 12.76 μm), cylindrical, often somewhat abaxially depressed, smooth in profile; contents homogeneous or with 1–several small dark granules or guttules; wall up to 0.3 μm thick; hilar appendix curved, not prominent, broad; ornamentation none or occasionally a suggestion of longitudinally oriented ridges and warts.

This species will be published shortly by Schild & Keller, so I am using this designation to avoid pre-empting their proposal.

A somewhat confusing array of smooth-spored taxa has been revealed in recent years in *Ramaria* subg. *Laeticolora*. At least ten species and several infraspecific taxa are involved, probably a heterogeneous assemblage. Nonetheless, several taxa show fruitbody tendencies toward stout stipes, yellow to greenish yellow apices and clamped hyphae.

The specimens below differ sharply from *R. obtusissima* var. *scandinavica* in spore size [Italian 12.2–16.2 \times 4.7–5.4 μm (\bar{L}^m = 13.7 μm); Swedish 11.2–12.6 \times 4.0–4.7 μm (\bar{L}^m = 11.8 μm)] and brunnescent stipe surfaces. In other respects, TENN 36846 (Italy) showed common abortive branchlets, while fruitbodies of the other collections exhibited smooth stipes. Strikingly similar, however, are: 1) very thick-walled stipe tramal hyphae; 2) smooth spores; 3) clamped basidia; and 4) bright yellow coloration. The species can be diagnosed by the combination of these characters. Variation in spore size could be used to segregate an infraspecific taxon, but until more Scandinavian material is examined, such a proposal seems premature.

SPECIMENS EXAMINED. — DEUTSCHE BUNDES REPUBLIK: Arberhutte, Bayerischewald, VIII. 1912, Killermann no. 1 (as *C. flava*) (M) — ITALY: vic. Trento, IX.1972, coll. Gruppo G. Bresadola (TENN no. 36835); vic. Sopramento, 1902, coll. Bresadola (as *C. flava*) (NCU); vic. Trento, 22.IX.1972, coll. Gruppo G. Bresadola (TENN no. 36846). — SWITZERLAND: location unknown, no date, Schild & Keller 1637 (TENN no. 47652).

Fruitbodies (Schild, 1977: fig. 1A–C) up to 12 × 8 cm, sphaeropedunculate to broadly comma-shaped in outline. Stipe up to 5 × 2.5 cm, single, without abortive branchlets, smooth, tapering gradually to rounded base, off-white; brunnescence not recorded; flesh off-white, marbled, with moist or gelatinous areas, discoloration not recorded, drying hard, impenetrable. Major branches several, hardly terete, upward concolorous with branches. Branches in 3–7 ranks, more or less terete, pale lemon yellow (*teste* Nannfeldt) to sulphur yellow (S. 289, 290, 312, *teste* Schild), mellowing in age to dull ochraceous flesh color (S. 199); internodes diminishing gradually upward; axils rounded; flesh off-white, marbled to gelatinous. Apices minutely rounded to minutely turbinate, dichotomous, concolorous with branches (*teste* Nannfeldt, Schild) or somewhat paler (S. 320, *teste* Schild). Odor not recorded; taste mild (*teste* Nannfeldt).

Macrochemical reactions not recorded.

Tramal hyphae of upper branches 3–16 µm diam., hyaline, thin-walled, strictly parallel, firmly adherent (not agglutinated), clampless; crystalline deposits occasional, amorphous, interhyphal; ampulliform septa up to 15 µm broad, thick-walled (wall up to 0.5 µm thick), symmetrically tibiiform, unornamented or with delicate stalactitiform ornamentation; gloeoplerous hyphae hardly refringent, 2–4 µm diam., strongly cyanophilous, as short lengths sometimes delimited by a septum. Subhymenium extensive; hyphae 1.5–2.5 µm diam., hyaline, thin-walled, clampless, tightly interwoven. Hymenium thickening; basidia 50–60 × 7–8 µm, clavate, clampless; contents homogeneous or multivacuolate, and then often with a few minute, scattered granules; sterigmata 4, delicate, curved.

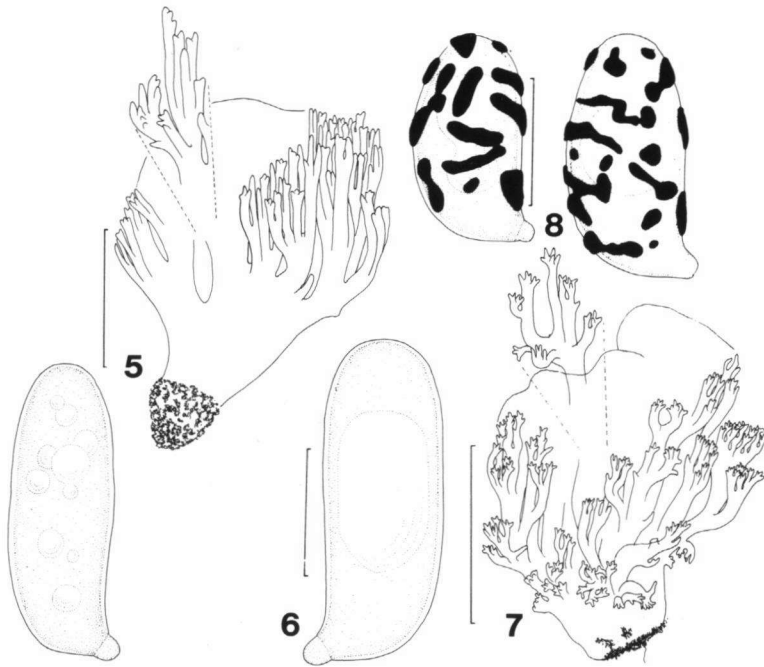
Spores (Schild, 1977: Fig. 2A) 6.5–9.0 × 4.0–4.7 µm ($\bar{E} = 1.64$ –2.09; $\bar{E}^m = 1.87$; $\bar{L}^m = 8.09$ µm), ellipsoid to subcylindrical, flattened adaxially, delicately roughened in profile; contents 1–2-guttulate, the guttules dark, non-refringent; wall up to 0.2 µm thick; hilar appendix small, papillate; ornamentation mostly short ridges with no apparent orientation, with some small, discrete warts.

Superficially, fruitbodies of *R. lutea* resemble those of *Ramaria* European taxon I, with substantial, tapering stipe and yellow upper parts. The latter, however, produces smooth spores (12.2–16.2 × 4.7–5.4 µm; $\bar{L}^m = 13.7$ µm), clamped basidia, and common abortive branchlets. Concomitantly, *R. obtusissima* var. *scandinavica* exhibits clamped basidia, smooth spores (11.2–12.6 × 4.0–4.7 µm; $\bar{L}^m = 11.8$ µm), but smooth stipe.

Microscopically *R. lutea* seems quite similar to *R. flavo-saponaria*, which shares adherent to agglutinated tramal tissue, clampless basidia and small spores (7.2–11.2 × 3.6–5.4 µm; $\bar{L}^m = 9.1$ µm). The two are easily separated, however, by fruitbody stature and shape. Fruitbodies of *R. flavo-saponaria* show a small stipe beset with numerous clusters of abortive branchlets.

Surely specimens of *R. lutea* have passed under the name *R. flava*, as have several other taxa. With *R. flava* now secured to a type specimen (see above and Petersen, 1974), it is possible to segregate inaccurately identified specimens. *Ramaria flava* fruitbodies show clear lemon yellow color, non-rooting stipe, non-gelatinous flesh, clamped basidia and somewhat larger spores (11.8–14.8 × 5.2–5.9 µm; $\bar{L}^m = 12.9$ µm) than those of *R. lutea*.

Branch color was reported as 'schwefelgelb' by Schild, and colors shown by Séguy (1936) are light lemon yellow, with some green component. Colors of continental European specimens (see Schild, 1977), therefore, are exactly those of the Scandinavian specimen cited below.



Figs. 5, 6. *Ramaria obtusissima* var. *scandinavica*, TENN 39791. — 5. Fruitbody. — 6. Spores.
Figs. 7, 8. *Ramaria pallido-saponaria*, TENN 36849. — 7. Fruitbody. — 8. Spores. Standard bars = 4 cm for fruitbodies, 5 μ m for spores.

Schild (1977: 413) measured spores as (5.5–)6–10.5(–10.8) \times 3.2–5.5 μ m. While not furnishing statistics, median values of these dimensions are very close to those described above for the Scandinavian collection.

SPECIMENS EXAMINED. — BELGIUM: location unknown, IX.1972, V. Demoulin (TENN no. 36899). — SWEDEN: Östergötland, Gryt parish, 23.IX.1972, Nannfeldt 22659 (TENN no. 37786).

***Ramaria obtusissima* var. *scandinavica* R. Petersen, var. nov. — Figs.5, 6**

Ut variete typica, sed: (i) ramuli flavi ad virido-flavi; (ii) sporae 11.2–12.6 \times 4.0–4.7 μ m.
Typus: Suecia, Biludden, 30.VIII.74 (TENN no. 39791).

Fruitbodies (Fig. 5) up to 13 \times 9 cm, ellipsoid, sphaeropedunculate or broadly comma-shaped in outline. Stipe discrete, up to 4 \times 3 cm, without abortive branchlets, smooth upward, pruinose and involving significant substrate below, tapering downward evenly to a point, off-white below, upward abruptly concolorous with major branches, not brunnescent, although small wounds and/or derm peelings turn slowly watery brown; flesh white, moist but not gelatinous or slippery, without discoloration. Major branches 3–5, hardly terete, somewhat divergent, 'ochraceous buff' below, somewhat paler above. Branches in 3–6 ranks, curved-ascending, more or less terete, sometimes rugulose and irregularly inflated, buff-colored

('warm buff'); internodes diminishing gradually upward; axils rounded. Apices ochraceous yellow to greenish yellow ('mustard yellow,' 'amber yellow'), sometimes suffusing a ruddy blush where bruised or confined, or perhaps after frost, either: (i) blunt, molar-like, almost minutely turbinate; or (ii) irregularly inflated, subpistillariform, rugose. Odor mild of nitrobenzol; taste negligible.

Stipe tramal hyphae 3–24 μm diam., hyaline, thick-walled (wall up to 2.5 μm thick, irregularly thickened, often with sphincter-like banding), occasionally clamped, not adherent or agglutinated; ampulliform swellings and gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3–14 μm diam., hyaline, thin-walled (septum wall occasionally up to 0.5 μm thick), somewhat inflated inward, clamped, locally weakly adherent to non-adherent; ampulliform septa up to 13 μm broad, thin-walled, unornamented; gloeoplerous hyphae 1.5–2.5 μm diam., tortuous, yellow-refringent, as short lengths of non-septate hyphae sometimes ending in an inflated septum. Subhymenium extensive, pseudoparenchymatous. Hymenium thickening; basidia 50–70 \times 8–10 μm , clavate, clamped; contents homogeneous; sterigmata 4, long, delicate, curved.

Spores (Fig. 6) 11.2–12.6 \times 4.0–4.7 μm ($\bar{E} = 2.46$ –3.00; $\bar{E}^m = 2.65$; $\bar{L}^m = 11.82$ μm), cylindrical, often somewhat sway-backed, smooth to minutely, obscurely roughened; contents homogeneous or with 1–several small, dark granules or guttules; wall up to 0.3 μm thick; hilar appendix curved, not prominent, broad; ornamentation none or occasionally very delicate, interrupted longitudinally oriented ridges and warts.

It is, of course, too tidy to divide subg. *Laeticolora* into smooth-spored versus rough-spored taxa. First, it would be artificial, including otherwise dissimilar taxa in both groups. Second, such taxa as *R. obtusissima* var. *scandinavica* could be placed in both groups, for while the majority (perhaps 80–90%) of spores are smooth, the rest show a suggestion of delicate ridges and warts, much like the typical variety.

As described here, *R. obtusissima* var. *scandinavica* bridges characters of several taxa, but I have placed it here based on pistillariform branch tips and spore size. Additional fresh material may necessitate transfer to a more appropriate position.

Most similar is *R. obtusissima* (Peck) Corner [var. *obtusissima*]. Until recently (Petersen & Scates, 1988), I assumed that this belonged in subg. *Ramaria*, but descriptions of similar other taxa has convinced me that it is better placed in subg. *Laeticolora*. From var. *scandinavica* it differs chiefly in more muted fruitbody colors and spore size [for *R. obtusissima*, 12.6–15.8 \times 4.0–4.3 μm ; $\bar{E}^m = 3.30$; $\bar{L}^m = 13.7$ μm (cf. Petersen, 1986; for type specimen, 12.6–15.4 \times 3.8–4.2 μm ; $\bar{E}^m = 3.36$; $\bar{L}^m = 13.61$ μm]. Both varieties share a tendency to inflate upper branches and apices into pistillariform shapes, as well as smooth stipe, general yellow color, and clamped basidia.

Similar to the specimens listed below is *R. magnipes* Marr & Stuntz, described from western North America. It shares stout stipe, yellow to greenish yellow coloration, brunnescent stipe surfaces, clamped basidial septa, and (consistently) smooth spores with appropriate dimensions. Most diagnostic, however, fruitbodies of *R. magnipes* (var. *magnipes* and var. *albidior*) exhibit clusters of abortive branchlets, while the stipe of *R. obtusissima* var. *scandinavica* lacks them.

Ramaria obtusissima var. *scandinavica* can be separated from European taxon I (see above) as follows: (i) spores of the former are smaller than those of the latter and consistently smooth; (ii) fruitbodies of the latter exhibit clusters of abortive branchlets, while the fruitbody

stipe of the former is smooth; and (iii) fruitbody branches of European taxon I show no tendency to inflate to pistillariform shapes as in the former. Spore data on appropriate taxa are furnished in Table I.

Table I. Spore data on selected smooth-spored *Ramaria* taxa

Name	Dimension (μm)	E ^m	L ^m
<i>R. magnipes</i> var. <i>magnipes</i>	9.4–13.3 × 3.2–5.0	2.89	11.51
<i>R. magnipes</i> var. <i>albidior</i>	10.8–11.9 × 3.6–4.3	2.84	11.49
<i>R. obtusissima</i>	12.6–15.8 × 4.0–4.3	3.30	13.70
<i>R. obtusissima</i> var. <i>scandinavica</i>	11.2–12.6 × 4.0–4.7	2.65	11.82
<i>R. rasilispora</i> var. <i>rasilispora</i>	8.3–11.5 × 3.6–4.3	2.57	9.95
<i>R. rasilispora</i> var. <i>scatesiana</i>	9.4–11.9 × 3.2–4.3	2.85	10.62
<i>R. schildii</i>	12.9–15.9 × 4.4–5.6	3.02	14.60
European taxon I	11.2–16.2 × 4.0–5.4	2.69	12.76

SPECIMENS EXAMINED. — FINLAND: Kuusamo, Taivalkoski, Kylmäla, 23.IX.1972, E. & M. Ohenoja, no. XV (OULU). — SWEDEN: Biludden, 30.VIII.1974 (as *R. 'semi-aromatica'*), no. 39791 (holotype, TENN).

Ramaria pallido-saponaria R. Petersen, *spec. nov.* — Figs. 7, 8

Basidiocarp multiramiosi, ad 7 × 9 cm, depresso-ellipsoidae ad sphaericae. Basi ad 1.5 × 1.5 cm, tenui, singulati, cum ramuli abortivi; contusi non-brunnescenti; caro subalbo, subgelatinoso. Rami et ramuli pallido-flavi. Apices tenui, flavi. Odor fragrant; sapor nullo. Hyphae contextualis afibulatae, crassitunicatae (tunica ad 0.5 μm lata). Basidia 65–80 μm longa, clavata, afibulata. Sporae 7.9–9.4 × 4.3–4.7 μm , ellipsoidae ad lato-cylindricae, subcorrugatae.

Typus: Italia, 21.IX.72 (TENN no. 36849).

Fruitbodies (Fig. 7) up to 7 × 9 cm, circular to depressed-ellipsoid in outline. Stipe up to 1.5 × 1.5 cm, discrete, obtriangular, tapering sharply, covered with white mycelium and amorphous rhizomorphic strands below, involving significant substrate, brittle, usually breaking when picked, with abundant abortive branchlets like miniature cauliflorets, white, pruinose between substrate particles, off-white to cream-colored above; discoloration not recorded; abortive branchlets bright lemon yellow (S. 242) at all ages; flesh off-white, marbled, slippery to subgelatinous when cut, drying hard, impenetrable. Major branches 2–4, short, laterally channeled, with abundant abortive twigs, concolorous with branches. Branches in 3–7 ranks, ascending, hardly terete, dull pallid yellow (pale and yellower than S. 199); internodes diminishing gradually upward; axils narrowly rounded; flesh marbled, brittle, drying very brittle. Apices delicate, cristate, dichotomous or double-dichotomous, clear yellow (S. 228). Odor mildly spicy-fragrant; taste negligible.

Macrochemical reactions: FSW, FSA, FCL = positive; GUA, PYR, ANO, NOH = negative; KOH = bright yellow.

Stipe tramal hyphae 3–11 μm diam., hyaline, thin- to thick-walled (wall often up to 0.5 μm thick), heavily adherent to agglutinated, tortuous, tightly interwoven; ampulliform infla-

tions up to 15 μm broad, aliiform to irregularly nodulose, thick-walled (wall locally up to 1 μm thick), with densely spaced, delicate stalactitiform ornamentation; agglutinating substance sparingly liberated into 2% KOH mount; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3–12 μm diam., hyaline, thin- to thick-walled (wall rarely up to 0.5 μm thick), clampless, parallel, adherent; ampulliform septa not observed; gloeoplerous hyphae occasional, 2.5–3.5 μm diam., yellow-refrinct, rarely irregularly inflated. Subhymenium extensive; hyphae 1.5–2.5 μm diam., hyaline, clampless, tightly interwoven. Hymenium thickening; basidia 65–80 \times 7–9 μm , clavate, clampless; contents homogeneous, weakly cyanophilous; sterigmata 4, delicate, curved.

Spores (Fig. 8) 7.9–9.4 \times 4.3–4.7 μm (\underline{E} = 1.69–2.17; \underline{E}^m = 1.93; \underline{L}^m = 8.47 μm), broadly cylindrical to ellipsoid, delicately roughened in profile; contents usually 1–2-guttulate, the guttules dark, non-refrinct; wall up to 0.2 μm thick; hilar appendix small, broad, not prominent; ornamentation mostly short, anastomosing ridges with no apparent orientation, with a few scattered, discrete warts.

This species is very similar to *R. flavo-saponaria* from eastern North America except in color. The two taxa share subgelatinous flesh, presence of abundant abortive branchlets, clampless basidia and small spores (for *R. flavo-saponaria*: 7.2–11.2 \times 3.6–5.4 μm ; \underline{L}^m = 9.1 μm) (Petersen, 1985).

Fruitbodies of *R. flavo-saponaria* are brilliant yellow on all upper parts, with off-white abortive branchlets where protected. *Ramaria pallido-saponaria* exhibits yellow apices but muted, pallid yellow-buff branches. Abortive branchlets, even where protected, are bright lemon yellow, indicating that color is not photo-induced.

Other members of this complex include *R. stuntzii* (bright red, western North America) and *R. aenea* (bronze coloration, maritime eastern Canada). Neither of these exhibits subgelatinous flesh, but other microscopic and macroscopic characters (i.e. abundant abortive branchlets; clampless basidia; small spores) are too similar to be dismissed.

Originally, TENN 36849 (*R. pallido-saponaria*) was thought to be conspecific with TENN 37786 (*R. lutea*). Fruitbodies of the latter, however, show a large, tapering stipe, no abortive branchlets, pale lemon coloration across the upper parts and occur under *Abies* and *Picea* in coniferous forests of northern Europe.

SPECIMENS EXAMINED. — AUSTRIA: Vienna, Eichgraben, IX.1925, *K. v. Keissler*, ex CGE (Corner no. 499, as *R. flava*), ex Doty (TENN no. 31723); Kärnten, vic. Glötschach, 16.IX.1968, *M.A. Donk 13467* (L). — ITALY: vic. Trento, 21.IX.1972, coll. Gruppo G. Bresadola (holotype, TENN no. 36849).

Ramaria rasilispora var. *scatesiana* Marr & Stuntz

Ramaria rasilispora var. *scatesiana* Marr & Stuntz. 1973. In *Biblioth. Mycol.* 38: 108.

Fruitbodies up to 12 \times 7 cm, circular to obovate in outline. Stipe up to 6 \times 4 cm, usually smaller, single, rounded at base, smooth above, often mycelioid at base, often with blunt abortive protuberances, white to off-white ('pale cinnamon pink'), not tomentose, not brunnescent or very weakly so upward on handling; flesh white, solid, homogeneous, drying firm-friable with hard rind. Major branches 2–4, ascending, hardly terete. Branches in 4–6 ranks, somewhat crowded when young, open at maturity, more or less terete, pale to light ochraceous cream-colored ('pale ochraceous buff,' 'pale ochraceous salmon,' 'pale yellow

orange,' 'cream buff,' 'light ochraceous buff') sometimes with a hint of pink in age ('cream buff,' 'light ochraceous buff,' 'pinkish buff'); flesh white, somewhat stringy; internodes diminishing gradually at maturity; axils rounded to obtusely angled. Apices crass at all ages, molar-like when young, expanding by maturity to bluntly cauliflower-like to obtusely angled, clear yellow ('maize yellow') to pastel greenish yellow when young ('straw yellow,' 'cream color,' 'pale ochraceous salmon,' 'Naples yellow'), mellowing to buff-colored ('warm buff'), in age often with a hint of pink ('pinkish cinnamon,' 'pinkish buff'). Odor negligible to weakly fragrant; taste negligible to weakly musty or sour.

Macrochemical reactions: FSW, FCL = positive; SYR = sometimes positive in upper branches, negative on stipe sections; GUA, ANO, ANW, PYR, PHN, KOH, NOH, TYR = negative; IKI = negative to weakly positive on stipe flesh.

Tramal hyphae of stipe flesh 4–14 μm diam., hyaline, usually (but not invariably) clamped, thick-walled (wall up to 2 μm thick, usually undulate), free, tightly interwoven; ampulliform inflations not observed; gloeoplerous hyphae rare, yellow-refracting, 4–8 μm diam., undelimited, with occasional abrupt inflations. Tramal hyphae of upper branches 5–18 μm diam., hyaline, usually (but not invariably) clamped, thick-walled (wall up to 1.5 μm thick, often undulate), free inward, adherent and narrower outward, parallel; ampulliform inflations and gloeoplerous hyphae not observed. Subhymenium extensive; hyphae 2–4 μm diam., parallel inward, tightly interwoven outward. Hymenium thickening; basidia 60–70 \times 7–8 μm , clavate, clamped; contents tardily multiguttulate; sterigmata 4, spindly, more or less straight.

Spores 9.4–11.9 \times 3.2–4.3 μm (\bar{E} = 2.50–3.22; \bar{E}^m = 2.85; \bar{L}^m = 10.62 μm), cylindrical to subboletoid, almost smooth; contents univacuolate to guttulate, with guttules dark, amorphous, non-refracting; wall up to 0.3 μm thick; hilar appendix gradual; ornamentation none or a few slender, meandering ridges.

The specimens listed below cannot be placed under any other taxon in this paper, and are rather similar to fruitbodies of *R. rasilispora* var. *scatesiana* in general shape and size. They are, unfortunately, without notes except for their alleged name (as *R. flava*), and an obscure hint of brunnescence of stipe surfaces. The above description of *R. rasilispora* var. *scatesiana* is repeated from another paper (Petersen & Scates, 1988).

Spores of the European material are consistently smooth, cylindrical, and measure 9.4–12.2 \times 4.0–4.7 μm (\bar{E} = 2.28–2.82; \bar{E}^m = 2.50; \bar{L}^m = 10.61 μm), virtually identical to those of western North American specimens.

Petersen & Scates (1988) concluded that *R. rasilispora* and *R. magnipes* were very difficult to separate from dried specimens only, except on spore length. With obvious danger of tautology, I place the specimen below here for precisely this reason, as well as somewhat knobby branch tips. Moreover, in western North America, var. *scatesiana* is the only taxon within the *R. rasilispora* - *R. magnipes* complex which fruits autumnally.

One Finnish specimen (OULU - Ohenoja no. XLVIII) seems quite similar except for a long, attenuate, plushy stipe. Spores are identical to those of others listed below, too short for *R. schildii*. No dichohyphidia were seen, eliminating forms of *R. cystidiophora* from consideration (that taxon also produces rough spores). *Ramaria rasilispora* fruitbodies form such rooting stipes when fruiting from a hole in soil or duff, so such a form is not unexpected.

SPECIMENS EXAMINED. — FINLAND: Muhos, Hyrkas, Muhospera, 20.IX.1970, no. 48, *M. Ohenoja* (OULU); Riistavesi, Keljan, 2.IX.1966, *A.J. Huuskonen, s.n.* (OULU). — POLAND: vic. Dzimiany and Koscierzyzna, 25.IX.1970, *F. Podhorodecki, s.n.* (WA).

Ramaria schildii R. Petersen

Ramaria schildii R. Petersen. 1988. In *Mycologia* 80: 229.

Fruitbodies up to 12 × 7 cm, superficially obconical to trumpet-shaped in outline, but old fruitbodies becoming lax and assuming semi-grotesque positions. Stipes slender (not more than 8 mm thick), rooting to some extent, fasciculate or with a very small point of union at the base, or solitary, minutely tomentose and off-white below substrate, creamy above, becoming darker to tannish-ochre in age; surface obviously weakly brunnescent where handled; flesh white, fibrous-fleshy, moist but not slippery or gelatinous, slowly weakly brunnescent. Major branches few per stipe, several per fascicle, often channeled or flattened, light yellow (S. 230, with a hint of ochre) when young, fading to pale fleshy tan (S. 249) in age; flesh yellowish near hymenium; surface vinescent around dirt specks and flesh slowly so when ripped; axils narrowly rounded to acute when young, often lunate in age; internodes diminishing gradually upward, giving an open, lax appearance. Apices short and straight, lemon yellow (S. 243) when young, becoming divaricate and lobed in age, and then fading through more ochre (S. 259) to finally concolorous with branches (about S. 250). Odor and taste not recorded.

Macrochemical reactions: FCL, FSW, GUA = positive; KOH = leaching yellow. Stipe surface blue in GUA.

Stipe tramal hyphae hyaline, thin-walled, clamped, weakly cyanophilous, of two types: (i) 3–13 μm diam., parallel, somewhat inflated; and (ii) dendrohyphidia 1.6–2.0 μm diam., tortuous, often with abundant side branches arising at almost right angles and usually ending as abortive pegs or short branches, infrequently clamped, locally densely interwoven with more inflated hyphae. Stipe surface hyphae identical to predominant flesh hyphae. Tramal hyphae of upper branches 3–10 μm diam., thin-walled, parallel, clamped, hyaline, free. Hymenium thickening; basidia 62–67 × 9.5–10.5 μm, clavate, clamped, often sinuate or geniculate; contents more or less homogeneous when young, becoming guttulate proximally by maturity; sterigmata 4, long, stout, slightly divergent.

Spores 12.9–15.9 × 4.4–5.6 μm ($\bar{E} = 2.40\text{--}3.46$; $\bar{E}^m = 3.02$; $\bar{L}^m = 14.6$ μm), cylindrical, smooth in profile; contents uni- to several-guttulate, the guttules refringent; wall up to 0.2 μm thick; hilar appendix truncate, somewhat prominent, abrupt; ornamentation absent.

This description is taken from the original, and is added here for completeness. The species belongs to the *R. cystidiophora* complex, diagnosed by production of dichohyphidial elements in the outer stipe context and surface. Fruitbodies of all taxa in the complex (except *R. cystidiophora* var. *anisata*) are yellow, with attenuate, slender stipe bases usually covered with white tomentum. *Ramaria schildii* differs from others in the complex in producing smooth spores of significantly larger size.

SPECIMEN EXAMINED. — ITALY: vic. Trento, 21.IX.1972, coll. Gruppo G. Bresadola (TENN no. 36847).

Ramaria vittadinii Petersen, spec. nov. — Figs. 9, 10

Basidiocarpi multiramosi, ad 10 × 9 cm, lato-ovati. Basi ad 3.5 × 4 cm, crassi, singulati, cum ramuli abortivi, flavi pallidi superne; contusi brunnescenti infirmi; caro albo, non-gelatinoso. Rami flavi pallidi deorsum; ramuli pallido-salmonicolor. Apices tenui, flavi. Hyphae contextualis afibulatae, crassitunicatae (tunica ad 0.5

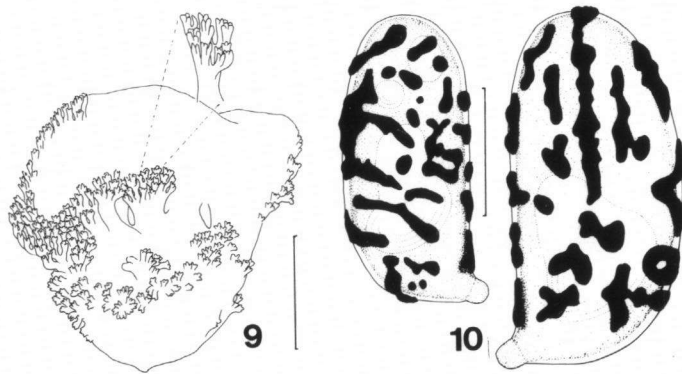
μm lata). Basidia 60–70 μm longa, clavata, aſibulata. Sporae 11.2–13.7 \times 5.0–6.8 μm , ellipſoidae, ſubcorrugatae.

Typus: Italia, Trento, 20.IX.72 (TENN no. 36850).

Fruitbodies (Fig. 9) up to 10 \times 9 cm, broadly ovate in outline. Stipe up to 3.5 \times 4 cm, massive, tapering downward to broadly rounded base, with small scattered clusters of abortive branchlets, white below, upward light clear yellow (S. 244, 245) when young, fading in age to paler shades (S. 259, 260), all surfaces dull watery pale brown where handled, smooth but not glabrous; flesh off-white, firm but not hard, not marbled or mottled, without discoloring bands or patches; abortive branchlets white where protected, pale yellow where exposed. Major branches several, short, more or less terete, fleshy, concolorous with upper stipe. Branches in 3–5 ranks, short, terete, clustered, pale muted salmon (more orange than S. 185, pinker than S. 199, paler and pinker than S. 214); internodes all short, diminishing gradually upward; axils rounded. Apices clustered, minutely dichotomous to dichotomous, molar-like when young, never terraced, clear bright yellow (S. 228) over apical 2–3 mm. Odor and taste not recorded.

Stipe tramal hyphae 3–11 μm diam., hyaline, thin- to thick-walled (wall occasionally up to 0.5 μm thick), clampless, tightly interwoven, not adherent or agglutinated; ampulliform swellings up to 10 μm broad, rare, thick-walled (wall locally up to 0.5 μm thick), with very densely spaced, delicate stalactitiform ornamentation; gloeoplerous hyphae not observed. Tramal hyphae of upper branches 3–4 μm diam., hyaline, thin-walled, often inflated, with patchy wall thickenings, clampless, parallel, free; ampulliform inflations not observed; gloeoplerous hyphae common, 2–4 μm diam., yellow-refringent, not inflated, tortuous. Subhymenium extensive; hyphae 1.5–3 μm diam., clampless, tightly interwoven. Hymenium thickening; basidia 60–70 \times 8–9 μm , clavate, clampless; contents homogeneous; sterigmata 4, delicate, curved.

Spores (Fig. 10) 11.2–13.7(–14.4) \times (4.5–)5.0–6.8 μm (\bar{E} = 1.94–2.54; \bar{E}^m = 2.14; \bar{L}^m = 12.55 μm), ellipsoid, conspicuously roughened in profile; contents heterogeneous, usually without discrete guttules but with amorphous, dark, indiscrete areas; wall up to 0.2 μm thick; hilar appendix broad, not prominent; ornamentation of complex, anastomosing ridges and a few discrete warts with no apparent orientation.



Figs. 9, 10. *Ramaria vittadinii*, TENN 36850. — 9. Fruitbody. — 10. Spores. Standard bars = 4 cm for fruitbody, 5 μm for spores.

Ramaria vittadinii can be diagnosed by the following characters: (i) salmon branches with yellow upper stipe and apices; (ii) massive stipe with abortive branchlets; (iii) clampless basidia; and (iv) characteristic large, prominently ornamented spores.

Ramaria neoformosa Petersen might be considered similar to *R. vittadinii*, for fruitbodies show salmon branches and yellow apices (clampless basidia are assumed). No sign of yellow stipe apex can be discerned, however, stipe size is small and stipes appear fasciculate, and spores are somewhat smaller ($10.7\text{--}11.8 \times 4.8\text{--}5.6 \mu\text{m}$; $\overline{E}^m = 2.09$; $\overline{L}^m = 10.9 \mu\text{m}$). Fruitbody flesh of both species is macrochemically reactive, and *R. neoformosa* fruitbodies show a tendency toward brunnescence where handled.

Macroscopically, *Ramaria lutea* is quite similar to *R. vittadinii*. The former (until recently) was known only from the original abbreviated description and plate. The sole fruitbody depicted appears juvenile, with large stipe, very short, luteous branches, and delicate, crowded apices. Schild (1977, see above) neotypified *Ramaria lutea* and furnished a revised description combining several fresh collections. As such, neither fruitbody color nor spore dimensions are close to those of *R. vittadinii*.

Most similar in all respects is *Ramaria aurea* (Schaeff.) Quél., which shows the same, although somewhat more intense, color pattern, watery brunnescence, and clampless basidia. The representative specimen proposed by Petersen (1974: Deutsche Bundes Republik, vic. Regensburg, TENN no. 36865) bore spores $11\text{--}13 \times 4.8\text{--}5.9 \mu\text{m}$ ($\overline{E}^m = 2.30$; $\overline{L}^m = 11.20 \mu\text{m}$). Schild (1978), in an abbreviated key, gave spore dimensions for the species as $(7.7\text{--})8\text{--}13 \times (3.7\text{--})4\text{--}6 \mu\text{m}$ (no statistics calculated, but \overline{L}^m approaching $10.5 \mu\text{m}$). Specimens described from maritime eastern Canada (Petersen, 1986) produced spores of comparable size ($9.7\text{--}12.6 \times 4.7\text{--}5.4 \mu\text{m}$; $\overline{L}^m = 10.95 \mu\text{m}$), also smaller than those of the representative specimen. All told, spores of *R. vittadinii* are longer than any material of *R. aurea* reported so far, and fruitbody stature does not match that of *R. aurea*. I choose to keep the two taxa separate, therefore, until further documentation can prove otherwise.

The species is named for Carlo Vittadini, in honor of his contribution to our knowledge of *Ramaria*.

SPECIMENS EXAMINED. — ITALY: vic. Trento, 20.IX.1972, coll. Gruppo G. Bresadola (holotype, TENN no. 36850). — SWITZERLAND: data unknown, *E. Schild 833* (TENN no. 47651).

ACKNOWLEDGEMENTS

My thanks are extended to Herr Edwin Schild for much help over the years in understanding the European taxa, to Dr. Egon Horak (ZT) and Dr. M. Morevec (P) for loan of herbarium specimens. To the members of Gruppo G. Bresadola (Trento, Italy), the Dreiländer Tagung, and Deutsche Gesellschaft für Mykologie go my thanks for aid in the field. Such groups, by extending hospitality to foreign workers, provide the basis in living specimens for better taxonomy and more complete data on geographical distribution of taxa.

REFERENCES

- KORNERUP, A. & WANSCHER, J.H. (1967). Methuen's handbook of colour. Methuen & Co., London. 243 p.
 MAAS GEESTERANUS, R. A. (1976). De fungi van Nederland. De clavarioide fungi. *In* Wetensch. Mededel. Koninkl. Nederl. Natuurh. Veren. 113. 92 p.

- MARR, C.D. (1968). *Ramaria* of western Washington. Dissertation, ined., Univ. Washington, Seattle.
- MARR, C.D. & STUNTZ, D.E. (1973). *Ramaria* in western Washington. In *Biblioth. Mycol.* 38: 232 p.
- PETERSEN, R.H. (1974). Contribution toward a monograph of *Ramaria*. I. Some classic species redescribed. In *Amer. J. Bot.* 61: 739–748.
- (1976). Contribution toward a monograph of *Ramaria*. III. *R. sanguinea*, *R. formosa* and a new species from Europe. In *Amer. J. Bot.* 63: 316–319.
- (1985). Notes on clavarioid fungi. XX. New taxa and distributional records in *Clavulina* and *Ramaria*. In *Mycologia* 77: 903–919.
- (1986). *Ramaria* taxa in Nova Scotia. In *Canad. J. Bot.* 64: 1786–1811.
- PETERSEN, R. & SCATES, C. (1988). Vernally fruiting taxa of *Ramaria* from the Pacific northwest. *Mycotaxon* 33: 101–144.
- RIDGWAY, R. (1912). Color standards and color nomenclature. Publ. Priv., Washington, D.C. 43 p. + 53 pls.
- SCHILD, E. (1977). *Clavaria lutea* Vitt., ein eigene Art. In *Persoonia* 9: 409–416.
- (1978). Was ist *Ramaria aurea* und *Ramaria flava*? In *Zeitschr. Mykol.* 44(2): 171–178.
- (1982a). Studie über Ramarien. In *Schweiz. Zeitschr. Pilzk.* 123: 33–45.
- (1982b). *Ramaria*-Studien. In *Zeitschr. Mykol* 48: 117–128.
- (1983a). Studie über Ramarien-II. In *Mycol. Helvet.* 1: 47–56.
- (1983b). Studie über Ramarien-III. In *Mycol. Helvet.* 1: 95–98.
- SÉGUY, E. (1936). Code Universal des Couleurs. *Encycl. Prat. Nat.* 30: 48 pls. + text.