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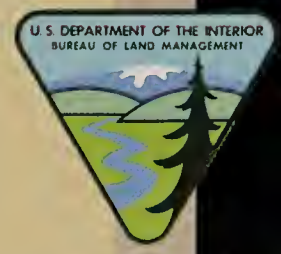
Ramaria of the Pacific Northwestern United States

Ronald L. Exeter, Lorelei Norvell & Efrén Cázares

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Salem District

Ramaria of the Pacific Northwestern United States

Ronald L. Exeter, Lorelei L. Norvell & Efrén Cázares

United States Department of Interior
Bureau of Land Management
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Authors:

Ronald L. Exeter is a botanist for the Marys Peak Resource Area
Salem District Bureau of Land Management
1717 Fabry Road SE
Salem, Oregon 97306.

Lorelei Norvell is a professional mycologist
Editor-in-Chief of Mycotaxon, and president of the Pacific Northwest Mycology Service
6720 NW Skyline Boulevard
Portland, Oregon 97229.

Efrén Cázares is a senior research assistant professor
Department of Forest Science
Oregon State University
Richardson Hall 321
Corvallis, Oregon 97331.

Design and Layout:

Tim Jacobsson
Salem District Bureau of Land Management
1717 Fabry Road SE
Salem, Oregon 97306.

Front Cover:

Center, *Ramaria botrytoides*. Clockwise from top: *R. botrytoides*, *R. stricta*,
R. flavigelatinosa var. *carnisalmonea*, *R. formosa*, *R. leptofornosa*, *R. stuntzii*,
R. apiculata, and *R. cystidiophora*.

Photos by Lorelei Norvell and R. L. Exeter.

Abstract

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As a result of the Record of Decision (1994), Bureau of Land Management and United States Forest Service planning documents within the range of the northern spotted owl specified guidelines for surveying for "rare" and "uncommon" fungi species. This document included a list of 28 of the 80+ species and varieties of coral fungi (*Ramaria*) then known to occur in the Pacific Northwestern United States. At that time, the *Ramaria* species descriptions were scattered throughout various journals and books. Until now, there has been no single key written to identify all species known to occur in the region. This publication offers a key to all *Ramaria* species now known to occur in the Pacific Northwestern United States. This treatment covers the four subgenera assigned to the genus *Ramaria*; these include the subgenera *Lentoramaria*, *Echinoramaria*, *Ramaria*, and *Laeticolora*. Summary descriptions extracted from previous publications and color photographs (if available) are provided for all species. In addition a new species is described from NW Oregon, subg. *Laeticolora*, *Ramaria rasilisporoides*.

Key words: *Ramaria*, *Lentoramaria*, *Echinoramaria*, *Laeticolora*, Coral Fungi.

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Color Bar Key

A) Key to the subgenera of *Ramaria*



B) *Echinoramaria*



C) *Lentoramaria*



D) *Ramaria*



E) *Laeticolora* 'clamped'



F) *Laeticolora* 'non-clamped'



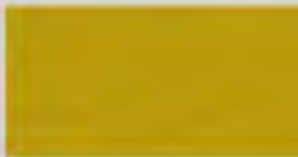
G) Appendix



H) Glossary



I) Bibliography



<i>Ramaria cyaneigranosa</i> var. <i>persicina</i>	117
<i>Ramaria flavigelatinosa</i> var. <i>flavigelatinosa</i>	118
<i>Ramaria flavigelatinosa</i> var. <i>carnisalmonea</i>	120
<i>Ramaria flavigelatinosa</i> var. <i>fragrans</i>	121
<i>Ramaria flavigelatinosa</i> var. <i>megalospora</i>	122
<i>Ramaria foetida</i>	123
<i>Ramaria fumosiavellanea</i>	124
<i>Ramaria gelatiniaurantia</i> var. <i>gelatiniaurantia</i>	125
<i>Ramaria gelatiniaurantia</i> var. <i>violeitingens</i>	126
<i>Ramaria hilaris</i> var. <i>olympiana</i>	127
<i>Ramaria longispora</i>	128
<i>Ramaria marrii</i>	129
<i>Ramaria raveneliana</i>	130
<i>Ramaria rubiginosa</i>	131
<i>Ramaria rubribrunnescens</i>	132
<i>Ramaria spinulosa</i> var. <i>diminutiva</i>	133
<i>Ramaria stuntzii</i>	134
<i>Ramaria synaptopoda</i>	135
<i>Ramaria verlotensis</i>	136
APPENDIX	137
Table 1. Comparison of “red” colored ramarias that occur in the Pacific Northwestern United States.....	137
Table 2. Comparison of non-clamped Subg. <i>Laeticolora</i> species with a yellow color band on the lower stipe	138
Table 3. Comparison of ‘Clamped’ vs. ‘Non-clamped’ subgenera <i>Ramaria</i> and <i>Laeticolora</i>	139
Marr and Stuntz key to subgenus <i>Laeticolora</i>	140
Marr and Stuntz key to subgenus <i>Ramaria</i>	144
Ronald H. Petersen and Catherine Scates key to spring <i>Ramaria</i> species of subgenus <i>Laeticolora</i>	145
Synonyms	147
<i>Ramaria</i> species known from the Pacific Northwestern United States	148
Glossary	151
Acknowledgements	155
Bibliography	155

Introduction

Ramaria is a genus of coral fungi with more than 500 described species worldwide. North America's Pacific Northwest (PNW) comprises one global center of species diversity for the genus (Index Fungorum, 2005; Marr & Stuntz, 1973). *Ramaria* was initially treated as a subgenus within *Clavaria* (Coker, 1923; Doty, 1944) until Corner (1970) elevated *Ramaria* to genus rank. It now is regarded as a well-established genus within the basidiomycete order, Gomphales (Marr & Stuntz, 1973; Petersen, 1982; 1988; Hawksworth et al, 1995; Humpert et al., 2001). The type species for the genus is *R. botrytis* (Pers.: Fr.) Ricken.

Ramaria species are characterized by having a highly branched basidiocarp, which descriptions usually divide into stipe, branches, and apices. Important diagnostic morphological characters include color, staining reactions, stipe consistency, and spore print color.

Staining and bruising reactions vary in intensity and color (brown, red, red-brown or violet-brown). The context (inner tissues) of stipe, branches, and apices can be fleshy-fibrous, cartilaginous, or gelatinous. Subtle differences in the colors of spore deposits are also helpful for differentiating species or varieties.

Distinguishing anatomical characters used to differentiate *Ramaria* species include the presence or absence of clamp connections on basidia and context hyphae and spore ornamentation. Macrochemical tests have proven taxonomically useful, among which the positive reaction of ferric sulphate (FSW) on hymenial surfaces and Melzer's reagent and FSW on stipe context are particularly helpful.

Phylogenetic Relationships

At one time, all coral fungi were treated in the genus *Clavaria* in the family Clavariaceae. Originally *Clavaria* included all species with simple to profusely branched basidiocarps. In 1970, however, Corner erected the family Ramariaceae to separate the rough-spored clavarioid from the smooth-spored cantharelloid species. This family included *Ramaria*, *Lentaria*, *Delentaria* and *Kavinia*. In their recent phylogenetic study based on morphological characters, Villegas et al. (1999) proposed placing the Ramariaceae into the order Gomphales with the Lentariaceae, Beenakiaceae, and Gomphaceae. Molecular phylogenetic studies (Bruns et al., 1998; Hibbett et al., 1997; Humpert et al., 2001; Giachini, 2004) also nest *Ramaria* well within the Gomphales along with *Clavariadelphus*, *Gautieria*, *Gomphus*, and *Kavinia*.

Four subgenera are currently recognized within the genus *Ramaria*: *Echinoramaria*, *Laeticolora*, *Lentoramaria*, and *Ramaria*. Giachini (2004) recently proposed raising the subgenera *Echinoramaria* and *Lentoramaria* to generic level based on his molecular phylogenetic analyses, however, in this publication we will treat *Echinoramaria* and *Lentoramaria* as subgenera of *Ramaria*.

Primary diagnostic characters used to differentiate between the subgenera include: basidiocarp size and color; substrate type (terricolous vs. lignicolous); spore morphology, ornamentation, and size; presence or absence of clamp connections; staining and bruising reactions; and reactions to chemical reagents. The four subgenera of *Ramaria*, which can be distinguished through substrate type, basidiocarp size and spore ornamentation, often separate easily into two groups.

Subgenera *Lentoramaria* and *Echinoramaria* are either lignicolous ('wood-loving') or humicolous ('humus-loving') in habit. They are small in size and often dingy colored in tones of brown, cream or pale yellow. Humicolous species have rhizomorphic strands that often bind the underlying organic substrate closely to the stipe of the basidiocarp, while lignicolous species fruit on wood. In general appearance, *Lentoramaria* and *Echinoramaria* species have small and simple branched basidiocarps. They often arise from a single thin stipe or arise from multiple stipes and appear "bushy." *Echinoramaria* is distinguished from *Lentoramaria* by its i) echinulate to echinulate-verrucose spores, ii) usually humicolous habit, and iii) monomitic rhizomorphs. *Lentoramaria* is distinguished by its i) generally lignicolous (or humicolous) habit, ii) warted or verrucose spores, and iii) dimitic rhizomorphs (*R. apiculata* and *R. suecica* excepted). *Lentoramaria* and *Echinoramaria* are often difficult to distinguish from each other when dried. Both fresh color notes and rhizomorphs are necessary for identification.

Subgenera *Ramaria* and *Laeticolora* are terricolous and rarely bind substrate to the stipe of the basidiocarp. Basidiocarps in both subgenera are generally medium to large in size and often with single or massive stipes and brightly colored (orange, yellow, red, purple) branches and apices.

Characters that distinguish *Ramaria* from *Laeticolora* are i) spores with longitudinal to oblique striations, ii) positive amyloid reaction of stipe tissues (often weak and slow), iii) frequently massive stipes, iv) fruitbodies with cream or pale colored branches but brightly colored (orange, red to purple) apices, v) clamped basidia, and vi) spores often averaging more than 11 μm in length.

Laeticolora, the subgenus containing the largest number of species, can be diagnosed by the combination of i) almost smooth to distinctly warted spores, ii) usually non-amyloid stipe tissues, iii) single to massive stipe bases, iv) fruitbodies with both branches and apices brightly colored, v) clamped and non-clamped basidia, and vi) spores usually averaging less than 11 μm in length. *Laeticolora* is the only subgenus with both "clamped" and "non-clamped" species.

Taxonomic Characters

Stipe

The size and shape of the stipe is often diagnostic. The stipe may be described as single, fasciculate (many small stipes in a cluster), compound, or a combination of all of these. It may be small or massive relative to the entire fruitbody. The base may be equal or bulbous. The presence of abortive branches or branchlets on the upper stipe that are found in many species also may aid in identification.

The consistency of the stipe and/or stipe context can vary from fleshy-fibrous to cartilaginous to gelatinous or a combination. The consistency may also vary depending on the maturation stage of the basidiocarp and environmental factors. Corner (1966) wrote,

"Gelatinous fruit bodies may be connected with dry fruit bodies by the subgelatinous, and in several cases it is clear that this description refers not to the normal, but to the aging or decayed fruit bodies."

A few species, within the sub-genus *Laeticolora*, have a band of brown contextual hyphae that is present in the base of a radially sectioned stipe. This has been termed, a "rusty root." The "rusty-root" is often arched upward and can vary in size. It may be present in the bottom 1-2 mm or it may extend upward for several cm in the stipe.

Branches and Apices

Branch and apex color is a distinguishing factor in identification and is mentioned below. The majority of species cannot be distinguished through branch morphology or branching patterns. However, a few species (*R. conjunctipes*, *R. synaptopoda*) lack highly branched basidiocarps, and have fasciculate branches.

Basidiocarp pigmentation

"The more collections that I study, the less clear become any specific ideas. The perplexity arises partly from the varying deficiency of field notes so that for more than half the species in herbaria microscopic characters cannot be correlated with the most striking one of colour." (Corner, 1966)

Color notes are crucial for the identification of *Ramaria*. As with all fleshy fungi, the primary colors of the basidiocarp can fade or minor colors become dominant as the fungus matures, and most fruitbodies turn some shade of brown as they begin to decay. Most *Ramaria* keys separate species into 3 major color groups; 1) white to cream, 2) yellow, and 3) red to orange.

It is important to note the coloration (both outer and inner tissue), of the stipe, branches and apices for identification. Different colors often become dominant during the maturation processes or soon after collecting. Immature specimens with yellow apices may appear as a yellow species if the salmon or orange branches have not begun to elongate (e.g., *R. formosa*, *R. celerivirescens*, *R. flavigelatinosa*). The apices, which are the first to break the soil surface, are generally the first to develop color and usually the first to lose the color intensity. Some species have what is called a yellow "belly-band." This "belly-band" occurs when the upper stipe and lower branches (mostly yellow) are a different color than the upper branches (mostly orange). In *R. flavigelatinosa*, however, the "belly-band" is a brighter, more dominant yellow than the pale yellow of the upper branches and apices.

Accurate *Ramaria* identification depends upon care taken to collect specimens representing all developmental stages and to make careful color notes on both immature and mature material.

Bruising reactions

The presence of bruising or the staining of tissues is an important characteristic and often a distinguishing feature. Staining or bruising reactions may occur on a specimen during developmental or maturation stages and may be present where the basidiocarp pressed against the substrate, or it may occur during handling/packaging of the specimen. Bruising may also occur from environmental conditions (frost, heat).

Generally, there are four categories which describe color changes; 1) virescent, bruising or staining green, 2) rubribrunnescent, staining reddish brown, 3) brunnescent, bruising brown to yellow-brown and 4) vivescent, bruising the color of red wine.

Basidia

The basidia of all species included in this publication have four sterigmata. However, not all species have clamp connections at the base of the basidia.

Clamp Connections

In basidiomycetes, clamp connections are small, semicircular, hollow outgrowth, laterally attached to the walls of two adjoining cells and arching over the cross-wall (septum) between them. This hyphal outgrowth grows backwards after cell division to connect the new cell to the older cell. Subg. *Laeticolora* is the only subgenera with both 'clamped' and 'non-clamped' species. Subg. *Echinoramaria*, *Lentoramaria* and *Ramaria* all have clamped basidia. The determination of 'clamped' vs. 'non-clamped' must be established by examining the basidia. Several species with clamped basidia have 'non-clamped' tramal hyphae. In addition, *R. foetida* is included as a species without 'clamps'. However, 'rare' clamps may be present 1% of the time. The presence or absence of clamped basidia, which is extremely important for accurate species identification, is noted in each species description.

As Corner (1966) noted, perhaps the most important character used in identifying species of subg. *Laeticolora* is the clamp connection:

"I have learnt from the many collections of Clavaria [Ramaria] sent to me for study since the publication of my monograph (Corner, 1950), that the absence of clamps from the hyphae of certain species of Ramaria is of the greatest use in their identification."

Several western North American species belonging to subg. *Laeticolora* are macroscopically indistinguishable and can only be positively identified by the presence or absence of clamp connections. Table 3, included in the appendix, compares species of subg. *Ramaria* and *Laeticolora* with clamp connections to species of subg. *Laeticolora* without clamp connections.

Basidiospores

Spore size and ornamentation are often distinguishing features within *Ramaria*. As noted earlier, the four subgenera are diagnosed by spore ornamentation: species with striate spores are placed in subg. *Ramaria*, those with echinate spores in *Echinoramaria*, while *Lentoramaria* and *Laeticolora* species have verrucose or warted spores. The degree of spore ornamentation varies among species, and different species may have spores with few to many or with low to large coarse ornamentation. Some *Lentoramaria* spores have "tall" warts that might be interpreted as small spines, leading to a misidentification of *Echinoramaria*. On the other hand, some *Echinoramaria* spores with short spines could be interpreted as having instead low warts, resulting in a misidentification of a *Lentoramaria*. Fortunately, there are other characters —such as habitat and morphology of rhizomorphic strands —that help distinguish between these two subgenera.

Spore measurements for each species express either an average or median value. Marr and D.E. Stuntz (1973) listed spore range and average spore measurement when describing their species. R.H. Petersen's species descriptions or redescriptions list spore range and median spore measurements. Petersen determined E values (spore length divided by width) for each spore from which he calculated the median E value (**Em**) and range for each specimen. An **Lm** (median spore length) was also calculated for each collection. The **Em** and **Lm** values cited in Petersen's descriptions were determined by pooling statistics on all collections analyzed. Values cited in type specimen descriptions, however, referred only spores from the actual holotype. In most cases spore Lm values were rounded to the nearest one-tenth.

Which spores should be measured? Marr and Stuntz (1973) measured free-floating spores in a squash mount of the hymenium. Their measurements did not include the apiculus but did include ornamentations (except where noted).

Parmasto & Parmasto (1987), however, observed,

"...spores taken from the hymenium are more variable than the spores of the spore print. Spores from the hymenium may consist of small undeveloped spores or the spores may be large, old spores with thickened walls. Both types of spores should be avoided."

They also noted that there were no significant differences in the average spore size or spore range of spores taken from different parts of one basidiocarp nor were there significant differences in spores from separate basidiocarps joined by common trunks or confluent stipes. Nor, for that matter, did the average spore size/range differ significantly within one fairy ring. Parmasto & Parmasto (1987) did, however, remark on a few exceptions as noted in large, older fairy rings that may have included basidiocarps from another mycelium.

How many spores should be measured? Petersen (1975) compiled his statistics using no fewer than 10 spores per specimen while Marr and Stuntz (1973) measured an average of 20 spores per specimen. Parmasto and Parmasto (1987) recommended that 30 spores per specimen would suffice unless the researcher was involved in a special study that demanded greater accuracy. They also stated,

"The idea that as many spores must be measured may seem to be very commendable but it ignores the basic principles of experimental design. What is needed is not maximal but optimal number of measurements."

Chemical tests

Many *Ramaria* keys require the use of several chemicals (e.g., phenol, aniline) that are both hazardous and difficult to obtain. The keys in this publication attempt to minimize the use of chemicals as much as possible by including additional diagnostic characters. For the most part, only Melzer's reagent and ferric sulfate (10% aqueous solution) are necessary to the keys. Unfortunately, Melzer's reagent contains a controlled substance (chloral hydrate) that limits its availability. Iodine or IKI (potassium iodine) can be substituted, but caution must be given, as IKI or iodine does not always reveal the same positive reaction that might be obtained using Melzer's.

Most macrochemical tests are conducted on the stipe flesh. Note that the majority of species (except *R. coulterae*) with a "rusty-root" will also test positive with ferric sulfate. Tests are generally conducted by removing a small piece of stipe flesh and placing it in a white 'depression plate.' Generally only one drop of chemical is needed per test. Mixing of chemicals is not advised.

The following abbreviations are used throughout the keys and descriptions:

FSW = ferric sulfate + water

When applied to the stipe context, several *Ramaria* species react by turning some shade of green. This usually rapid reaction is regarded as *positive*. Context that exhibits no shade of green or other color change shows a *negative* reaction. The outer branches and apices of all ramarias react positively to FSW. The rate of the positive reaction on the branch context may be diagnostic, however.

IKI (potassium iodine) or **Melzer's** reagent

Amyloid refers to a positive reaction and *non-amyloid* (or *inamyloid*) refers to a negative reaction. Context that turns dull to deep violet color is said to be amyloid; context that turns only pale brownish or shows no violet hue is non-amyloid. As stated above, Melzer's reagent is better than IKI or iodine for revealing a positive reaction. Melzer's reagent is made by dissolving 1.5 grams of potassium iodide and 0.5 grams of iodine in a mixture of 20 ml of water and 20 ml of Chloral hydrate.

KOH = potassium hydroxide in water

KOH reactions are diagnostic for only a few species of *Ramaria*. KOH is generally applied on the hymenium of purplish coral fungi or rhizomorphic strands of *Echinoramaria* and *Lentoramaria*. The variable reaction color is described in the text where appropriate.

Microscope Slide Preparation

Apply a drop of reagent to a microscope slide. Remove and place a very small amount of hymenial tissue in the reagent and gently mix. Place a coverslip over the material and gently spread the material with the eraser end of a pencil by applying pressure on the cover slip.

Cotton Blue (Aniline Blue) enhances spore ornamentation and is used in determining presence of absence of cyanophilous granules in basidia. This stain can also be used in determining the presence or absence of 'clamps'. Applying heat aids in the absorption of the dye and spore ornamentation is more readily observed. Cotton blue can be prepared by dissolving 0.05 grams of the stain in 30 ml of lactic acid and filtered.

Congo Red (Phloxine) is used for cell wall examination. It is often used in hyphal measurements and determining the presence of absence of 'clamps.' Congo Red solution can be prepared by mixing 2 grams of sodium chloride in 20 ml deionized water and 0.5 grams of Congo Red powder in 100 % absolute alcohol 80 ml.

Dried material can be rehydrated in water and prepared like fresh material or a KOH solution can be used for a more rapid rehydration of the material. Some literature states KOH can be mixed with the Congo Red solution. We caution against mixing or heating chemicals with open flames.

Distribution

Approximately 234 species belonging to the *Ramaria* subgenera *Ramaria* and *Laeticolora* have been described worldwide. In addition, Petersen (1975, 1980) identified over 60 species for the subgenera *Echinoramaria* and *Lentoramaria*.

Laeticolora comprises the largest – and most complex – subgenus. Thus far, approximately 210 species have been described in *Laeticolora*, with an estimated 109 species found in North America (Marr & Stuntz, 1973; Petersen 1985, 1986, 1988; Petersen & Scates 1988, 2000; Index Fungorum, 2006). Of the approximately 24 world species placed in subg. *Ramaria*, most occur in North America and Europe.

The majority of described *Ramaria* species are found in the northern hemisphere. There are still many unexplored forested regions in the world with suitable habitats where *Ramaria* species new to science may yet be discovered.

Worldwide distribution of *Ramaria* subgenera *Ramaria* and *Laeticolora*.

Country-Distribution	Subgenus		Total
	<i>Laeticolora</i>	<i>Ramaria</i>	
Asia	30	2	32
Australasia	4		4
Australia	8	1	9
Australia-New Zealand	1		1
New Zealand	6	1	7
Europe	51	6	57
Europe-Australia-Asia	1		1
Europe-Australia	4	1	5
Europe-Australia-North Africa	1		1
Europe-South America		1	1
North America	83	7	90
North America-Asia	2		2
North America-Australia	2		2
North America-Australia-New Zealand	1		1
North America-Europe	5		5
North America-Europe-Australia	1		1
North America-Europe-Australia-Asia	2	1	3
North America-Europe-Australia-Asia-South America	1		1
North America-Europe-South America	1	1	2

Country-Distribution	Subgenus		Total
	<i>Laeticolora</i>	<i>Ramaria</i>	
North America-Europe-New Zealand		1	1
South America-Australia	1		1
South America	4	2	6
Central America	1		1
Total	210	24	234

Keys and species descriptions

The book is divided into the following sections according to subgenus: (1) *Echinoramaria*, (2) *Lentoramaria*, (3) *Ramaria*, (4) *Laeticolora* with clamps, and (5) *Laeticolora* without clamps.

Keys:

Keys to each *Ramaria* subgenus precede descriptions and photographs (when available) of the species.

Species descriptions:

Information supplied for each species description was compiled from the references listed at the bottom of each species page. Color data are generalized; more specific color data can be found in the references cited. All descriptions of rhizomorphic strands in the *Echinoramaria* and *Lentoramaria* sections come directly from the Petersen reference for that species.

Substrate, habitat, phenology:

Little is known about the ecological requirements of *Ramaria* from the Pacific Northwestern United States. The majority of *Ramaria* species produce basidiocarps in the autumn, while a few species fruit mainly in the spring. Most species are associated with coniferous forests (Pinaceae) and fewer occur within hardwood forests. The majority of herbarium collections lack information on precise habitat type, and so it is not possible to assign ecological types or plant association types for each species at this time. Habitat requirements for each species are broad, but where habitat types are known, we do provide the information.

Distribution:

A herbarium search for all the Pacific Northwestern United States ramarias was not conducted for this publication, but the known range is included for each species where possible. When the entire range is not known, a species is simply listed as occurring in the Pacific Northwest. For this publication the Pacific Northwest includes species known from Central California, north into British Columbia (Canada) and east to the Rocky Mountains.

Synonyms:

The web site, <http://indexfungorum.org>, Index Fungorum, was consulted to establish recent synonyms. Synonyms proposed in publications that have not been updated on Index Fungorum are also noted in the discussion of a species where necessary. Due to funding and time constraints, synonyms are listed only for those species where the names in current use differ from the references consulted. Earlier names used by authors are noted in the list of references for each species.

Key to the subgenera of *Ramaria*

- 1A. Basidiocarps lignicolous or humicolous, small to medium sized, often dingy colored; rhizomorphs often present and binding substrate, of monomitic to dimitic construction; spores warted to echinate, never smooth; clamp connections present, often conspicuously inflated in the rhizomorphic strands 2
- 1B. Basidiocarps terricolous, medium sized to large, often brightly colored; rhizomorphs lacking or if present of monomitic construction; spores smooth, warted or striate, not echinate; clamp connections either lacking or not conspicuously inflated 3
 - 2A. Spores echinulate; basidiocarps humicolous; rhizomorphs monomitic subgenus *Echinoramaria* (p.8)
 - 2B. Spores smooth or warted; basidiocarps humicolous or lignicolous; rhizomorphs dimitic in most species (monomitic in *R. apiculata* and *R. suecica*) subgenus *Lentoramaria* (p.20)
- 3A. Spores striate, often > 11 μm long; branches mostly white to cream colored or cream colored with brightly colored apices; stipe context generally amyloid (clamp connections always present; stipe single, often massive) subgenus *Ramaria* (p.37)
- 3B. Spores smooth or warted, generally < 11 μm long; branches and apices mostly brightly colored; stipe context mostly non-amyloid (clamp connections either present or lacking; stipe single (then usually slender), fasciculate or compound, small or medium sized) 4
 - 4A. Clamp connections present subgenus *Laeticolora*, species with clamped basidia (p.48)
 - 4B. Clamp connections absent subgenus *Laeticolora*, species without clamped basidia (p.97)

Subgenus *Echinoramaria*



Photo by R.L. Exeter

Ramaria eumorpha

Key to *Ramaria* Subgenus *Echinoramaria*

- 1A. Spore Lm < 5.0 μm , spines generally < 0.3 μm 2
- 1B. Spore Lm > 5.5 μm , spines mostly > 0.5 μm 3
- 2A. Branches open, delicate, chamois to honey yellow; spore spines up to 0.3 μm , Lm = 4.8 μm (4.4–5.7 \times 2.6–3.5 μm); under conifers *Ramaria myceliosa*
- 2B. Branches congested, irregular cream buff to yellow-ochre; spore spines fine to verrucose, Lm = 4.4 μm (4.2–5.2 \times 2.8–3.5 μm); under *Pinus* *Ramaria curta*
- 3A. Basidiocarp bruising blue green upon collecting; spore Lm = \geq 8.2 μm 4
- 3B. Basidiocarp not bruising blue green upon collecting or if blue-green stains present, inconspicuous and limited to small areas on stipe (*R. mutabilis*); spore Lm = \leq 7.8 μm 5
- 4A. Spore Lm = 9.5 μm (8.2–11.1 \times 4.4–5.5 μm , spines 0.5–0.7 μm); basidiocarp bulky (up to 15 cm tall); major branches lobed in cross-section..... *Ramaria glaucoaromatica*
- 4B. Spore Lm = 8.2 μm (7.0–9.0 \times 3.7–4.5 μm , spines up to 1.0 μm); basidiocarp diminutive (usually < 5 cm tall); branches often flattened *Ramaria abietina*
- 5A. Spore Lm \leq 6.5 μm (length range 4.5–8.0 μm) 6
- 5B. Spore Lm \geq 7.4 μm (length range 6–10 μm) 7
- 6A. Small areas of stipe often with blue-green stains; dried branch tips olive–brown; spore spines \leq 0.6 μm , Lm = 6.53 μm (5.5–7.5 \times 3.3–4.1 μm) *Ramaria mutabilis*
- 6B. Stipe white bruising brown, lacking blue-green stains; dried branch tips white; spore spines longer, \leq 1.2 μm , Lm = 6.28 μm (4.5–8.0 \times 3.0–4.5 μm) *Ramaria argentea*
- 7A. Branches completely fertile (e.g., hymenium amphigenous); rhizomorphs yellowish white to pale yellow; spore Lm = 7.8 μm (6.3–10 \times 3.3–4.8 μm) *Ramaria eumorpha*
- 7B. Branches with significant decurrent sterile patches (e.g., hymenium unilateral); rhizomorphs white; spore Lm \sim 7.4 μm 8
- 8A. Spore spines up to 0.8 μm (6.5–8.9 \times 3.5–5.4 μm , Lm = 7.38 μm); basidiocarps slender and weak with one or more branches often splitting away from stipe or bending to touch the substrate; stipe not staining or bruising; branch tips tan to golden *Ramaria flaccida*
- 8B. Spore spines longer, up to 2.0 μm (6.0–8.6 \times 3.3–4.5 μm , Lm = 7.45 μm); basidiocarps stout; stipe browning when handled; branch tips honey-brown to whitish *Ramaria incognita*

Ramaria abietina (Pers.) Quél. 1888, Fl. Myc. Franc.: 467.

=*R. ochraceovirens* (Jungh.) Donk 1933, Rev. Niederl. Homob. Aphyll. 2: 112.

Capsule summary—A yellowish, golden, or greenish white slender, small coral ($\leq 7.5 \times 3.5$ cm) that stains deep blue green when handled. Clustered to gregarious among conifer debris in the autumn. Rare.

Stipe: Slender and distinct, at other times nearly lacking with branches arising at or below substrate level; base olive-ochraceous to dull ochre, quickly turning deep blue-green when handled. Dried specimens nearly the same as fresh ('moss green,' 'deep green,' 'olive brown').

Rhizomorphic strands: Snow-white cottony basal mat (fresh or dried).

Under microscope—hyphae 1.4–2.6 μm diam., hyaline, thin-walled, conspicuously clamped; clamps abundant, ampulliform, $\leq 14 \mu\text{m}$ broad, slightly thick-walled; stellate crystals often present in basal mat.

Branches: In irregular tiers, often flattened; when fresh generally some shade of ochre (yellowish, gold, greenish to grass green), when handled or confined quickly turning blue-green (small branchlets also often deep blue-green).

Apices: Slightly more intensely yellow than branches and usually changing color little upon handling.

Spores: *Petersen*: $L_m = 8.2 \mu\text{m}$ ($7.0\text{--}9.0 \times 3.7\text{--}4.5 \mu\text{m}$, $E_m = 1.9 \mu\text{m}$); ornamented with numerous scattered strongly cyanophilous warts or rounded spines $\leq 1 \mu\text{m}$ (often $0.5 \mu\text{m}$ long). *Marr & Stuntz*: $\bar{x} = 7 \times 4.1 \mu\text{m}$ ($6\text{--}8 \times 4\text{--}4.5 \mu\text{m}$), lacrymiform with a distinct oblique apicular end; ornamented with short cyanophilous spines or tubercles.

Habitat: Terrestrial in needle duff or on conifer debris scattered throughout conifer forests (Douglas fir often present) in the temperate North Temperate Zone.

Distribution: *Pacific Northwest*—n. California (coastal), Oregon (Klamath basin), Washington (Olympic Peninsula and western Cascade slope), Idaho. *Extralimital*—North America (western USA; eastern USA & Canada—Colorado, eastern—Michigan, Minnesota, New York); Europe.

Diagnostic characters: *Ramaria abietina* can be recognized by its (1) blue-green bruising reactions, (2) slender aspect and small size, (3) small spores $\sim 7.0\text{--}8.2 \mu\text{m}$ long), and (4) spiny spores.

Additional comments: *R. abietina* resembles *R. eumorpha* and *R. curta*, which both lack greenish tones and do not stain blue-green.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 134–135 (as *R. ochraceovirens*).

Petersen, R.H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 103–111.



Photo by C.D. Marr TYPE M506



Photo by R.L. Exeter 2005-54



Photo by R.L. Exeter 2005-54d

Ramaria argentea R.H. Petersen 1981, *Bibl. Mycol.* 79: 111.

Capsule summary—A golden to honey colored small, slender coral ($\leq 7.5 \times 5$ cm), with whitish tips that does not green or blue when handled. Clustered to gregarious among conifer debris in California and Idaho. Autumnal.

Stipe: Complex (or single in less developed specimens); snow white when fresh, remaining white when dried, bruising brown.

Rhizomorphic strands: Snow white, usually flattened, moderately soft, often reticulate, somewhat mealy, easily broken when dry. Surface browning quickly in 10% KOH and slowly leaching a brown liquid.

Under microscope—surface (pellicular) hyphae very narrow, adherent; outer tramal hyphae 1.5–2.2 μm diam., long-celled, hyaline, thin-walled, and with conspicuous unornamented clamps ≤ 14 μm diameter with somewhat thickened walls ≤ 0.7 μm thick.

Branches: Irregular and usually highly congested; *major branches* ≤ 5 mm diam., usually flattened or channeled (sometimes very palmate), pale olivaceous to 'honey color'; *secondary branches* 'honey color' to yellow ochre to moderately olivaceous tan, on drying becoming subcartilaginous and dark brown; flesh off-white when fresh.

Apices: Minute, acute, irregular and congested when young, becoming flattened and irregularly-digitate to mitten-shaped in age; usually becoming whitish or pewter-like when dry.

Spores: $L_m = 6.3$ μm ($4.5\text{--}8.0 \times 3.0\text{--}4.5$ μm , $E_m = 1.73$ μm), ellipsoid to teardrop-shaped; hilar appendix obscure; ornamented with densely scattered, narrowly rounded, cyanophilous spines ≤ 1.2 μm , long.

Habitat: On humus and/or woody debris in coniferous forests.

Distribution: *Pacific Northwest*—California (San Francisco), Idaho (McCall). *Extralimital*—USA (Colorado, New Mexico, Utah); Europe (Sweden).

Diagnostic characters: *Ramaria argentea* can be recognized by its (1) non-greening basidiocarp, (2) branch tips that remain white when dried, and (3) spiny spores ~ 6.3 μm long.

Additional comments: The white tips distinguish *R. argentea* from the similar *R. abietina*, *R. eumorpha*, and *R. curta*. *R. abietina* and *R. curta* both stain blue-green and *R. curta* has much shorter (~ 4.4 μm) spores. The non-staining *R. eumorpha* has yellowish rhizomorphs.

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 111-115.

Ramaria curta (Fr.) Schild 1994, Z. Mykol. 60(1): 125

=*R. myceliosa* var. *microspora* R.H. Petersen 1981, Bibl. Mycol. 79: 157

=*R. pusilla* (Peck) Corner 1950, Ann. Bot. Mem. 1: 617

Capsule summary—A very small (usually $4.5 \times 2.5\text{ cm}$) creamy to yellowish coral that has intricate branches with slightly paler tips and dries grayish yellow. Terrestrial in Pacific coast and inland forests in the autumn.

Stipe: Discrete or complex-cespitose, base covered with a felty to appressed mat of white mycelium below, yellow-ochre ('honey-color') above.

Rhizomorphic strands: A few slender, stringy, white rhizomorphic strands.

Under microscope—Hyphae skeletalized generatives $\leq 2.5\ \mu\text{m}$ diam., walls $\leq 0.5\ \mu\text{m}$; ampulliform clamps abundant, $\leq 12\ \mu\text{m}$ broad, subspherical, smooth. (no mention of crystals.)

Branches: Congested, intricate and several tiered; color creamy to ochraceous ('cream buff' to 'yellow-ochre').

Apices: Pale when fresh, paler than branches when dry.

Spores: *Petersen:* $L_m = 4.4\ \mu\text{m}$ ($4.2\text{--}5.2 \times 2.8\text{--}3.5\ \mu\text{m}$, $E_m = 1.48\ \mu\text{m}$), ovoid to broadly teardrop-shaped; ornamented with very fine spines or verruculae, sparsely scattered. *Marr & Stuntz:* $\bar{x} = 4.6 \times 3\ \mu\text{m}$ ($4.5\text{--}5 \times 2.5\text{--}4\ \mu\text{m}$), ovate, echinulate; ornamentation fine, cyanophilous.

Habitat: Terrestrial in coniferous forests.

Distribution: Throughout the northern NORTH TEMPERATE ZONE. *Pacific Northwest*—Washington (Whidbey Island), Oregon (Corvallis). *Extralimital*—USA (New York); Europe (Finland, Sweden).

Diagnostic characters: *Ramaria curta* can be recognized by its (1) congested cream to yellow branches, (2) very short spores ($\sim 4.4\ \mu\text{m}$ long), (3) lack of gloeoplerous hyphae in the rhizomorphic strands, and (4) echinate spores with short spines.

Additional comments: The very short spores most easily differentiate *R. curta* from the similar *R. abietina* ($\sim 8.2\ \mu\text{m}$ long) and *R. eumorpha* ($\sim 7.8\ \mu\text{m}$ long).

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 135–137 (as *R. pusilla*).

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 156–160 (as *R. myceliosa* var. *microspora*).

Ramaria eumorpha (P. Karst.) Corner 1950, Ann. Bot. Mem. 1: 575.

=*R. invalii* (Cotton & Wakef.) Donk 1933, Mededeel. Bot. Mus. Univ. Utrecht 9: 113.

Capsule summary—A golden yellow small to medium coral ($\leq 8 \times 6$ cm) that darkens in age and dries to a dull rusty color. Terrestrial in coniferous and mixed forests in the autumn.

Stipe: Very small, ranging from 20 mm to almost absent; usually concolorous with branches or darker with areas of dull pallid olive on the surface.

Rhizomorphic strands: Slender, yellowish, bright yellow in 15% KOH; strands in a basal mat intermixed with white to yellowish cob-webby plate-like sheets.

Under microscope—Hyphae ≤ 7.5 μm diam., walls thickening to 1.5 μm near clamped septa; ampulliform clamps ≤ 12 μm diam., broadly ovoid to subspherical, smooth; crystals negligible.

Branches: *Petersen:* Congested, always with central branches longer than outer branches, lower branches when young light ochre, when mature somewhat darker and duller 'clay color.' *Marr & Stuntz:* Branches and apices golden yellow, not bruising or staining.

Apices: Buff-yellow when young, becoming honey color in age.

Spores: *Petersen:* $L_m = 7.8$ μm ($6.3\text{--}10 \times 3.3\text{--}4.8$ μm , $E_m = 1.94$ μm); *Marr & Stuntz:* $\bar{x} = 6.8 \times 3.7$ μm (not including spines), $\bar{x} = 7.6 \times 4.9$ μm (including spines); range $6\text{--}8.5 \times 4\text{--}6$ μm . Lacrymiform (tear-shaped) with a distinctly oblique apicular end; ornamented with numerous, short (≤ 1 μm) sharp cyanophilous spines scattered randomly over spore surface.

Habitat: Terrestrial in coniferous and broad-leaved (*Fagus*, *Quercus*) forests.

Distribution: Common. *Pacific Northwest*—California, Idaho, Oregon, Washington. *Extralimital*—USA (Indiana, Massachusetts, Michigan, Minnesota, New York, North Carolina, Tennessee), Canada, Europe.

Diagnostic characters: *Ramaria eumorpha* can be recognized by its (1) non-greening basidiocarp, (2) off-white to yellow rhizomorphs, (3) amphigenous hymenium, and (4) spiny spores ~ 7.8 μm long.

Additional comments: Rhizomorph color and lack of green staining help differentiate *R. eumorpha* from the similar *R. abietina* and *R. curta*.

Petersen (1981) further notes that (i) when crushed dried branches are placed in 2% KOH, a pale apricot or peachy pigment leaches into the liquid and (ii) upper branches and apices often dry to a dull rusty orange color.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 132–133 (as *R. invalii*).

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 131–137.



Photo by R.L. Exeter 2005-53



Photo by R.L. Exeter
R. suecica 2005-52 Left
R. eumorpha 2005-53 Right



Photo by R.L. Exeter 2002-22

Ramaria flaccida (Fr.) Bourdot 1918, Vadem. Pilzfr.: 254.

Capsule summary—A tan many-branched small coral ($\leq 6 \times 4$ cm) with very slender 'flaccid' branches that often collapse of their own weight. In northeastern North American and European forests in the autumn.

Stipe: Usually distinct from branches ('discrete'), but often absent; when present, pale below substrate and neutral brown to ochre-brown above, not changing color on picking or bruising.

Rhizomorphic strands: Stringy and intermixed with occasional small loose sheets of mycelium, cream-colored becoming pale ochre on drying with hints of brown where handled.

Under microscope—Rhizomorphic strands becoming dingy yellow in 2% KOH. Microscopic descriptions of rhizomorphic strands are not included in the species description.

Branches: Hymenium usually unilateral, with rusty brown sterile areas running down from axils contrasting with brownish fertile areas. Major branches when wet tending to split away from stipe to lie on the substrate.

Apices: Needle-like and long, tan to ochre-tan.

Spores: $L_m = 7.4 \mu\text{m}$ ($6.5\text{--}8.9 \times 5.5\text{--}6.5 \mu\text{m}$, $E_m = 1.75 \mu\text{m}$), elongate comma- to teardrop-shaped; ornamented with scattered sharp spines $\leq 0.8 \mu\text{m}$ long.

Habitat: Coniferous forests.

Distribution: Rare in the northern North Temperate zone. *Pacific Northwest*—not known from the region.

Extralimital—northeastern Canada & USA; Europe.

Diagnostic characters: *Ramaria flaccida* can be recognized by its (1) non-greening basidiocarp, (2) unilateral hymenium, and (3) spiny spores $\sim 7.4 \mu\text{m}$ long.

Additional comments: *Ramaria flaccida* is not thought to occur in the Pacific Northwest. However, because its name has often been misapplied to *R. curta*, *R. eumorpha*, and *R. myceliosa*, we include its description here for the sake of comparison.

Petersen (1981) notes, "fruitbodies of *R. flaccida* are so slender and weak, the branches often split away from the stipe or merely bend to touch the substrate (especially after rain)."

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 138–141.

Ramaria glaucoaromatica R.H. Petersen 1981, *Bibl. Mycol.* 79: 141.

Capsule summary—A greenish ochre tall medium sized coral ($\leq 15 \times 5$ cm) with a white fuzzy stipe, numerous erect olive branches with pointed yellowish tips, and blue-green stains that turn olive. Terrestrial on conifer duff in the autumn.

Stipe: ≤ 1.5 cm thick, often swollen below substrate level, basal tomentum abundant; snow-white and cottony below substrate level, remaining so after drying.

Rhizomorphic strands: Delicate inconspicuous white rhizomorphic strands.

Under microscope—Hyphae of basal tomentum $1.4\text{--}2.3$ μm diam., thin-walled, hyaline, conspicuously clamped; ampulliform clamps to 12 μm , broad, thin-walled; stellate crystalline material often found in basal mat.

Branches: Erect above narrow, acute axils; color ochraceous olive, staining in the field to intense blue-green and slowly changing to deep olive after picking or on exposure.

Apices: Pointed; yellow to cream.

Spores: $L_m = 9.5$ μm ($8.2\text{--}11.1 \times 4.4\text{--}5.5$ μm , $E_m = 2.05$ μm), sublacrymiform to ovoid with subattenuate apicular end often curved; ornamented with numerous, scattered, strongly cyanophilous warts or rounded spines (≤ 1 μm , but usually $0.5\text{--}0.7$ μm long).

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—Idaho. *Extralimital*—western Canada (Alberta) & USA (Colorado, New Mexico, Utah).

Diagnostic characters: *Ramaria glaucoaromatica* can be recognized by its (1) intense blue-green stains, snow-white stipe base & copious basal tomentum, (2) distinctive strong sweet (fenugreek) odor when dried, and (3) spiny spores ~ 9.5 μm long.

Additional comments: The basal tomentum in *R. glaucoaromatica* is much more conspicuous than in the similarly colored and staining *R. abietina*, which can also be distinguished by its smaller habit and smaller, more delicate spores ~ 8.2 μm long.

Petersen (1981) mentioned the basidiocarps of *R. glaucoaromatica* are easily recognized by the intense blue-green stains on the stipe, usually just above the snow-white stem base. Within a few hours after collecting, the entire basidiocarp turns a deep greenish olive except for the snow-white stipe.

While fresh specimens have no odor, dried material smells strongly of fenugreek (the same 'maple-syrup' odor associated with the 'candy-cap' *Lactarius*).

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 141–145.

Ramaria incognita R.H. Petersen 1981, *Bibl. Mycol.* 79: 145.

Capsule summary—A small ($\leq 5 \times 3$ cm) repeatedly and densely branched ochraceous coral similar in appearance to *R. argentea* (see 'additional comments' below). Fruits during autumn in western North American coniferous forests.

Stipe: Virtually missing to $\leq 20 \times 8$ mm, smooth above ground level, minutely felty or mealy below substrate; snow-white below and browning when handled, upwards ochraceous and concolorous with branches.

Rhizomorphic strands: Usually substantial with branched rhizomorphs up to 3 cm long, slender, pure white. Microscopic descriptions of rhizomorphic strands are not included in the species description.

Branches: Large sterile areas usually decurrent from axils with sparse basidia in scattered clumps downward on branch surfaces; deep ochre to honey brown when fresh, drying deep dull orange brown.

Apices: Very small; concolorous with branches or (rarely) white to silvery.

Spores: $L_m = 7.5 \mu\text{m}$ ($6\text{--}8.6 \times 3.3\text{--}4.5 \mu\text{m}$, $E_m = 1.95 \mu\text{m}$); ellipsoid to elongate-comma shaped; ornamented with scattered slender, rounded $\leq 2 \mu\text{m}$ long spines and occasional short crests.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—(California, Idaho, Washington). *Extralimital*—western USA (Arizona, Colorado, New Mexico)

Diagnostic characters: *Ramaria incognita* can be recognized by its (1) relatively stout small basidiocarp that does not stain green, (2) extensive sterile areas on branches, (3) spores ($\sim 7.4 \times 3.8 \mu\text{m}$), and (4) spores with long spines up to $2 \mu\text{m}$.

Additional comments: Petersen (1981), noting that *R. incognita* was a 'left-over' taxon that did not fit into any named group, could offer little guidance for separating the species from others in the field due to the absence of notes with the specimens: "Fruitbodies are larger than those of *R. abietina*, do not turn green at any time, and are relatively robust.... In general appearance, *R. incognita* seems most similar to *argentea*."

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 145–147.

Ramaria mutabilis Schild & R.H. Petersen 1981, *Bibl. Mycol.* 79: 149.

Capsule summary—A greenish gold, somewhat spindle-shaped medium-sized coral ($\leq 16 \times 10$ cm) with greenish-tan stipe and dull yellow branches with yellow-greenish tips. Terrestrial (sometimes on woody debris) in coniferous forests in autumn.

Stipe: Variable: ill-defined in large specimens to slender and well-defined in smaller fruitbodies; white below from basal mycelium, brown to olive-brown above. Occasionally with definite greenish coloration (especially in stout-stiped fruitbodies), often turning red-brown where handled.

Rhizomorphic strands: Snow-white in both fresh and dried material, bruising brown in limited areas. Mycelium also snow-white.

Under microscope—Hyphae thin-walled, 1.5–3.0 μm diam., hyaline; ampulliform clamps ≤ 12 μm diam., onion-shaped to humped, thin- to very slightly thick-walled, unornamented; crystals not abundant, amorphous (somewhat plate-like).

Branches: Dull to yellowish olive-brown. All branches become extremely brittle upon drying.

Apices: Slender and elongated; creamy yellow green when young, becoming ochraceous olive or duller in age.

Spores: $L_m = 6.5$ μm ($5.5\text{--}7.5 \times 3.3\text{--}4.1$ μm , $E_m = 1.75$ μm); ovoid to elliptical (slightly flattened adaxially); ornamented with closely set, scattered sharp spines up to 0.6 μm long.

Habitat: Terrestrial (sometimes on woody debris) in coniferous forests.

Distribution: *Pacific Northwest*—USA (California, Idaho, western Montana, Oregon, Washington) and Canada (British Columbia). *Extralimital*—USA (Arizona, Colorado, Michigan, New York, Utah); Europe (Hungary, Switzerland), India.

Diagnostic characters: *Ramaria mutabilis* can be recognized by its (1) blue-green stains on stipe and (2) small spiny spores ($\sim 6.5 \times 3.7$ μm).

Additional comments: The smaller spores and the absence of blue-green stains in *R. myceliosa* and *R. curta* separate those otherwise similar species from *R. mutabilis*. *R. abietina* has larger spores (8.2×4.3) and branches that stain blue-green when handled.

Petersen (1981) notes that fresh basidiocarps usually include some olive-green tones in the basic brown coloration. However, the olive color generally disappears in dried material, which remains a neutral or slightly rusty brown. He also notes that the variability of the overall stature may be due to substrate: "fruitings on wood or woody duff seem to produce larger, more complex and congested fruitbodies."

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 149–154.

Ramaria myceliosa (Peck) Corner 1950, Ann. Bot. Mem. 1: 607.

Capsule summary—An ochraceous to tan very small coral (≤ 5 cm & narrow or ≤ 3.5 cm & wider) with copious long stringy white rhizomorphs and branch tips always paler than branches. Terrestrial in moist Pacific coast and inland forests in the autumn.

Stipe: Ranging in stature from (a) slender ($\leq 15 \times 3$ mm) and distinct to (b) obscure and branching; light ochre when distinct.

Rhizomorphic strands: Copious long, slender, stringy, off-white rhizomorphic strands.

Under microscope—Hyphae thin-walled, generally parallel, of two types: (a) hyaline and with smooth ampulliform clamps ≤ 10 μm diam. & with ≤ 0.5 μm thick walls, pyriform to broadly ovate; and (b) gloeoplerous with golden refringent ≤ 2 μm diam. crystals distributed along many discrete segments.

Branches: Extensively unilateral hymenium concentrated on outer branch surfaces; tan-ochre when young, darker and with more green-olive tones in age. Sterile areas are more neutral brown after drying.

Apices: Always paler than branches: pale yellowish tan when young, somewhat darker in age, eventually almost concolorous with branches.

Spores: $L_m = 4.8$ μm ($4.4\text{--}5.7 \times 2.6\text{--}3.5$ μm , $E_m = 1.65$ μm), broadly ellipsoid to short-cylindrical; ornamented with small (≤ 0.3 μm) sharp prickles sparsely scattered over the entire spore surface.

Habitat: Terrestrial on litter in coniferous forests of the northern North Temperate zone.

Distribution: *Pacific Northwest*—USA (California, Idaho, Oregon, Washington); Canada (Manitoba). *Extralimital*—USA (Michigan, Minnesota, New Hampshire, New York); Europe (Finland, Germany, Italy, Sweden); India.

Diagnostic characters: *Ramaria myceliosa* can be recognized by its (1) small spore length, (2) open branched basidiocarp, (3) honey yellow coloration, (4) presence of gloeoplerous hyphae in rhizomorphs, and (5) spiny spores with short spines.

Additional comments: The similar *R. curta* can be separated by its shorter spores ~ 4.4 μm long.

Reference:

Petersen, R. H. 1981. *Ramaria* subgenus *Echinoramaria*. *Bibliotheca Mycologica* 79: 154–156.

Subgenus *Lentoramaria*



Ramaria rubella

Photo by R.L. Exeter

Key to *Ramaria* Subgenus *Lentoramaria*

- 1A. Spores smooth under 1000x*Lentaria* or *Clavicornia* (not covered in this publication)
- 1B. Spores ornamented2
- 2A. Spores average ~ 6.0 μm long; basidiocarp mostly off-white to pale ochraceous (humicolous; rhizomorphs dimitic; spores 5.5–7.1 \times 3.3–4.4 μm , Lm = 6.0 μm)*Ramaria gracilis*
- 2B. Spores average \geq 7.0 μm long; basidiocarp variously colored (humicolous or lignicolous; rhizomorphs mono- or dimitic) 3
- 3A. Spores average \leq 7.5 μm long; young branches pinkish buff to ruddy purplish with white to pale cream tips; lignicolous 4
- 3B. Spores average $>$ 8.0 μm long; young branches and tips variously colored; humicolous or lignicolous 5
- 4A. Rhizomorphic strands turning bright mauve pink in 10% KOH; hymenium amphigenous or, if not, with sterile areas running down from axils in narrow lines; stipe grey to brownish; branches dull violaceous to pinkish; spore Lm ~ 7.5 μm (6.3–9.5 \times 4.1–5.5 μm).....*Ramaria rubella* f. *rubella*
- 4B. Rhizomorphic strands unchanging or yellowish in 10% KOH; hymenium clearly unilateral (especially in dried specimens); stipe whitish; branches pinkish buff; spore Lm ~ 7.1 μm (6.3–8.1 \times 4.4–5.9 μm) *Ramaria rubella* f. *blanda*
- 5A. Basidiocarps humicolous6
- 5B. Basidiocarps lignicolous7
- 6A. Spore Wm ~ 4.3 μm ; rhizomorphs monomitric and with unornamented inflated clamps; spore Lm ~ 9.0 μm (8.1–10.4 \times 3.7–5.2 μm)..... *Ramaria suecica*
- 6B. Spore Wm ~ 5.0 μm ; rhizomorphs dimitic and with conspicuously ornamented inflated clamps; spore Lm ~ 9.5 μm (8.1–11.1 \times 4.4–5.9 μm) *Ramaria rainierensis*
- 7A. Upper branches and apices light to citron yellow; spore Lm ~ 8.4 μm (7.5–10 \times 4–5 μm)..... *Ramaria stricta*
- 7B. Upper branches and apices dull ochraceous, dull buffy tan to cream colored; spores various 8
- 8A. Rhizomorphs monomitric; Lm ~ 9.7 μm 9
- 8B. Rhizomorphs dimitic; Lm ~ 8.5 μm (*R. tsugina* Lm = 9.1 μm)11
- 9A. Upper branches and apices with light green to light bluish green colorations; spore Lm ~ 9.7 μm (8.5–11.0 \times 4.1–5.2 μm)..... *Ramaria apiculata* var. *apiculata*
- 9B. Upper branches and apices without greenish colorations10
- 10A. Basidiocarps small; branches sparse ascending to erect, not crowded, not anastomosing; lignicolous; spore Lm = 9.8 μm (9.2–11.0 \times 3.8–5.0 μm).....*Ramaria apiculata* var. *brunnea*
- 10B. Basidiocarps usually large and broadly ovoid in outline; branches numerous, congested and often anastomosing; on wood debris or sawdust; spores similar to *Ramaria apiculata* var. *brunnea*
.....*Ramaria apiculata* var. *brunnea* f. *compacta*
- 11A. Stipe, branches or apices with green stains; spore Lm ~ 9.1 μm (7–9.3 \times 3.5–4.2 μm)*Ramaria tsugina*
- 11B. Stipe, branches and apices lacking green stains; spore Lm ~ 8.1 μm (7.8–10 \times 3.7–4.8 μm)
..... *Ramaria concolor*

Key to forms of *Ramaria concolor*

- A. Branches open, lax, curved ascending *R. concolor* f. *marrii*
- A. Branches erect, often crowded but not lax and openB

- B. Branch axils with greenish colors*R. concolor* f. *tsugina* [*Ramaria tsugina*]
- B. Branch axils concolorous with branches, without greenish colorations C
- C. Basidiocarp base, stipe and lower branches deep chocolate brown *R. concolor* f. *fumida*
- C. Basidiocarp base and stipe more or less concolorous with branches, ochraceous brown to deep cinnamon brown but not deep chocolate brown *R. concolor* f. *concolor*

Ramaria apiculata (Fr.) Donk 1933, *Bibl. Mycol.* 21: 105.

var. *apiculata*

Capsule summary—A tan to reddish brown coral (usually smaller than 17 × 12 cm) with tips that bruise pale green. Often clustered on well-rotted conifer and deciduous wood in late autumn.

Stipe: Single or branched from the base so as to appear multiple or cespitose, often covered with felty basal mycelium, white to cream colored or often some shade of green to pale blue-green.

Rhizomorphic strands: A tangle of somewhat mealy and often webbed slender white rhizomorphs that yellow or brown in 10% KOH.

Under microscope—Hyphae of basal mat and rhizomorphic strands monomitic, of two types: *a*) generative – densely interwoven, 2.5–4.0 μm diam., thin-walled, hyaline, and with conspicuous, usually delicately ornamented inflated clamps ≤ 13 μm diam.; *b*) rare skeletalized generative segments – 3.2–4.5 μm diam., usually > 1000 μm long, arising from and ending in clamps.

Branches: *Petersen:* Usually erect, somewhat slender, with long internodes below; dull buffy tan where fertile, darker where sterile, bruising brownish-vinescent. *Marr & Stuntz:* Immature branches 'reddish gray,' soon maturing 'reddish brown.'



Photo by C.D. Marr TYPE 505a

Apices: *Petersen:* Concolorous with branches or yellow-green to pale green. *Marr & Stuntz:* Pale green to malachite green, quickly darkening when cut.

Spores: *Petersen:* Lm = 9.7 μm (8.5–11.0 × 4.1–5.2 μm, Em = 2.02 μm), cylindrical to narrowly ovoid or ellipsoid, roughened in profile and ornamented with very small, cyanophilous, densely scattered, low warts, often in lines or portions of adaxial spirals. *Marr & Stuntz:* \bar{x} = 8.6 × 4.4 μm (7–10 × 3.5–5 μm), finely ornamented with low cyanophilous warts of small diameter.

Habitat: Lignicolous on rotting or well-rotted conifer and deciduous wood; exceptionally on buried wood and appearing as though on humus.

Distribution: *Pacific Northwest*—USA (California, Idaho, Oregon, Washington), Canada (British Columbia). *Extralimital*—North America: USA (Alabama, Arizona, Michigan, Minnesota, New Mexico, New York, Vermont), Canada (Ontario), Mexico (Oaxaca); Europe (Finland, Germany, Italy, Sweden).

Diagnostic characters: *Ramaria apiculata* var. *apiculata* can be recognized by its (1) blue-green branch tips, (2) lignicolous habit, (3) monomitic rhizomorphic strands, (4) spores ~ 9.7 μm long, and (5) spores lightly ornamented with low warts.

Additional comments: The minutely warted spores of *R. apiculata* var. *apiculata* will help separate it from greening species within subg. *Echinoramaria*. *Ramaria tsugina* also has green colors but is dimittic and produces (on average) slightly shorter spores (Lm = 9.1 μm). In reporting Currie Marr's suggestion that the greenish coloration of the typical variety is a physiological response to cold temperatures, Petersen (1975) noted this observation might explain why the typical variety is found more commonly in northern latitudes and at higher elevations further south. Petersen also pointed out that basidiocarps with green tones present on stipe or branch axils tend to retain the green colors after drying and that specimens with the green restricted to branch tips lose the green tones and become difficult to separate from var. *bruunea*.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 139–141.

Petersen R.H. 1975. *Ramaria* subgenus *Leutoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 35–43.



Photo by C.D. Marr M908



Photo by R.L. Exeter 2005-110A



Photo by R.L. Exeter 2005-110d

Ramaria apiculata

var. *brunnea* R.H. Petersen 1972, Amer. J. Bot. 59: 1042.

Capsule summary—A cinnamon to reddish brown repeatedly branched small coral ($\leq 8 \text{ cm} \times 5 \text{ cm}$) that darkens slowly when bruised but does not become green. Solitary, gregarious or caespitose on rotting conifer wood in late summer through autumn. Throughout cooler North American regions or at higher elevations in the southwest.

Stipe: Usually discrete and often branched from the base; base with white felty tomentum otherwise dull brown.

Rhizomorphic strands: Small patches of appressed, minutely felty to mealy white basal tomentum extending from the fruit body base and branching through the substrate, often with very slender ($< 1 \text{ mm}$) ill-defined, white rhizomorphic strands.

Under microscope—Hyphae of rhizomorphic strands monomitic, of two types; *a*) generative – $2.5\text{--}4.5 \mu\text{m}$ diam., thin-walled, hyaline, and with conspicuous, usually delicately ornamented, inflated clamps $\leq 20 \mu\text{m}$ diam. and with walls $\leq 0.5 \mu\text{m}$ thick; *b*) locally common to (usually) extremely rare or absent skeletalized generative segments – $2.1\text{--}4.5 \mu\text{m}$ diam., thick walled ($\leq 0.8 \mu\text{m}$ thick), usually $> 1000 \mu\text{m}$ long (arising from and ending in clamps).



Photo by C.D. Marr M510A

Branches: *Petersen*: Cinnamon colored where fertile, darker where sterile and slowly bruno-rufescent where bruised. *Marr & Stuntz*: Young branches 'grayish orange' and maturing 'reddish brown.'

Apices: Light cinnamon colored when young, becoming darker in maturity.

Spores: $Lm = 9.8 \mu\text{m}$ ($9.2\text{--}11.0 \times 3.8\text{--}5.0 \mu\text{m}$, $Em = 2.17 \mu\text{m}$), narrowly ovoid to ellipsoid, roughened in profile; ornamented with scattered small, strongly cyanophilous, non-anastomosing warts. *Marr & Stuntz*: Microscopic structures: Similar to '*apiculata*.'

Habitat: Lignicolous on rotting conifer wood.

Distribution: *Pacific Northwest*—USA (California, Idaho, Montana, Oregon, Washington), Canada (British Columbia). *Extralimital*—North America: USA (Alabama, Arizona, Colorado, Iowa, Kentucky, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Wisconsin), Canada (Alberta, Manitoba, Nova Scotia, Ontario), Mexico (Oaxaca); Europe (Czechoslovakia, England, Finland, Italy, Sweden).

Diagnostic characters: *Ramaria apiculata* var. *brunnea* can be recognized by its (1) non-greening basidiocarp, (2) lignicolous habit, (3) monomitic rhizomorphic strands, (4) spores $\sim 9.8 \mu\text{m}$ long and lightly ornamented with low warts.

Additional comments: The elliptical shape of its spores easily separates *Ramaria apiculata* var. *brunnea* from *R. rubella* and other members of subg, *Lentoramaria* that produce broadly ovoid spores.

Petersen (1975) also describes a sessile form (*R. apiculata* var. *brunnea* f. *compacta*) that occurs on sawdust or very rotten conifer wood and has a small ($\leq 8 \times 5 \text{ cm}$) dull cinnamon, densely branched basidiocarp with frequently anastomosing compressed branches. The stipe is generally absent, but the cottony white 'basal tomentum' fills in the spaces between the anastomosed branches. Microscopic characteristics are similar to 'f. *brunnea*.' 'f. *compacta*' probably has the same range as 'f. *brunnea*' but is recorded only from Canada (Ontario) and the United States (Idaho and Michigan).



Photo by C.D. Marr f.compacta M510

References:

- Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 141–143.
- Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 43–54.

Ramaria concolor (Corner) R.H. Petersen 1975, *Bibl. Mycol.* 43: 54.

= *R. stricta* var. *concolor* Corner 1950, *Ann. Bot. Mem.* 1: 623, 700.

Capsule summary—A tan to brownish small coral (≤ 14 cm \times 10 cm) with an upright to relaxed habit that lacks greenish colors. Solitary, gregarious or caespitose on rotting coniferous or deciduous wood in the autumn.

Stipe: Variable, often branched almost from the base, cinnamon (most varieties) when fresh and young, somewhat violaceous or ruddy (chocolate brown in one form) in age.

Rhizomorphic strands: Stout, ropy; arising from tomentose to felty basal mycelial mat and permeating the substrate to an indefinite distance; white.

Under microscope—Hyphae of basal mat and rhizomorphic strands of three types: *a*) generative – 2.2–4.5 μ m diam., generally thin-walled, densely interwoven, hyaline, and with conspicuous, unornamented, inflated clamps ≤ 11 μ m diam.; *b*) skeletal – 1.6–2.6 μ m diam., thick-walled, straight, aseptate (arising from a clamp connection but ending blindly), hyaline; and *c*) very rare gloeoplerous hyphae – 3.4–4.5 μ m diam., thin-walled, with strongly cyanophilous foamy contents.

Branches: *Petersen:* Numerous, erect, strict to lax (open in one form), dull gold to tan, darkening in age.

Hymenium usually unilateral, with sterile areas restricted to narrow lines running down from axils. *Marr & Stuntz:* The fresh fruiting body almost entirely 'grayish orange' or the stipe a bit darker 'camel brown' and the apices slightly paler, any part of the basidiocarp bruising brownish with a slight violet tint.

Apices: Some shade of pale ochre-tan to tan, but not yellow or greenish yellow.

Spores: *Petersen:* Lm = 8.1 μ m (7.8–10 \times 3.7–4.8 μ m, Em = 1.92 μ m), elongate-ovoid to ellipsoid; ornamented with very obscure, low warts and ridges, moderately cyanophilous, hardly anastomosing, ill-defined. *Marr & Stuntz:* Similar to *R. stricta* var. *stricta*.

Habitat: Lignicolous; gregarious or caespitose on rotting deciduous and conifer wood.

Distribution: *Pacific Northwest*—USA (California, Idaho, Oregon, Washington) and Canada (British Columbia).

Extralimital—USA (Connecticut, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia); Canada (Nova Scotia, Ontario).

Diagnostic characters: *Ramaria concolor* can be recognized by its (1) tan to creamy colors, (2) branch tips that do not turn green, (3) lignicolous habit, (4) dimitic rhizomorphic strands, and (5) warted spores ~ 8.1 μ m long.

Additional comments: *Ramaria concolor* can be distinguished from other taxa in subg. *Lentoramaria* by its lignicolous habit, dimitic rhizomorphs, and spore length. Yellow to citron yellow branch tips differentiate *R. stricta* from *R. concolor* (with creamy, tan, or buffy ochre branches and tips). Given the lignicolous habit and microscopic similarities of *R. stricta* and *R. concolor*, DNA studies are needed for these species.

The Marr & Stuntz (1973) descriptions included above refer to what they called *R. stricta* var. *concolor* (currently also listed by Index Fungorum as the accepted name). However, Marr (pers. comm., 2006) notes that *R. stricta* var. *concolor* as defined by Corner is not valid because the name is not based on a type specimen. Petersen (1975) designated a neotype for *R. stricta* var. *concolor* on p. 54 in his 1975 monograph and elevated the variety to species level. We follow Petersen and recognize his four forms. Petersen's descriptions of three forms — '*concolor*,' '*fumida*,' and '*marrii*' are given directly below.

***R. concolor* f. *concolor*:** "Conforming to the species description, and to the following restrictions: *a*) stipe deep cinnamon color to avellaneous, not deep chocolate brown. *b*) branch axils concolorous with branches and apices upright, more or less crowded, erect, not lax and curved-ascending.... On rotting wood, usually deciduous ... but not uncommonly coniferous, common in eastern North America, occasional to rare in western North America...."

R. concolor* f. *fumida (Peck) R.H. Petersen 1975, *Bibl. Mycol.* 43: 61. "Conforming to the species description, and to the following restrictions: *a*) stipe deep chocolate brown to hair brown when fresh, usually branched almost from base, and lower branches concolorous; *b*) generative hyphae of rhizomorphic strands thick-walled; and *c*) upper branches and apices erect, as in typical form, not lax and curved-ascending, not green or greenish." *Extralimital*—USA (New York), Canada (Ontario).

R. concolor* f. *marrii R.H. Petersen 1975, *Bibl. Mycol.* 43: 62. (= *Ramaria stricta* var. *laxiramosa* Marr 1968, thesis, Univ. Washington ined.). Stipe arising from a white mycelial mat and white rhizomorphic strands. Stipe cinnamon brown bruising 'saya brown'; branches lax, curved-ascending, open to somewhat

divaricate, cinnamon buff; apices delicate, digitate, 'cream buff' to light 'ochraceous buff.' Cystidioid structures in hymenium hyphal 1.5 μm diam., projecting from hymenial surface up to 40 μm , thin-walled, gnarled, often once-branched, leptocystidial. Microscopic characteristics and spores conform to species descriptions. *R. concolor* f. *marrii* is reported from decaying deciduous wood, under western red cedar. Distribution: *Pacific Northwest*—USA (Idaho and Washington). Rare.

We treat Petersen's fourth form, *R. concolor* f. *tsugina*, as an independent species, *R. tsugina*, which is distinguished by larger spores ($\sim 8.7 \times 4.6$), dimitic rhizomorphic strands, and green colors on branch tips.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 149–150. (as *R. stricta* var. *concolor*)

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 54–66.



Photo by C.D. Marr 419
R. concolor f. *marrii* (*R. stricta* var. *laxiramosa*)



Photo by C.D. Marr 1951
R. concolor

Ramaria gracilis (Pers.) Quél. 1888, Flore Mycol.: 463.

Capsule summary—A very small to small (2.5 × 2 cm, but up to 8 cm) repeatedly branched, broadly fusiform coral with pale pinkish yellow to orangish branches with white tips that is extremely fragile and brittle when dry. Humicolous on conifer twigs and needles in autumn. Rare.

Stipe: Usually single but often fused with 1–2 others, suede-like, soft and pliable; white to cream color when young and protected, somewhat darkening in age.

Rhizomorphic strands: Slender, delicate, well defined but often becoming diffuse as small mycelial tangles or sheets; white.

Under microscope—Hyphae of three types: *a*) generative – 2.2–4 μm diam., thin-walled, hyaline and with conspicuous clamps; inflated areas not restricted to clamps, ≤ 14 μm broad, thin- to thick-walled, delicately to coarsely ornamented over wide areas; *b*) skeletalized generative – 3–4.5 μm diam., thick-walled, arising and ending in clamp connections or (rarely) ending blindly; *c*) skeletal – 1.5–2.2 μm diam., thick-walled, ± straight, arising from clamp connections, tapering gradually to an acute tip, ending blindly, flexible but not easily collapsed; walls strongly cyanophilous.



Photo by C.D. Marr M503

Branches: *Petersen:* Usually off-white when young becoming pale ochre to pale ochraceous cinnamon later, pale pinkish buff. *Marr and Stuntz (1973) note:* “the lower three-fourths of the fresh fruiting body are ‘pale orange’ and the ultimate branches milk white.”

Apices: White (sometimes darkening in age).

Spores: *Petersen:* Lm = 6.0 μm (5.5–7.1 × 3.3–4.4 μm, Em = 1.65 μm), broadly ovoid to broadly ellipsoid; ornamented with low scattered, strongly cyanophilous warts and meandering ridges. *Marr & Stuntz:* \bar{x} = 5.3 × 3.5 μm (5–6.5 × 3.5–4 μm), ellipsoid to ovoid with a prominent apiculus; ornamented with shallow lobed, cyanophilous warts in subspiral arrangement.

Habitat: *Petersen:* Conifer duff especially pine. *Marr & Stuntz:* Coniferous forests, western red cedar and Douglas-fir.

Distribution: *Pacific Northwest*—USA (California, Idaho, Oregon, Washington) and Canada (British Columbia). *Extralimital*—USA (Connecticut, Georgia, Michigan, Minnesota, New Jersey, New York, North Carolina, South Carolina, Tennessee, Vermont, Virginia); Canada (Nova Scotia, Ontario, Quebec); Europe (Czechoslovakia, Denmark, England, France, Holland, Italy, Norway, Poland, Sweden, Switzerland).

Diagnostic characters: *Ramaria gracilis* can be recognized by its (1) white upper branches and branch tips, (2) humicolous habit, (3) dimitic rhizomorphic strands, and (4) small spores ~ 6 μm long ornamented with shallow lobed warts.

Additional Comments: Marr (pers. comm., 2006) mentions the most outstanding (diagnostic) microcharacter of *R. gracilis* is the very strongly cyanophilous walls of the skeletal hyphae in contrast with the pale background of generative hyphae. No other ramaria shows this feature.

Petersen (1975) compares R. gracilis to R. rainierensis, which “appears superficially similar in the field, but is stouter and taller, usually, and produces significantly larger spores.”

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 142–143.

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 68–75.

Ramaria rainierensis Marr & D. E. Stuntz 1973. *Bibl. Mycol.* 38: 145.

Capsule summary—A pale yellowish fanshaped small coral (2–8 × 0.4–7 cm) that is distinctly stiped, repeatedly branched, and ages to grayish orange. Humicolous on conifer twigs and needles in autumn. Rare.

Stipe: Gregarious but not cespitose; smooth above but often covered with basal mat below; yellowish white.

Rhizomorphic strands: Slender, ill-defined, often minutely webbed, not extensive; white, basal tomentum white to off-white.

Under microscope—Hyphae of rhizomorphic strands and basal mat of three types: *a*) generative – 3–4.5 μm diam., thin-walled, hyaline, often encrusted with crystalline material, and with conspicuous coarsely and widely ornamented inflated clamps $\leq 13 \mu\text{m}$ broad, somewhat thick-walled ($\leq 1.2 \mu\text{m}$ thick); *b*) skeletalized generative – 3–4.5 μm diam., refringent under phase contrast, apparently thick-walled, relatively rigid to lax and crumpled in mounts; *c*) skeletal – rare, irregularly shaped, $\leq 9 \mu\text{m}$ diam. at origin, thick-walled ($\leq 3 \mu\text{m}$ thick).

Branches: Yellowish white when young, aging to a pale grayish orange (upper branches slightly paler than the lower).

Apices: Somewhat paler than branches.

Spores: *Petersen:* $L_m = 9.5 \mu\text{m}$ (8.1–11.1 × 4.4–5.9 μm , $E_m = 1.89 \mu\text{m}$), broadly cylindrical to broadly ellipsoid; ornamented with scattered, significantly raised, cyanophilous warts and small ridges. *Marr & Stuntz:* $\bar{x} = 8.5 \times 5 \mu\text{m}$ (7–10 × 4.5–6 μm), ellipsoid; ornamented with distinct, lobed, cyanophilous warts arranged in subspirals.



Photo by C.D. Marr M431

Habitat: On humus in coniferous forests.

Distribution: *Pacific Northwest*—USA (California, Idaho, Washington).

Diagnostic characters: *Ramaria rainierensis* can be recognized by its (1) humicolous habit, (2) warty spores that are ~ 8.5–9.5 μm long and ~ 5 μm wide, (3) dimitic rhizomorphic strands, and (4) ornamented inflated clamps.

Additional comments: Petersen (1975) observes, "Superficially, this taxon appears similar to *R. gracilis* and *R. suecica* in the field, sharing the humicolous habitat and stipitate stature." In addition, *R. gracilis* has much shorter spores ~ 6 μm long, the rhizomorphic strands in *R. suecica* are monomitic, and the average spore width of both species is less than those of *R. rainierensis*.

Marr and Stuntz note, "*Ramaria rainierensis* is regarded as belonging to subg. *Lentoramaria* because of its dimitic fruiting bodies. It differs from all other species of the subgenus by the following combination of characteristics: (i) terrestrial habit, (ii) cream to buff-colored fruitbodies, (iii) spores of the *R. formosa*-type, and (iv) skeletal hyphae with nearly acyanophilous walls."

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 145–147.

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 79–81.

Ramaria rubella* f. *rubella (Schaeff.) R.H Petersen 1974, Am. J. Bot. 61(7): 746
= *R. acris* (Peck) Corner 1961, Trans. Br. Mycol. Soc. 44: 235.

Capsule summary—A pale pinkish cinnamon small coral (3–10 × 0.5–7 cm) with a ± amphigenous hymenium and which repeatedly branches out to whitish branch tips. Lignicolous on coniferous and deciduous wood in autumn.

Stipe: Single to multiple, whitish below to 'hair brown' upward, aging to dark brownish drab ('benzo brown').

Rhizomorphic strands: Whitish but changing to bright mauve pink in 10% KOH; mycelial felt also whitish.

Under microscope—Hyphae of rhizomorphic strands of two distinct types: *a*) thin-walled generative hyphae – 2–5 µm diam., hyaline, conspicuously clamped, and *b*) skeletalized generative hyphae – 3–4 µm diam., thick-walled, each arising from the "clamped septum of generative hypha and almost invariably ending in the same manner," acyanophilous, hyaline; inflated clamp connections abundant, up to 35 µm diam., somewhat thick-walled, not ornamented.

Branches: Amphigenous or with sterile areas restricted to narrow lines running down from the axils; *Petersen*: Dull violaceous rose when young, in maturity buff pink, light vinaceous cinnamon and in age to pinkish cinnamon, bruising to fawn color or somewhat vinescent when handled. Upper branches more brightly colored, russet, vinaceous russet. *Marr & Stuntz*: Basal branches of fresh fruit bodies white in tomentum-covered regions, otherwise 'pale red' to 'grayish red,' most branches 'pale red' in young basidiocarps or 'grayish red' in older ones. Primordial apices white slowly maturing concolorous with branches.



Photo by R.L. Exeter 2005-70b

Apices: White, aging to pale pinkish cinnamon (concolorous with branches).

Spores: *Petersen*: Lm = 7.5 µm (6.3–9.5 × 4.1–5.5 µm, Em = 1.75 µm), broadly cylindrical to slightly ovoid, roughened in outline; ornamented with low, scattered, strongly cyanophilous warts to delicate ridges. *Marr & Stuntz*: \bar{x} = 6.4 × 4.6 µm (5.5–8 × 4–5.5 µm), ellipsoidal; ornamentation with numerous small but distinct, papillate, cyanophilous warts.

Habitat: Lignicolous on coniferous and deciduous wood.

Distribution: *Pacific Northwest*—USA (California, Idaho, Oregon, Washington); Canada (British Columbia). *Extralimital*—USA (Massachusetts, Michigan, New Hampshire, New York, North Carolina, Tennessee, Vermont); Canada (Nova Scotia, New Brunswick, Ontario, Quebec); Europe (Austria, Germany, Switzerland).

Diagnostic characters: *Ramaria rubella* f. *rubella* can be recognized by its (1) pinkish branches, (2) lignicolous habit, (3) rhizomorphic strands that turn bright pink in 10% KOH, (4) dimitic rhizomorphic strands, (5) amphigenous hymenium, or sterile areas restricted to narrow lines from axils, and (6) warty spores ~ 6.4–7.5 µm long.

Additional comments: The ruddy coloration of the branches of *R. rubella* is distinctive; the rhizomorphic strands of f. *rubella* always turn bright pink in 10% KOH while those of f. *blanda* do not. *R. rubella* f. *blanda* is further distinguished by a distinctly unilateral hymenium and shorter spores ~ 7.1 µm long.

See *Ramaria rubella* f. *blanda* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. Bibliotheca Mycologica 38: 137–139. (as *R. acris*)

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. Bibliotheca Mycologica 43: 81–89.



Photo by C.D. Marr M500



Photo by R.L. Exeter 2004-33



Photo by R.L. Exeter 2004-73b

Ramaria rubella f. blanda R.H. Petersen 1975, *Bibl. Mycol.* 43: 89.

Capsule summary—A pale pinkish cinnamon small coral (8 × 5.5 cm) with a clearly lateral hymenium and which repeatedly branches out to whitish branch tips. Lignicolous on coniferous (*Picea*) and deciduous (*Alnus*) wood in autumn. Rare.

Stipe: Very short, almost branched from base, arising from copious basal mycelium; white at base, upward concolorous with branches.

Rhizomorphic strands: Basal mycelium in small sheets and slender, discrete rhizomorphic strands, or a combination of both, white or whitish, separable from substrate, extensive, unchanging or yellowish in 10% KOH.

Under microscope—Hyphae of rhizomorphic strands of two types: *a*) generative – 1.5–4.5 μm diam., thin-walled, tightly packed, hyaline, conspicuously clamped; inflated clamps up to 15 μ broad, somewhat thick-walled (wall up to 1.2 μm thick), abundant, unornamented, and *b*) skeletalized generative – usually over 1000 μ long, straight, 2.2–3.8 μm diam., thick-walled, refringent under phase contrast, arising and ending in clamp connections.



Photo by C.D. Marr M498

Branches: Some shade of cinnamon pink ('pinkish-buff,' 'fawn color,' 'pale pinkish cinnamon,' 'light vinaceous cinnamon').

Apices: White to pale cream color.

Spores: Lm = 7.1 μm (6.3–8.1 × 4.4–5.9 μm, Em = 1.45 μm) broadly ovoid to broadly ellipsoid, roughened in profile; ornamented with scattered prominent warts or short meandering ridges.

Habitat: Lignicolous on coniferous (*Picea*) and deciduous (*Alnus*) wood.

Distribution: *Pacific Northwest*—USA (California, Washington); Canada (British Columbia). *Extralimital*—USA (Tennessee).

Diagnostic characters: *Ramaria rubella f. blanda* can be recognized by its (1) pinkish branches, (2) lignicolous habit, (3) rhizomorphic strands that are unchanging or yellowish in 10% KOH, (4) dimitic rhizomorphic strands, (5) unilateral hymenium, and (6) warted spores ~ 7.1 μm long.

Additional comments: *Ramaria rubella f. blanda* was proposed when Petersen (1975) noted that rhizomorphic strands of *R. rubella* occasionally did not turn its characteristic bright pink when tested in 10% KOH. He further noted that the hymenium of such specimens was distinctly unilateral (rather than with sterile areas merely decurrent as lines from the branch axils as in *f. rubella*) and that the spores were shorter (*f. rubella* Lm = ~ 7.5 μm based on Petersen's measurements). The ruddy coloration of the branches of *R. rubella* is distinctive.

Ramaria rubella f. blanda has been referred to as *R. rubella var. blanda*. Petersen (1975) refers to 'var. *blanda*' in the introduction and within "Key to North American taxa." but describes *R. rubella f. blanda* and includes both '*f. rubella*' and '*f. blanda*' in the "Key to the infraspecific taxa of *Ramaria rubella*."

See *Ramaria rubella f. rubella* for additional comments.

Reference:

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 89–92.

Ramaria stricta (Pers.) Quèl. 1888. Flore. Mycol. p. 464.

Capsule summary—A yellowish to cinnamon small to medium upright ('strict') coral ($\leq 14 \times 10$ cm) with yellowish upper branches and tips, orangish lower branches, and all parts bruising brown. Lignicolous from rotting coniferous and (occasionally) deciduous wood in autumn.

Stipe: Discrete or branched from the base, often covered with white, felty-tomentose basal mycelium, upward dull ochraceous to dull brownish; branches and stipe bruising brownish burgundy to cinnamon-brown.

Rhizomorphic strands: Tangle of strands or basal mat; white.

Under microscope—Hyphae of basal mat and rhizomorphic strands or two types *a*) generative – 2.2–3.8 μm diam., thin-walled, conspicuously clamped, densely interwoven, hyaline, commonly with clamps inflated ≤ 13 μm broad and often slightly thick-walled; *b*) skeletal – common to abundant, aseptate, 1.3–2.2 μm diam., thick-walled.

Branches: Yellowish above and toward tips, some shade of cinnamon below; browning everywhere when bruised.

Petersen: Branches cinnamon to vinaceous ochre in color, light pinkish cinnamon, sometimes variable to 'syal brown' where bruised. *Marr & Stuntz:* Mature but not old specimens about 'grayish orange' in the lower one-third to two-thirds, above 'light yellow' to 'pastel yellow' near the apices, any part of the fruiting body bruising 'light brown,' context brownish white and darkening when cut.

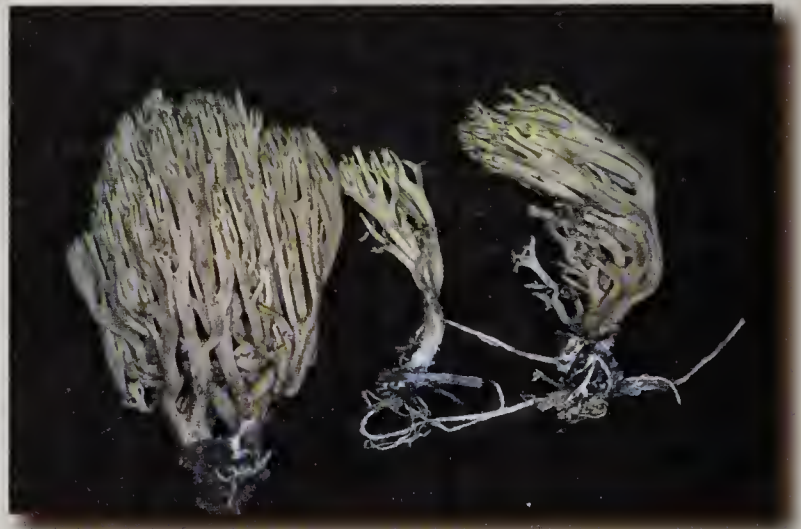


Photo by OSU 23544

Apices: Pale yellow to light greenish yellow, aging to pinkish buff.

Spores: *Petersen:* $L_m = 8.4$ μm ($7.5\text{--}10.0 \times 4.0\text{--}5.0$ μm , $E_m = 1.99$ μm), narrowly ovoid to subellipsoid, roughened, ornamented with very obscure, low, moderately cyanophilous, scattered, hardly anastomosing warts or ridges. *Marr & Stuntz:* $\bar{x} = 8.5 \times 4.4$ μm ($7.0\text{--}10 \times 3.5\text{--}5.5$ μm), ellipsoid; ornamented with minute, shallow, cyanophilous warts.

Habitat: Decaying coniferous and occasionally on decaying deciduous wood.

Distribution: *Pacific Northwest*—USA (California, Idaho, Montana, Oregon, Washington); Canada (British Columbia). *Extralimital*—USA (Massachusetts, Maine, Michigan, Minnesota, New Hampshire, New York, North Carolina, Tennessee, Wisconsin); Canada (Quebec); Europe (Austria, Belgium, Denmark, France, Germany, Great Britain, Holland).

Diagnostic characters: *Ramaria stricta* can be recognized by its (1) lignicolous habit, (2) yellow upper branches and apices, (3) flesh bruising to brown where handled, (4) warty spores ~ 8.4 μm long, and (5) dimitic rhizomorphic strands.

Additional comments: The bright yellow to chartreuse colored upper branches and tips, pale peach lower branches, and all parts bruising brown separates *R. stricta* from all other members of subg. *Lentoramaria*.

Some Oregon collections growing on big leaf maple (*Acer macrophyllum*) were found to have *i*) a small size (≤ 3 cm tall) and relatively few strict branches, *ii*) bright to citron yellow or chartreuse mid and upper branches, *iii*) pale peach to salmon colored lower branches, and *iv*) a brunnescent basidiocarp that turned brown where handled or cut. One collection (Exeter 2005-68A), found fruiting on the inside bark of a big leaf maple snag, was entirely white except for citron yellow on the uppermost (0.5 mm) tips.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 147–149.

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 92–99.



Photo by R.L. Exeter 2003-14



Photo by C.D. Marr M405



Photo by Michael Beug



Photo by R.L. Exeter 2005-68A

Ramaria suecica (Fr.) Donk 1933, Mededeel. Univ. Utrecht 9: 105.
=*R. circinans* (Peck) Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 130.

Capsule summary—A pale pinkish white small coral (4–8 × 0.75–3 cm) with pale yellow to pinkish branches with white tips. Humicolous on mostly conifer and occasionally deciduous twigs and needles in autumn. Rare.

Stipe: Short or indistinct, pale dingy ochre when young, deeper ('cinnamon buff') when old.

Rhizomorphic strands: Ill-defined and not extensive, very slender and fragile, often delicately webbed; white; dried strands turning pale lemon yellow in 2% KOH. Mycelial mat small, white.

Under microscope—Hyphae usually somewhat rigid and straight, but often easily collapsed, usually encrusted with crystalline material, 1.5–3.7 µm diam., thin-walled, hyaline, and conspicuously and copiously clamped; clamps inflated ≤ 15 µm broad, broadly ovoid to onion-shaped, somewhat thick-walled, unornamented or very rarely and sparsely ornamented.

Branches: *Petersen:* Pale to pinkish ochre when fresh, cinnamon when old. *Marr & Stuntz:* Fresh fruiting bodies generally 'orange white' with 'grayish orange' to 'brick red' bruises or stains on the lower branches; context 'orange white', quickly darkening after cutting.



Photo by R.L. Exeter 2005-52

Apices: White when young, maturing through pale ochre then pale pinkish cinnamon, aging to light pinkish buff.

Spores: *Petersen:* Lm = 9.0 µm (8.1–10.4 × 3.7–5.2 µm, Em = 2.12 µm), narrowly rhomboidal to cylindrical, usually tapering asymmetrically toward the apiculus and often tapering asymmetrically distally abaxially, roughened in profile; ornamented with coarse, cyanophilous, meandering ridges and scattered warts or papillate of coarse warts only. *Marr & Stuntz:* \bar{x} = 8.5 × 4.1 µm, (7–10 × 3.5–4.5 µm), elongate-ellipsoid with an exaggerated oblique apiculus and obtuse apex; ornamented with small, distinct, cyanophilous tubercles.

Habitat: On humus and leaf mold (usually coniferous but not infrequently deciduous).

Distribution: *Pacific Northwest*—USA (Alaska, Idaho, Minnesota, Oregon); Canada (British Columbia).
Extralimital—USA (New Hampshire, New York, North Carolina, Tennessee); Canada (Alberta), Europe (Finland, Holland, Switzerland).

Diagnostic characters: *Ramaria suecica* can be recognized by its (1) humicolous habit, (2) white to flesh colored basidiocarp, (3) monomitic rhizomorphs, (4) spore size ~ 8.5–9 × 4.1–4.2 µm, (5) unornamented clamp connections, and (6) spores with small cyanophilous tubercles.

Additional comments: Petersen (1975), noting the similarity between *R. rainierensis* and *R. suecica* in the field, pointed out the microscopical differences, "...the inflated clamps of the rhizomorphic strands of *R. suecica* are abundant, and unornamented, while those of *R. rainierensis*, while not so common, are almost invariable heavily and widely ornamented. In addition, the two types of skeletalized hyphae are present in the rhizomorphic strands of *R. rainierensis*." Finally, the spores of *R. suecica* (~ 4.1–4.2 µm wide) are narrower than those in *R. rainierensis* (~ 5.0 µm wide).

Marr & Stuntz (1973) descriptions above are for what they called *R. circinans* var. *anceps*, which Petersen (1975) synonymized with *R. suecica* two years later. Index Fungorum (www.indexfungorum.org, July 28, 2006) accepts that synonymy.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 130–132. (as *R. circinans* var. *anceps*)

Petersen R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 99–103.



Photo by R.L. Exeter 2005-52B

Ramaria tsugina (Peck) Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 150

≡ *Clavaria tsugina* Peck. 1903. *Bull. N.Y. St. Mus.* 67: 27–285.

≡ *R. concolor* f. *tsugina* (Peck) R.H. Petersen 1975, *Bibl. Mycol.* 43: 64.

=*R. tsugina* var. *prasina* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 150

Capsule summary—A small (≤ 10 cm \times 5 cm) ‘bushy’ brownish-orange coral with pale green branch tips that lacks a stipe and branches directly from the substrate. Lignicolous on rotting coniferous wood in the autumn. Rare.

Stipe: Marr & Stuntz [‘var. *prasina*’]: Small or not distinct (“branches directly from the substratum”); Petersen [‘f. *tsugina*’]: Distinct $\leq 7 \times 12$ mm.; rapidly turning burgundy where bruised.

Rhizomorphic strands: Tangled under a small basal tomentose mat, slender; white.

Under microscope—Marr & Stuntz [‘var. *prasina*’]: Hyphae of rhizomorphic strands of two types; a) generative – 2–4 μ m diam., clamped, often ampulliform near septa, thin-walled; b) skeletal – 3.5–3[sic] μ m diam, thick-walled, ≤ 1.5 μ m thick. Hyphae of tomentum narrow, 2–3 μ m diam., thin-walled, clamped, but without ampulliform inflations.” Petersen [‘f. *tsugina*’]: Hyphae of basal mat and rhizomorphic strands of two types; a) generative – 2.4–4.5 μ m diam., thin-walled, densely interwoven, hyaline, and with conspicuous, usually delicately punctulate, inflated clamps ≤ 12 μ m diam.; b) skeletal – common to abundant, straight but flexible, aseptate, 1.3–2.2 μ m diam., thick-walled.

Branches: Marr & Stuntz [‘var. *prasina*’]: Branches mostly ‘brownish orange’, a few discoloring to ‘reddish brown’; context yellowish-white. Petersen [‘f. *tsugina*’]: Major branches few, stout, divergent; branches \pm erect, numerous, round in cross-section; strongly brownish burgundy when bruised; Peck (1903): “young ‘plants’ and growing tips creamy yellow, older parts and mature plants vinaceous cinnamon or reddish brown. Axils show obvious greenish coloration.”

Apices: Marr & Stuntz [‘var. *prasina*’]: Apices minutely virescent, pastel green. Petersen [‘f. *tsugina*’]: ≤ 4 mm long; creamy yellow when young, aging to some shade of cinnamon.

Spores: Marr & Stuntz [‘var. *prasina*’]: $\bar{x} = 8.7 \times 4.6$ μ m (7–10 \times 3.5–5 μ m) ellipsoid with a truncate apiculus, finely ornamented with low small cyanophilous warts. Petersen [‘f. *tsugina*’]: $L_m = 9.1$ μ m (7.0–9.3 \times 3.5–4.2 μ m, $E^m = 1.93$ μ m), ellipsoid to subcylindrical, roughened; ornamented with scattered, low, strongly cyanophilous warts.

Habitat: Marr & Stuntz [‘var. *prasina*’]: On rotting coniferous wood. Petersen [‘f. *tsugina*’]: On coniferous wood (*Tsuga canadensis* [eastern hemlock]).

Distribution: Pacific Northwest [‘var. *prasina*’] —USA (Oregon, Washington – Sulfur Creek (Snohomish Co.), 1965 type locality for *R. tsugina* var. *prasina*). Extralimital—USA (New York: 1902 type locality for *Clavaria tsugina*).

Diagnostic characters: *Ramaria tsugina* can be recognized by its (1) lignicolous habit on decaying hemlock, (2) green colors of stipe, branch axils, and/or branch tips, (3) warted spores ~ 8.7 –9.1 μ m long, and (4) dimitic rhizomorphs.

Additional comments: *Ramaria apiculata*, a green-staining species that resembles *R. tsugina*, can be distinguished by its monomitic rhizomorphs and slightly longer spores.

The key and the capsule summary above are based on the 1965 Washington holotype of *R. tsugina* var. *prasina* described by Marr & Stuntz (1973). Before naming their new variety, the authors also examined the New York holotype of *Clavaria tsugina* [= *Ramaria tsugina* var. *tsugina*]. That specimen had a short but distinct stipe and green colors on both stipe and branch axils, whereas their Washington ‘var. *prasina*’ branched directly from the substrate, had a bushy aspect, and the green color was confined to the branch tips.

Petersen (1975) also examined the *Clavaria tsugina* holotype, noting that the specimen was the “only green-axiled *Ramaria concolor* on record... [and] its preference for *Tsuga* wood ... is unusual for *R. concolor*.” He synonymized *R. tsugina* var. *prasina* with *R. concolor* f. *tsugina*, although he did not examine the Washington type collection.

However, Index Fungorum (www.indexfungorum.org, July 28, 2006) synonymizes both *R. tsugina* var. *prasina* and *R. concolor* f. *tsugina* under *Ramaria tsugina*, based on Stalpers (cf. CBS Aphyllophorales database, n.d.).

We have decided here to use *Ramaria tsugina*. We agree that it is probably closely related to Petersen's '*R. concolor*,' but feel that the differences in spore size, branch and branch tip colors, and stipe morphology in the Pacific Northwest type collection warrant recognition as a taxon separate from *R. concolor* s.s.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 150–151. (as *R. tsugina* var. *prasina*)

Petersen, R.H. 1975. *Ramaria* subgenus *Lentoramaria* with emphasis on North American taxa. *Bibliotheca Mycologica* 43: 64–66. (as *R. concolor* f. *tsugina*)



Photo by C.D. Marr New York TYPE



Photo by C.D. Marr var. *prasina* TYPE 144



Photo by OSU 26915

Subgenus *Ramaria*



Ramaria botrytis

Photo by R.L. Exeter

Key to *Ramaria* subgenus *Ramaria*

- 1A. Entire basidiocarp white to cream colored, sometimes with faint violet tinged apices 2
- 1B. Basidiocarp distinctly salmon, pink or red colored and with brightly colored apices 3
- 2A. Spores Lm = 14.1 μm (12–18 \times 3.5–6 μm), rarely less than 13 μm *Ramaria subviolacea*
- 2B. Spores Lm = 11.8 μm (10.4–13.7 \times 4.0–5.5 μm), rarely > 12.5 μm *Ramaria rubrievanescens*
- 3A. Spores Lm \leq 12.2 μm 4
- 3B. Spores Lm \geq 13.5 μm 5
- 4A. Stipe milk-white (discoloring yellowish), bruising brownish violet; apices buffy pink to pale rose when young, fading soon after collecting or during maturation to yellowish white; autumnal; spores Lm = 11.8 μm (10.4–13.7 \times 4.0–5.5 μm) *Ramaria rubrievanescens*
- 4B. Stipe white to yellowish-white, surface not staining or bruising; apices pale pink to buffy or blood red, fading over time to dull rosy pink, color persisting after collecting; autumnal or vernal; spores Lm = 12.2 μm (10.4–10.4–15.5 \times 4.0–5.0 μm) *Ramaria rubripermanens*
- 5A. Terminal branches red to pinkish red; spores Lm = 13.8 \times 4.7 μm (11–17 \times 4–6 μm) *Ramaria botrytis* var. *botrytis*
- 5B. Terminal branches light orange to orange-brown; spores slightly shorter than above: Lm = 13.5 \times 4.7 μm (12–16 \times 4–6 μm) *Ramaria botrytis* var. *aurantiiramosa*

Ramaria botrytis (Pers.) Ricken 1918, Vademecum. 253.
var. *botrytis*

Capsule summary—A whitish medium-sized coral (7–12 × 4–12 cm) with reddish white to magenta apices and often massive base. Terrestrial in coniferous forests in autumn.

Stipe: Single, massive; opaque white with stains or bruises varying from pale yellow to light brown; context white, fleshy fibrous to punky firm when fresh.

Stipe context reactions: FSW negative; amyloid but positive reaction slow (often taking ≥ 30 minutes).

Branches: Lower ranks chalk white, upper ranks pale flesh color with a faint violaceous tint.

Apices: Reddish white to grayish ruby or magenta.

Basidia: Clamped.

Spores: $\bar{x} = 13.8 \times 4.7 \mu\text{m}$ (11–17 × 4–6 μm), subcylindrical, mummy-shaped, ornamented with spiraled to nearly longitudinal striae.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest. Extralimital*—Canada (Nova Scotia).

Diagnostic characters: *Ramaria botrytis* var. *botrytis* can be recognized by its (1) reddish to magenta apices, (2) ± massive stipe with yellowish stains, (3) weak amyloid reaction, (4) long (~ 13.8 μm) striate spores, and (5) clamped basidia.

Additional comments: In shape and color, *R. botrytis* could be confused with the shorter spored *R. rubripermanens* or *R. rubrievanescens*. Petersen (1986) notes that *R. botrytis* is further distinguished by having copious abortive branchlets and dark red to purplish apices. Stipes are variable in western Oregon *R. botrytis* collections, either (a) massive or (b) single, slender, and medium-sized.

See *R. rubrievanescens* for additional discussion.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 38–40.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1790–1791.

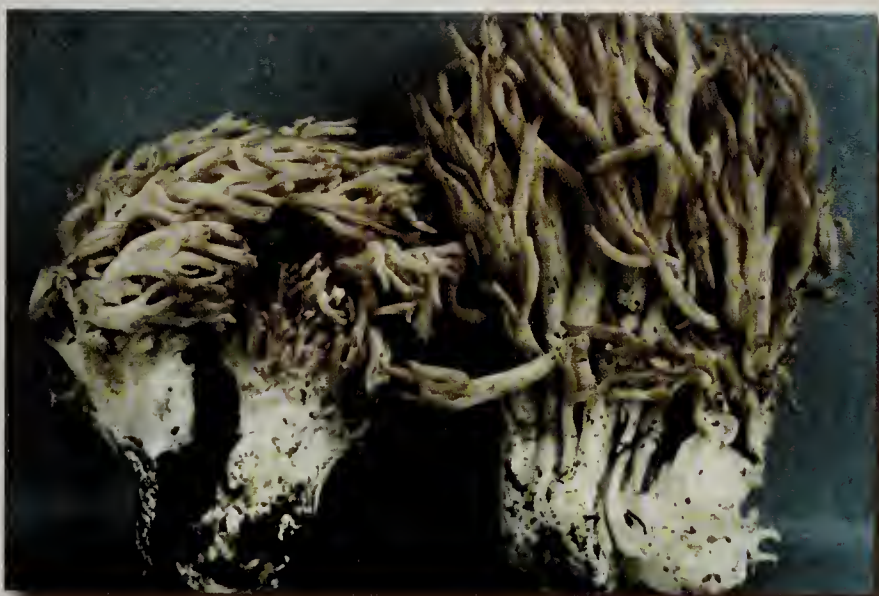


Photo by C.D. Marr M 833



Photo by C.D. Marr TYPE M 457



Photo by R.L. Exeter 2004-49



Photo by R.L. Exeter 2005-59



Photo by R.L. Exeter 2004-49

Ramaria botrytis

var. aurantiiramosa Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 41.

Capsule summary—A white medium-sized broad coral (8–15 × 6–17 cm) with a massive base and light orange branch tips. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single; massive, opaque white, bruising light yellow to grayish orange.

Stipe context reactions: FSW negative; amyloid but positive reaction slow (often taking ≥ 30 minutes).

Branches: Primary branches chalk white, terminal branches light orange or slightly browner.

Apices: Light orange.

Basidia: Clamped.

Spores: $\bar{x} = 13.5 \times 4.7 \mu\text{m}$ (12–16 × 4–6 μm), convex on both front and back, ornamented with steeply oblique striae.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—California (Jedediah Smith Redwood State Park) and Washington (both Mt. Rainier and Olympic National Parks).

Diagnostic characters: *Ramaria botrytis* var. *aurantiiramosa* can be recognized by its (1) orange branch tips, (2) massive stipe, (3) weak amyloid reaction, (4) long (~ 13.5 μm) striate spores, and (5) clamped basidia.

Additional comments: The orange apices distinguish *R. botrytis* var. *aurantiiramosa* from the red to magenta tipped *R. botrytis* var. *botrytis*.

See *R. rubrievanescens* for additional discussion.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 41.



Photo by C.D. Marr M 458

Ramaria rubrievanescens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 41.

Capsule summary— A whitish medium-sized coral ($\leq 20 \times 18$ cm) with a massive stipe that bruises brownish violet and pinkish branch tips that soon fade to white after collecting. Terrestrial in coniferous forests in autumn.

Stipe: Massive with occasional small abortive or primordial branches; milk-white, discoloring yellowish and bruising brownish violet (drab); context white, fleshy fibrous.

Stipe context reactions: FSW negative; amyloid. Although the literature notes that the positive purplish reaction is relatively slow; several western Oregon specimens have reacted quickly to Melzer's.

Branches: Yellowish white when mature.

Apices: Primordial branch tips first flushed with a shell pink color that is lost during maturation or soon after collecting (i.e., 'evanescent'), then concolorous with the lower branches.

Basidia: Clamped.

Spores: *Petersen:* $L_m = 11.8 \mu\text{m}$ ($10.4\text{--}13.7 \times 4.0\text{--}4.7 \mu\text{m}$, $E_m = 2.67 \mu\text{m}$), mummy-shaped, smooth in profile, ornamented with delicate, closely spaced striae in an abaxial-distal to adaxial-proximal orientation. *Marr & Stuntz:* $\bar{x} = 11.7 \times 4.9 \mu\text{m}$ ($11\text{--}13 \times 4\text{--}5.5 \mu\text{m}$), mummy-shaped, ornamented with cyanophilous striae.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest. Extralimital*—Canada (Nova Scotia).

Diagnostic characters: *Ramaria rubrievanescens* can be recognized by its (1) massive browning stipe, (2) branch tips that rapidly lose their pink colors, (3) striate spores, and (4) clamped basidia.

Additional comments: *Ramaria rubrievanescens* is unique in having pink upper branches and apices that fade during development or soon after collection. Often only the protected primordial branches retain the pink colors. The species otherwise most resembles *R. rubripermanens*. The longer lasting pink colors on the tips, the non-browning stipe, and slightly shorter spores distinguish *R. rubripermanens*. Petersen and Scates (1988) note, "*R. rubripermanens* is rather variable in color, and fruits vernal and autumnally, while *R. rubrievanescens* is always pink to pale pink over the apices, always show rufescent stipe surfaces, and apparently only fruits autumnally."

Although *R. botrytis* and *R. subviolacea* have longer spores than either *R. rubrievanescens* or *R. rubripermanens*, entirely white *R. rubrievanescens* and smaller spored *R. subviolacea* specimens may be difficult to differentiate.

R. botrytoides and *R. coulterae*, which greatly resemble species in subg. *Ramaria*, lack clamp connections and have non-amyloid stipe tissue and warted (non-striate) spores. *R. botrytoides* branch tips do have a transitory color (pinkish orange) similar to *R. rubrievanescens*, but its branch context is yellow, and spores are warted. *Ramaria coulterae* has a 'rusty root' (brown band) in the stipe context and smooth to finely warted spores.

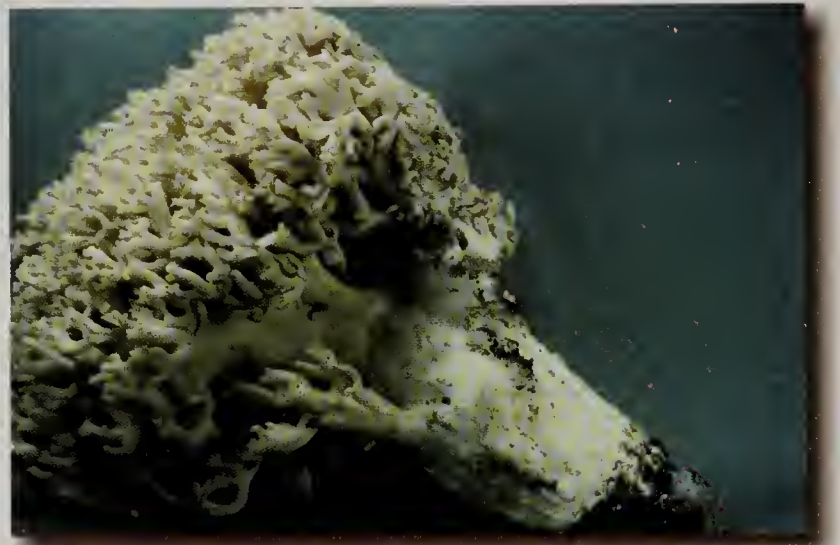


Photo by C.D. Marr M809

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 41–43.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1790–1791.

Petersen, R.H. and C. Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 105–108.



Photo by C.D. Marr TYPE M584



Photo by C. Scates 5944

Ramaria rubripermanens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 43.

Capsule summary—A whitish to pinkish medium to large coral (up to 20 × 10 cm) with a non-bruising massive stipe and pink to reddish branch tips. Terrestrial in coniferous forests primarily in the spring but also in autumn.

Stipe: Moderately large to massive, with clusters of abortive branchlets toward the top, white to off-white, non-staining; context white, firm and hard when young, becoming soft and fleshy in age.

Stipe context reactions: FSW negative; amyloid, with the deep violet-brown positive reaction often occurring slowly.

Branches: White when young, ivory to fleshy cinnamon when mature.

Apices: At first pale pink to buffy or blood red (especially where protected); over time fading significantly to dull rosy pink; color persisting after harvest (i.e., not 'evanescent').

Basidia: Clamped.

Spores: *Petersen:* Lm = 12.2 μm (10.4–15.5 × 4.0–5.0 μm, Em = 2.6 μm), ellipsoid to sub-boletoid; ornamented with prominent cyanophilous striae. *Marr & Stuntz:* \bar{x} = 10.3 × 3.8 μm (8–13 × 3.5–4.5 μm), sub-ellipsoid to mummy-shaped, ornamented with longitudinal striae.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria rubripermanens* can be recognized by its (1) pink to red apices that generally do not fade, (2) non-brunnescent stipe, (3) striate spores, and (4) clamped basidia.

Additional comments: It is difficult to distinguish *R. rubripermanens* from *R. rubrievanescens*. Petersen and Scates (1988) offer the following, i) the pink colors last longer in *R. rubripermanens*, ii) *R. rubripermanens* has non-staining stipe surfaces, and iii) *R. rubrievanescens* is only known from autumn collections.

Spore lengths for *R. rubripermanens* cited in Petersen and Scates (1988) are considerably longer than those in Marr and Stuntz (1973). Marr and Stuntz cited spore data from only 4 (2 autumn, 2 vernal) collections. Petersen and Scates spore data was arrived from many more collections.

See *R. rubrievanescens* for additional discussion.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 43–45.

Petersen, R.H. and C. Scates. 1988. Vernaly fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 104–108.



Photo by M. Beug 51



Photo by Tom O'Dell OSU 9098



Photo by Dick Bishop

Ramaria subviolacea R.H. Petersen & Scates 2000, *Karstenia* 40: 139.

Misapplication = *R. strasseri* sensu Marr & Stuntz (1973)

Capsule summary— An entirely white medium to large coral (8–23 × 6–23 cm) with a massive base and with faint violet hue to the upper branches. Terrestrial in coniferous forests in early summer and autumn.

Stipe: Single, often comprising more than half the height of the entire basidiocarp, off-white; context white, solid fleshy-fibrous.

Stipe context reactions: FSW negative; amyloid (violet-brown positive reaction quick and distinct).

Branches: Off-white to yellowish gray.

Apices: Vinaceous drab when young, mellowing to yellowish gray.

Basidia: Clamped.

Spores: *Petersen:* Lm = 14.1 μm (12.0–18.0 × 5.0–7.0 μm, Em = 2.39 μm); ellipsoid, longitudinally to obliquely striate.
Marr & Stuntz: \bar{x} = 14.3 × 4.6 μm (11–20 × 3.5–6 μm), mostly subcylindrical to mummiform, ornamentation strongly cyanophilous, steeply spiraled, sometimes sub-reticulate or rarely striate-verrucose.



Photo by R.L. Exeter 2003-12

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria subviolacea* can be recognized by its (1) off white basidiocarp, (2) massive stipe, (3) overall buffy violaceous or avellaneous branch apices, (4) brunnescent basidiocarp, (5) strong amyloid reaction, (6) striate spores, and (7) clamped basidia.

Additional comments: *Ramaria subviolacea* may be our only known described “white” species within the subgenus *Ramaria*. Petersen and Scates (2000) note,

“Within subgenus *Ramaria* there is a complex of taxa exhibiting similar basidiomata; all with buffy violaceous or avellaneous branch apices, and all with massive stipes. The European material is *R. strasseri* (Bres.) Corner.... “It would appear that *Ramaria subviolacea* is the same as at least some of the specimens cited by Marr and Stuntz (1973: 46-47) under *R. strasseri*.”

The above Marr & Stuntz (1973) descriptions are for what they were calling *R. strasseri*. They cited two species similar to *R. strasseri* but with smaller spores: i) *R. secunda* (Berk.) Corner (spores 9.5–13 × 3–5 μm) and ii) *R. crassipes* Peck (spores 9.5–12 × 4–5 μm).

Several western Oregon collections fit the macroscopic description for *R. subviolacea* but have much smaller spores (Lm = 11.6 μm; 10–13 × 3.5–5.0 μm) than those documented for *R. subviolacea*. In addition, a few collections were found in early June and July. Future studies of the “white” species within the subgenera *Ramaria* may reveal additional species from western North America.

Petersen and Scates (1988) mentioned the difficulty in separating mature (or over-mature) specimens of *R. rubrievanescens* from *R. subviolacea* [Marr’s *R. ‘strasseri’*]: “the latter was characterized in [Marr’s doctoral dissertation] as follows: (1) pale yellow to light tan fruiting bodies [and] (2) sweet, spicy aroma.” They suggest that as the type description and European collections of *R. strasseri* seems to restrict the color range to “pinkish beige to cinnamon tan fruitbodies with somewhat violaceous apices, ... Marr’s inclusion of pale yellow fruitbodies may be too permissive.”

See *R. rubrievanescens* for additional discussion.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 45–49. (as *R. strasseri*)

Petersen, R.H. and C. Scates. 1988. Vernaly fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 107-109.

Petersen, R.H. and C. Scates. 2000. A New Species of *Ramaria* subg. *Ramaria* from western North America *Karstenia* 40: 139-142.



Photo by R.L. Exeter 2004



Photo by C.D. Marr 534 (as *R. strasseri*)

Subgenus *Laeticolora*
Species with Clamped Basidia



Ramaria formosa

Photo by R.L. Exeter

Key to *Ramaria* subg. *Laeticolora*—species with clamped basidia

- 1A. Basidiocarps (at least at the stipe apex or lower branches) lilac, violet or purple 2
- 1B. Basidiocarp not lilac, violet or purple 3
 - 2A. Branches and apices intensely violet to purple (amethyst-lilac when young, remaining so or aging to ochraceous purple; spores Lm = 10.29 μm (9–11.2 \times 4.7–5.4 μm) *Ramaria purpurissima* var. *purpurissima*
 - 2B. Branches and apices less intense (pale to dull violet when young, aging smoky drab, cinnamon, or dark olive); spores Lm = 10.42 μm (9–13 \times 4.3–5.4 μm) *Ramaria violaceibrunnea*
- 3A. Stipe compound (a gelatinous mass of fused stipes); spores Lm = 8.9 μm (7–10 \times 4.5–6 μm)..... *Ramaria gelatinosa* var. *oregonensis*
- 3B. Stipe various (*not* a mass of fused gelatinous stipes) or spores not as above 4
 - 4A. Any basidiocarp part bruising brown or wine-colored immediately when cut; FSW instantly turning stipe context blue-green; white stipe mostly single and covered with white tomentum; branches "maize yellow" when young, then red-brown with tips remaining yellow; spores Lm = 11.76 μm (9.5–14 \times 4.2–6.4 μm) *Ramaria testaceoflava*
 - 4B. Not as above 5
- 5A. Stipe with 'rusty root' (brown band) in radial section; stipe flesh usually blue green in FSW; stipe base often streaked with red-brown superficial hyphae 6
- 5B. Stipe lacking 'rusty root' (brown band) in radial section; stipe flesh not blue green in FSW; stipe usually lacking streaked red-brown superficial hyphae 8
 - 6A. Stipe flesh instantly turning blue-green on application of FSW 7
 - 6B. Stipe flesh not turning blue-green on application of FSW undescribed *Ramaria* spp. Petersen & Scates (1988) knew of two undescribed taxa with brownish stipe flesh that did not react immediately to ferric salts. Both were clamped and autumnal fruiters.
- 7A. Stipe context amyloid (dried specimens instantly turning dark brown); branches light orange to salmon; spores Lm = 8.9 μm (7–10 \times 3–4 μm) *Ramaria amyloidea*
- 7B. Stipe context non-amyloid; branches (creamy) white to pale yellow; spores Lm = 9.0 μm (8–12 \times 3.5–5 μm) *Ramaria velocimutans*
- 8A. Stipe slender, sub-fasciculate, covered with a well developed white tomentum; branches and apices (citron) yellow to pale salmon; acantho-dendroid gloeoplerous hyphae (multi-directional, freely branched, studded with lateral spurs, narrow, thin-walled, in cotton blue densely cyanophilous granular) present in the peripheral stipe context *Ramaria cystidiophora*

Key to *Ramaria cystidiophora* varieties:

- A. Spore Lm = 8.0 μm ; branches yellow or salmon B
- A. Spore Lm \geq 9.5 μm ; branches yellow, lacking salmon tinge or pigments C
 - B. Branches and tips yellow to citron yellow; spores Lm = 8.0 μm (7–9 \times 3–4 μm) *R. cystidiophora* var. *cystidiophora*
 - B. Branches pale salmon with light clear yellow young tips (tips faded when mature); spores Lm = 8.2 μm (7.6–8.6 \times 3.2–3.9 μm) *R. cystidiophora* var. *anisata*
- C. Stipe context cartilagino-gelatinous (basal hyphal walls gelatinizing); basidiocarps not bruising or staining; odor fabaceous; spores Lm = 9.7 μm (8–11 \times 3.5–5 μm) *R. cystidiophora* var. *fabiolens*
- C. Stipe context fleshy-fibrous (no gelatinization); basidiocarps bruising brown to reddish; odor sweet or none; spores Lm \geq 10.3 μm D

- D. Spores Lm = 10.3 μm (9–13 \times 3.5–5.0 μm); basidiocarps bruising brown..... *R. cystidiophora* var. *citronella*
- D. Spores Lm = 11.8 μm (10–14 \times 3.5–5.0 μm); basidiocarps bruising reddish-brown *R. cystidiophora* var. *maculans*
- 8B. Not as above; acantho-dendroid gloeoplerous hyphae absent in peripheral context of stipe 9
- 9A. Base and lower stipe with wine-colored stains 10
- 9B. Base lacking wine-colored stains or bruises 11
- 10A. Branches peach to salmon with yellow tips; stipe context slowly amyloid (up to 45 minutes;) spores Lm = 10.2 μm (9–11 \times 4–5 μm) *Ramaria maculatipes*
- 10B. Both branches and tips yellow-white to pale yellow; stipe context non-amyloid; spores Lm = 12.5 μm (11.2–14.0 \times 4.3–5.0 μm) *Ramaria vinosimaculans*
- 11A. Spores Lm \geq 12.5 μm (warted); stipe flesh non-amyloid 12
- 11B. Spores Lm \leq 12 μm (smooth to warted); stipe flesh amyloid or non-amyloid 14
- 12A. Basidiocarp white to pale yellow; stipe massive; vernal (spores Lm = 13.28 μm , 11.6–15.8 \times 4.0–5.0 μm) *Ramaria thiersii*
- 12B. Basidiocarp light orange to salmon; stipe slender; autumnal 13
- 13A. Both branches and tips intense orange; stipe broadly conical with small abortive branchlets frequent on the upper base; spores Wm = 4.5 μm , Lm = 13.4 μm (11–15 \times 3–5 μm) *Ramaria largentii*
- 13B. Branches flesh-pink to salmon colored with bright orange tips; stipe bluntly acute or obconical and lacking abortive branchlets; spores Wm = 5.3 μm , Lm = 13.7 μm (12.6–16.3 \times 4.8–6.3 μm) *Ramaria distinctissima* var. *americana*
- 14A. Branches orange, salmon, or red; if yellow, then branch context salmon or orange 15
- 14B. Branches yellow to cream colored (lacking orange to red to salmon colors) 18
- 15A. Spores Wm = 5.4 μm ; branches peach, light red to salmon colored & stipe context non-amyloid; apices yellow when young; basidiocarp staining or bruising wherever handled; spores coarsely warted (Lm = 10.4 μm ; 9–12 \times 4.5–6 μm) *Ramaria formosa*
- 15B. Spores Wm \leq 4.5; branches orange (if salmon colored, stipe context amyloid, see *R. rubricarnata*); apices yellow to orange; basidiocarp browning or not where handled; spores ornamented with fine to low warts and ridges 16
- 16A. Stipe base flesh non-amyloid; stipe single to fasciculate, slender to large; branches orange to light red with concolorous or yellow tips; autumnal 17
- 16B. Stipe base flesh amyloid; stipe single, large to massive; branches light orange, pale salmon-buff to yellow to salmon-orange with yellow tips; autumn & spring..... *Ramaria rubricarnata*

Key to *Ramaria rubricarnata* varieties (from Petersen & Scates 1988):

- A. Autumnal; spores Lm \sim 10 μm (8.6–1.2 \times 4.0–4.7 μm); branches pale cream to salmon-yellow (occasionally yellow) with pale to light yellow tips.....*R. rubricarnata* var. *rubricarnata*
- A. Vernal; spores Lm \geq 11.1 μm ; stipe, branches, and tips as above or paler B
- B. Branches short stalked, salmon-orange to light salmon with salmon-orange flesh and yellow to rich yellow tips; spores Lm = 11.1 μm (10.4–12.2 \times 4.0–5.0 μm)..... *R. rubricarnata* var. *verna*
- B. Branches elongated, buff colored to pale buffy yellow with muted pinkish-buff branch flesh and dull greenish-yellow (young) to light yellow (mature) tips; spores Lm = 11.4 μm (9.7–14.4 \times 4.0–4.7 μm) *R. rubricarnata* var. *pallida*

- 17A. Spores Lm = 10.6 μm (8–13 \times 3–5 μm); basidiocarp elongated; branches light orange to light red with sunflower/dark yellow or chrome orange tips; stipe context fleshy fibrous; bruising or staining reactions slight or entirely absent *Ramaria leptiformosa*
- 17B. Spores Lm = 8.1–8.6 μm (6.5–10 μm); basidiocarp mostly compact; branches pale to deep orange with orange or yellow tips; stipe context sub-gelatinous to rubbery; outer stipe occasionally with dull violet bruised areas *Ramaria sandaracina*

Key to *Ramaria sandaracina* varieties:

- A. Apices bright yellow when young; spores Lm = 8.6 μm (6.5–9.0 \times 3.5–4.5 μm) *R. sandaracina* var. *euosma*
- A. Apices orange; spore Lm = 8.1–8.3 μm B
- B. Basidiocarps broad (commonly > 8 cm wide); stipe base sub-gelatinous with gelatinous streaks present when cut and numerous elongated primary branches arising from a broad fasciculate to compound base; branches and tips salmon to orange; spores Lm = 8.3 μm (7–10 \times 3.5–5 μm) *R. sandaracina* var. *chondrobasis*
- B. Basidiocarps slender (usually < 8 cm wide); stipe base sometimes slightly gelatinous in part with several primary branches arising from a single stipe; lower branches and upper base bright yellow, upper branches and tips deep orange; spores Lm = 8.1 μm (6.5–9.0 \times 3.5–4.5 μm) *R. sandaracina* var. *sandaracina*
- 18A. Spores entirely smooth or almost smooth at 1000x; primarily vernal 19
- 18B. Spores distinctly warted at 1000x; primarily autumnal 22
- 19A. Spore Lm = 11.5; stipe surface weakly brunnescent; stipe massive; vernal; (*R. magnipes*) 20
- 19B. Spore Lm = 10.0–10.6; stipe surface not brunnescent; stipe large to massive; vernal and autumnal; (*R. rasilispora*) 21
- 20A. Branches white to very pale yellow (cream to ivory where exposed); tips pale yellow (young) or bright greenish-yellow where unprotected; spores Lm = 11.5 μm (10.8–11.9 \times 3.6–4.3 μm) *Ramaria magnipes* var. *albidior*
- 20B. Branches light to clear yellow when young (pale fleshy ochre to fleshy tan in age); tips when young cauliflower-like and white where protected or bright yellow to chartreuse-yellow where exposed, in age mellowing to buff-colored; spore Lm = 11.5 μm (9.4–13.3 \times 3.2–5.0 μm) *Ramaria magnipes* var. *magnipes*
- 21A. Branches buffy yellow, pale ochraceous yellow to fleshy buff when young; tips pale chartreuse-yellow but often blushing to onion skin pink if exposed to cold, dry air; vernal; spores Lm = 10.0 μm (8.3–11.5 \times 3.6–4.3 μm) *Ramaria rasilispora* var. *rasilispora*
- 21B. Branches pale to ochraceous cream colored (sometimes with a hint of pink in age) or cream buff; young tips clear yellow or pale greenish-yellow aging buff-colored; vernal and autumnal; spores Lm = 10.6 μm (9.4–11.9 \times 3.2–4.3 μm) *Ramaria rasilispora* var. *scatesiana*
- 22A. Stipe context amyloid 23
- 22B. Stipe context non-amyloid 24
- 23A. Spores Lm \geq 10 \times 4.0–4.7 μm wide; basidiocarp cream to salmon-yellow; branch context salmon or orange *Ramaria rubricarnata* (see lead 16B)
- 23B. Spores Lm = 9.1 μm (7–10 \times 3–4.5 μm); basidiocarp pale yellow to yellow; branch context white to pale yellow *Ramaria rasilisporoides*
- 24A. Spores Lm = 10.4 μm , Wm = 4.0 μm (9–12 \times 3–5 μm), and covered with small obscure warts; basidiocarp pale yellow; odor sweet (like gardenias or curry) *Ramaria flavobrunnescens* var. *aromatica*
- 24B. Spores Lm \leq 9.3 μm , Wm \geq 4.5 μm , and covered with distinct warts; basidiocarp pale buff to brownish yellow; odor musty to faintly bean-like (fabaceous) 25

- 25A. Branches and tips brownish yellow to 'mustard yellow'; spores Lm = 8.8 μm (7.5–11 \times 4–6 μm)
..... *Ramaria cartilaginea*
- 25B. Branches and tips pale buff to light tan to coffee colored; spores Lm = 9.3 μm (8.3–10.4 \times 4.7–5.8 μm)
..... *Ramaria caulifloriformis*

Ramaria amyloidea Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 53.

Capsule summary—An orangish medium-sized coral (7–13 × 5–15 cm) with light orange branches, light orange to yellow tips, and a frequently large stipe with scattered brown patches outside and a brown band in the flesh. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single, often massive for size of basidiocarp, white to orange white with sub-areolate regions of brown superficial hyphae (in mature basidiocarps almost entirely brown); radially sectioned context with a rusty root (a distinctive band of pale 'camel brown' hyphae).

Stipe context reactions: FSW positive (instantly 'turquoise green'); instantly amyloid in both fresh (violet-brown) and dried (dark brown) specimens.

Branches: Light orange with a tinge of pale red (occasionally with small violet gray bruised spots).

Apices: Concolorous with branches, slightly more yellow, or darkening.

Basidia: Clamped.

Spores: $\bar{x} = 8.9 \times 3.6 \mu\text{m}$ (7–10 × 3–4 μm), narrowly cylindrical; almost smooth (sometimes entirely) with very fine ornamentations.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—Washington & Oregon (Cascade Mountains), California (northwest).

Diagnostic characters: *Ramaria amyloidea* can readily be recognized by its (1) stipe base streaked with reddish-brown areas, (2) stipe flesh showing a "rusty root" in radial section, (3) stipe flesh with positive amyloid and FSW reactions, (4) narrow cylindrical, nearly smooth spores, and (5) clamp connections.

Additional comments: Clamp connections combined with a stipe context that is both amyloid and turns blue-green in FSW makes *Ramaria amyloidea* unique. The similar *R. celerivirescens* lacks clamps and *R. velocimutans* is non-amyloid, and is cream colored.

Only five other species in subg. *Laeticolora* are both amyloid and clamped: *R. maculatipes*, *R. magnipes*, *R. rasilispora*, *R. rubricarnata*, and *R. rasilisporoides*. Those five species, however, lack a 'rusty root' and have larger spores. Furthermore, *R. magnipes*, *R. rasilispora*, and *R. rasilisporoides* are yellow and *R. maculatipes* develops wine-colored stains.

Ramaria velocimutans and *R. testaceoflava* are the only other described clamped species that have a positive FSW reaction on stipe context and both are non-amyloid.

Ramaria celerivirescens, *R. coulterae* and *R. velocimutans* are the only other described species with a "rusty-root."

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 53–55.



Photo by M. Beug

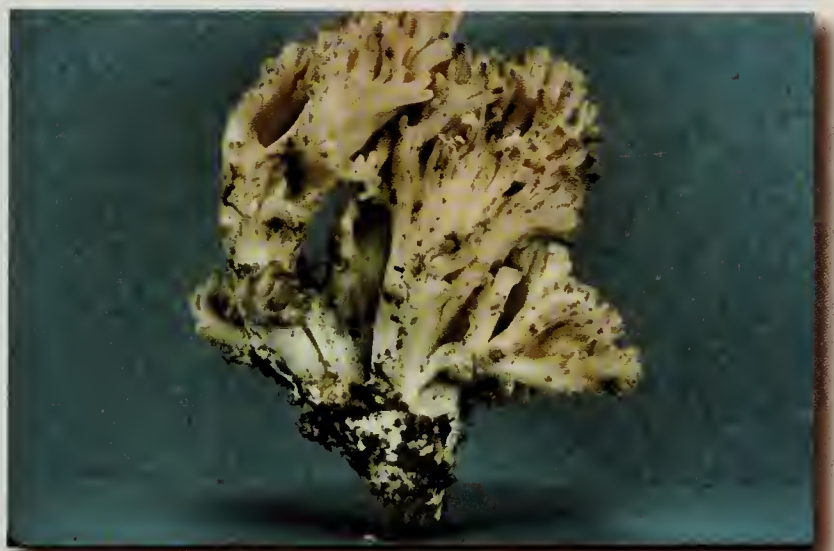


Photo by C.D. Marr M670

Ramaria cartilaginea Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 59.

Capsule summary—A tannish yellowish medium-sized (3–13 × 4.5–10 cm) cartilaginous (brittle) coral. Terrestrial in coniferous forests in autumn.

Stipe: Base usually single, covered with a thin white basal tomentum; underground or unexposed areas white, pale yellow near emergence from substratum.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Brownish 'light yellow' when young, turning more tannish yellow during maturation (especially near the apices).

Apices: Concolorous with branches when young, contrasting slightly in age.

Basidia: Clamped.

Spores: $\bar{x} = 8.8 \times 4.5 \mu\text{m}$ (7.5–11 × 4–6 μm), subcylindrical to ellipsoidal; ornamented with distinct, irregularly lobed, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria cartilaginea* can be recognized by its (1) pale to brownish yellow colors, (2) numerous abortive branchlets, (3) branches and tips contrasting in age, (4) short wide spores (~ 8.8 × 4.5 μm), and (5) clamped basidia.

Additional characters: *Ramaria flavobrunnescens* var. *aromatica*, which could be confused with *R. cartilaginea*, has longer, narrower spores and a sweet odor. Marr & Stuntz (1973) mention *R. cartilaginea* has thick-walled hyphae (0.5–3.0 μm) in the stipe of mature specimens. The hyphae in the stipe of *R. flavobrunnescens* var. *aromatica* is thin to slightly thickened (0.25–1.5 μm). Exeter's field descriptions for *R. cartilaginea* note an overall 'greenish' or 'mustard yellow' hue to the young branches.

See *R. caulifloriformis* for additional discussion.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 59–61.



Photo by R.L. Exeter 2005-83



Photo by R.L. Exeter 2005-87

Ramaria caulifloriformis (Leathers) Corner 1956. *Mycologia* 48:278.

Capsule summary—A brownish to cinnamon colored compact and highly branched medium-sized coral (16×15 cm). Terrestrial in coniferous and hardwood forests in autumn (less often in spring).

Stipe: *Petersen and Scates:* Single to falsely fasciculate with numerous abortive branchlets and clusters (especially high on the stipe), the rounded base mycelial and involving copious substrate when picked; exterior off-white where protected, browning only slightly; context white to off-white. *Leathers:* Short and broad ($1-3 \times 1-3$ cm); stipe white to creamy brown; context watery-marbled, often brittle.

Stipe context reactions: FSW negative; non-amyloid.

Branches: *Petersen & Scates:* Pale buff to pale pinkish buff; flesh 'pale ochraceous buff.' *Leathers:* Branches moderately compact and erect and parallel or tightly compacted, cauliflower-like; uniformly creamy brown to light chocolate brown or darker ('pinkish buff' through 'cinnamon buff'); context white or concolorous, solid and pith-like.

Apices: *Petersen and Scates:* Pale pinkish buff, often turning dark brown where exposed or dried in the field, all upper parts cinnamon in age.

Basidia: Clamped.

Spores: *Petersen and Scates:* $Lm = 9.3 \mu m$ ($8.3-10.4 \times 4.7-5.8 \mu m$, $Em = 1.8 \mu m$), short-cylindrical to broadly ellipsoid, distinctly roughened in profile; ornamentation of small warts, mostly discrete, some lobed in outline. *Leathers:* $8-10 \times 4-5 \mu m$, distinctly verruculose to verrucose.

Habitat: Coniferous forests in the Pacific Northwestern USA. Leathers reports *R. caulifloriformis* occurs in mixed stands of aspen and red oak in Michigan. *R. caulifloriformis* is known from autumnal and vernal collections. However, Petersen and Scates (1988) mention that only two vernal collections of *R. caulifloriformis* have been collected, both from the Sierra Nevada Mountains in California.

Distribution: Pacific Northwest. Extralimital—USA (Midwest).

Diagnostic characters: *Ramaria caulifloriformis* can be recognized by its (1) pale buff to light tan to coffee colors, (2) numerous abortive branchlets, (3) short, wide spores ($\sim 9.3 \times 5.2 \mu m$), and (4) clamped basidia.

Additional comments: *Ramaria caulifloriformis* is microscopically extremely close to *R. cartilaginea*. In their discussion of *R. cartilaginea*, Marr & Stuntz (1973) classify *R. cartilaginea* as a 'yellow' ramaria, noting, "*R. caulifloriformis* and *R. cartilaginea* differ only in fruiting body color." Leathers (1956) describes *R. caulifloriformis* as "uniformly creamy brown to light chocolate brown or darker, tips darkening in age to vinaceous brown." Petersen & Scates (1988) describe *R. caulifloriformis* as pale pinkish buff and list similarities between *R. caulifloriformis* and *R. cartilaginea* and conclude, "*R. caulifloriformis* is an older epithet which should be used in place of *R. cartilaginea*." For the time being, we prefer to recognize two species differentiated by color.

References:

Leathers, C. R. 1956. New Species and Varieties of *Clavaria* From Michigan. *Mycologia* 48: 278-280.

Petersen, R. H. & Catherine Scates. 1988. Vernally Fruiting Taxa of *Ramaria* From the Pacific Northwest. *Mycotaxon* 33: 113-115.



Photo by R.H. Peterson

Ramaria cystidiophora Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 72.
var. *cystidiophora*

Capsule summary—A yellow medium-sized coral ($\leq 10\text{--}12$ cm, usually taller than broad) with a white fuzzy lower stipe, light yellow branches with citron yellow tips, and sweet anise-like odor. Terrestrial in coniferous forests in autumn.

Stipe: Long or sub-fasciculate, tapering downwards, yellowish white or pale yellow, white at the extreme base and covered by a white tomentum; cartilaginous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Buff yellow to warm buff, upward citron yellow.

Apices: Citron yellow.

Basidia: Clamped.

Spores: $\bar{x} = 8 \times 3.6 \mu\text{m}$ ($7\text{--}9 \times 3\text{--}4 \mu\text{m}$), subcylindrical with a suprahilar depression; ornamented with fine warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cystidiophora* var. *cystidiophora* can be recognized by its (1) citron yellow colors, (2) well defined white tomentum covering the stipe base, (3) fruitbody that does not stain or become brown, (4) sweet odor similar to anise, (5) acantho-dendroid gloeoplerous hyphae in the outer stipe context, (6) small narrow spores ($W_m \sim 3.6 \mu\text{m}$), and (7) clamped basidia.

Additional comments: The citron yellow colors, elongate fruitbodies, and fasciculate stipe covered in white tomentum diagnose *Ramaria cystidiophora* in the field. Petersen (1989) points out, "Fruitbodies of all taxa in the *cystidiophora* complex (except *R. c.* var. *anisata*) are yellow, with attenuate, slender stipe bases usually covered in white tomentum." This group can be further distinguished by the presence of acantho-

dendroid gloeoplerous hyphae in the lower stipe, introduced to Marr & Stuntz by Petersen. Marr & Stuntz (1973) explain, "In *R. cystidiophora* acantho-dendroid gloeoplerous hyphae occur in the peripheral regions of the stipe context. This hyphal type is characteristically freely branched and studded with lateral spurs, multi-directional, of narrow diameter, thin-walled, and containing a densely cyanophilous, granular protoplasm." These cells are best viewed when stained with cotton blue or a similar reagent.

Varieties are distinguished as follows: i) '*cystidiophora*' has the shortest spores ($\leq 8.5 \mu\text{m}$) and a sweet anise-like odor, ii) '*anisata*' has peach colored branches and a sweet anise-like odor, iii) '*fabiolens*' has spores $\sim 9.7 \mu\text{m}$ long and a string bean odor, iv) '*citronella*' bruises brownish and has spores $\sim 10.3 \mu\text{m}$ long and the sweet odor of citrus blossoms, and v) '*maculans*' bruises reddish-brown and has spores $\sim 11.8 \mu\text{m}$ long.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 72–73.

Petersen, R. H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. 14(1): 39.



Photo by R.L. Exeter
acantho-dendroid gloeoplerous hyphae



Photo by R.L. Exeter 2004-57

Ramaria cystidiophora

var. *anisata* R.H. Petersen 1988. *Mycologia* 80 (2):223.

Capsule summary—A peach-colored small to medium coral (11 × 6 cm, usually taller than broad) with a white fuzzy lower stipe, light peach branches with yellow tips, and sweet anise-like odor. Terrestrial in coniferous forests in autumn.

Stipe: Single, slender, tapering gradually downward, hoary white, rooting, often geniculate or gnarled below substrate level, often falsely fasciculate, sometimes with a few abortive branchlets, weakly watery-brunnescent where handled; context off-white, moist but not slippery.

Stipe context reactions: FSW not recorded; amyloid (positive reaction noted as *purple-green* on stipe flesh). Two Oregon collections have been recorded as FSW negative and non-amyloid.

Branches: Pale or light ochraceous salmon, opaque, often ruddy in age; outer context concolorous with surface, inner context whitish and stringy.

Apices: Light clear yellow when young, fading slightly when mature.

Basidia: Clamped.

Spores: Lm = 8.2 μm (7.6–8.6 × 3.2–3.9 μm , Em = 2.2 μm), cylindrical to narrowly ellipsoid; roughened in profile and ornamented with scattered small, flat warts (sometimes arranged in oblique rows).

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—California (Mendocino County), Oregon (Benton & Lane Counties).

Diagnostic characters: *Ramaria cystidiophora* var. *anisata* can be recognized by its (1) pale salmon (peachy) branches, (2) yellow branch tips, (3) stipe covered by a well defined white fuzz (tomentum), (4) strong spicy anise-like odor, (5) acantho-dendroid gloeoplerous hyphae in the exterior stipe context, (6) small narrow spores (~ 8.2 × 3.7 μm), and (7) clamped basidia.

Additional comments: The peach to salmon colors separate *Ramaria cystidiophora* var. *anisata* from all other *R. cystidiophora* varieties. It is most similar to var. *cystidiophora*. Recent Oregon specimens are fairly strict (elongated) with a stipe covered by a well-developed tomentum and pale 'creamsicle' orange branches with yellow tips.

See *R. cystidiophora* var. *cystidiophora* for additional discussion.

Reference:

Petersen, R.H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany. *Mycologia*, 80(2): 223-234.

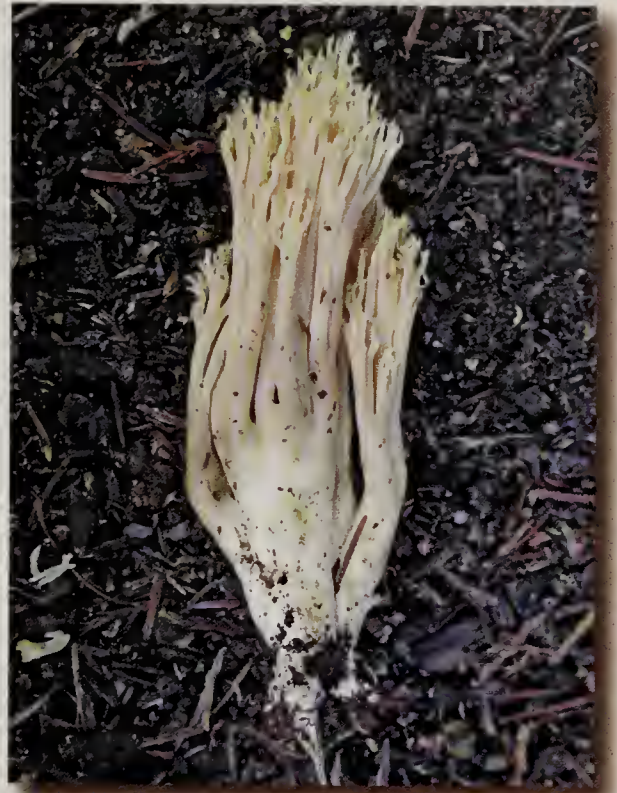


Photo by R.L. Exeter 2005-75



Photo by R.L. Exeter 2005-86



Photo by R.L. Exeter 2005-24

Ramaria cystidiophora

var. *citronella* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 73.

Capsule summary—A yellowish (brunnescent) small to medium coral (9–13 × 3.5–5 cm, usually taller than broad) with a white fuzzy lower stipe, citron yellow branches and tips, and sweet orange blossom-like odor. Terrestrial in coniferous forests in autumn.

Stipe: Single or compound, white, covered with a well defined white tomentum, stipe and lower branches bruising brown, camel brown or sometimes with a faint reddish tinge; context fleshy-fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: 'Light yellow'; context yellowish white.

Apices: Concolorous with branches or brighter ('maize' or 'sunflower') yellow.

Basidia: Clamped.

Spores: $\bar{x} = 10.3 \times 4.2 \mu\text{m}$ (9–13 × 3.5–5 μm), subcylindrical with a slight dorsal convexity and suprahilar depression; ornamented with fine cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cystidiophora* var. *citronella* can be recognized by its (1) yellow branches with intense yellow tips, (2) stipe covered by a well defined white fuzz (tomentum), (3) brunnescent basidiocarp, (4) pungently sweet orange-blossom odor, (5) acantho-dendroid gloeoplerous hyphae in the exterior stipe context, (6) spores ~ 10.3 μm long, and (7) clamped basidia.

Additional characters: *Ramaria cystidiophora* var. *citronella* appears to be the 'common' variety in western Oregon and Washington. Its elongate growth form, citron yellow upper branches and apices, and distinctive citrus odor are distinctive. Marr & Stuntz (1973) note, "Variety *citronella* differs from variety *cystidiophora* by its non-gelatinizing hyphae and larger spores, from variety *fabiolens* by its pungently sweet odor and non-gelatinizing hyphae, and from variety *maculans* by not staining 'reddish brown' and its shorter spores (average length 10.3 μm versus 11.8 μm)." Variety *anisata* has peach to salmon colored branches.

See *R. cystidiophora* var. *cystidiophora* for additional discussion.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 73–75.

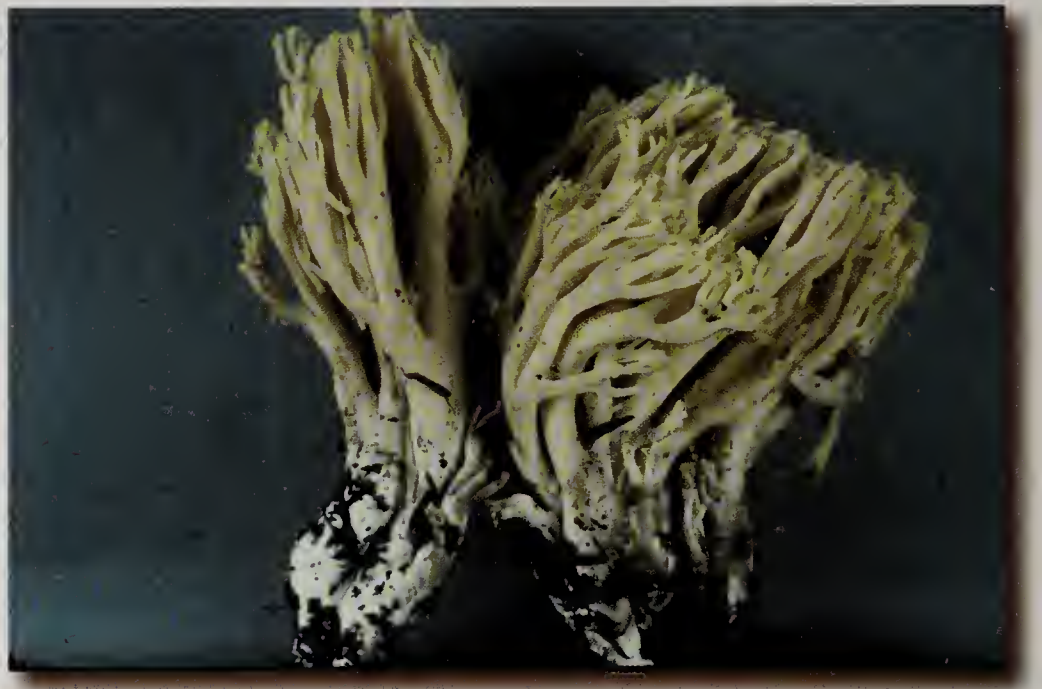


Photo by C.D. Marr TYPE M715



Photo by R.L. Exeter 2004-58



Photo by R.L. Exeter 2005-49



Photo by C.D. Marr M750



Photo by R.L. Exeter 2004 - 58c

Ramaria cystidiophora

var. *fabiolens* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 75.

Capsule summary—A yellow medium-sized coral (9–19 × 7–15 cm) with a white fuzzy lower stipe, light yellow branches and tips, and string bean like odor. Terrestrial in coniferous forests in autumn.

Stipe: Single or fasciculate, frequently several axes originating from a connate basal mass and small abortive or primordial basal branch systems commonly present; white or yellowish white and covered with a ± distinct white tomentum; context cartilagino-gelatinous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light yellow (context concolorous).

Apices: Concolorous with branches in older specimens; more intensely yellow (maize, sunflower) when younger.

Basidia: Clamped.

Spores: $\bar{x} = 9.7 \times 4.2 \mu\text{m}$ (8–11 × 3.5–5 μm), subcylindrical to elongate-ellipsoidal with a slight suprahilar depression; ornamented with small irregularly shaped, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cystidiophora* var. *fabiolens* can be recognized by its (1) overall light yellow colors, (2) stipe covered by a well defined white fuzz (tomentum), (3) non-bruising basidiocarp, (4) fabaceous (string bean) odor, (5) acantho-dendroid gloeoplerous hyphae in the exterior stipe context, (6) spores ~ 9.7 μm long, and (7) clamped basidia.

Additional comments: Marr & Stuntz (1973) suggest that “the string-bean like odor, very broad fruiting bodies, and larger spores separate var. *fabiolens* from var. *cystidiophora*.” Both varieties have cartilagino-gelatinous consistency unlike the fleshy fibrous consistency of the other varieties.

See *R. cystidiophora* var. *cystidiophora* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 75–77.

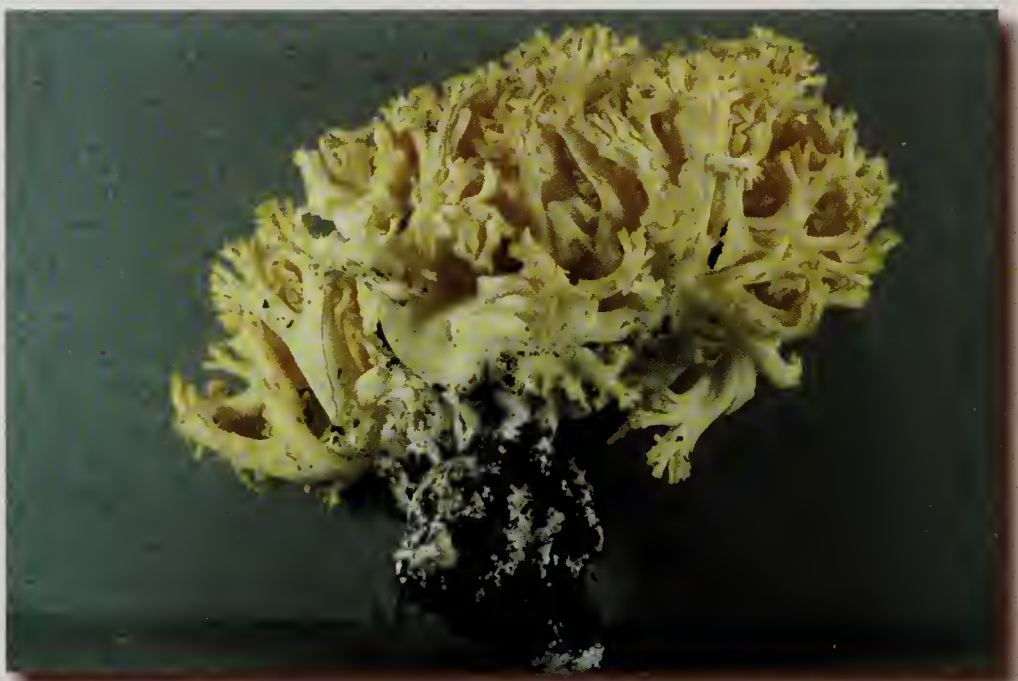


Photo by C.D. Marr M466

Ramaria cystidiophora

var. maculans Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 77.

Capsule summary—A yellow medium-sized coral (usually taller than broad and staining reddish-brown) with a white fuzzy lower stipe and light yellow branches with citron yellow tips. Terrestrial in coniferous forests in autumn.

Stipe: Similar to variety *cystidiophora* (long or sub-fasciculate, tapering downwards, yellowish white or pale yellow, white at the extreme base and covered by a white tomentum) but staining or bruising distinctly reddish brown and with a fleshy fibrous (not cartilaginous) consistency.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Similar to variety *cystidiophora* (Buff yellow to warm buff, upward citron yellow) but staining or bruising distinctly reddish brown.

Apices: Citron yellow, but staining or bruising distinctly reddish brown.

Basidia: Clamped.

Spores: $\bar{x} = 11.8 \times 4.0 \mu\text{m}$ (10–14 \times 3.5–5 μm), subcylindrical; ornamented with fine, usually linear cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cystidiophora* var. *maculans* can be recognized by its (1) citron yellow colors, (2) stipe covered by a well defined white fuzz (tomentum), (3) its tendency to stain or bruise reddish brown, (4) acantho-dendroid gloeoplerous hyphae in the exterior stipe context, (5) long narrow spores $\sim 11.8 \times 4.0 \mu\text{m}$, and (6) clamped basidia.

Additional comments: *Ramaria cystidiophora* var. *maculans* can be separated from other '*cystidiophora*' varieties by its fleshy fibrous stipe context, long spores, and red-brown staining basidiocarps.

Other ramarias found with reddish-brown stains on the stipe are the clamped *R. maculatipes* & *R. vinosimaculans* and non-clamped *R. rubribrunnescens*, *R. synaptopoda* & *R. rubiginosa*. The pale red to salmon colored branches of *R. rubribrunnescens* and *R. maculatipes* separate them from the other species (all pale yellow). Tomentose, fasciculate stipes and acantho-dendroid hyphae in the outer stipe tissues further separate *R. cystidiophora*.

See *R. cystidiophora* var. *cystidiophora* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 77.



Photo by C.D. Marr TYPE M521



Photo by OSU 25561

Ramaria distinctissima

var. americana R.H. Petersen 1988. *Mycologia* 80(2): 225.

Capsule summary—An orange & yellow medium-sized coral ($\leq 14 \times 9$ cm) with bright yellow upper stipe and salmon colored branches with bright orange tips. Terrestrial in coniferous forests in autumn.

Stipe: Tapering downward to the bluntly acute or obconical base; base tomentose and white, upper part smooth (no abortive branchlets) and bright to golden yellow (fading to flat yellow in age); context white, solid, and moist but not slippery.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Flesh-pink to salmon colored; context pastel orange under hymenium, paler to white in the center.

Apices: Bright orange when young and fresh, fading to concolorous with upper branches in age.

Basidia: Clamped.

Spores: $L_m = 13.7 \mu\text{m}$ ($12.6\text{--}16.3 \times 4.8\text{--}6.3 \mu\text{m}$; $E_m = 2.6 \mu\text{m}$), ellipsoid to sub-boletoid, often flattened adaxially and conspicuously roughened in profile; ornamented with scattered, prominent cyanophilous warts and short meandering ridges.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—British Columbia (southern), Idaho (northern).

Diagnostic characters: *Ramaria distinctissima* var. *americana* can be recognized by its (1) bright yellow upper stipe and lower branches, (2) pinkish to salmon colored branches with bright orange tips, (3) long spores ($\sim 13.7 \mu\text{m}$), and (4) clamped basidia.

Additional comments: Petersen (1988) comments; "the only taxon with spores as long as those of *R. distinctissima* var. *americana* included by Marr & Stuntz (1973) is *R. lagentii*. The colors of that species, however, are much paler, as reported by Marr & Stuntz. Nonetheless, the stipe shows pale yellow coloration, and the branches pale salmon to pale pinkish-salmon shades, so the collections reported to them could be faded or ill-colored specimens of this taxon." Petersen (1989) also includes this species in his key to taxa exhibiting yellow color band ("bellyband") on upper stipe.

Although Petersen states the colors of *R. lagentii* are much paler than *R. distinctissima* var. *americana*, Marr (pers. comm.) points out the branch coloration of *R. lagentii* is bright orange with intense orange apices while *R. distinctissima* var. *americana* is pinkish flesh to salmon colored. Both taxa are candidates for future DNA studies.

References:

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany *Mycologia*, 80(2) 225–226.

Petersen, R. H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. vol 14, part 1, 31.



Photo by R.H. Petersen

Ramaria flavobrunnescens

var. *aromatica* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 85.

Capsule summary—A yellow, often fan-shaped and medium-sized coral (4.5-18 × 3-18 cm) with light yellow branches, brighter yellow tips, and sweet gardenia-like odor. Terrestrial in coniferous forests in autumn.

Stipe: Single, pale yellow; base with short abortive or primordial branches; context fleshy fibrous to cartilaginous when fresh.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light yellow, becoming brownish in age; context white.

Apices: Deep yellow when young, concolorous with branches in age.

Basidia: Clamped.

Spores: $\bar{x} = 10.4 \times 4.0 \mu\text{m}$ (9-12 × 3-5 μm), subcylindrical; ornamented with small obscure warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria flavobrunnescens* var. *aromatica* can be recognized by its (1) pale yellow color, (2) sweet gardenia-like odor, (3) non-amyloid stipe context, (4) spore size and ornamentation, and (5) clamped basidia.

Additional comments: *Ramaria flavobrunnescens* var. *aromatica* could be confused with four other yellow clamped species: *R. cartilaginea*, *R. magnipes*, *R. rasilispora*, and *R. rasilisporoides*. *R. cartilaginea* has shorter, wider, and more distinctly ornamented spores ($\bar{x} = 8.8 \times 4.5 \mu\text{m}$), *R. rasilisporoides* has shorter spores ($\bar{x} = 9.1 \mu\text{m}$), while the spores of both *R. rasilispora* and *R. magnipes* are smooth under 1000x. Furthermore, *R. magnipes*, *R. rasilispora*, and *R. rasilisporoides* are amyloid and lack a sweet odor. Petersen & Scates observe, "*R. flavobrunnescens* var. *aromatica* always seems to show a yellow-brown diffuse patch of flesh at the stipe base."

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 85-88.

Petersen, R.H. & Catherine Scates. 1988. Vernally fruiting taxa of *Ramaria* from the Pacific Northwest *Mycotaxon* 33: 101-144.



Photo by C.D. Marr M667



Photo by C.D. Marr M711

Ramaria formosa (Pers.) Quel. 1888. Fl. Myc. 466.

Capsule summary—A pale salmon medium to large coral (7–20 × 7–14 cm) with massive stipe, salmon colored branches, and yellow tips. Terrestrial in coniferous forests in autumn.

Stipe: Single, massive, sub-fasciculate or fasciculate, white or brownish white, covered by a thin white tomentum, small whitish abortive or primordial branches frequently present; context fleshy fibrous, somewhat spongy at the base when fresh.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Peach or light red; context concolorous or more intensely colored than the surface, any part becoming pale grayish orange to cinnamon brown when handled.

Apices: Yellow when young, nearing the color of the branches in age.

Basidia: Clamped.

Spores: *Petersen*: Lm = 12.2 μm (10.7–15.5 × 5.6–6.7 μm; Em = 2.1 μm), elongate-ovoid, adaxially flattened, roughened in profile; ornamentation easily seen without staining under phase contrast, strongly cyanophilous, of small scattered warts and meandering ridges up to 0.4 μm high. *Marr & Stuntz*: \bar{x} = 10.4 × 5.4 μm (9–12 × 4.5–6 μm), ellipsoidal, apiculus usually prominent; ornamented with large, irregularly lobed, strongly cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest. Extralimital*—northern temperate zone: North America (Canada, USA); Europe.

Diagnostic characters: *Ramaria formosa* can be recognized by its (1) peach or light red colored branches with yellow tips, (2) massive stipe, (3) pale brunnescent basidiocarp (4) wide (~ 5.5–6 μm) spores, (5) coarsely ornamented spores, and (6) clamped basidia.

Additional comments: *Ramaria formosa* is fairly unique in having salmon colored branches with bright yellow tips, a compound to massive stipe, and a tendency to brown slightly when handled. The similar *R. maculatipes* has wine-colored stains on the lower stipe and positive amyloid stipe tissue.

The stipe of *R. formosa* is most often massive for its size but can range from single and slender to compound and massive. Any part of the pale peach colored basidiocarp turns weakly brown where handled with some parts often brown prior to collecting. Young specimens just breaking the surface of the humus have pale yellow upper branches and apices with no salmon coloration in evidence. However, longitudinal sections of the branches will reveal the salmon colored interior.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 88–91.

Petersen R. H. 1976. Contribution Toward a Monograph of *Ramaria* III. *R. sanguinea*, *R. formosa*. and two new species from Europe. *American J. Bot.* 63(3): 313–314..



Photo by R.L. Exeter 2004-56



Photo by C.D. Marr M223



Photo by R.L. Exeter 2005-67



Photo by R.L. Exeter 2002-13



Photo by R.L. Exeter

Ramaria gelatinosa

var. oregonensis Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 95.

Capsule summary—A rubbery, orange, medium-sized broad coral (8–15 × 5–12 cm) with a yellow 'belly band' on the upper stipe, yellow apices, and fused translucent gelatinous stipes. Terrestrial in coniferous forests in autumn.

Stipe: Compound, consisting of a wrinkled, gelatinous mass of fused branches, surface white, light yellow or light orange; fresh context gelatinous (resembling stiff agar). In a radially sectioned basidiocarp, the fused branches are seen as layers of translucent to grayish orange context and contrasting thin outer whitish branch tomentum.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light orange, darkening ('grayish orange,' 'agate brown') in age and sometimes with a violet gray cast; branch axils often golden yellow from spore accumulation; lower branches retaining a yellow color band.



Photo by R.L. Exeter 2005-15

Apices: Golden yellow to concolorous with branches or distinctly paler.

Basidia: Clamped.

Spores: $\bar{x} = 8.9 \times 5.1 \mu\text{m}$ (7–10 × 4.5–6 μm), broadly ovoid to broadly cylindrical with a prominent lateral apiculus up to 2 × 2 μm ; coarsely ornamented with lobed, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria gelatinosa* var. *oregonensis* can be recognized by: (1) the gelatinous context of the wrinkled, fused branches, (2) orange branches with golden-yellow tips and a yellow color band on lower branches, (3) coarsely warted spores (4) spores > 4.5 μm wide, and (5) clamped basidia.



Photo by R.L. Exeter 2005-15

Additional comments: The branches of *Ramaria gelatinosa* var. *oregonensis* tend to be densely branched and crowded. The stipe is often deep rooting and the basidiocarp is often found adjacent to woody debris. No other Pacific Northwest species can be confused with *R. gelatinosa* var. *oregonensis*. The orange branches, yellow apices, and fasciculate, gelatinous fused stipes are distinctive.

Petersen (1982) considered the var. *oregonensis* quite distinct from var. *gelatinosa* because the hyphal walls of former do not disintegrate during gelatinization as they do in the latter. He added, "I consider *R. gelatinosa* var. *oregonensis* dissimilar to the typical variety, surely not conspecific to it." The western variety needs reevaluation and possible elevation to species rank.

Doty (1944) suggested a 'tobacco-like' odor and taste for the taxon. Marr & Stuntz (1973) noted that the taste was not distinctive, but that the flesh had a musty sweet odor.

References:

Doty, Maxwell S. 1944. *Clavaria*, the species known from Oregon and the Pacific Northwest. Oregon State College Press.

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 95-98.

Petersen, R.H. 1982. Contributions toward a monograph of *Ramaria*. V. Type specimen studies of taxa described by W.C. Coker. *Sydowia* 35: 193.



Photo by R.L. Exeter 2003-11



Photo by R.L. Exeter 2002-29



Photo by R.L. Exeter

Ramaria largentii Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 98.

Capsule summary—A medium-sized broad coral (12–15 × 7–14 cm) with light to intense bright orange branches and tips. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single to sub-fasciculate, cylindrical or broadly conical, often massive, small abortive branches frequently diverging from the upper stipe; white to pale yellow with a basal tomentum; context white, fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: 'Light orange' to intense orange, often arising in a dense tuft from base, context concolorous becoming lighter toward the interior.

Apices: Orange–concolorous with branches or more intense (near 'Persian orange').

Basidia: Clamped.

Spores: \bar{x} = 13.4 × 4.5 μ m (11–15 × 3.5–5 μ m), subcylindrical; ornamented with conspicuous, irregularly shaped cyanophilous warts, in subspirals.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria largentii* can be recognized by its (1) compact, intensely orange basidiocarp, (2) base with dense tuft of branches, (3) long, coarsely ornamented spores, and (4) clamped basidia.

Additional comments: The large warted spores and clamped hyphae separate *R. largentii* and *R. distinctissima* var. *americana* from all other species of *Ramaria*. The two can be separated by the color of the branches.

See *R. distinctissima* var. *americana* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 98–99.



Photo by C.D. Marr TYPE M439

Ramaria leptiformosa Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 101.

Capsule summary—An orange medium-sized coral (relatively tall: 4.5–17 × 2–10 cm) with orange branches and yellow to orange tips. Terrestrial in coniferous forest in autumn.

Stipe: Single to compound, sometimes slightly bulbous, small basal abortive or primordial branch systems sometimes present; yellowish or orange-white; bruising or staining slightly to not at all; context fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light orange or light red, context concolorous with surface.

Apices: Sunflower or dark yellow or chrome orange.

Basidia: Clamped.

Spores: $\bar{x} = 10.6 \times 4.1 \mu\text{m}$ (8–13 × 3–5 μm), subcylindrical with a suprahilar depression and slight dorsal convexity; ornamented with fine linearly lobed cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria leptiformosa* can be recognized by its (1) slender, elongate orange basidiocarp, (2) negative chemical reactions on the stipe flesh, (3) fleshy fibrous stipe context, (4) spores measuring ~ 10.6 × 4.1 μm , and (5) clamped basidia.

Additional comments: *Ramaria leptiformosa* is common in northwest Oregon. It can be distinguished by an elongate growth habit, and carrot to creamsicle orange branches with bright yellow tips. *Ramaria sandaracina* could be confused with *R. leptiformosa*. However, *R. sandaracina* has a yellow color band on the upper stipe and shorter spores (Lm ~ 8.3–8.6 μm).

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 100–101.



Photo by R.L. Exeter 2005-26



Photo by R.L. Exeter 2005-61



Photo by C.D. Marr M839

Ramaria maculatipes Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 103.

Capsule summary—A pale orange medium-sized coral (10 × 9 cm) with peach colored branches, yellow tips, and red stains on the base. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single to compound or fasciculate; underground portion orange-white, base and lower branches staining or bruising reddish.

Stipe context reactions: FSW negative; slowly amyloid (positive reaction requiring up to 45 minutes).

Branches: Peach, context concolorous with surface.

Apices: Light yellow.

Basidia: Clamped.

Spores: $\bar{x} = 10.2 \times 4.3 \mu\text{m}$ (9–11 × 4–5 μm), subcylindrical with a slight suprahilar depression and dorsal convexity; ornamented with fine, cyanophilous warts in sub-spirals.



Photo by C.D. Marr TYPE M840

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—USA (California (northern), Oregon, Washington); known from only a few locations.

Diagnostic characters: *Ramaria maculatipes* can be recognized by its (1) red-wine stains or bruises on stipe and lower branches, (2) amyloid reaction of the stipe tissues, (3) peach colored branches with yellow tips, and (4) clamped basidia.

Additional comments: *Ramaria formosa* is similar in color to *R. maculatipes* but *R. formosa* has wider coarsely warted spores, no vinescent stains on the lower stipe, and non-amyloid stipe flesh. The only other ramarias with wine-colored stains on the stipe when found include the clamped *R. cystidiophora* var. *maculans* & *R. vinosimaculans* and non-clamped *R. rubribrunnescens*, *R. synaptopoda*, & *R. rubiginosa*. *R. rubribrunnescens* and *R. maculatipes* have pale red, peach or salmon colored branches while the other species are all pale yellow.

The weak amyloid reaction may vary. On one Oregon collection, a 3-4 mm thick portion of the stipe context tested positive within minutes, while thinner sections (1 mm) tested negative. Only five other members of subg. *Laeticolora* have both a positive amyloid reaction and clamped hyphae; *R. amyloidea*, *R. magnipes*, *R. rasilispora*, *R. rasilisporoides*, and *R. rubricarnata*.

The Marr & Stuntz (1973) spore measurements come from only one collection (M-840). Spore measurements from the four additional collections from western Oregon suggest slightly longer spores: $\bar{x} = 10.9 \times 4.2 \mu\text{m}$ (9–13 × 3.75–4.5 μm). Exeter's collections: R2003-23 (11.3 × 4.25 μm), R2004-27 (10.5 × 4.0 μm), R2005-46 (10.8 × 4.2 μm) and R2005-92 (10.9 × 4.3 μm).

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 103–105.



Photo by R.L. Exeter 2005-92



Photo by R.L. Exeter 2005-23

Ramaria magnipes Marr & D. E. Stuntz 1973. *Bibl. Mycol.* 38: 105.
var. *magnipes*

Capsule summary—A light yellow large coral (9–25 × 14–24 cm) with a large to massive weakly brunnescent stipe and light to greenish yellow apices. Terrestrial in coniferous forests in the spring.

Stipe: Single with rounded base ('rooting' and 'steeply tapered to broadly conical' in *Marr & Stuntz, 1973*), usually large to massive, sometimes with cauliflower-like clusters of abortive branches and branchlets; smooth but covered with sandy to gritty soil and patchily tomentose between substrate particles; white to off-white, often weakly brunnescent to neutral brown; abortive branchlets white where protected.

Stipe context reactions: FSW negative; amyloid (positive 'black & blue' reaction relatively slow and weak, sometimes requiring up to one hour).

Branches: Some shade of yellow: 'butter' or 'maize' yellow to pale (greenish) yellow when young, slowly mellowing to pale salmon or buff ('light ochraceous buff'), pale pinkish ochre or tan in age; context very pale cream above and white below.

Apices: Cauliflower-like when young, in age usually inflating to irregular club-like shapes; white where protected, where exposed bright yellow to intense chartreuse yellow (then mellowing in age to buff-colored), often changing to brick red when crushed, bruised or exposed to frost.

Basidia: Clamped.

Spores: *Petersen & Scates:* $L_m = 11.5 \mu\text{m}$ (9.4–13.3 × 3.2–5.0 μm , $E_m = 2.9 \mu\text{m}$), cylindrical to narrowly ellipsoid (and then flattened adaxially), smooth; smooth or ornamented with a few slender, meandering ridges. *Marr & Stuntz:* $\bar{x} = 11.8 \times 3.7 \mu\text{m}$ (10–14 × 3–4.5 μm), cylindrical; entirely smooth to roughened with very fine cyanophilous warts (obscure under 1000x magnification).

Habitat: Mixed coniferous forests.

Distribution: *Pacific Northwest*—more common east of the Cascade Mountains in the Pacific Northwest.

Diagnostic characters: *Ramaria magnipes* var. *magnipes* can be recognized by its (1) vernal habit, (2) light yellow colors, (3) massive stipe, (4) primarily subsurface development, (5) brownish staining stipe surfaces, (6) long (~ 11.5 μm) smooth spores, and (7) clamped basidia.

Additional comments: *Ramaria magnipes* var. *magnipes* is similar to *R. rasilispora* but has larger spores and more intensely colored branches. *Marr & Stuntz (1973)*, in distinguishing these two species from other ramarias, note, "The entirely smooth to obscurely warted spores of narrow diameter, the large stipe with weakly amyloid context, and the spring to summer fruiting habit are characteristics that distinguish *R. rasilispora* and *R. magnipes* from all other species.... *R. magnipes* is distinguished from *R. rasilispora* by its more intensely yellow fruiting bodies, more massive stipe, longer spores, and bitterness when cooked."

Petersen & Scates (1989) add, "The only sure way to separate *R. rasilispora* from *R. magnipes* in the dried condition is spore length. Spores of *R. magnipes* are considerably longer ($L_m = [11.5]$) than those of *R. rasilispora* ($L_m = 9.95$). When fresh, upper branches and apices of *R. magnipes* are more intensely colored than those of *R. rasilispora*. Stipe surfaces in *R. magnipes* are easily brunnescent, while those in *R. rasilispora* are not so."

Petersen & Scates (1988) also describe the color reaction of the stipe flesh of *R. magnipes* and *R. rasilispora* to Melzer's as deep blue-green with yellow tints, similar to the bruising reaction of humans called "black and blue."

Only five other members of subg. *Laeticolora* have a positive amyloid reaction and clamped hyphae; *R. amyloidea*, *R. maculatipes*, *R. rasilispora*, *R. rasilisporoides* and *R. rubricarnata*.

The two varieties of *R. magnipes* are separated as follows: i) *R. magnipes* var. *magnipes* develops above the humus layer; its branches are bright greenish yellow with intensely greenish yellow tips. ii) *R. magnipes* var. *albidior* develops within the humus layer (breaking the surface only when mature); its branches are white to pale yellow with greenish yellow tips.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 105–107.

Petersen, R. H. & Catherine Scates. 1988. Vernaly fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 118–121.

Petersen, R. H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. vol 14, part 1, 39.



Photo by C. Scates



Photo by R.L. Exeter 2004-4

Ramaria magnipes

var. albidior R.H. Petersen 1988. Mycotaxon 33: 121.

Capsule summary—A cream colored medium to large coral ($\leq 19 \times 15$ cm) with a massive weakly brunnescent stipe and yellow branch tips. The basidiocarp often develops within the humus layer and breaks through only when mature. Terrestrial in coniferous forests in the spring.

Stipe: Single, massive, base mycelioid and rooting below the humus layer, abortive stumps common and recurved high on stipe; white, browning weakly where handled; context white and often mottled with small hygrophaneous spots.

Stipe context reactions: FSW negative; amyloid (positive reaction tardy and weak).

Branches: White where protected, cream to ivory where exposed, ('cream colored,' 'pale ochraceous buff'); context white. (Petersen & Scates note, "A single specimen from the Sierra Nevada showed stature and general coloration identical to those of *R. magnipes* var. *albidior*, but the flesh of upper branches was pale salmon.")

Apices: Pale yellow when young, bright greenish yellow where unprotected, usually with a blush of muted pink where exposed.

Basidia: Clamped.

Spores: $L_m = 11.5 \mu\text{m}$ ($10.8\text{--}11.9 \times 3.6\text{--}4.3 \mu\text{m}$; $E_m = 2.8 \mu\text{m}$), subcylindrical to narrowly ellipsoid, flattened adaxially, smooth in profile and the surface either entirely smooth or with only a few obscure smudges.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—California (Sierra Nevada Mountains).

Diagnostic characters: *Ramaria magnipes* var. *albidior* can be recognized by its (1) vernal habit, (2) light cream to ivory colors, (3) massive stipe, (4) primarily subsurface development, (5) brownish staining stipe, (6) long ($\sim 11.5 \mu\text{m}$) smooth spores, and (7) clamped basidia.

Additional comments: *Ramaria magnipes* var. *albidior* is also similar to *R. rasilispora* but has larger spores and less intensely colored branches. As noted under *R. magnipes* var. *magnipes*, that variety differs in developing above the humus layer and having a more intense (bright greenish yellow) coloration.

See *Ramaria magnipes* var. *magnipes* for additional observations.

Reference:

Petersen, R.H. & Catherine Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 121–123.

Ramaria purpurissima R.H. Petersen & Scates 1987. Sydowia Band 40: 211.
var. *purpurissima*

Capsule summary—An entirely purple medium coral ($\leq 14 \times 15$ cm) with a massive stipe that remains purple throughout its development. Terrestrial in coniferous forests in autumn.

Stipe: Single, massive, rounded below before tapering gradually downward; surface with fine white tomentum concentrated in furrows, otherwise smooth; off-white, occasionally with brunnescent areas appearing as substrate smudges; context solid (hard when dry), white or violaceous around grub holes.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Major branches dull violaceous to dull purplish, upward intensely violaceous to purple “grayish reddish purple.”

Apices: Intensely violaceous to purple.

Basidia: Clamped.

Spores: $L_m = 10.3 \mu m$ ($9-11.2 \times 4.7-5.4 \mu m$, $E_m = 2.1 \mu m$), ellipsoid with adaxial bulge, conspicuously roughened in profile; ornamented with complex low warts and short ridges, often arrayed cross-wise.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—Idaho (northern region).

Diagnostic characters: *Ramaria purpurissima* can be recognized by its (1) massive stipe, (2) the unchanging purple color throughout its life-span, and (3) clamped basidia.

Additional comments: Petersen (1987) notes, “*R. purpurissima* ... is unique in its intense purple coloration which hardly changes during maturation. The color retention may be attributed to the sparse production of spores, resulting in little spore accumulation.” The similar *R. violaceibrunnea* can be distinguished by its i) single stipe, ii) branches that mature to a cinnamon color, and iii) the purple color band on the upper stipe.

Reference:

Petersen R. H. 1987. Contribution toward a monograph of *Ramaria*. VI. The *Ramaria fennica-versatilis* complex. Sydowia Band 40/1987: 211–2112.



Photo by C. Scates 6951



Photo by C. Scates 4649

Ramaria rasilispora Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 107.
var. *rasilispora*

Capsule summary—A pale yellow large coral (5–15 × 6–15 cm) with brighter yellow apices and non-brunnescent stipe. Terrestrial in coniferous forests in the spring.

Stipe: Single, stout with an obscurely rounded base (usually wider than tall), minutely tomentose between substrate particles, commonly with abortive branchlets shaped like blunt or tapered stumps; white, not brunnescent; context (off-) white, solid.

Stipe context reactions: FSW negative; amyloid (positive reaction slow and weak, taking ~ one hour).

Branches: Surface yellowish ('pale ochraceous salmon,' 'warm buff,' 'cream color,' 'apricot yellow') aging to grayish orange, context white.

Apices: Concolorous—yellowish (light to pale chartreuse) when young, often blushing to 'onion skin pink' where exposed to cold, dry air or turning dark brown with age or when dried.

Basidia: Clamped.

Spores: *Petersen & Scates:* Lm = 10.0 μm (8.3–11.5 × 3.6–4.3 μm; Em = 2.6 μm), cylindrical, occasionally sub-boletoid (swollen adaxially), smooth (at 1000x); smooth to ornamented with a very few meandering ridges. *Marr & Stuntz:* \bar{x} = 9.5 × 3.4 μm (8–11 × 3–4 μm), cylindrical, entirely smooth to very finely warted, cyanophilous warts obscure under 1000x.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria rasilispora* (var. *rasilispora*) can be recognized by its (1) spring fruiting pattern, (2) large size, (3) pale yellow colors, (4) non-browning stipe surface, (5) amyloid stipe flesh, (6) smooth spores, and (7) clamped basidia.

Additional comments: *Ramaria rasilispora* and *R. magnipes* are similar enough to be included in a loose 'complex.' *R. magnipes* is more intensely colored yellow and has longer (~ 11.5 μm) spores.

Petersen & Scates (1988) describe *R. rasilispora* as non-brunnescent. However, in collections from the north Cascade Mountains in Oregon many of the collections had minute wine-colored speckles all over the mid- and upper stipe. These stains appeared to be confined around volcanic ashy soil particles. This characteristic was present in approximately ½ of the collections examined.

Regarding the two varieties of *R. rasilispora*, Petersen & Scates (1988) describe the branches of var. *rasilispora* as having more flesh tones and with brighter and deeper yellow tips than those of var. *scatesiana*, but also point out that the two varieties are difficult to separate when dried. Unlike var. *scatesiana*, var. *rasilispora* has never been collected in the autumn.

See *Ramaria magnipes* var. *magnipes* and *R. rasilispora* var. *scatesiana* for additional observations.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 107–108.

Petersen, Ronald H. & Catherine Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 126–128.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. vol 14, part 1, 37–38.



Photo by R.L. Exeter 2006-10



Photo by R.L. Exeter 2006-02



Photo by R.L. Exeter 2006-08



Photo by R.L. Exeter 2006-11

Ramaria rasilispora

var. scatesiana Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 108.

Capsule summary—A creamy yellow medium to large coral (5–24 × 4–17 cm) with greenish yellow apices and non-brunnescent stipe. Terrestrial in coniferous forests in both autumn and spring.

Stipe: Single, rounded at base, often with blunt abortive protuberances; surface often mycelioid at base, smooth above, not brunnescent or very weakly so upward upon handling; context solid, white.

Stipe context reactions: FSW negative; non-amyloid to weakly positive on stipe flesh.

Branches: Generally yellowish with orange tinges ('pale to light ochraceous cream' to 'pale ochraceous salmon' to 'pale yellow orange'); context white, somewhat stringy.

Apices: Clear yellow to pale greenish yellow when young, mellowing to buff-colored, in age often with a hint of pink 'cream buff.'

Basidia: Clamped.

Spores: Lm = 10.6 μm (9.4–11.9 × 3.2–4.3 μm, Em = 2.85 μm), cylindrical to sub-boletoid, smooth to ornamented with a very few meandering ridges (otherwise similar to *R. rasilispora* var. *rasilispora*).

Habitat: Coniferous forests.

Distribution: Pacific Northwest.

Diagnostic characters: *Ramaria rasilispora* var. *scatesiana* can be recognized by its (1) mostly vernal fruiting pattern, (2) yellowish white to light yellow colors, (3) non-browning stipe surfaces, (4) amyloid stipe flesh, (5) smooth spores, and (6) clamped basidia.

Additional comments: *Ramaria rasilispora* var. *scatesiana* is the only taxon within the *magnipes-rasilispora* complex known from autumnal collections. The variety tends to be paler colored than var. *rasilispora*. Petersen & Scates (1988) explain, "Just as in *R. magnipes* [var. *albidior*], fruitbodies of *R. rasilispora* var. *scatesiana* from drier habitats develop within the humus layer and are not exposed to sunlight until adolescence. Colors are generally paler than in typical material, but exposed branch apices are light bright yellow to pallid greenish yellow." Marr & Stuntz (1973) add, "variety *scatesiana* differs from variety *rasilispora* in the color of fruiting bodies, branches of young and mature specimens varying from yellowish white to light yellow. In other characteristics it appears to be the same."

Only five other members of subg. *Laeticolora* have a positive amyloid reaction and clamped hyphae: *R. amyloidea*, *R. maculatipes*, *R. magnipes*, *R. rasilisporoides* and *R. rubricarnata*.

See *Ramaria magnipes* and *R. rasilispora* var. *rasilispora* for additional observations.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 108–109.

Petersen, Ronald H. & Catherine Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 129–131.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. vol 14, part 1, 37–38.



Photo by R.L. Exeter 2006-03



Photo by R.L. Exeter 2006-02, 03
var. *rasilispora* (back) var. *scatesiana* (front)

Ramaria rasilisporoides R.L. Exeter sp. nov.

Basidiocarpus *terrestris* in *sylvis coniferarum, caulifloriformis ut crudus, multiramosus, ad 28 × 20 cm*. Basus *ad 11 × 4 cm, crassus, radicans, cum ramuli abortive, albus vel leviter brunnescente; contextus firmus, cartilagineus vel carnosus-fibrosus, albus, amyloideus*. Rami *luteus pallidus, apicis cauariini vel citrini*. Hyphae *contextualae fibulatae*. Basidia $37-77 \times 4-7 \mu\text{m}$, *clavata, fibulata*. Sporae $7-10 (11) \times 3-4.5 \mu\text{m}$, *cylindratae, verruculosae*. *

Type : Exeter-R2003-33 (WTU)

Matrix: USA. OREGON. BENTON Co. — Alsea Falls: 22.IX.2004 Exeter R2004-22 (WTU); — Mary's Peak: 20.X.2004 Exeter #'s 2004-41, 2004-42, 2004-43 & 2004-44 (WTU); 14.XI.2005 Exeter 2005-94. LANE Co. — Lobster Valley: 7.XI.2003 Exeter R2003-33 (WTU), 8.XI.2005 Exeter R2005-71. POLK Co. — Bald Mountain area: 18.XI.2003 Exeter R2003-43 (WTU).

Capsule summary—An entirely yellow medium to large coral (10–28 × 7–20 cm) with a deeply rooting stipe and many abortive branchlets. Terrestrial in coastal coniferous forests in autumn.

Stipe: Large to massive (5–11 × 3–4 cm), single to compound, often deeply rooting with recurved abortive branchlets common high on the stipe; white (somewhat watery brunnescent where handled) where protected, abortive branchlets pale yellow where exposed; context fleshy fibrous, hard and firm, cartilaginous, grainy mottled, white.

Stipe context reactions: FSW negative; amyloid.

Branches: Lower branches white to very pale yellow; upper branches pale yellow, yellow-cream, pale yellow to canary yellow, maturing pale caramel colored or 'creamed coffee' color to a brownish orange; context pale yellow, white yellow lacking any orange or salmon colorations.

Apices: White where protected, pale to citron yellow, the most intense coloration of the basidiocarp, maturing concolorous with upper branches.

Basidia: Clamped.

Spores: $\bar{x} = 9.1 \times 3.6 \mu\text{m}$ (7–10)(11) × 3–4.5 μm), narrowly cylindrical, smooth to mostly finely warted or broken ridges in faint linear lines toward the "base" of the spore.

Habitat: Coniferous forests (*Pseudotsuga, Tsuga, Thuja*)

Distribution: *Pacific Northwest*—Oregon (the Oregon Coast Range in Benton, Lane and Polk Counties).

Diagnostic characters: *Ramaria rasilisporoides* can be recognized by its (1) large size and yellow colors, (2) amyloid stipe base, (3) short, finely warted spores, and (4) clamped basidia.

Additional comments: Important field characters of *R. rasilisporoides* are its large size (up to 28 × 20 cm), deep rooting, compact 'cauliflower' appearance when young, mutable colors (white where protected, yellow where exposed, pale-orange in age), elongating branches, and apices that become 'knobby' when mature.

Only five other ramarias have a positive amyloid reaction of the stipe tissues and possess clamped basidia are known from the Pacific Northwest: *R. amyloidea*, *R. maculatipes*, *R. magnipes*, *R. rasilispora*, and *R. rubricarnata*. They differ from the new *R. rasilisporoides* as follows: *R. amyloidea* is salmon colored with a stipe context that has a distinctive brown band ('rusty root') and reacts blue-green to FSW; *R. maculatipes* is salmon colored and has a stipe with wine-colored stains; *R. magnipes* and *R. rasilispora* both have smooth spores (in oil immersion) and fruit primarily in the spring; and *R. rubricarnata* is mostly salmon colored and has longer and wider spores (~10–11.4 × 4.3 μm). In general, *R. rasilisporoides* has the stature, coloration and chemical reactivity of *R. rasilispora*, with spore size and ornamentation similar to *R. amyloidea* ($\bar{x} = 8.9 \times 3.6 \mu\text{m}$).

**Ramaria rasilisporoides* (English technical description):

BASIDIOCARP terrestrial in conifer forests, 10-28 × 7-20 cm, cauliflower-like when young. STIPE BASE 5-11 × 3-4 cm, single to compound, often deeply rooting with recurved abortive branchlets high on the stipe; color white or slightly watery brunnescent where handled, branchlets becoming pale yellow where exposed; context firm, cartilaginous to fleshy-fibrous, white. BRANCHES generally some shade of yellow with lower tier white to very pale yellow and upper tier pale yellow to yellow-cream to canary yellow; maturing to pale caramel or 'creamed coffee' to brownish orange; context pale or whitish yellow and lacking any orange hues. APICES pale to citron yellow, most intense for badiocarp at first but eventually fading to concolorous with upper branches.

BASIDIOSPORES: $\bar{x} = 9.1 \times 3.6 \mu\text{m}$ (7-10 (11) × 3-4.5 μm)*, narrowly cylindrical, smooth to mostly finely warted or with broken ridges arrayed linearly toward the hilar appendage.

* Average dimensions and Em values for the 9 Exeter collections of *R. rasilisporoides* cited in the protologue are: R2003-33 (9.52 × 3.56, Em = 2.67), R2003-43 (9.04 × 3.53, Em = 2.56), R2004-22 (8.60 × 3.48, Em = 2.47), R2004-41 (9.29 × 3.71, Em = 2.50), R2004-42 (8.93 × 3.65, Em = 2.45), R2004-43 (8.93 × 3.50, Em = 2.55), R2004-44 (8.91 × 3.57, Em = 2.50), R2005-71 (9.22 × 3.63, Em = 2.54), R2005-94 (8.76 × 3.52, Em = 2.49).

BASIDIA: 37-77 × 4-7 μm , clavate, 4-spored, bases with clamp connections. HYPHAE (contextual) clamped, 3-6 μm diam

MACROCHEMICAL REACTIONS: FSW negative; Melzer's amyloid.

ECOLOGY: Autumnal, associated with *Thuja heterophylla*, *Pseudotsuga menziesii*, and *Thuja plicata*. Thus far known only from 4 localities (9 collections) in the Oregon coast range.



Photo by R.L. Exeter TYPE 2003-33



Photo by R.L. Exeter 2004-41



Photo by R.L. Exeter 2004-44



Photo by R.L. Exeter 2004-41D

Ramaria rubricarnata Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 113.
var. *rubricarnata*

Capsule summary—A salmon & yellow small to medium coral (5–13 × 3–12 cm) with a massive stipe and salmon to yellow branches with salmon colored flesh and yellow tips. Terrestrial in coniferous forests in autumn.

Stipe: Single, large to massive, broadly conical to subcylindrical, stout, at base with a white tomentum, upwards with frequent cauliflower-like clusters of abortive branchlets (white where protected); surface off-white, minutely pruinose in some areas with the pruina easily rubbed off (then weakly brunnescent); context solid, cartilagino-fibrous, brittle when fresh white.

Stipe context reactions: FSW negative; weakly amyloid (both stipe and branches).

Branches: Compact and with all internodes short; surface light orange to yellow ('pale salmon,' 'light ochraceous salmon,' 'apricot yellow,' 'light orange yellow'); interior some shade of salmon color.

Apices: Light yellow to yellow ('maize yellow').

Basidia: Clamped.

Spores: *Petersen & Scates:* $L_m = 10.0 \mu\text{m}$ ($8.6\text{--}11.2 \times 4.0\text{--}4.7 \mu\text{m}$, $E_m = 2.3 \mu\text{m}$), ellipsoid, obscurely roughened in profile; ornamented with low small warts and short meandering ridges. *Marr & Stuntz:* $\bar{x} = 10.4 \times 4 \mu\text{m}$ ($9\text{--}12 \times 3.5\text{--}5 \mu\text{m}$), ellipsoid with a suprahilar depression and slight dorsal convexity; ornamented with distinct but small cyanophilous warts in subspirals.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria rubricarnata* var. *rubricarnata* can be recognized by its (1) autumnal fruiting pattern, (2) pale salmon to occasionally yellow colors (3) salmon branch context, (4) yellow branch tips, (5) large, massive stipe, (6) amyloid stipe flesh, (7) spore length ($\sim 10 \mu\text{m}$), and (8) clamped basidia.

Additional Comments: Marr & Stuntz (1973) described *R. rubricarnata* var. *rubricarnata* as an autumnal fruiter with (most often) a massive stipe, adding, "the hymenium of young specimens is a beautiful, rich maize yellow, reflecting a light orange to pinkish color in the lower branches due to the underlying salmon-colored context."

Subsequently, Petersen & Scates (1988) described two vernal varieties, *pallida* and *verna*. They noted all three varieties share weakly amyloid flesh, salmon outer branch flesh underlying a yellow hymenium, and similarly sized roughened spores.

R. rubricarnata var. *rubricarnata* generally has smaller stipes and its branches are generally shorter, stockier, and more vividly colored than those of var. *pallida*, which produces longer branches with more muted coloration. *R. rubricarnata* var. *pallida* also differs in its (i) longer ($\sim 11.4 \mu\text{m}$) spores, (ii) vernal habit, and (iii) yellow stipe flesh when dried.

R. rubricarnata var. *verna*, which does not differ significantly in stature or color from var. *rubricarnata*, does differ in its (i) longer ($\sim 11.1 \mu\text{m}$) spores, (ii) vernal habit, and (iii) yellow color of the lower branches and stipe flesh when dried.

Only five other ramarias in subg. *Laeticolora* are both amyloid and clamped: *R. amyloidea*, *R. maculatipes*, *R. magnipes*, *R. rasilispora*, and *R. rasilisporoides*.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 113–114.

Petersen, Ronald H. & Catherine Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 131–133.



Photo by C.D. Marr M748



Photo by C.D. Marr TYPE M800

Ramaria rubricarnata

var. pallida R.H. Petersen & Scates 1988. Mycotaxon 33: 133.

Capsule summary—A pale yellow cream medium-sized coral ($\leq 13 \times 10$ cm) with a massive stipe and faintly salmon-tinged elongated branches and yellow branch tips. Terrestrial in coniferous forests in spring.

Stipe: Single, massive, broadly tapering to a rounded base, usually with some recurved, abortive stumps but not branchlets, smooth to pruinose where protected; surface white, browning weakly or not at all; context solid, white, sometimes minutely streaked.

Stipe context reactions: FSW negative; weakly amyloid.

Branches: Exterior surfaces buff colored to pale buffy yellow with a hint of salmon; context streaked off-white to pinkish-buff.

Apices: Dull greenish yellow when young, light yellow when mature.

Basidia: Clamped.

Spores: Lm = $11.4 \mu\text{m}$ ($9.7\text{--}14.4 \times 4.0\text{--}4.7 \mu\text{m}$, Em = $2.7 \mu\text{m}$), ellipsoid to subcylindrical, obscurely roughened in profile, ornamented with small, low warts and scattered meandering ridges.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria rubricarnata* var. *pallida* can be recognized by its (1) vernal habit, (2) pale yellow to salmon colors, (3) light yellow branch tips, (4) massive stipe, (5) amyloid stipe context, (6) spore length ($\sim 11.4 \mu\text{m}$), and (7) clamped basidia.

Additional comments: *Ramaria thiersii* could be confused with *R. rubricarnata* var. *pallida*, but it has longer ($\sim 13.3 \mu\text{m}$) spores, a pure white branch context, and non-amyloid stipe flesh.

R. rubricarnata var. *rubricarnata* differs from var. *pallida* by its i) shorter ($\sim 10.0 \mu\text{m}$) spore length, ii) salmon & yellow stocky branches, and iii) autumnal fruiting habit. Variety *verna* differs from var. *pallida* by its stocky salmon & yellow branches.

See *R. rubricarnata* var. *rubricarnata* for additional comparisons.

Reference:

Petersen, Ronald H. & Catherine Scates. 1988. Vernally fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 133–135.

Ramaria rubricarnata

var. *verna* R.H. Petersen & Scates 1988. Mycotaxon 33: 135.

Capsule summary— A salmon & yellow small to medium coral ($\leq 9 \times 7$ cm) with a massive stipe, yellow 'belly band' on upper stipe and lower branches, orangish branches with salmon colored flesh and yellow tips. Terrestrial in coniferous forests in the spring.

Stipe: Single, large, with numerous cauliflower-like clusters of abortive branchlets; surface minutely pruinose in some areas, the pruina easily rubbed off and there browning weakly; color white below (abortive branchlets also white where protected), light yellow above; context solid, white in both fresh and dried material.

Stipe context reactions: FSW negative; weakly amyloid (on both stipe and branches).

Branches: Internodes uniformly short; lower branches light yellow (part of an indistinct 'belly band'), upward salmon-orange to light salmon, staining wine-colored around soil particles; context bright salmon or salmon-orange.

Apices: Yellow to rich yellow, but quickly fading to branch colors.

Basidia: Clamped.

Spores: $L_m = 11.1 \mu m$ ($10.4\text{--}12.2 \times 4.0\text{--}5.0 \mu m$, $E_m = 2.55 \mu m$), ellipsoid, delicately but distinctly roughened in profile; ornamented with very delicate small low warts and/or short meandering ridges.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria rubricarnata* var. *verna* can be recognized by its (1) spring fruiting pattern, (2) salmon to salmon-orange colors, (3) light yellow 'belly band' (on upper stipe & lower branches) and branch tips, (4) massive stipe, (5) amyloid stipe tissues, (6) spore length ($\sim 11.1 \mu m$), and (7) clamped basidia.

Additional comments: Western Oregon collections tend to have orange branches when exposed but pale salmon to pale orange-yellow branches when protected by the organic layer. They fruit earlier in the northern Oregon Coast Range (late February — March) but later in the Cascades (May — June).

Petersen (1989) includes *R. rubricarnata* var. *verna* in his key to taxa exhibiting yellow color band on upper stipe. Variety *rubricarnata* differs from var. *verna* by its (i) lack of yellow on the lower branches, (ii) shorter ($\sim 10.0 \mu m$) spores, and (iii) yellow stipe flesh when dried. Variety *pallida* differs in its (i) paler colors and (ii) elongated form.

The similar *R. armeniaca* can be differentiated by its non-amyloid stipe flesh, smooth to faintly warted spores, and absence of clamps.

See *R. rubricarnata* var. *rubricarnata* for additional comments.



Photo by R.L. Exeter 2004-01

References:

Petersen, Ronald H. & Catherine Scates. 1988. Vernaly fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 135–138.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. Persoonia. vol 14, part 1, 30.



Photo by R.L. Exeter 2006-01b



Photo by R.L. Exeter 2004-01a

Ramaria sandaracina Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 114.
var. *sandaracina*

Capsule summary—An orange & yellow slender small to medium coral (5–10 × 3–7 cm) with a fleshy fibrous or slightly gelatinous consistency, yellow 'belly band' on the upper stipe, and deep orange branches and tips. Terrestrial in coniferous forests in autumn.

Stipe: Single or sub-fasciculate, conical; surface smooth, lower regions covered with a thin white tomentum, underground portion white to pale yellow, brighter yellow upward; context brittle fleshy-fibrous, sometimes a small area of the stipe slightly gelatinous.

Stipe context reactions: FSW negative, non-amyloid.

Branches: Lower branches yellow, upper branches deep orange; faint small drab (violet gray) bruised spots sometimes persistent.

Apices: Deep orange.

Basidia: Clamped.

Spores: $\bar{x} = 8.1 \times 3.9 \mu\text{m}$ (6.5–9 × 3.5–4.5 μm), subcylindrical to ellipsoidal; ornamented with numerous papillate cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*



Photo by C.D. Marr TYPE M804

Diagnostic characters: *Ramaria sandaracina* var. *sandaracina* can be recognized by its (1) deep orange branches and tips, (2) drab bruising reaction, (3) yellow 'belly band' on the upper stipe, (4) a green-bean like ('fabaceous') odor, (5) short (~ 8.1 μm) warted spores, and (6) clamped basidia.

Additional comments: Short spores help distinguish *R. sandaracina* varieties from other orange clamped *Ramaria* species. The slender aspect of var. *sandaracina* helps separate it from vars. *chondrobasis* and *euosma*.

Marr & Stuntz (1973) separated the three varieties of *R. sandaracina* as follows:

i) var. *sandaracina* has a slender (usually narrower than 8 cm) basidiocarp with several primary branches arising from a single stipe, infrequent basal primordial branch systems, and a green bean like odor.

ii) var. *chondrobasis* has a broad (commonly wider than 8 cm) basidiocarp with numerous primary branches arising from a broad, compound, subgelatinous base, frequent small basal primordial branch systems, and a green bean like odor.

iii) var. *euosma* has distinctly yellow tips and a sweet, fragrant odor.

See *R. sandaracina* var. *chondrobasis* and var. *euosma* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 114–116.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. Vol 14, part 1, 29–30.



Photo by C.D. Marr M900



Photo by C.D. Marr M494

Ramaria sandaracina

var. *chondrobasis* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 116.

Capsule summary—An orange & yellow broad small to medium coral (8–15 × 6–13 cm) with a gelatinous consistency, yellow 'belly band' on the upper stipe, and salmon to orange branches and tips. Terrestrial in coniferous forests in autumn.

Stipe: Compound or fasciculate but lacking a distinct single or sub-fasciculate base, commonly producing small, light-colored primordial branches, smooth; context subgelatinous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Salmon to salmon orange (similar to *R. sandaracina* var. *sandaracina*).

Apices: Concolorous with branches (orange).

Basidia: Clamped.

Spores: $\bar{x} = 8.3 \times 4 \mu\text{m}$ (7–10 × 3.5–5 μm), otherwise similar to var. *sandaracina*.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria sandaracina* var. *chondrobasis* can be recognized by its (1) broad aspect, (2) deep orange branches and tips, (3) yellow 'belly band' on upper stipe and lower branches, (4) gelatinous consistency, (5) a green-bean like ('fabaceous') odor, (6) short (~ 8.3 μm) warted spores, and (7) clamped basidia.

Additional comments: Orange branches and tips and small spore size distinguish *R. sandaracina* varieties *sandaracina* and *chondrobasis*. Marr & Stuntz (1973) distinguished var. *chondrobasis* from var. *sandaracina* by the former's (i) more gelatinous consistency, (ii) compound base, and (iii) numerous compactly arranged branches that form a larger, broader basidiocarp.

Petersen (1989), who included var. *chondrobasis* in his key to taxa with yellow banded upper stipes and also cited the compound fasciculate subgelatinous stipe as diagnostic, also emphasized the hollow branches, and salmon to orange branch and tip colors as helpful. Yellow apices and sweet odor help separate var. *euosma* from the other two varieties.

See also comments under *R. sandaracina* var. *sandaracina* and *R. sandaracina* var. *euosma*.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 1-232.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. Vol 14, part 1, 29-30.



Photo by C.D. Marr TYPE M848



Photo by C. Scates 4730

Ramaria sandaracina

var. euosma Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 117.

Capsule summary— An orange & yellow broad small to medium coral (8 × 9 cm) with slightly gelatinous to rubbery consistency, yellow 'belly band' on the upper stipe, orange branches with yellow tips, and occasionally sweet odor. Terrestrial in coniferous forests in autumn.

Stipe: Compound; white below, light yellow above; context gelatinous, rubbery.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Lower branches light yellow, shading upward into pale orange then deep to salmon orange, orange branches bruising dull violet; context translucent, similar in color to the surface.

Apices: Light yellow.

Basidia: Clamped.

Spores: \bar{x} = 8.6 × 3.8 μm (7–10 × 3.5–4 μm), subcylindrical with a slight suprahilum depression and dorsal convexity, ornamented with small cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria sandaracina* var. *euosma* can be recognized by its (1) deep orange branches with yellow tips, (2) yellow 'belly band' on upper stipe and lower branches, (3) dull violet bruising, (4) sweet fragrant odor, (5) short (~ 8.6 μm) warted spores, and (6) clamped basidia.

Additional comments: Distinctly yellow branch tips and sweet odor separate *R. sandaracina* var. *euosma* from varieties *chondrobasis* and *sandaracina*. The latter two varieties have a fabaceous odor. Marr (pers. comm., 2006) now notes that the 'sweet odor' that prompted the varietal name may not be consistent enough to serve as a diagnostic feature.

Ramaria leptiformosa could be mistaken for *R. sandaracina* var. *euosma*. Both have orange branches with yellow tips but *R. leptiformosa* lacks the yellow 'belly band' on the lower branches and has longer (~ 10.6 μm) spores.

Petersen (1989), who includes var. *R. sandaracina* var. *euosma* in his key to taxa with yellow banded upper stipes, distinguishes it by its orange branches with bright yellow tips and upper stipe. He also noted that while Marr & Stuntz (1973) partly diagnosed *R. sandaracina* by the gelatinizing tendency of the fruitbody flesh, gelatinization was not as noticeable in "var. *sandaracina* as in var. *euosma*."

See also comments under *R. sandaracina* var. *sandaracina* and *R. sandaracina* var. *chondrobasis*.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 117–118.

Petersen, R.H. 1989. Contributions toward a monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. Vol 14, part 1, 29–30.



Photo by C.D. Marr TYPE M483



Photo by R.L. Exeter 2002-09



Photo by R.L. Exeter 2005-23

Ramaria testaceoflava (Bres.) Corner 1950. Ann. Bot. Mem. 1: 630.

=*R. testaceoflava* var. *brunnea* (Zeller) Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 122.

Capsule summary— A brownish small to medium coral (5–14 × 1.5–9 cm) with a tomentose stipe, light chocolate colored branches, yellow branch tips, and a tendency for any part to bruise dark brown (especially when cut). Terrestrial in coniferous forests in autumn.

Stipe: Single to 'falsely' fasciculate (individual slender stipes appearing as single — especially pronounced in deep duff), with a basal tomentum below and sometimes with small abortive branchlets above; color white, off-white to pale tan but easily and quickly changing to chocolate brown when bruised or cut; context brownish white, brunnescent.

Stipe context reactions: FSW positive (greenish); non-amyloid.

Branches: Distinctly flattened laterally; color at first 'maize yellow' when very young, then dulling to gold, and finally light chocolate or drab brown; branch axils often dusted with yellow spores; all parts quickly bruising dark brown when handled or cut.



Photo by R.L. Exeter 2005-107

Apices: Extreme tips golden to ochraceous yellow (especially when young), next 3-4 mm inward tan, eventually becoming concolorous with branches.

Basidia: Clamped.

Spores: *Petersen*: $L_m = 11.7 \mu\text{m}$ (9.5–14 × 4.2–6.4 μm , $E_m = 2.3 \mu\text{m}$), ellipsoid, adaxially often swollen (occasionally flattened); rough and ornamented with scattered, discrete low warts (mostly covering the central third of the spore surface and occasionally arranged in vague spirals from upper abaxial to lower adaxial surfaces). *Marr & Stuntz*: $\bar{x} = 11.5 \times 4.6 \mu\text{m}$ (9–14 × 3.5–6 μm), ellipsoid, apiculus usually prominent ($\leq 2 \times 1 \mu\text{m}$), ornamented with distinct cyanophilous warts.

Habitat: Coniferous forests.

Distribution: Northern hemisphere in temperate to cool climates on humus or mossy humus; usually in coniferous forests, but occasionally in mixed forests. *Pacific Northwest*—USA (California, Idaho, Oregon, Washington). *Extralimital*—Canada (Nova Scotia), Europe (Austria, Finland, France, Italy, Sweden, Switzerland).

Diagnostic characters: *Ramaria testaceoflava* can be recognized by its (1) light chocolate brown branches with yellow tips, (2) whitish tomentum on the stipe, (3) a tendency for any part to bruise dark brown on handling (especially when cut), (4) stipe flesh that turns greenish in FSW, (5) wide (~ 4.6 μm) coarsely warted spores, and (6) clamped basidia.

Additional comments: *Ramaria testaceoflava*, *R. amyloidea* and *R. velocimutans* are the only described western North American 'clamped' species with stipe flesh showing a positive FSW reaction. *R. testaceoflava* is separated from the other two species by its characteristic colors (chocolate to drab brown branches with golden yellow tips) and absence of a 'rusty-root.' Very old, rotting dark-brown *R. velocimutans* specimens that could be mistaken for *R. testaceoflava* can be properly identified from their shorter (~ 9 μm), narrower (~ 4 μm) spores. *R. amyloidea* can be distinguished by the amyloid stipe context and pale orange branch coloration.

Doty (1944) noted the smallest branches were solid but the larger ones hollow. Neither Marr & Stuntz nor Petersen mention this characteristic.

References:

Doty, Maxwell S. 1944. *Clavaria*, the species known from Oregon and the Pacific Northwest. Oregon State College Press.

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 122-124. (As *Ramaria testaceoflava* var. *brunnea*)

Petersen, R.H. 1979. Contribution to a monograph of *Ramaria* IV. *R. testaceo-flava* and *R. bataillei*. *Nova Hedwigia* 31(1+2): 26-34.



Photo by R.L. Exeter 2004-48



Photo by C.D. Marr 668

Ramaria thiersii R.H. Petersen & Scates 1988. Mycotaxon 33: 138.

Capsule summary—A yellowish buff medium-sized coral ($\leq 15 \times 8$ cm) with a massive stipe that often develops under the litter layer in gritty soil at high altitudes. Terrestrial in coniferous forests in the spring.

Stipe: Obpyramidal, smooth and without abortive branchlets or stumps; color white, staining weakly to strongly brownish where rubbed or bruised; context not marbled, soft to spongy, often grub ridden, white.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Surface white to pale yellow ('pale ochraceous salmon,' 'cream buff'); flesh white in hypogeous forms, salmon-colored in exposed basidiocarps.

Apices: White where protected, pale greenish yellow ('cream color,' 'straw color') where exposed.

Basidia: Clamped.

Spores: $L_m = 13.3 \mu\text{m}$ ($11.6\text{--}15.8 \times 4.0\text{--}5.0 \mu\text{m}$, $E_m = 3.1 \mu\text{m}$), cylindrical to narrowly ellipsoid, occasionally sub-sigmoid, obscurely roughened in profile and ornamented with small, discrete low warts.

Habitat: Coniferous forests at high altitudes (> 5000 ft in California).

Distribution: *Pacific Northwest*—Idaho (northern region), Oregon (Cascades), California (Sierra Nevadas).

Diagnostic characters: *Ramaria thiersii* can be recognized by its (1) vernal habit, (2) long spores ($\sim 13.3 \mu\text{m}$), (3) non-amyloid stipe context, (4) verruculose spore ornamentation, and (5) clamped basidia.

Additional comments: The long spores and pale color of *R. thiersii* are unique. The species might be confused with *R. rubricarnata* var. *pallida*, which, however, has amyloid stipe flesh and smaller spores ($\sim 11.4 \mu\text{m}$ long).

Basidiocarps of *R. thiersii* tend to have yellowish pigmentation when exposed to sunlight but often develop underground and lack the yellow coloration. Petersen & Scates note: "Fruitbody stature is very variable, dictated at least in part by weather. In the normally drier Sierra Nevada, fruitbodies are subhypogeous and therefore pale in color, but in wetter northern Idaho, fruitbodies usually develop above ground, are larger and more brightly colored. In the latter form, branch flesh is usually somewhat salmon colored, but not so as to give hymenial surface this hue." They also mention under *R. rubricarnata* var. *pallida*, "In *R. thiersii* branch colors usually do not include any salmon tint, branch flesh is pure white, and all parts show conspicuous brunnescence where handled or rubbed."

Ramaria caulifloriformis, normally known as an autumnal fruiter in western North America, is known from two spring collections in the Sierra Nevada Mountains, California. It is similar in color to *R. thiersii* but its spores are much shorter ($\sim 9.3 \mu\text{m}$).

Reference:

Petersen, Ronald H. & Catherine Scates. 1988. Vernally fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 138–140.

Ramaria velocimutans Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 124.

Capsule summary—A medium to very large coral (7–30 × 3.5–26 cm) that has a 'rusty root' and is cream-colored when fresh but turns entirely brown in age. Terrestrial in coniferous forests in autumn.

Stipe: Single to occasionally compound; surface at first white, aging to pale yellow to brown and with large streaked regions of 'brown' superficial hyphae (especially where pressed against substrate); context with a 'rusty root'.

Stipe context reactions: FSW instantly deep green (positive); non-amyloid.

Branches: Pure white, soon cream colored to pale yellow (especially yellow in axils where spores accumulate); speckling or turning brown in patches and becoming entirely brown in age.

Apices: Concolorous with branches.

Basidia: Clamped.

Spores: $\bar{x} = 9 \times 4 \mu\text{m}$ (8–12 × 3.5–5 μm), subcylindrical, ornamented with fine, lobed, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

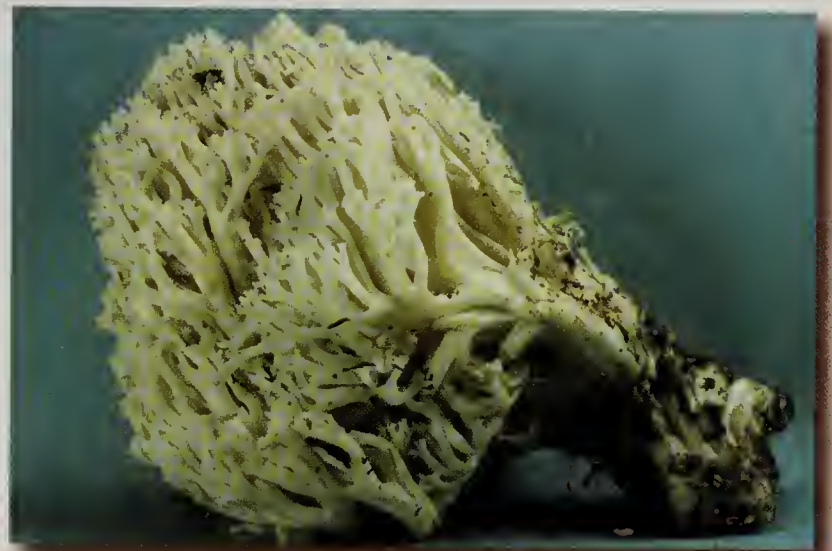


Photo by C.D. Marr M811

Diagnostic characters: *Ramaria velocimutans* can be recognized by its (1) creamy large to massive, basidiocarps that turn brown when old, (2) 'rusty root,' (3) stipe flesh that turns deep green in FSW, (4) stipe surface streaked with brown patches, (5) finely warted spores, and (6) clamped basidia.

Additional comments: *Ramaria velocimutans* resembles both *R. celerivirescens* and *R. amyloidea*. All three species have streaked regions of 'brown' superficial hyphae on the stipe. However, *R. amyloidea* has light orange branches and amyloid stipe tissue while *R. celerivirescens* has pale salmon colored branches with bright yellow tips, slowly amyloid stipe tissue, and non-clamped basidia.

Ramaria amyloidea, *R. celerivirescens*, and *R. coulterae* are the only other described species with a "rusty-root." The "rusty root" in *R. velocimutans* may vary according to the size of the stipe. Usually, the stipe is short and stalky so that the "rusty root" is broad and fan shaped. On slender, elongated stipes, the entire stipe context may be brown and woody or tough, even extending up into the lower branches.

R. velocimutans, *R. amyloidea*, and *R. testaceoflava* are the only described 'clamped' species with stipe tissues that react positively to FSW. *R. testaceoflava* has brownish-red branches with yellow tips and a basidiocarp that browns distinctly when cut.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 124–126.



Photo by R.L. Exeter
R. celerivirescens 2005-62 - left
R. velocimutans 2005-63 - right



Photo by R.L. Exeter 2004



Photo by R.L. Exeter 2005-18



Photo by R.L. Exeter 2004-12b

Ramaria vinosimaculans Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 128.

Capsule summary—A pale yellow medium to large coral (12–19 × 9–19 cm) that develops small burgundy colored stains (particularly on lower stipe) during maturation. Terrestrial in coniferous forests in late summer or autumn.

Stipe: Single, rounded at base to tapering downward, often with a few abortive branchlets, smooth to minutely tomentose between substrate particles; white to off-white, any part but especially the base developing wine-red (burgundy colored) stains; slowly becoming brown; context solid, white.

Stipe context reactions: FSW negative; non-amyloid.

Branches: *Petersen and Scates:* Major branches off-white; branches crowded when young, open at maturity, very pale cream color to yellow, often vinaceous around soil particles, context white. *Marr and Stuntz:* Yellowish white to pale yellow or orange; context white.

Apices: *Petersen and Scates:* Crowded and somewhat terraced when young, somewhat divergent at maturity, jonquil yellow to slightly greenish yellow when young, paler were protected, in age occasionally discoloring to pallid brown. *Marr and Stuntz:* Concolorous with branches.

Basidia: Clamped.

Spores: *Petersen & Scates:* $L_m = 12.5 \mu\text{m}$ ($11.2\text{--}14.0 \times 4.3\text{--}5.0 \mu\text{m}$, $E_m = 2.7 \mu\text{m}$), narrowly ellipsoid, often with suprahilar depression, obscurely roughened in profile. *Marr & Stuntz:* $\bar{x} = 12 \times 4.1 \mu\text{m}$ ($9\text{--}13.5 \times 3.5\text{--}5 \mu\text{m}$), subfusiform with a slight suprahilar depression; in a single specimen a few spores entirely smooth but most finely ornamented with irregularly shaped, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria vinosimaculans* can be recognized by its (1) ivory or cream colors when young, (2) burgundy-colored stains (particularly noticeable on the stipe), (3) long ($\sim 12.5 \mu\text{m}$), finely ornamented spores, and (4) clamped basidia.

Additional comments: The only other ramarias with wine-colored stains on the stipe when collected include the clamped *R. cystidiophora* var. *maculans* and *R. maculatipes* and the non-clamped *R. rubribrunnescens*, *R. synaptopoda*, and *R. rubiginosa*. *R. rubribrunnescens* and *R. maculatipes* have pale red or salmon colored branches; the other species (including *R. vinosimaculans*) are all pale yellow. *R. cystidiophora* var. *maculans* can be differentiated by the acanthodendroid hyphae in the outer stipe tissues. *R. synaptopoda* can be differentiated by its fasciculate habit (in addition to lacking clamps).

The Pacific Northwestern *R. rubiginosa* and the extralimital (eastern North American) *R. sanguinea* and *R. xanthosperma* are similar but lack clamps. Petersen & Scates (1988) point to the different staining intensities to distinguish between *R. sanguinea* [and by extension *R. rubiginosa*] and *R. vinosimaculans*. They suggest, "Normally, the maroon stains on *R. vinosimaculans* are ill-defined spots and streaks and are not as defined as in *R. sanguinea*."

Marr & Stuntz (1973) note that both *R. vinosimaculans* and *R. xanthosperma* produce large white fruiting bodies with extensively reddish to violet brown stains when collected. They describe the color of the basidiocarp of *R. vinosimaculans* as 'yellowish white' (4A2), the same color used to describe *R. velocimutans* (white to cream colored when fresh), but they also add pale yellow to orange (4-5A3), the same color used to describe *R. rasilispora* var. *scatesiana*. Petersen & Scates (1988) also describe the colors of the base and major branches of *R. vinosimaculans* as white to off-white (4A2) and the branches as very pale cream color to yellow with more intensely yellow apices. They also cite its resemblance to *R. xanthosperma* and describe both as having pale yellow branches and yellow apices.

One Oregon collection (D. Bishop 81) was amyloid but otherwise fit the species description and needs further investigation.

See *R. rubiginosa* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 128–129.

Petersen, R.H. 1976. Contribution toward a monograph of *Ramaria* III. *R. sanguinea*, *R. formosa*, and two new species from Europe. *American J. Bot.* 63(3): 311.

Petersen, Ronald H. & Catherine Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 140–143.



Photo by C.D. Marr TYPE 264



Photo by Dick Bishop Spring Ramaria 81



Photo by C. Scates

Ramaria violaceibrunnea (Marr & D.E. Stuntz) R.H. Petersen, in Petersen & Zang. 1986.

Acta Bot. Yunn. 8(3): 293.

= *R. fennica* var. *violaceibrunnea* Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 78.

= *R. versatilis* var. *violaceibrunnea* (Marr & D.E. Stuntz) R.H. Petersen. 1988 ('1987'). Sydowia 40: 222

Capsule summary—A pale purplish small to medium coral (5–13 × 1.5–8 cm) with pale violet young branches, drab older branches with brownish tips, and purple 'belly band' on the upper stipe. Terrestrial in coniferous forests in autumn.

Stipe: Single to fasciculate (often with small basal primordial branchlets), slender to stout, base rounded, smooth but often with many ropy white rhizomorphs; color white below and browning in furrows, violet to drab (pale grey-violet) above; context solid, white to yellowish.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Primordial branches some shade of violet (often intense), then drab and less intense, finally dark brown ('buffy brown,' 'light brownish olive') in age except for (often) a thin wavy pale violet band on the upper base and distinctly violet tinged lower branches.

Apices: Brownish tinged ('buffy olive,' 'light olive brown'), darkening in age.

Basidia: Clamped.

Spores: *Petersen:* Lm = 10.4 μm (9–13 × 4.3–5.4 μm, Em = 2.1 μm), ellipsoid to ovate, obscurely roughened in profile and ornamented with many small, isolated cyanophilous warts (≤ 0.1 μm). *Marr & Stuntz:* \bar{x} = 10.7 × 4.7 μm (9–13 × 3.5–5 μm), ellipsoidal, ornamented with distinct, small to medium cyanophilous warts.

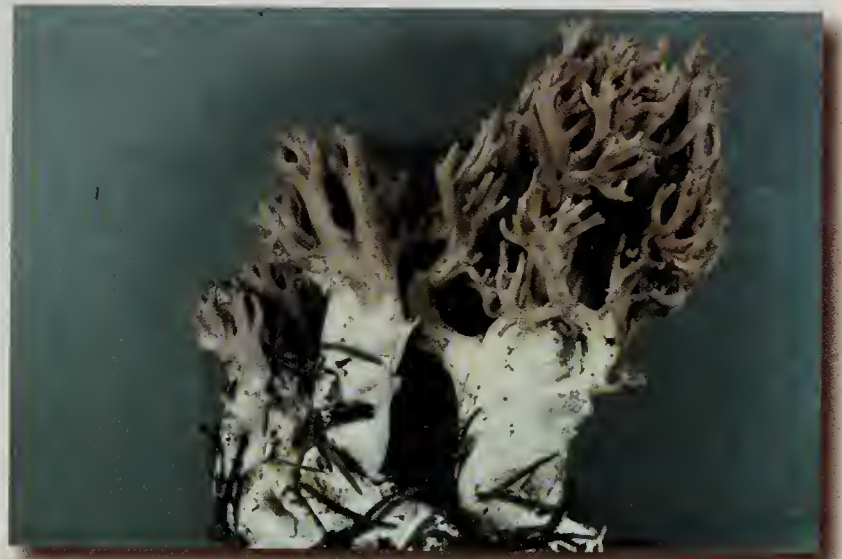


Photo by C.D. Marr TYPE M512

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria violaceibrunnea* can be recognized by its (1) young pale violet branches, (2) long lasting purplish band on the upper stipe, (3) slender aspect, (4) finely ornamented spores, and (5) clamped basidia.

Additional comments: *Ramaria purpurissima* var. *purpurissima* is similar in color but its branches and apices retain their intense violet colors when mature and its stipe is massive (not at all slender). *R. violaceibrunnea* branches are dull (cinnamon in age), although the purple color band usually remains on the upper stipe, which is usually slender.

It is unclear whether both *R. violaceibrunnea* and *R. versatilis* var. *versatilis* Quelet (which Index Fungorum now cites as synonymous with *R. fennica* var. *griseolilacina* Schild) occur in western North America. All specimens examined as *R. versatilis* var. *versatilis* by Petersen (1987) were from eastern North America while those examined as *R. versatilis* var. *violaceibrunnea* [now *R. violaceibrunnea*] were from western North America. However, Petersen (1987) acknowledged, *R. versatilis* var. *violaceibrunnea* [*R. violaceibrunnea*] and var. *versatilis* [*R. fennica* var. *griseolilacina*] represented 'the complex in western North America'. He also mentions he applied his herbarium name, '*Ramaria gouphoides*' (referring to the hymenium color in *Gouphus clavatus*) to both of these varieties from the Pacific Northwest. Additional studies are needed for the Pacific Northwestern species. Petersen (1987) separates the two varieties by the following key leads:

- A. Apices buffy olive to tan when young; spore print "Isabella color"; branches olivaceous drab when mature, western north America *R. violaceibrunnea*
- A. Branches and apices lilac, purple to reddish tan when young; spore print "clay colored"; branches cinnamon when mature; Europe, eastern and western North America
..... *R. fennica* var. *griseolilacina* [= *R. versatilis* var. *versatilis*]

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 78–81 (as *Ramaria fennica* var. *violaceibrunnea*).

Petersen, R.H. 1987. Contribution toward a monograph of *Ramaria*. VI. The *Ramaria fennica-versatilis* complex. *Sydowia* 40: 218, 222–224.



Photo by R.L. Exeter 2005-58 Young specimen



Photo by R.L. Exeter 2005-58



Photo by R.L. Exeter 2005-82 Mature specimen



Photo by R.L. Exeter 2005-96A

Subgenus *Laeticolora*
Species without Clamped Basidia



Ramaria araiospora

Photo by Michael Wood

Key to *Ramaria* subgenus *Laeticolora* — species without clamped basidia

- 1A. Branches and apices red to scarlet; stipe context strongly and rapidly amyloid; spores $\bar{x} = 8.3 \times 4 \mu\text{m}$ (7–10 \times 3–5 μm) *Ramaria stuntzii*
- 1B. Branches and apices not red or, if red, stipe context not amyloid 2
- 2A. Branches white to cream with brightly (more intensely) colored apices (orange, pink, red, fleshy beige or fleshy-pink) 3
- 2B. Branches usually more brightly colored with yellow or concolorous apices 4
- 3A. Autumnal; radially sectioned stipe lacking a brown band of contextual hyphae; spore Lm = 8.44 μm (6.8–10.1 \times 4.0–5.0 μm) *Ramaria botrytoides*
- 3B. Vernal; brown band of brown contextual hyphae visible in radially sectioned stipe; spore Lm = 9.95 μm (8.3–12.6 \times 2.9–4.0 μm) *Ramaria coulterae*
- 4A. Stipe flesh moderately amyloid; basidiocarp with a disagreeable odor (of coal tar), very large overall, and pale yellow to cream colored; spore Lm = 9.10 μm (7.9–10.4 \times 3.6–4.3 μm) *Ramaria foetida*
- 4B. Stipe flesh either amyloid or non-amyloid, but basidiocarp and spores not as above 5
- 5A. Basidiocarp cauliflower-like, yellowish-pink; stipe single, small, white below but yellow at substrate level; stipe flesh solid, white-marbled, firm-gelatinous to hard-rubbery, watery when fresh; major branches connate from base, pale salmon or pale orange to light pinkish cinnamon; tips concolorous with branches or pallid yellow; spore Lm = 10.1 μm (9.0–11.2 \times 4.7–6.1 μm) *Ramaria verlotensis*
- 5B. Not as above 6
- 6A. Stipe with a 'rusty root' (containing a band of brown contextual hyphae) visible in a radially sectioned stipe; stipe flesh turning instantly blue-green in ferric salts (FSW); spores $\bar{x} = 9.5 \times 4.6 \mu\text{m}$ (8–11 \times 4–6 μm) *Ramaria celerivirescens*
- 6B. Stipe lacking brown contextual hyphae in radially sectioned stipe base; stipe flesh non-reactive with FSW 7
- 7A. Basidiocarp up to 4 cm tall; stipe fasciculate, slender to 4 mm thick; branches sparingly branched, flesh colored, usually hollow, brittle; apices clear yellow to pale orange-yellow to pale ochraceous salmon; spore Lm = 9.9 μm (8.9–11.1 \times 5.0–6.1 μm) *Ramaria raveneliana*
- 7B. Basidiocarp larger than 4 cm; otherwise, not as above 8
- 8A. Basidiocarps pale to dingy colored (brown, violet-brown, orange-brown, or white to cream), often brunnescent 9
- 8B. Basidiocarps mostly brightly colored (yellow, orange, red or salmon colored), bruising reactions various 12
- 9A. Vernal; stipe single to compound (often fused in longitudinal section), massive; branches cinnamon to chocolate brown, never white; spore Lm = 9.9 μm (8.6–11.6 \times 4.3–5.4 μm) *Ramaria marrii*
- 9B. Autumnal; stipe mostly single to fasciculate (hardly or not fused), slender; branches white, brown to violaceous-brown 10
- 10A. Stipe flesh dull brown, streaky (like wood grain); branches tan to brown; spore Lm = 8.56 μm (7.2–10.1 \times 4.7–6.1 μm) *Ramaria spinulosa* var. *diminutiva*
- 10B. Stipe flesh white to off-white; branches white or drab (brownish violet); spore Lm ~ 10.0 μm 11

- 11A. Branches white to cream when immature (often tinged pinkish or purplish), soon fading during maturity to light brown; brunnescent; spore Lm = 10.1 μm (8–14 \times 4–6 μm) *Ramaria acrisiccescens*
- 11B. Branches violet gray; spore Lm = 10.3 μm (9–13.5 \times 4.5–7 μm) *Ramaria fumosiavellanea*
- 12A. Spores \bar{x} > 8.5 μm or Wm < 4.5 μm , or not as described below 13
- 12B. Spores \bar{x} = 7.5 \times 4.9 μm (6–10 \times 4–6.5 μm); base a fascicle of steeply tapered to slightly bulbous bases covered in a white tomentum where buried; branches salmon to peach, frequently < 5mm diam.; apices light to maize yellow *Ramaria conjunctipes*
- Key to *R. conjunctipes* varieties:**
- A. Base a fascicle of stringy, white stipes; sparsely branched above; fruiting bodies rarely taller than 10 cm
..... *R. conjunctipes* var. *sparsiramosa*
- A. Base single to densely fasciculate; stipes not stringy; densely branched above; fruiting bodies up to 18 cm tall
..... *R. conjunctipes* var. *tsugensis*
- 13A. Spore Lm > 12.0 μm ; stipe context fleshy-fibrous; branches bright orange or salmon colored 14
- 13B. Spore Lm generally < 12.0 μm , or if Lm \geq 12.0 μm , stipe context cartilaginous to gelatinous (*R. flavigelatinosa* var. *megalospora*); branch coloration various 15
- 14A. Wine-colored stains present on stipe and lower branches when collected; lower and upper branches pale red to salmon; spore Lm = 12.3 μm (10–14 \times 3.5–5 μm) *Ramaria rubribrunnescens*
- 14B. Wine-colored stains lacking on stipe and lower branches; lower branches yellow, upper branches light to deep orange; spore Lm = 13.5 μm (10–18 \times 4–6 μm) *Ramaria longispora*
- 15A. Basidiocarps predominantly yellow 16
- 15B. Basidiocarps showing orange, red to salmon branch colorations 18
- 16A. Basidiocarp branching sparsely with rarely more than 3 ranks; stipe base compound to fasciculate; spore Lm = 9.9 μm (9–11.5 \times 3.5–4.5 μm) *Ramaria syuaptopoda*
- 16B. Basidiocarp branching more frequently with 3 to 7 ranks; stipe base single to compound 17
- 17A. Stipe single or divided into thick stems and with extensive vinescent stains when collected; stipe context fleshy-fibrous; spore Lm = 9.4 μm (7–11 \times 3.5–6 μm) *Ramaria rubiginosa*
- 17B. Stipe compound or sub-compound, consisting of several to numerous connate stipes, occasional small to minute vinescent stains present; stipe context firmly gelatinous to cartilaginous *Ramaria flavigelatinosa*

Key to *Ramaria flavigelatinosa* varieties:

- A. Basidiocarp predominately yellow with orange or salmon colors in the upper branches due to the salmon-colored branch context B
- A. Basidiocarp entirely yellow; branch context yellow C
- B. Spores \bar{x} = 9.6 \times 4.1 μm (8–11 \times 3.5–4.5 μm); stipe context firmly gelatinous (translucent white) when fresh *R. flavigelatinosa* var. *carnisalmonea*
- B. Spores \bar{x} = 12 \times 4.5 μm (9–15 \times 4–6 μm); stipe context cartilaginous when fresh
..... *R. flavigelatinosa* var. *megalospora*
- C. Spores \bar{x} = 9.6 \times 4.1 μm (8–11 \times 3.5–6 μm); odor fabaceous or not distinctive; stipe context firmly gelatinous (translucent white) when fresh *R. flavigelatinosa* var. *flavigelatinosa*
- C. Spores \bar{x} = 10 \times 4.8 μm (8.5–13 \times 3.5–6 μm); odor sweet; stipe context cartilaginous when fresh
..... *R. flavigelatinosa* var. *fragrans*

- 18A. Upper stipe and lower branches with a distinct yellow band; upper branches orange to salmon; stipe context gelatinous to cartilaginous or fleshy-fibrous 19
- 18B. Upper stipe and lower branches lacking a distinct yellow band; upper branches red to salmon colored; stipe context fleshy fibrous, neither gelatinous or cartilaginous 24
- 19A. Apices yellow 20
- 19B. Apices orange 22
- 20A. Branches with salmon to orange context and yellow colored surfaces; stipe compound to sub-compound, context firm-gelatinous to cartilaginous *Ramaria flavigelatinosa* (see lead 17b)
- 20B. Branches with yellow context and salmon to apricot yellow colored surfaces; stipe single to compound; context subgelatinous to firm-gelatinous with a translucent to hyaline interior 21
- 21A. Stipe single; context firm-gelatinous with a translucent to hyaline interior surrounded by whitish exterior; spore Lm = 10.1 (9.4–11.2 × 4.0–5.0 μm) *Ramaria hilaris* var. *olympiana*
- 21B. Stipe single to compound, usually slender and rooting; stipe context subgelatinous; bruising dull violet; spore Lm = 9.3 μm (8–11 × 3.5–5 μm) *Ramaria gelatiniaurantia* var. *violeitingens*
- 22A. Stipe context fleshy-fibrous; spore Lm ≥ 10.2 μm; vernal or autumnal 23
- 22B. Stipe context gelatinous to subgelatinous, marbled, translucent greyish-white alternating with waxy, opaque white areas; spore Lm = 9.3 μm (8–11 × 3.5–5 μm); autumnal
..... *Ramaria gelatiniaurantia* var. *gelatiniaurantia*
- 23A. Stipe large to massive; vernal; spore Lm = 10.3 μm (8.6–11.5 × 3.6–4.3 μm) *Ramaria armeniaca*
- 23B. Stipe slender, single to compound; autumnal; spore Lm = 10.8 μm (8.5–14 × 3–5 μm)
..... *Ramaria aurantiiscescens*
- 24A. Spore Wm = 3.7 μm; spores finely ornamented; branches red; basidia content not conspicuously granular when stained with cotton blue 25
- 24B. Spore Wm ≥ 4.5 μm; spores distinctly ornamented; branches light red to peach to salmon; basidia content granular and densely cyanophilous in cotton blue *Ramaria cyaneigranosa*

Key to *R. cyaneigranosa* varieties:

- A. Apices concolorous with branches, never yellow; internodes and general habit slender and conspicuously elongated; spore Lm = 9.2 μm (8–10 × 4–5 μm) *R. cyaneigranosa* var. *elongata*
- A. Apices dotted with yellow; internodes and general habit not conspicuously elongated; spore Lm ≥ 9.6 μm
..... B
- B. Branches light red; base single or sub-compound, thick or slightly bulbous; spore Lm = 11 μm (8.5–15 × 4–6 μm) *R. cyaneigranosa* var. *cyaneigranosa*
- B. Branches salmon to peach; base single, steeply tapered, slender (covered by a white basal tomentum); spore Lm = 9.6 μm (7–11 × 3.5–6 μm) *R. cyaneigranosa* var. *persicina*

- 25A. Mature apices yellow; branches red, spore Lm = 9.9 μm (8–13 × 3–4.5 μm)
..... *Ramaria araiospora* var. *araiospora*
- 25B. Mature apices and branches both red; spore Lm = 9.8 μm (8–14 × 3–5 μm)
..... *Ramaria araiospora* var. *rubella*

Ramaria acrisiccescens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 50.

Capsule summary—A pale, medium-sized to large coral (5–29 × 1.5–18 cm), often taller than wide with elongated, crowded, straight branches. Branches and apices white to cream colored with a faint violet tinge when fresh but soon becoming brown during maturation, brunnescent. Terrestrial in coniferous forests in autumn.

Stipe: Single to subfasciculate, a well defined basal tomentum usually present, white, but turning brown in age; context fleshy fibrous, white.

Stipe Context Reactions: FSW negative; non-amyloid.

Branches: White when fresh, turning brown in age or brunnescent; upper branches on fresh specimens often with a faint pinkish tint, context brownish-white.

Apices: Concolorous with branches.

Basidia: Non-clamped.

Spores: $\bar{x} = 10.1 \times 4.9 \mu\text{m}$ (8–14 × 4–6 μm), subcylindrical to ellipsoidal with a prominent lateral apiculus; ornamented with distinct, lobed, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria acrisiccescens* can be recognized by the (1) immature whitish basidiocarp that browns slightly when handled and matures to pale (pinkish) brown, (2) upright long parallel branches, (3) white base context; (4) pronounced bitter ('acid') taste when dried, (5) wide spores averaging 4.9 μm in diameter, and (6) non-clamped basidia.

Additional comments: *Ramaria acrisiccescens* is the only western North American species that is white and lacks clamped basidia. The similar *Ramaria velocimutans* is differentiated by having clamped basidia, regions of brown superficial hyphae on the lower stipe, a band of brown contextual hyphae in the stipe, and a positive reaction of the stipe flesh to FSW. *R. acrisiccescens* may occasionally have a small area of pale tan contextual hyphae in the lower base, but its context does not react to ferric salts. *Ramaria acrisiccescens* could be confused with *R. marrii*, *R. fumosiavellanea* or *R. spinulosa* var. *diminutiva* when it is mature and brown. Marr & Stuntz report abundant gloeoplerous hyphae in the stipe of *R. acrisiccescens* that are not observed in *R. fumosiavellanea*. Petersen and Scates (1988) did not observe any gloeoplerous hyphae in *R. marrii* and there is no mention of gloeoplerous hyphae in the description for *R. spinulosa* var. *diminutiva*. See *R. fumosiavellanea* for additional discussion.

In western Oregon, species that key to *R. acrisiccescens* consist of two types: i) an entirely white, elongated basidiocarp that matures to a light brown and has a single to fasciculate, elongated stipe covered with white tomentum, and ii) a short, broad, light brown basidiocarp with a short, single to fasciculate stipe. In the second variant, the lower stipe tends to be a darker shade of brown than the light brown branches; there are also reddish-brown scattered bruises on the lower stipe, which lacks any tomentum. This type also tends to have slightly smaller spores. It is not known whether the variation is due to environmental or developmental causes: further study is needed to determine whether the elongate, white stipe develops deep within the duff while the darker, bald stipe develops on compacted ground or in areas with less duff. Both are shown in Exeter's 2005-100,101 photo.



Photo by R.L. Exeter 2004-32

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 50–53.



Photo by C.D. Marr TYPE M535



Photo by R.L. Exeter 2005 -100,101



Photo by C.D. Marr M897

Ramaria araiospora Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 55.

Capsule summary—A red, small to medium-sized coral (5–13 × 2–8 cm) with a slightly bulbous stipe, and red branches with yellow (var. *araiospora*), or red tips (var. *rubella*). Terrestrial in coniferous forests in autumn.

Stipe: Single, slightly bulbous, sometimes nearly fasciculate; covered with a thin white tomentum and with abortive branchlets often present at base, white to yellow white or discoloring brownish white; context white, fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Red, fading to light red and yellowing from apex downward during maturation (var. *araiospora*) or bluish red or crimson (var. *rubella*).

Apices: Yellow to pale or deep orange (var. *araiospora*) or red (var. *rubella*).

Basidia: Non-clamped.

Spores: $\bar{x} = 9.9 \times 3.7 \mu\text{m}$ (8–13 × 3–4.5 μm), subcylindrical, finely ornamented with linearly lobed cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria araiospora* can be recognized from other red colored species by its (1) single, slender bulbous stipe, (2) generally non-amyloid stipe reactions, (3) finely ornamented spores averaging ~ 9.9 × 3.7 μm , and (4) non-clamped basidia.

Additional comments: Marr & Stuntz describe two varieties of *R. araiospora*. Variety *araiospora* has scarlet red branches with yellow apices when young. The branches and apices of *Ramaria araiospora* var. *rubella* Marr & D.E. Stuntz (1973. *Bibl. Mycol.* 38: 57) are red to crimson through maturation, never yellow. The average spore dimensions are very slightly smaller for *R. araiospora* var. *rubella* 9.8 × 3.6 μm (overall 8–14 × 3–5 μm). Otherwise, all characteristics are similar to variety *araiospora*.

Ramaria cyaneigranosa and *R. stuntzii* are the only other red colored species known from western North America. *R. stuntzii* has i) smaller spores (8.3 × 4 μm), ii) generally, a large to massive base, iii) reddish orange coloration on the upper stipe, iv) red apices, and v) amyloid stipe tissue. *Ramaria cyaneigranosa* differs in, i) wider, distinctly warted spores, ii) generally pinkish to salmon basidiocarp, iii) basidia with masses of cyanophilous granules.

A few fresh collections of *R. araiospora* var. *araiospora* from northwest Oregon had a rapid, positive amyloid reaction on the stipe context, which might suggest *R. stuntzii*. However, the following characters indicate a closer affinity to *R. araiospora*: i) single, slender stipe, ii) no orange "belly band" on the lower branches, iii) yellow apices, and iv) a spore $L_m = 10 \mu\text{m}$. Additional study is needed.

See Appendix, Table 1. Comparison of "Red" colored ramarias that occur in the Pacific Northwest.



Photo by C.D. Marr TYPE M739
var. *araiospora*

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 55–57.



Photo by Michael Wood var. *araiospora*



Photo by R.L. Exeter 2004-75 var. *araiospora*



Photo by C.D. Marr Type M741
var. *rubella*



Photo by R.L. Exeter 2004-36 var. *rubella*

Ramaria armeniaca R.H. Petersen & Scates 1988. Mycotaxon 33: 111.

Capsule summary—An orange, medium-sized (up to 12 × 8 cm), rounded (subcircular to broadly obovate) coral with pale yellow lower branches and orange upper branches and apices. Terrestrial in coniferous forests in spring.

Stipe: Large to massive, single, smooth, usually without abortive branchlets, broadly tapering down to a point, white to off-white; context white, fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Pale to deep orange to bright apricot. Lower branches pale yellow where the white stipe and orange branches meet.

Apices: Orange to deep orange, but often yellow where protected by duff.

Basidia: Non-clamped.

Spores: Lm = 10.3 μm (8.6–11.5 × 3.6–4.3 μm, Em = 2.65 μm), narrowly ellipsoid to subcylindrical, obscurely undulate in profile; ornamentation none or merely a suggestion of very low warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—northern Idaho and western Oregon (Douglas & Polk Counties).

Diagnostic characters: *Ramaria armeniaca* can be recognized by its (1) spring fruiting pattern, (2) orange branches, (3) fleshy fibrous stipe flesh, (4) almost smooth spores ~ 10.3 μm long, and (5) non-clamped basidia.

Additional comments: *Ramaria armeniaca* is the only non-clamped "orange" species known from the Pacific Northwest that fruits in the spring. *R. rubricarnata* var. *verna* is morphologically similar to *R. armeniaca* but has clamped basidia and finely warted spores.

See *R. gelatiniaurantia* var. *violeitingens* for a comparison of other non-clamped species showing a yellow band on the lower stipe.

Reference:

Petersen, R.H. and C. Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 111–113.



Photo by R.L. Exeter 2003-04



Photo by R.L. Exeter 2003-04

Ramaria aurantiisiccescens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 57.

Capsule summary—A brightly colored, small to medium-sized coral (8–10 × 2–8 cm) with “sunflower” yellow lower branches and orange branches and apices. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single to nearly compound, with a thin white basal tomentum; lower base white, upper base light yellow to sunflower yellow. Sometimes with pale superficial stains of caramel brown; context similarly colored, fleshy fibrous.

Stipe context reactions: IKI negative; non-amyloid.

Branches: Lower branches ‘light yellow’ to ‘sunflower yellow’, shading upwards into ‘light orange’ to intensely orange colored, lower branches sometimes with pale superficial stains of caramel brown; context subconcolorous. Dried branches retain the orange (‘carrot red’) color.

Apices: The most intensely colored, about dark orange.

Basidia: Non-clamped.

Spores: $\bar{x} = 10.8 \times 4.0 \mu\text{m}$ (8.5–14 × 3–5 μm), cylindrical to sub-pip-shaped; ornamented with fine, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria aurantiisiccescens* can be recognized by its (1) bright orange basidiocarps that are neither rubribrunnescent nor vivescent, (2) fleshy fibrous stipe context; (3) finely warted cyanophilous spores ~ 10.8 × 4.0 μm , and (4) non-clamped basidia.

Additional comments: *Ramaria aurantiisiccescens* is one of several non-clamped species that have orange branches and a yellow color band on the lower branches. *Ramaria aurantiisiccescens* can be distinguished by its longer spores and orange branch tips.

See *R. gelatiniaurantia* var. *violetingens* for a comparison to other non-clamped species exhibiting a yellow color band on the lower stipe.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 57–59.



Photo by C.D. Marr M738



Photo by C.D. Marr TYPE M749

Ramaria botrytoides (Peck) Corner 1950. Ann. Bot. Mem. 1: 652.

Capsule summary—A pale medium-sized coral ($\leq 17 \times 18$ cm) with white to cream colored branches, yellow to orange branch context and evanescent orange to pink apices. Terrestrial in coniferous forests in autumn.

Stipe: Single to compound, fasciculate, often fused, beset with numerous abortive branchlets; exterior pale buff, smooth; flesh solid, white and minutely mottled to gelatinous and/or soapy; abortive branchlets bright rose pink where protected.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Pale buff below, 'cream buff' in mid-branch, upward slightly flesh-colored to 'pinkish buff'; upper context pale yellow.

Apices: Pale rosy red, 'coral red' or pink-orange when young, darker where protected and fading in age to become eventually nearly concolorous with branches in age.

Basidia: Non-clamped.

Spores: Lm = $8.44 \mu\text{m}$ ($6.8\text{--}10.1 \times 4.0\text{--}5.0 \mu\text{m}$; Em = $1.90 \mu\text{m}$), elongate-ovate to ellipsoid; minutely roughened in profile and ornamented with slender, meandering but generally longitudinal ridges.



Photo by R.L. Exeter 2004-20

Habitat: Coniferous forests in the Pacific Northwest.

Distribution: *Pacific Northwest*—California, Oregon. *Extralimital*—North America (southeastern Canada south to southern Appalachian Mountains); China.

Diagnostic characters: *Ramaria botrytoides* can be distinguished by its (1) white to cream colored basidiocarp with rosy to pink-orange branch tips, (2) yellow branch interior, (3) short warty spores $\sim 8.4 \mu\text{m}$ long, and (4) non-clamped basidia.

Additional comments: *Ramaria botrytoides* could be mistaken for members of subg. *Ramaria*. However, representatives of that subgenus have striate spores and amyloid, fleshy fibrous stipe context. *R. botrytoides* can be recognized in the field by its pink-orange apices when young, yellow to orange branch context, and a stipe that often is partly gelatinous and has visibly fused trunks or 'branches' when seen in radial-section.

Petersen (1986) adds, "Fruit bodies of *R. botrytoides* (Peck) Corner exhibit a more or less compound stipe with many abortive branchlets, and apices abruptly bright pink-orange." The tip coloration tends to fade during maturation. Mature western Oregon specimens often retain the pink colors only on protected abortive branchlets. *Ramaria botrytoides* could also be mistaken for *R. coulterae*, except that the latter species has a stipe context with a brown band in radial-section, longer and narrower spores, and a spring fruiting pattern.

References:

Petersen R.H. and P.D. Olexia. 1967. Type Studies in the Clavarioid Fungi I. The Taxa Described by Charles Horton Peck. Mycologia. vol 59, 772–773.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. Canadian Journal Botany. 64: 1810.

Petersen R.H. 2005-2006. [personal communication: unpublished species notes on western North American material].

Petersen, R.H. and M. Zang. 1989. *Ramaria* subgenera *Ramaria* and *Laeticolora* in Yunnan. Acta Botanica Yunnanica 11: 363-396.



Photo by R.L. Exeter 2004-11



Photo by R.L. Exeter 2004-50



Photo by R.L. Exeter 2004-11



Photo by R.L. Exeter 2004-50

Ramaria celerivirescens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 61.
= *R. claviramulata* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 63.

Capsule summary—A pale orange to salmon-colored medium-sized coral (6–18 × 3–10 cm) with yellow tips. The white stipe has reddish-brown patches on the exterior and a brown band in the interior.

Stipe: Single to compound, white or yellowish white, covered with sub-aerolate patches of brown to reddish brown superficial hyphae; context fleshy fibrous, white above with a distinctive contextual band of pale 'camel brown' hyphae visible in the radial section of the base.

Stipe context reactions: FSW positive: stipe context instantly turning 'dark green'; fresh material amyloid, but the reaction is usually weak and slow or hard to detect.

Branches: Pale to light orange, pinkish orange.

Apices: Light to sunflower yellow.

Basidia: Non-clamped.

Spores: $\bar{x} = 9.5 \times 4.6 \mu\text{m}$ (8–11 × 4–6 μm), subcylindrical with a prominent lateral apiculus; ornamented with coarse, irregularly shaped, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria celerivirescens* can be distinguished by its (1) distinct brownish band in a radially sectioned stipe, (2) scattered patches of brown on the stipe surface, (3) light salmon colored branches, (4) yellow branch tips, and (5) non-clamped basidia.

Additional comments: *Ramaria celerivirescens* is the only non-clamped species with a band of brown contextual stipe hyphae that reacts positive to ferric salts. *R. coulterae* is the only other non-clamped species with a "rusty-root." *R. coulterae* can be distinguished by its magenta colored apices, vernal fruiting habit and the stipe flesh does not react with ferric salts. *R. amyloidea* and *R. velocimutans* are the only described "clamped" species from the Pacific Northwest with a "rusty-root." Besides possessing clamps, these species can further be distinguished by the following: *R. amyloidea* has quickly reacting amyloid stipe tissues and *R. velocimutans* is white when young but matures brown. The stipe of *R. velocimutans* and *R. amyloidea*, like that of *R. celerivirescens*, has sub-aerolate patches of brown superficial hyphae on the surface.

Marr & Stuntz (1973) recorded a positive amyloid reaction for fresh *R. celerivirescens* stipe tissues. The reaction is usually slow, and many collections from western Oregon have been recorded as non-amyloid. The amyloid reaction, which may be weak or not detectable, needs further study. *Ramaria foetida* and *R. stuntzii* are the only other non-clamped species from the Pacific Northwest with amyloid stipe context.

The rDNA analysis of Humpert et. al. (2001) suggests that *R. claviramulata* is not a unique species and may represent an aborted or malformed specimen of the *R. amyloidea/R. celerivirescens* complex. In this publication, we include *R. claviramulata* as a synonym of *R. celerivirescens*.

References:

Humpert, Andrea J. et. al. 2001. Molecular phylogenetics of *Ramaria* and related genera: evidence from nuclear large subunit and mitochondrial small subunit rDNA sequences. *Mycologia*: Vol 93, No.3, pp.465-477.

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 61–63.



Photo by R.L. Exeter 2004-55



Photo by R.L. Exeter 2005-11

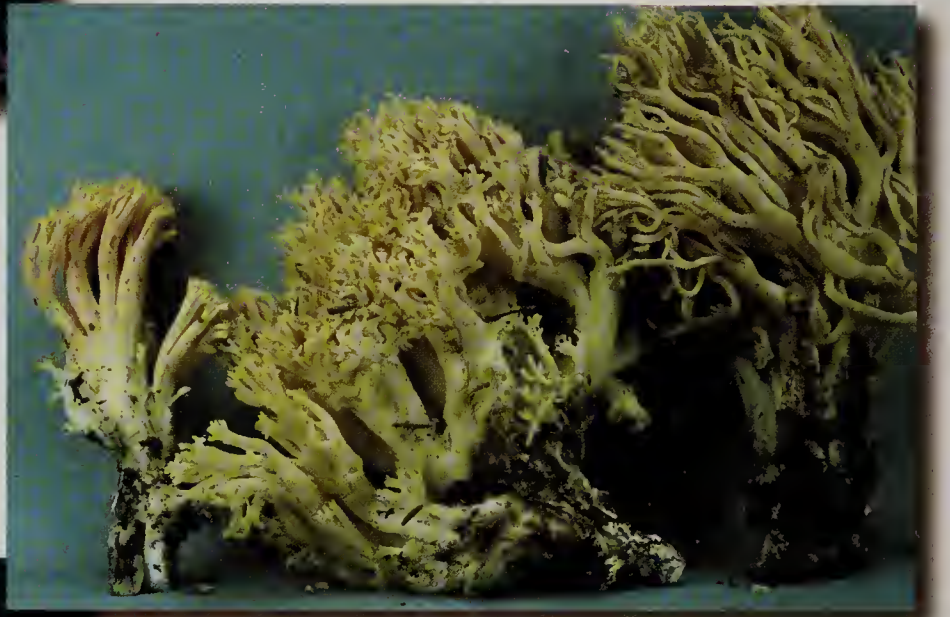


Photo by C.D. Marr Type M841



Photo by R.L. Exeter 2002-18



Photo by R.L. Exeter
R. celerivirescens 2005-62 - left
R. velocimutans 2005-63 - right

Ramaria conjunctipes

var. *tsugensis* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 65.

Capsule summary—A pinkish-orange small to medium-sized fasciculate coral (4.5–18 × 3–7 cm) with salmon to peach colored slender branches and bright yellow tips. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Rarely single, usually a fascicle of steeply tapered to slightly bulbous stipes; covered with a white tomentum where buried; context with fleshy fibrous or rubbery consistency when fresh.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Salmon to peach colored with a waxy translucent quality, inconspicuous faint dull violet bruising areas sometimes present; context concolorous or paler.

Apices: Light to maize yellow.

Basidia: Non-clamped.

Spores: $\bar{x} = 7.5 \times 4.9 \mu\text{m}$ (6–10 × 4–6 μm), ovate or shortly ellipsoidal; nearly smooth (occasional) to covered with fine, linearly lobed, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria conjunctipes* var. *tsugensis* can be recognized by its (1) fasciculate habit, (2) base covered with white tomentum, (3) light salmon to peach colored branches with yellow apices, (4) short (~ 7.5 μm), broadly ellipsoid spores, and (5) non-clamped basidia.

Additional comments: *Ramaria conjunctipes* is unique in its fasciculate habit and pale peach colored branches, which appear somewhat "waxed."

There is considerable taxonomic confusion surrounding the five varieties of *R. conjunctipes* recognized by Marr & Stuntz (1973). Two ('*conjunctipes*' and '*odora*') are restricted to deciduous woods of the southeastern United States while the others ('*raveneliana*', '*sparsiramosa*' and '*tsugensis*') are endemic to hemlock forests of western North America.

Of the western varieties treated by Marr & Stuntz (1973), '*sparsiramosa*' can be distinguished from '*tsugensis*' by its slender form, smaller size, and more densely fasciculate habit. *R. conjunctipes* var. *sparsiramosa* Marr & D.E. Stuntz (1973. *Bibl. Mycol.* 38: 67) produces clusters that are ~ 10 × 3–5 cm and have very slender (2–3 mm diam) sparingly branched primary axes (resembling a cluster of white strings) with only 2–3 branches present near the apices. *R. conjunctipes* var. *raveneliana* can be distinguished by its very small size.

Petersen (1982) remarked on the rarity of the typical variety [*R. conjunctipes* var. *conjunctipes*], known to him only from Coker's original type specimen. He treated the more common '*odora*' not as a variety of *R. conjunctipes*, but as an independent species. When he elevated the variety, he did not use the epithet '*odora*', noting that "odor is so variable over many collections [that] the epithet '*odora*' would be inappropriate." Calling the new species *R. fasciculata*, Petersen noted, "my own concept of these taxa has been forced to change, and ... specimens annotated as *R. conjunctipes* by me in the past, and mentions of that taxon in my previous publications, must be taken as *R. fasciculata*."

Petersen treated six taxa in a taxonomic complex characterized by fruitbodies with (i) orange to pink branches with yellow tips, (ii) clampless septa, (iii) wide spores, and (iv) fasciculate, slender stipes—*Ramaria conjunctipes* var. *conjunctipes*, *R. conjunctipes* var. *tsugensis*, *R. conjunctipes* var. *sparsiramosa*, *R. raveneliana*, *R. ignicolor*, and *R. fasciculata*.

In comparing *Ramaria conjunctipes* var. *sparsiramosa* and *R. conjunctipes* var. *tsugensis* to Nova Scotian specimens of *R. fasciculata*, Petersen suggested that var. *tsugensis* might eventually be shown to be conspecific with *R. fasciculata*. For this publication, we treat '*conjunctipes*', '*sparsiramosa*' and '*tsugensis*' as varieties of *Ramaria conjunctipes* but do recognize two other varieties as independent species: *R. fasciculata* (= *R. conjunctipes* var. *odora*) and *R. raveneliana* (= *R. conjunctipes* var. *raveneliana*).

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 65–68.

Petersen, R.H. 1982. Contributions toward a monograph of *Ramaria*. V. Type specimen studies of taxa described by W.C. Coker. *Sydowia* 35: 184–188, 193–195.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1796–1797.



Photo by C.D. Marr M 520
R. conjunctipes var. *sparsiramosa*



Photo by R.L. Exeter 2005-76a
R. conjunctipes var. *sparsiramosa*



Photo by R.L. Exeter 2005-91 *R. conjunctipes* var. *tsugensis*

Ramaria coulterae Scates 1988. Mycotaxon 33: 115.

Capsule summary—A pinkish medium to large coral ($\leq 12 \times 10$ cm) with white to cream colored branches, pink to red tips, and stipe flesh with a brownish band. Terrestrial in coniferous forests in the spring.

Stipe: Large to massive, single, deeply lined or channeled; surface smooth or with very blunt abortive branchlets; white to off-white, slowly turning brown to pale purple-gray (drab) where handled or bruised; context watery but not slippery or gelatinous, off-white but usually with fan-shaped band of brown contextual hyphae when cut lengthwise.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Off-white, pale yellow or very pale beige, darkening to flesh buff in age; context white, in upper branches very brittle and crisp, in lower branches stringy and fibrous.

Apices: Deep dull fleshy red to flesh beige when young, soon fading to flesh pink and becoming concolorous with branches when fully mature; at all ages the very tips brown to dark brown.

Basidia: Non-clamped.

Spores: $L_m = 9.95 \mu\text{m}$ ($8.3\text{--}12.6 \times 2.9\text{--}4.0 \mu\text{m}$; $E_m = 2.81 \mu\text{m}$), narrowly ellipsoid to cylindrical, smooth to obscurely undulate in profile; smooth or ornamented with a few ill-defined small, low warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—The intermountain area from north & west-central Idaho to north-central Oregon (Morrow County), south to the Sierra Nevada of California.

Diagnostic characters: *Ramaria coulterae* can be recognized by its (1) cream colored basidiocarp with dull red to pink apices, (2) brownish fan-shaped band in the stipe, (3) vernal fruiting habit, (4) non-striate spores, (5) FSW negative and non-amyloid stipe flesh, and (6) non-clamped basidia.

Additional comments: *Ramaria coulterae* could be mistaken for *R. botrytoides* or another species of subg. *Ramaria*. The band of brown contextual hyphae in the stipe context would distinguish *R. coulterae* from these species. Furthermore, representatives of subg. *Ramaria* have striate spores and clamped basidia. Both *R. coulterae* and *R. botrytoides* have non-striate spores, but *R. botrytoides* has a slightly gelatinous stipe context and yellow to orange branch context. *R. celerivirescens* is the only other Pacific Northwest non-clamped species with a brown band of contextual hyphae in the base of the stipe; however that species has a uniquely positive reaction of stipe flesh to ferric salts. Petersen & Scates (1988) mention, "In general aspect *R. coulterae* closely resembles certain forms of *R. celerivirescens*, which also exhibits the brown patch of stipe flesh, but the flesh of which instantly turns deep green in FSW." They also refer to two other similar taxa with brownish stipe flesh that does not turn green with ferric salts. Both taxa (neither yet described) have clamped hyphae and fruit in autumn.

Pacific Northwest clamped species that possess a "rusty-root" include *R. amyloidea* and *R. velocimutans*. Both are autumnal fruiters.

Reference:

Petersen, R.H. and C. Scates. 1988. Vernal fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 115–118.



Photo by M. Beug



Photo by OSU 23270



Photo by C. Scates

Ramaria cyaneigranosa Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 68.
var. *cyaneigranosa*

Capsule summary—A pinkish salmon small to medium-sized coral (4–12 × 2–11 cm) with salmon to light red branches and reddish yellow apices. Terrestrial in coniferous forests in autumn.

Stipe: Single or compound, often thick or slightly bulbous, white; context fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light red.

Apices: Sometimes concolorous with branches, usually minutely dotted with light yellow or reddish yellow.

Basidia: Non-clamped; containing cyanophilous granules.

Spores: $\bar{x} = 11.0 \times 4.6 \mu\text{m}$ (8–15 × 4–6 μm), subcylindrical; ornamented with distinct, irregular shaped cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cyaneigranosa* var.

cyaneigranosa can be recognized by its (1) light red branches, (2) non-amyloid stipe context, (3) coarsely ornamented spores averaging $11.0 \times 4.6 \mu\text{m}$, (4) basidia with abundant cyanophilous granules, and (5) non-clamped basidia.

Additional comments: The three varieties of *R. cyaneigranosa* are separated according to (i) basidiocarp color, (ii) form, and (iii) average spore length. Variety *cyaneigranosa* has spores averaging $11 \mu\text{m}$ long and intensely reddish branches and yellow apices. Variety *elongata* has spores averaging $9.2 \mu\text{m}$ long and a slender spindly form with reddish primordial apices that fade during maturation but never yellow, and variety *persicina* has spores averaging $9.6 \mu\text{m}$ long and peach or salmon colored branches that are not at all red and have minutely yellow-dotted apices.

Petersen (1976) describes the branch coloration as salmon or pink and the flesh as brittle when dry for all varieties of *R. cyaneigranosa*. *Ramaria stuntzii* and *R. araiospora* are the only other red colored species known from western North America. *Ramaria stuntzii* has smaller spores ($8.3 \times 4 \mu\text{m}$), a more massive base, and a positive amyloid reaction on the stipe flesh. *Ramaria araiospora* has narrower, more finely ornamented spores, is more red than pink, and has basidia that lack cyanophilous contents.

See *R. araiospora* for additional comments and Appendix, Table 1. Comparison of "Red" colored ramarias that occur in the Pacific Northwest.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 68–72.

Petersen R. H. 1976. Contribution toward a monograph of *Ramaria* III. *R. sanguinea*, *R. formosa* and two new species from Europe. *American J. Bot.* 63(3): 314–316.



Photo by C.D. Marr M446



Photo by C.D. Marr M480

Ramaria cyaneigranosa

var. *elongata* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 70.

Capsule summary—A slender, reddish-salmon small to medium-sized slender coral (8–13 × 1.5–3.5 cm) with pale red to salmon branches and red to concolorous (never yellow) branch tips. Terrestrial in coniferous forests in autumn.

Stipe: Sub-compound, small, covered by white basal tomentum, white, component base fusing into a small primary root-like processes; context fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Pastel red in youth fading to a brownish salmon during maturation.

Apices: Red maturing concolorous with branches, never yellow.

Basidia: Non-clamped; containing cyanophilous granules.

Spores: $\bar{x} = 9.2 \times 4.5 \mu\text{m}$ (8–10 × 4–5 μm), otherwise similar to var. *cyaneigranosa*.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria cyaneigranosa* var. *elongata* can be separated from other red colored ramarias by its (1) slender, conspicuously elongated growth form, (2) red apices that never yellow, (3) non-amyloid stipe context, (4) coarsely ornamented spores averaging ~ 9.2 × 4.5 μm , (5) basidia containing masses of cyanophilous granules, and (6) non-clamped basidia.

Additional comments: See *Ramaria cyaneigranosa* var. *cyaneigranosa* and *R. araiospora* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 70–71.



Photo by C.D. Marr TYPE M542

Ramaria cyaneigranosa

var. persicina Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 71.

Capsule summary—A peach colored, small (7–8 × 3–4 cm), fan-shaped coral with peach to salmon colored branches and minutely dotted yellow branch tips. Terrestrial in coniferous forests in autumn.

Stipe: Single, steeply tapered, white, covered by white basal tomentum; context fleshy fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Peach or salmon, not at all red.

Apices: Minutely dotted yellow.

Basidia: Non-clamped; containing cyanophilous granules.

Spores: $\bar{x} = 9.6 \times 4.7 \mu\text{m}$ (7–11 × 3.5–6 μm), otherwise similar to variety *cyaneigranosa*.

Habitat: Coniferous forests, especially western hemlock.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria cyaneigranosa* var. *persicina* can be recognized by its (1) peach to salmon colored basidiocarp, (2) non-amyloid stipe context, (3) spores averaging ~ 9.6 × 4.7 μm , (4) coarsely ornamented spores, (5) basidia containing masses of cyanophilous granules, and (6) non-clamped basidia.

Additional comments: *Ramaria celerivirescens* and *R. rubribrunnescens* are the only other non-clamped species having peach to salmon colored branches and lacking a yellow color band on the lower branches.

See *R. cyaneigranosa* var. *cyaneigranosa* and *R. araiospora* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 71–72.



Photo by C.D. Marr TYPE M805

Ramaria flavigelatinosa Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 81.
var. *flavigelatinosa*

Capsule summary—A yellow small to medium-sized broad coral (5–14 × 3–24 cm) with yellow branches, tips, and branch flesh and a bean-like (fabaceous) odor. Terrestrial in coniferous forests in autumn.

Stipe: Base (sub-) compound, white; context translucent white and with a firm gelatinous consistency when fresh.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light yellow to maize yellow with concolorous context. Small to minute areas of the basidiocarp occasionally bruise 'dull violet.'

Apices: Concolorous with branches or brighter, sunflower yellow.

Basidia: Non-clamped.

Spores: $\bar{x} = 9.6 \times 4.1 \mu\text{m}$ (8–11 × 3.5–4.5 μm), subcylindrical; distinctly ornamented with irregularly shaped cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria flavigelatinosa* var. *flavigelatinosa* can be recognized by its (1) overall yellow coloration, (2) yellow branch context, (3) firm gelatinous stipe context, (4) spores averaging ~ 4.1 μm wide, and (5) non-clamped basidia.

Additional comments: The varieties of *R. flavigelatinosa* can be separated into two groups based on color of the branch context. Varieties *carnisalmonea* and *megalospora* show a blush of salmon on the branches from the salmon branch context. Varieties *flavigelatinosa* and *fragrans* have yellow branch context. Marr & Stuntz (1973) separated the varieties of *R. flavigelatinosa* as follows:

i) variety *flavigelatinosa* has a fabaceous odor, firm gelatinous stipe context, 4.1 μm average spore width, and yellow branch context.

ii) variety *carnisalmonea* differs from var. *flavigelatinosa* only in the salmon (orange) branch context.

iii) variety *fragrans* has a sweet odor, cartilaginous stipe consistency, 4.8 μm average spore width, and yellow branch context.

iv) variety *megalospora* differs from var. *flavigelatinosa* in the orange-yellow branch context and longer and wider spores (12 × 4.5 μm).

Although varieties *flavigelatinosa* and *fragrans* have pale yellow branches, they also have a distinctive brighter yellow color band on the lower branches. The hymenial layer on the branches of *R. flavigelatinosa* often appears pale yellow or whitish as it begins to dry.

See *Ramaria gelatiniaurantia* var. *violetingens* for additional comments and Appendix, Table 2. Comparison of non-clamped subgenus *laeticolora* species with a yellow color band on the upper stipe.



Photo by C.D. Marr M384

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 81–83.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1798–1799.



Photo by R.L. Exeter 2005-08



Photo by C.D. Marr M896



Photo by R.L. Exeter 2005-17a

Ramaria flavigelatinosa

var. *carnisalmonea* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 83.

Capsule summary— An orangish-yellow small to medium-sized broad coral (5–14 × 3–24 cm) with yellow branches and tips but with orange to salmon branch flesh that gives an overall orange color to the yellow branch surface. Terrestrial in coniferous forests in autumn.

Stipe: White, covered by a basal tomentum, otherwise similar to var. *flavigelatinosa*.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light yellow with a distinctive pinkish tint due to the underlying 'salmon' context; otherwise similar to var. *flavigelatinosa*.

Apices: Brighter yellow than branches at least in youth.

Basidia: Non-clamped.

Spores: Very close to *Ramaria flavigelatinosa* var. *flavigelatinosa*: $\bar{x} = 9.6 \times 4.1 \mu\text{m}$ (8–11 × 3.5–4.5 μm), subcylindrical, distinctly ornamented with cyanophilous warts of irregular shapes.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria flavigelatinosa* var. *carnisalmonea* can be recognized by its (1) yellow upper stipe and lower branches, (2) orange-salmon colored branches with salmon context, (3) yellow apices, (4) spores averaging ~ 9.6 μm long, and (5) non-clamped basidia.

Additional comments: *Ramaria flavigelatinosa* var. *carnisalmonea* and *R. flavigelatinosa* var. *megalospora* are unique in having branches with yellow outer tissues and salmon to orange context. They can be distinguished from each other by spore size. The other varieties of *flavigelatinosa* (*fragrans* and *flavigelatinosa*) all have yellow branches with yellow context.

See *R. flavigelatinosa* var. *flavigelatinosa* and *Ramaria gelatiniaurantia* var. *violeitingens* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 83.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1798–1799.



Photo by C.D. Marr TYPE M723



Photo by R.L. Exeter 2004-62



Photo by R.L. Exeter 2005-27

Ramaria flavigelatinosa

var. *fragrans* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 83.

Capsule summary—A yellow small to medium-sized broad coral (5.5 × 7 cm or similar to var. *flavigelatinosa*) with yellow branches, branch flesh, and tips and an overall sweet odor. Terrestrial in coniferous forests in autumn.

Stipe: Similar to var. *flavigelatinosa* (cartilaginous consistency when fresh).

Stipe context reactions: FSW negative; non-amyloid.

Branches: Marr & Stuntz note, "The coloration of the basidiocarp is very similar to var. *flavigelatinosa* but perhaps slightly more greenish yellow."

Apices: See branches.

Basidia: Non-clamped.

Spores: $\bar{x} = 10 \times 4.8 \mu\text{m}$ (8.5–13 × 3.5–6 μm), subcylindrical, distinctly ornamented with small cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria flavigelatinosa* var. *fragrans* can be recognized by its (1) overall yellow color, (2) yellow branch context, (3) sweet odor, (4) cartilaginous stipe context, (5) spores that are more than 4.5 μm wide and (6) non-clamped basidia.

Additional comments: The similar *R. flavigelatinosa* var. *flavigelatinosa* has a less sweet, bean-like odor and more slender spores.

See *R. flavigelatinosa* var. *flavigelatinosa* and *Ramaria gelatiniaurantia* var. *violetingens* for additional comments.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 83–84.

Ramaria flavigelatinosa

var. megalospora Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 84.

Capsule summary— An orangish-yellow small to medium-sized broad coral (5–14 × 3–24 cm) with yellow branches and tips but with orange to salmon branch flesh that gives an overall orange color to the yellow branch surface. Terrestrial in coniferous forests in autumn.

Stipe: *Petersen*: "Fasciculate, irregular in shape often beset with abortive branchlets, white where protected, light yellow where exposed; flesh solid, firm-gelatinous to soapy in consistency, white, mottled with small sub-translucent spots." *Marr & Stuntz*: "Cartilaginous consistency when fresh."

Stipe context reactions: FSW negative; non-amyloid.

Branches: *Petersen*: "Lower branches yellow when young, upward pallid salmon to orange-salmon fading in age to light pallid salmon to light orange-salmon." *Marr & Stuntz*: "Branches slightly more orange yellow, close to 'melon yellow,' otherwise similar to var. *flavigelatinosa*."

Apices: Bright yellow when young, fading to pallid yellow.

Basidia: Non-clamped.

Spores: *Petersen*: $Lm = 10.9 \mu m$ ($9.7-12.6 \times 4.3-5.4 \mu m$, $Em = 2.3 \mu m$), mean width $4.82 \mu m$, ellipsoid, flattened adaxially, with suprahilum bulge, distinctly roughened in profile; ornamentation of coarse warts and sometimes complex ridges. *Marr & Stuntz*: $\bar{x} = 12 \times 4.5 \mu m$ ($9-15 \times 4-6 \mu m$), subcylindrical.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest. Extralimital*—Canada (Nova Scotia).

Diagnostic characters: *Ramaria flavigelatinosa* var. *megalospora* can be recognized by its (1) yellow stipe base, (2) orange-salmon colored branches, (3) salmon to orange branch context, (4) yellow apices, (5) cespitose, fasciculate stipes, (6) spores averaging $\sim 10.9 \mu m$ long, and (7) non-clamped basidia.

Additional comments: *Ramaria flavigelatinosa* var. *megalospora* and *R. flavigelatinosa* var. *carnisalmonea* are unique in having yellow outer branch tissues and salmon to orange branch context. They can be distinguished from each other by spore size. The other varieties of *flavigelatinosa* (*fragrans* and *flavigelatinosa*) are yellow with a yellow branch context.

See *R. flavigelatinosa* var. *flavigelatinosa* and *Ramaria gelatiniaurantia* var. *violetingens* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 84–85.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1798–1799.

Ramaria foetida R.H. Petersen 1988. Mycologia 80(2): 226.

Capsule summary—A large (up to 23 × 20 cm) pale yellow coral with a disagreeable coal tar odor. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Broadly rounded at base, white to off-white, smooth with many abortive branchlets clumped like small cauliflowerets, covered with a layer of soil when picked, but not mycelioid, strongly brunnescent; abortive branchlets off-white; context white, or often suffused with sordid tan, solid to soft to somewhat mealy.

Stipe context reactions: Amyloid (FSW reaction not noted).

Branches: Often longitudinally lined or streaked, pale light yellow when young, darkening somewhat when mature; flesh off-white, stringy, occasionally with very obscure pink flushes; all parts browning weakly where rubbed.

Apices: Expanding to irregularly swollen-knobby at maturity, yellow when young, maize yellow, quickly concolorous with branches and remaining so, finally flushed brownish in age.

Basidia: Generally non-clamped. There are, however, rare ($\leq 1\%$) clamped basidia. Petersen (1988) notes that, when found, both basidial and nearby tramal hyphal clamps are "quite conspicuous, sometimes of the medallion type."

Spores: $L_m = 9.10 \mu m$ (7.9–10.4 × 3.6–4.3, $E_m = 2.38$), cylindrical, roughened to barely roughened in profile; ornamented with scattered, small, low, cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—known only from Mendocino County, California.

Diagnostic characters: *Ramaria foetida* can be recognized by its (1) very large pale yellow to cream colored basidiocarp, (2) obnoxious disagreeable odor of coal tar, (3) stipe with many abortive branchlets, (4) amyloid stipe flesh, and (5) usually non-clamped basidia.

Additional comments: *Ramaria celerivirescens* and *R. stuntzii* are the only other non-clamped species known from the Pacific Northwest with an amyloid stipe context. *R. rasilispora* and *R. rasilisporoides*, both clamped species are similar in color, spore size and have an amyloid stipe context.

Reference:

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany. Mycologia, 80(2) 226–227.

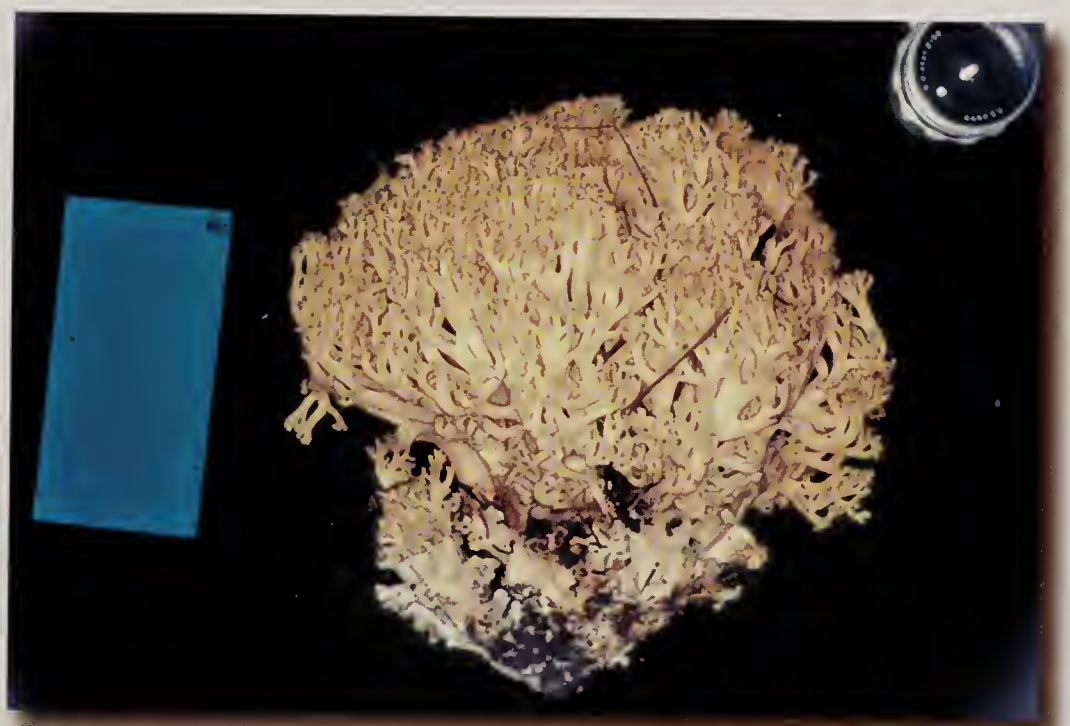


Photo by R.H. Petersen

Ramaria fumosiavellanea Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 91.

Capsule summary—A drab (violet gray), medium-sized (11 × 11 cm), fan shaped coral with white stipe flesh. Terrestrial in coniferous forests in autumn. Rare.

Stipe: *Petersen & Scates:* Fleshy fibrous stipe. *Marr & Stuntz:* Single or a fascicle of two connate stipes, grayish orange; context of base white.

Stipe context reactions: FSW negative; non-amyloid; direct application of 20% KOH & 10% H₂SO₄ quickly turns the violet surfaces of both fresh and dried material Venetian red (KOH) and maize yellow (H₂SO₄). Petersen (1986) notes the strong bright peach-red reaction of violaceous surfaces to KOH is shared by *R. fennica*, *R. violaceibrunnea*, and *R. fumosiavellanea*.

Branches: Drab (violet gray with a brownish component); context translucent brownish-white.



Photo by C.D. Marr TYPE M730

Apices: Apices and a short distance downward paler than grayish orange with a violaceous tint.

Basidia: Non-clamped.

Spores: \bar{x} = 10.4 × 5.4 μm (9–13.5 × 4.5–7 μm), elongate-ellipsoidal with a distinct apiculus; ornamented with fine, linearly lobed, cyanophilous warts, some nearly smooth.

Habitat: Growing in sandy soil in coniferous forests.

Distribution: *Pacific Northwest*—restricted to coastal regions from California through British Columbia.

Diagnostic characters: *Ramaria fumosiavellanea* can be recognized by its (1) violet gray basidiocarp, (2) off-white stipe flesh, (3) single to fasciculate stipe, and (4) non-clamped basidia.

Additional comments: There is some confusion regarding the taxonomic status of *R. fumosiavellanea*. Petersen (1988) implies a separation between the species and *R. spinulosa*; "There is a small complex of taxa with brown, tan-brown or violaceous brown branches and apices, clampless hyphae, and wide spores. In it are *R. spinulosa* (brown flesh, spore Lm = 10.5 μm, Europe and eastern North America), *R. spinulosa* var. *diminutiva* (brown flesh, spore Lm = 8.5 μm, California), and *R. fumosiavellanea* Marr & Stuntz (off-white flesh, spore Lm = 10.3 μm, Pacific Northwest). The stipe surface in *Ramaria spinulosa* is brown or orange-brown, while that of *R. fumosiavellanea* is off-white."

However, in a different paper published later the same year, Petersen & Scates (1988) equate the two species: "Our examination of the type specimens of *R. fumosiavellanea* ... show it to be conspecific with *R. spinulosa*."

For this publication, we treat *R. fumosiavellanea* as an independent species.

Ramaria marrii, *R. acrisiccenscens*, and *R. spinulosa* var. *diminutiva* are all dingy colored species that could be confused with *R. fumosiavellanea*. *R. marrii* fruits in the spring and often has a compound base. *R. acrisiccenscens* is white when immature, bruising or maturing brown. As mentioned above, *R. spinulosa* var. *diminutiva* has brown stipe flesh and shorter spores.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 91–92.

Petersen, R. H. 1986. Some *Ramaria* taxa from Nova Scotia. *Canadian Journal Bot.* 64: 1798.

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany. *Mycologia*, 80(2) 230.

Petersen, R.H. and C. Scates. 1988. Vernaly fruiting taxa of *Ramaria* from the Pacific Northwest. *Mycotaxon* 33: 125.

Ramaria gelatiniaurantia Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 93.
 var. *gelatiniaurantia*

Capsule summary—An orange medium to large-sized coral (6–22 × 4–11 cm) with a fasciculate habit, sunflower yellow upper (gelatinous) stipe, and orange branches & tips. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Compound, consisting of numerous, connate, gelatinous primary axes in various stages of development; light yellow to sunflower yellow immediately above and white below the substrate; consistency definitely gelatinous, context marbled with alternating translucent grayish white and waxy opaque white areas.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Most exposed branches 'deep orange.'

Apices: Deep orange.

Basidia: Non-clamped.

Spores: $\bar{x} = 9.3 \times 4.1 \mu\text{m}$ (8–11 × 3.5–5 μm), subcylindrical; ornamented with small, lobed cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria gelatiniaurantia* var. *gelatiniaurantia* can be recognized by its (1) definitely gelatinous stipe context, (2) deep orange branches and apices, (3) spores averaging ~ 9.3 μm long, and (4) non-clamped basidia.

Additional comments: *Ramaria gelatiniaurantia* var. *gelatiniaurantia* could be confused with *R. flavigelatinosa* varieties *megalospora* and *carnisalmonea*, but both varieties have yellow apices, pale orange branches and longer spores. Both *R. aurantiisiccescens* and *R. armeniaca* have orange branches and apices, but have a fleshy fibrous stipe context. Petersen (1986) specifically mentions the orange branches and apices, gelatinous white flesh, fasciculate stipes, and yellow lower branches of *R. gelatiniaurantia*. Marr & Stuntz (1973) emphasize that the stipe context is "definitely gelatinous."

See *Ramaria gelatiniaurantia* var. *violetingens* for additional comments and Table 2 in the Appendix for a comparison of similar species.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 93–94.

Petersen, R.H. 1986. Some *Ramaria* from Nova Scotia. *Canadian Journal Botany*. 64: 1799.



Photo by C.D. Marr TYPE M479

Ramaria gelatiniaurantia

var. *violeitingens* Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 94.

Capsule summary—A yellow, medium-sized (12–17 × 5–15 cm), subgelatinous coral with “apricot yellow” branches that bruise a dull violet and yellow branch tips. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single to compound, usually slender and rooting; context white, subgelatinous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Apricot yellow bruising dull violet; context yellow.

Apices: Light yellow or maize yellow.

Basidia: Non-clamped.

Spores: Similar to those of var. *gelatiniaurantia*: $\bar{x} = 9.3 \times 4.1$ μm (8–11 × 3.5–5 μm), subcylindrical; ornamented with small, lobed cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria gelatiniaurantia* var. *violeitingens* can be recognized by its (1) subgelatinous stipe context, (2) apricot yellow branches that bruise dull violet, (3) yellow apices, (4) spores averaging ~ 9.3 μm long, and (5) non-clamped basidia.

Additional comments: There is a group of non-clamped species that has i) a gelatinous to cartilaginous stipe context, ii) yellow upper stipe and lower branches, iii) pale orange to salmon upper branches, and iv) yellow apices. This group includes *R. gelatiniaurantia*, *R. flavigelatinosa*, *R. hilaris* var. *olympiana*, and *Ramaria verlotensis*.

R. armeniaca and *R. aurantiisiccescens* also have a yellow color band on the upper stipe and orange upper branches, but both have fleshy fibrous stipe contexts and *R. armeniaca* is a vernal fruiter.

The basidiocarps of *R. flavigelatinosa* varieties *flavigelatinosa* and *fragrans* lack any orange color and can be distinguished from each other by spore width and sporocarp odor.

The branch context of *R. flavigelatinosa* varieties *carnisalmonea* and *megalospora* is salmon to orange; spore length also separates these two varieties.

Both *R. gelatiniaurantia* and *R. hilaris* var. *olympiana* have yellow branch contexts but are separated by spore size. Additionally, the single stipe of *Ramaria hilaris* var. *olympiana* contrasts with the generally compound stipe of *R. gelatiniaurantia*.

The branches of *R. verlotensis* are described as “pale orange”; however, its broad cauliflower-like fruiting body is distinctively pale yellowish-pink overall.

Gloeoplerous hyphae are reported to be rare in the stipe context of *R. gelatiniaurantia* var. *gelatiniaurantia*, not observed in *R. hilaris* var. *olympiana*, prominent in base but rare in the branches of *R. gelatiniaurantia* var. *violeitingens*, and present in *R. verlotensis* and *R. flavigelatinosa*.

Distinguishing between the non-clamped species with orange upper branches and a yellow color band on the lower branches is difficult. Table 2 in the Appendix compares the non-clamped “orange branched” species with a yellow color band on the upper stipe and lower branches.



Photo by C.D. Marr M493

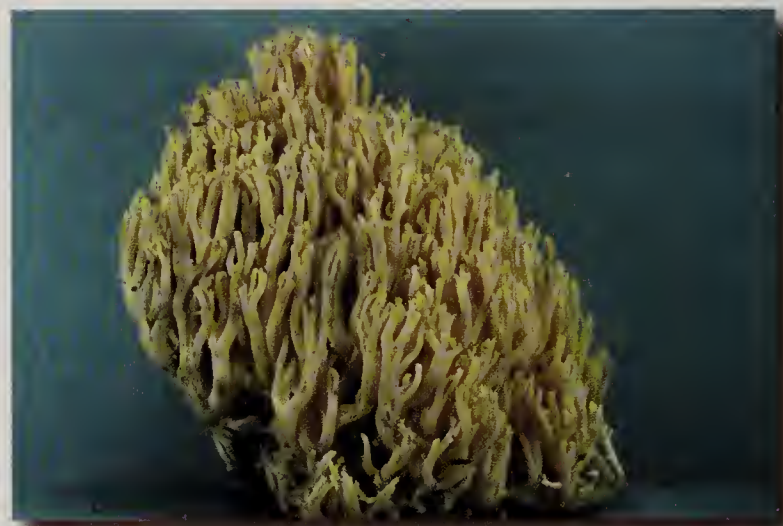


Photo by C.D. Marr M493b

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 94–95.

Ramaria hilaris

var. *olympiana* R.H. Petersen 1988. *Mycologia* 80(2): 228.

Capsule summary—A salmon & yellow, medium-sized ($\leq 10 \times 6$ cm), broadly fusiform to obconic (in outline) coral with firm-gelatinous translucent stipe flesh, yellow color band on the lower branches, and pale salmon upper branches with yellow context and bright yellow apices. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Single, tapering to a point, smooth and lacking abortive branchlets, rubbery in texture; off-white (pale ochraceous salmon) at base, bright rich yellow above; context firm-gelatinous, translucent and more or less colorless, white toward the surface.

Stipe context reactions: Non-amyloid (FSW reaction not noted).

Branches: Bright yellow below, a lively pale salmon above; context firm-gelatinous, progressively yellow upward with no pinkish tints (salmon color restricted to outermost tissues).

Apices: Bright rich yellow, hardly fading in maturity.

Basidia: Non-clamped.

Spores: $L_m = 10.10 \mu\text{m}$ ($9.4\text{--}11.2 \times 4.0\text{--}5.0 \mu\text{m}$, $E_m = 2.30 \mu\text{m}$), ellipsoid, usually flattened adaxially, obscurely roughened in profile; ornamented with scattered small, flat, occasionally lobed warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—Washington State (Jefferson County).

Diagnostic characters: *Ramaria hilaris* var. *olympiana* can be recognized by its (1) solitary gelatinous stipe, (2) branches with pale salmon outer tissue surrounding the yellow interior, (3) bright yellow apices and upper stipe, and (4) non-clamped basidia.

Additional comments: Petersen (1988) pointed out the following important features to help separate the following similar 'gelatinous' species from *R. hilaris* var. *olympiana*: the compound (opposed to single) stipe of *R. flavigelatinosa*, the presence of orange tramal pigments that cause the pinkish coloration in *R. flavigelatinosa* var. *carnisalmonea*, and the stout, 'cauliflower-like' (vs. solitary) habit of *R. verlotensis*.

See *Ramaria gelatiniaurantia* var. *violetingens* for additional discussion and Table 2 in the Appendix for a comparison to similar species.

Reference:

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and miscellany. *Mycologia*, 80(2) 228–229.



Photo by R.H. Petersen

Ramaria longispora Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 101.

Capsule summary—An orange slender small to medium-sized coral (4–18 × 2–9 cm) with yellow upper stipe and apices. The stipe is mostly single and slightly bulbous. Terrestrial in coniferous forests in autumn.

Stipe: Single, slightly bulbous or (more commonly) sub-compound; underground portion white, upper stipe pale yellow to sunflower yellow; fleshy-fibrous.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Light to deep orange; context concolorous (or paler within branch centers).

Apices: Immature tips saffron or 'chrome yellow,' becoming concolorous with branches during maturation.

Basidia: Non-clamped.

Spores: $\bar{x} = 13.5 \times 4.5 \mu\text{m}$ (10–18 × 4–6 μm), subcylindrical, sometimes with a slight suprahilar depression and dorsal convexity; ornamented with numerous, distinct, cyanophilous warts.

Habitat: Coniferous forests, especially western hemlock.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria longispora* can be recognized by its (1) orange branches with yellow tips, (2) slightly bulbous stipe base, (3) light yellow color on upper stipe and lower branches, (4) long (~ 13.5 μm) warty cyanophilous spores, and (5) non-clamped basidia.

Additional comments: The long spores and bright orange basidiocarp of *R. longispora* are distinctive. In the field, *R. longispora* may be confused with at least two clamped species: *R. sandaracina* var. *euosma* and *R. leptiformosa*. The single frequently swollen fleshy-fibrous stipe, yellow band on the lower branches, and orange upper branches are excellent field characters. The otherwise similar *Ramaria aurantiiscescens* and *R. gelatiniaurantia* lack clamps. Additionally, the stipe context is gelatinous in the smaller-spored *R. gelatiniaurantia* while *R. aurantiiscescens* can be distinguished by spore morphology (size, ornamentation) and stipe context reactivity to various chemicals.

See Table 2 in the Appendix for a comparison to similar species.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 101–103.



Photo by R.L. Exeter 2004-33



Photo by C.D. Marr M713



Photo by C.D. Marr M744

Ramaria marrii Scates 1988. Mycotaxon 33: 123.

Capsule summary—A tan, medium-sized, fleshy coral ($\leq 15 \times 9$ cm) with faint violet tints. Terrestrial in coniferous forest in the spring.

Stipe: Single to compound, broadly rounded; without abortive branchlets, smooth to minutely tomentose; white to off-white but chocolate brown where pressing against substrate and turning brown to watery brown when bruised (although rarely when cut); context solid or mottled often with fused bases, soft-spongy in large stipes, off-white.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Pale tan below, light brown to flesh tan above, often with avellaneous tints; more or less unchanging throughout development.

Apices: Deep fleshy tan when young, fading slightly when mature.

Basidia: Non-clamped.

Spores: $L_m = 9.85 \mu\text{m}$ ($8.6\text{--}11.6 \times 4.3\text{--}5.4 \mu\text{m}$, $E_m = 2.08 \mu\text{m}$), ellipsoid to narrowly ovate, flattened adaxially, obscurely roughened in profile; almost smooth to ornamented with narrow meandering ridges or large, discrete, low warts.



Photo by R.L. Exeter

Habitat: Coniferous forests (associated with *Pinus monticola* & *Abies grandis* in Idaho and *Pseudotsuga menziesii* & *Tsuga heterophylla* forests in Oregon).

Distribution: Pacific Northwest—Idaho, Oregon (Cascade Mountains).

Diagnostic characters: *Ramaria marrii* can be recognized by its (1) vernal fruiting habit, (2) uniformly tan colors, (3) broadly rounded single stipe, (4) brownish bruising reaction, and (5) non-clamped basidia.

Additional comments: *Ramaria marrii* is our only spring ramaria that is chocolate brown when fresh and one of the few spring ramarias lacking clamped basidia. *R. acrisiccenscens*, *R. fumosiavellanea*, and *R. spinulosa* var. *diminutiva* are three other dingy colored, non-clamped species that occur in western North America. All three species tend to have single to fasciculate stipes and fruit in the autumn. Although the type description of *R. marrii* describes the stipe as single, Oregon collections suggest that the stipe is better described as single to compound, usually comprising several fused stipes.

Reference:

Petersen, R.H. and C. Scates. 1988. Vernally fruiting taxa of *Ramaria* from the Pacific Northwest. Mycotaxon 33: 123–125.



Photo by R.L. Exeter



Photo by C. Scates

Ramaria raveneliana (Coker) R.H. Petersen 1982. *Sydowia* 35: 195.

≡ *Clavaria raveneliana* Coker. 1947. *Jour. Elisha Mitchell Sci. Soc.* 63: 44.

≡ *R. conjunctipes* var. *raveneliana* (Coker) Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 66.

Capsule summary—A pinkish to flesh-colored small (≤ 4 cm) obovoid to fusiform coral with flesh colored branches and orange to yellow tips. Terrestrial under hemlock and rhododendrons in autumn.

Stipe: Slender, ≤ 4 mm thick, fasciculate, off-white to very pale watery pink below; stuffed to hollow, context stringy when fresh.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Few to each stem, many in fascicles; slender; usually hollow, brittle; flesh colored.

Apices: Pale clear yellow to pale orange yellow to pale ochraceous salmon.

Basidia: Non-clamped.

Spores: $L_m = 9.94 \mu m$ ($8.9-11.2 \times 5.0-6.1 \mu m$, $E_m = 1.80 \mu m$), broadly cylindrical to ellipsoid, flattened adaxially, very obscurely roughened in profile; ornamented with small, scattered, strongly cyanophilous warts or raised patches.

Habitat: On shallow soil under *Tsuga* and *Rhododendron*.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria raveneliana* can be recognized by its (1) diminutive fasciculate habit (only up to 4 cm tall), (2) flesh colored, usually hollow branches (3) yellow branch tips, and (4) non-clamped basidia.

Additional Comments: *Ramaria raveneliana* and *R. conjunctipes* are unique in their fasciculate habit and sparingly branched, branches. The unusually small size and longer spores distinguish *R. raveneliana* from *R. conjunctipes* varieties. Petersen (1982) notes, "To my observations, fruitbodies of the type of [*R.*] *conjunctipes* are not hollow, while the fruitbodies of the type of [*R.*] *raveneliana* are consistently so, both in stipe and branch parts."

See *R. conjunctipes* var. *tsugensis* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 66-67. (As *R. conjunctipes* var. *raveneliana*)

Petersen, R.H. 1982. Contributions toward a monograph of *Ramaria*. V. Type specimen studies of taxa described by W.C. Coker. *Sydowia* 35: 193-195.



Photo by R.H. Petersen

Ramaria rubiginosa Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 109.

Capsule summary—A pale yellow medium-sized coral (5–18 × 4–17 cm) with wine-colored stains on the lower stipe. Terrestrial in coniferous forests in autumn.

Stipe: Single, thick, or sub-compound, with two to several thick axes arising from a small primary root-like structure, yellowish-white; context fleshy-fibrous when fresh; any part of the basidiocarp but especially the base and lower branches with wine-colored stains.

Stipe context reactions: FSW negative; non-amyloid or very faintly amyloid.

Branches: Yellowish white to light yellow.

Apices: Light yellow to 'sunflower yellow'; when young more intensely yellow, later concolorous with branches.

Basidia: Non-clamped.

Spores: $\bar{x} = 9.4 \times 4.4 \mu\text{m}$ (7–11 × 3.5–6 μm), cylindrical; ornamented by finely lobed, anastomosing warts that are faintly more cyanophilous than the general wall.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*

Diagnostic characters: *Ramaria rubiginosa* can be recognized by its (1) pale yellow basidiocarp, (2) wine-colored stains on the stipe and lower branches, and (3) non-clamped basidia.

Additional comments: Other ramarias that have vinescent stains while growing include *R. cystidiophora* var. *maculans*, *R. maculatipes*, *R. vinosimaculans* (all clamped species) and *R. synaptopoda* and *R. rubribrunnescens* (both non-clamped). *Ramaria rubribrunnescens* and *R. maculatipes* have pale red, peach, or salmon colored branches, while the other three species also have pale yellow branches. *Ramaria rubiginosa* differs from the non-clamped *R. synaptopoda* by possessing a more highly branched basidiocarp with a single stipe.

When comparing the eastern *R. xanthosperma* (Peck) Corner and the western *R. rubiginosa* to *R. sanguinea* (Pers. Per Secr.) Quel., Petersen (1976) remarked that *R. rubiginosa* "... shows a generally brighter yellow coloration in the lower branches, stouter fruit bodies, positive reaction of branch trama with iron salts, and slightly smaller spores." He further noted that if that combination of characters were not sufficient to support the taxon at the species level, "*R. rubiginosa* would appear as a synonym under *R. sanguinea*."

In Marr & Stuntz (1973), key lead #32 suggests that the context of *R. rubiginosa* reacts rapidly with 10% iron sulfate. Marr (personal comm.) recently clarified that the rapid reaction is on branch tissue and that the stipe of *R. rubiginosa* does not have a positive reaction with iron salts.

See *R. vinosimaculans* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 109–111.

Petersen R. H. 1976. Contribution toward a monograph of *Ramaria* III. *R. sanguinea*, *R. formosa*. And two new species from Europe. *American J. Bot.* 63(3): 311.

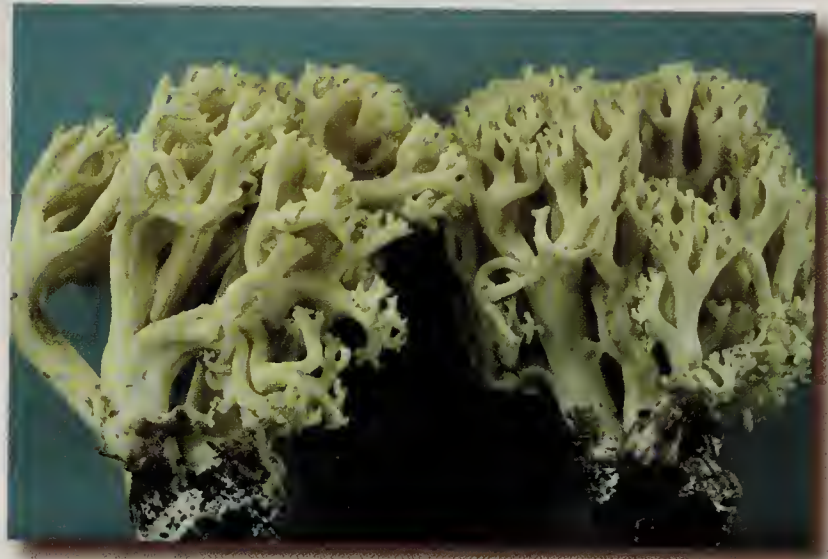


Photo by C.D. Marr M835



Photo by C.D. Marr M 746



Photo by R.L. Exeter, 2005-77

Ramaria rubribrunnescens Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 111.

Capsule summary—A pale orangish medium-sized coral (7–16 × 5.5–11 cm) with pale salmon to pale orange branches, yellow apices, and a lower stipe with red stains. Terrestrial in coniferous forests in autumn. Uncommon.

Stipe: When young, single (frequently slender and tapering), commonly with abortive or primordial branches; later often a sub-fascicle composed of several to numerous slender primary branches. White to orange white, but with 'wine-colored' stains (particularly extensive in age) at the base.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Surface and context both pale red when young and slightly browner than light orange when old; lower branches with 'wine-colored' red stains similar to those found on the lower stipe.

Apices: Light yellow.

Basidia: Non-clamped.

Spores: $\bar{x} = 12.3 \times 4.4 \mu\text{m}$ (10–14 × 3.5–5 μm), subcylindrical with a slight suprahilar depression and dorsal convexity, entire spore wall cyanophilous; ornamentations very fine, some spores smooth or nearly so.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*.

Diagnostic characters: *Ramaria rubribrunnescens* can be recognized by its (1) light salmon basidiocarp with vinescent stains on lower portions of branches and stipe, (2) yellow apices, (3) long (~ 12.3 μm) finely ornamented cyanophilous spores, and (4) non-clamped basidia.

Additional comments: *Ramaria rubribrunnescens* is unique in the pale salmon colored basidiocarp with vinescent stains on the stipe and lower branches, non-clamped basidia and long spores. The only other species of *Ramaria* that have maroon stains when found include; *R. cystidiophora* var. *maculans*, *R. maculatipes*, *R. vinosimaculans*, all clamped species, and *R. synaptopoda* and *R. rubiginosa* both non-clamped species. *Ramaria rubribrunnescens* and *R. maculatipes* have pale red, peach or salmon colored branches. The other species have pale yellow branches.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 111–113.



Photo by R.L. Exeter 2003-07



Photo by C.D. Marr M614



Photo by C.D. Marr TYPE M844

Ramaria spinulosa

var. *diminutiva* R.H. Petersen 1988. Mycologia 80(2): 230.

Capsule summary—A drab small to medium-sized coral ($\leq 13 \times 10$ cm) with brown to violaceous brown branches and dull brown stipe flesh. Terrestrial in coniferous (usually pine) forests in autumn. Rare.

Stipe: Overall deep tan to brown, but often orange-brown below and browning where handled; possessing relatively few abortive branchlets; context firm to somewhat tough, dull brown but streaked similar to wood grain.

Stipe context reactions: Non-amyloid (FSW not recorded).

Branches: Often rugulose lengthwise; brown to drab (dull purple brown).

Apices: Drab when young, losing purplish tinges and then concolorous with branches when mature.

Basidia: Non-clamped.

Spores: Lm = $8.6 \mu\text{m}$ ($7.2\text{--}10.1 \times 4.7\text{--}6.1 \mu\text{m}$, Em = $1.61 \mu\text{m}$), broadly cylindrical to ovoid, finely roughened in profile; ornamented with small ridges (seen as streaks) and small warts, occasionally obliquely oriented.

Habitat: Coniferous forests, usually under *Pinus*.

Distribution: *Pacific Northwest*—California (Marin & Mendocino Counties).

Diagnostic characters: *Ramaria spinulosa* var. *diminutiva* can be recognized by its (1) deep tan to brown basidiocarp, (2) dull brown stipe context, (3) small spores ~ 8.6 long, and (4) non-clamped basidia.

Additional comments: *Ramaria acrisiccescens*, *R. fumosiavellanea* are similar to *R. spinulosa* var. *diminutiva*. *Ramaria acrisiccescens* has longer spores, is white when fresh, but matures brown. *R. fumosiavellanea* has longer spores and white stipe flesh.

Petersen describes the colors of 'the complex' (*R. spinulosa*, *R. spinulosa* var. *diminutiva* and *R. fumosiavellanea*) as similar to *R. uarrii*, and mentions the color of the upper branches of *R. spinulosa* var. *diminutiva* are similar to the mature branches of *R. violaceibrunnea*. Occasional herbarium specimens may be found annotated under *R. "desjardinii"* and *R. "brunneocarnea."*

See *R. fumosiavellanea* for further comments.

Reference:

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany. Mycologia, 80(2) 230–231.



Photo by R.H. Petersen

Ramaria stuntzii Marr 1973. *Bibl. Mycol.* 38: 118.

Capsule summary—A red medium-sized coral (6–17 × 4–14 cm) with a relatively massive stipe with a faint orange band on the upper stipe and scarlet-red branches and branch tips. Terrestrial in coniferous forests in autumn.

Stipe: Single to (most often) massive, single and slightly bulbous, or with abortive white branchlets; surface white (light orange at substrate level); context white and fleshy fibrous.

Stipe context reactions: FSW negative; rapidly amyloid.

Branches: Upper branches 'scarlet' and fading to light orange-red as they age; (light) orange "bellyband" visible on lower branches; context concolorous (somewhat paler near branch centers).

Apices: Scarlet-red.

Basidia: Non-clamped.

Spores: $\bar{x} = 8.3 \times 4 \mu\text{m}$ (7–10 × 3–5 μm); subcylindrical; ornamented with small lobed warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest.*



Photo by R.L. Exeter 2004-39

Diagnostic characters: *Ramaria stuntzii* can be recognized by its (1) scarlet-red upper branches and apices, (2) orange banded upper stipe and lower branches, (3) often massive base, (4) strongly amyloid stipe context, (5) small ($\sim 8.3 \times 4 \mu\text{m}$) spores, and (6) non-clamped basidia.

Additional comments: Smaller spores and amyloid stipe context help differentiate *Ramaria stuntzii* from the other two Pacific Northwestern red ramarias (*R. araiospora*, *R. cyaneigranosa*). *Ramaria cyaneigranosa* tends to be more pinkish to salmon colored, and *R. araiospora* var. *araiospora* has yellow branch tips. With its red branch tips, *R. araiospora* var. *rubella* appears most similar to *R. stuntzii*, but the former has larger spores and a non-amyloid stipe context. *R. celerivirescens* and *R. foetida* are the only two other non-clamped western ramarias with amyloid stipe context.

See *R. araiospora* and *R. cyaneigranosa* for additional discussion and Appendix, Table 1. Comparison of "Red" Colored ramarias that occur in the Pacific Northwest.

Reference:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 118–120.



Photo by C.D. Marr M742A



Photo by R.L. Exeter
R. stuntzii 2005-48 left
R. araiospora var. *rubella* 2005-43 right

Ramaria synaptopoda Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 120.

Capsule summary—A small (6 × 4 cm), yellow, fasciculate coral with few branches and wine-stained stipe. Terrestrial in coniferous forests in autumn. Rare.

Stipe: Compound—a dense cluster of primary axes (rarely branching more than 3 times) with small primordial/abortive branch systems near the tomentose base; surface white with small wine-red stains.

Stipe context reactions: FSW negative; non-amyloid.

Branches: Pale to light yellow, with the color becoming increasingly intense from the base; context white.

Apices: Yellow.

Basidia: Non-clamped.

Spores: $\bar{x} = 9.9 \times 4.1 \mu\text{m}$ (9–11.5 × 3.5–4.5 μm), cylindrical with a prominent apiculus; ornamented with numerous, small, distinct cyanophilous warts.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—Washington (known from only one site in Pierce County).

Diagnostic characters: *Ramaria synaptopoda* can be recognized by its (1) overall yellow color, (2) small red stains on lower half of basidiocarp, (3) compound to fasciculate stipe, (4) branching up to 3 ranks, and (5) non-clamped basidia.

Additional comments: *Ramaria synaptopoda* and *R. conjunctipes* share similar branching habits, but the yellow *R. synaptopoda* lacks the orange coloration of *R. conjunctipes*. The only other species of *Ramaria* that have innate wine-colored (oxblood or vinescent) stains are the clamped *R. cystidiophora* var. *maculans*, *R. maculatipes*, and *R. vinosimaculans* and unclamped *R. rubribrunnescens* and *R. rubiginosa*. *R. rubribrunnescens* and *R. maculatipes* have pale red or salmon colored branches. The other species all have pale yellow branches, are more highly branched, and usually have a single stipe.

In the USDA-FS *Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan* (Castellano et al., 1999), *Ramaria synaptopoda* was treated as a possible synonym of the *R. lorithamnus* from Australia and New Zealand. We found no reference supporting the synonymy and we consider the two species to be independent and separate. Tony Young (pers. comm.), associated with the Queensland Herbarium in Australia supports our opinion. He noted that *R. synaptopoda* has i) much larger spores (6.3–8.2 × 4.8–5.6 μm for *R. lorithamnus*), ii) has a pungently sweet odor (vs. the fabaceous odor of *R. lorithamnus*), iii) has vinescent stains (lacking in *R. lorithamnus*), and iv) has a different mycorrhizal associate (western hemlock vs. *Eucalyptus* for *R. lorithamnus*).

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 120–122.

R. H. Petersen and R. Watling. 1989. New or interesting *Ramaria* taxa from Australia. *Notes RBG Edinb* 46(1):148



Photo by C.D. Marr TYPE M374



Photo by Tony Young [*R. lorithamnus*]

Ramaria verlotensis Marr & D.E. Stuntz. 1973. *Bibl. Mycol.* 38: 126.

Capsule summary—A pale yellow-pink, medium (9 × 10 cm) 'cauliflower-like' coral with salmon to pale orange branches and branch tips, yellow upper stipe, and firm (sub-) gelatinous stipe flesh. Terrestrial in coniferous forests in autumn. Rare.

Stipe: *Petersen:* Stipe single, small, branches almost from base or with abortive branchlets, white below, mealy to densely but superficially pruinose at base, maize yellow above; flesh solid, whitish, firm-gelatinous to hard-rubbery, watery when fresh. *Marr & Stuntz:* Single, small, numerous branch systems arising from the base, white, upwards light yellow; firmly gelatinous when fresh, white-marbled.

Stipe context reactions: FSW negative; non-amyloid.

Branches: *Petersen:* Branches pallid salmon to salmon colored ('salmon color,' light vinaceous cinnamon,' 'light pinkish cinnamon'); flesh apparently gelatinous to watery when fresh. *Marr & Stuntz:* Lower branches light yellow, upwards pale orange; context concolorous.

Apices: Concolorous with the branches or tipped with light yellow.

Basidia: Non-clamped.

Spores: *Petersen:* $L_m = 10.1 \mu m$ ($9.0-11.2 \times 4.7-6.1 \mu m$, $E_m = 1.91 \mu m$), broadly ellipsoid to subovate, prominently roughened in profile; ornamentation of large or low, discrete plates covering extensive wall area. *Marr & Stuntz:* $\bar{x} = 10.1 \times 4.9 \mu m$ ($9-11 \times 4.5-6 \mu m$), subcylindrical to ellipsoidal; ornamented with cyanophilous, lobed warts of some prominence.

Habitat: Coniferous forests.

Distribution: *Pacific Northwest*—known only from western Washington and coastal northern California.

Diagnostic characters: *Ramaria verlotensis* can be recognized by its (1) broad pale yellowish-pink cauliflower-like basidiocarp, (2) gelatinous stipe context, (3) major branches fused together to form a small base, and (4) non-clamped basidia.

Additional comments: See *Ramaria gelatiniaurantia* var. *violeitingens* for additional comments.

References:

Marr, C.D. and D.E. Stuntz. 1973. *Ramaria* of western Washington. *Bibliotheca Mycologica* 38: 126-128.

Petersen, R. H. 1988. Contributions toward a monograph of *Ramaria*. VII. New taxa and Miscellany. *Mycologia*, 80(2) 232-233.

Petersen, R. H. 1989. Contributions Toward a Monograph of *Ramaria* VIII. Some taxa sheltered under the name *Ramaria flava*. *Persoonia*. vol 14, part 1, 31.

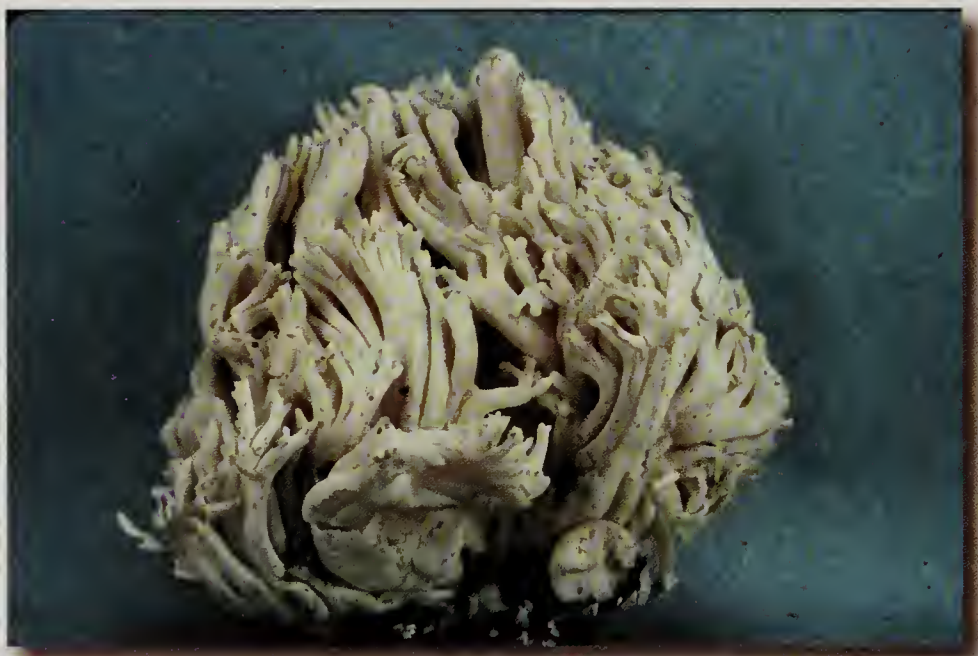


Photo by C.D. Marr TYPE M847

APPENDIX

Table 1: Comparison of "red" colored ramarias that occur in the Pacific Northwestern United States.

<i>Ramaria</i> species	Stipe Flesh	Branch color	Apical color	Basidia	Spore length Average (range)	Spore Width Average (range)	Spore ornamentation
<i>R. araiospora</i> var. <i>araiospora</i>	Non-amyloid	Red to light red	Yellow	Without cyanophilous granules	9.9 μm (8-13)	3.7 μm (3-4.5)	Finely warted
<i>R. araiospora</i> var. <i>rubella</i>	Non-amyloid	Red	Red	Without cyanophilous granules	9.8 μm (8-14)	3.6 μm (3-5)	Finely warted
<i>R. cyaneigranosa</i> var. <i>cyaneigranosa</i>	Non-amyloid	Light red	Light red to red-yellow	Granular & cyanophilous	11.0 μm (8-15)	4.6 μm (4-6)	Small lobed warts
<i>R. cyaneigranosa</i> var. <i>elongata</i>	Non-amyloid	Pastel red to brown salmon	Red, never yellow	Granular & cyanophilous	9.2 μm (8-10)	4.5 μm (4-5)	Small lobed warts
<i>R. cyaneigranosa</i> var. <i>persicina</i>	Non-amyloid	Salmon	Salmon	Granular & cyanophilous	9.6 μm (7-11)	4.7 μm (3.5-6)	Small lobed warts
<i>R. stuntzii</i>	Quickly amyloid	Scarlet to orange-red	Scarlet	Granular & cyanophilous	8.3 μm (7-10)	4.0 μm (3-5)	Small lobed warts

Table 2: Comparison of non-clamped subgenus *Laeticolora* species with a yellow color band on the upper stipe.

<i>Ramaria</i> species	Stipe context	Branch color	Branch context color	Apical color	Spore length Lm (range)	Spore width Wm (range)
<i>R. armeniaca</i>	fleshy fibrous	orange	white	orange	10.25 µm (8.6-11.5)	3.9 µm (3.6-4.3)
<i>R. aurantiiscescens</i>	fleshy fibrous	light orange, apricot yellow	sub-concolorous	dark orange	10.8 µm (8.5-14)	4.0 µm (3-5)
<i>R. flavigelatinosa</i> var. <i>carnisalmonea</i>	firm gelatinous	salmon to orange	salmon, orange	yellow	9.6 µm (8-11)	4.1 µm (3.5-4.5)
<i>R. flavigelatinosa</i> var. <i>flavigelatinosa</i>	firm gelatinous	yellow	yellow	yellow	9.6 µm (8-11)	4.1 µm (3.5-4.5)
<i>R. flavigelatinosa</i> var. <i>fragrans</i>	cartilaginous	yellow	yellow	yellow	10.0 µm (8.5-13)	4.8 µm (3.5-6)
<i>R. flavigelatinosa</i> var. <i>megalospora</i>	cartilaginous	salmon to orange	salmon, orange	yellow	12.0 µm (9.7-12.6)	4.5 µm (4.3-5.4)
<i>R. gelatiniaurantia</i> var. <i>gelatiniaurantia</i>	definitely gelatinous	deep orange	yellow	orange	9.3 µm (8-11)	4.1 µm (3.5-5)
<i>R. gelatiniaurantia</i> var. <i>violeitingens</i>	sub-gelatinous	apricot yellow to salmon	yellow	yellow	9.3 µm (8-11)	4.1 µm (3.5-5)
<i>R. hilaris</i> var. <i>olympiana</i>	firm gelatinous, translucent	salmon, orange	yellow	yellow	10.1 µm (9.4-11.2)	4.4 µm (4.0-5.0)
<i>R. longispora</i>	fleshy fibrous	light to deep orange	concolorous	yellow	13.5 µm (10-18)	4.5 µm (4-6)
<i>R. verlotensis</i>	gelatinous matrix clearly evident	yellowish salmon	concolorous	lt yellow to concolorous	10.1 µm (9-11.2)	4.9 µm (4.7-6.1)

Table 3. Comparison of 'Clamped' vs. 'Non-clamped' Subgenera *Ramaria* and *Laeticolora*.

Predominant branch color	Subg. <i>Ramaria</i> and "clamped" <i>Laeticolora</i>	Non-clamped Subg. <i>Laeticolora</i>
Red	—	<i>R. araiospora</i> <i>R. cyaneigranosa</i> ⁸ (vars; <i>cyaneigranosa</i> , <i>elongata</i>) <i>R. stuntzii</i> ^{1,7}
Orange or Salmon	<i>R. amyloidea</i> ^{1,2,3,7} <i>R. cystidiophora</i> var. <i>anisata</i> ⁷ <i>R. distinctissima</i> var. <i>americana</i> ^{6,8} <i>R. formosa</i> ⁸ <i>R. gelatinosa</i> var. <i>oregonensis</i> ^{7,8} <i>R. largentii</i> ^{6,8} <i>R. leptiformosa</i> <i>R. maculatipes</i> ^{1,4} <i>R. rubricarnata</i> ¹ <i>R. sandaracina</i> ⁷	<i>R. armeniaca</i> ⁵ <i>R. aurantiisiccescens</i> , <i>R. celerivirescens</i> ^{1,2,3,8} <i>R. conjunctipes</i> ^{7,8} <i>R. cyaneigranosa</i> ⁸ (vars; <i>elongata</i> , <i>persicina</i>) <i>R. flavigelatinosa</i> (vars; <i>carnisalmonea</i> , <i>megalospora</i> ^{6,8}) <i>R. gelatiniaurantia</i> <i>R. hilaris</i> var. <i>olympiana</i> <i>R. longispora</i> ⁶ <i>R. raveneliana</i> ⁸ <i>R. rubribrunnescens</i> ^{4,6} <i>R. verlotensis</i> ⁸
Yellow	<i>R. cartilaginea</i> ^{7,8} <i>R. cystidiophora</i> (vars; <i>cystidiophora</i> ⁷ , <i>citronella</i> , <i>fabiolens</i> , <i>maculans</i> ^{4,6}) <i>R. flavobrunnescens</i> var. <i>aromatica</i> <i>R. magnipes</i> ^{1,5,6} <i>R. rasilispora</i> ^{1,5} <i>R. rasilisporoides</i> ^{1,7} <i>R. vinosimaculans</i> ^{4,6}	<i>R. flavigelatinosa</i> (vars; <i>flavigelatinosa</i> , <i>fragrans</i> ⁸) <i>R. foetida</i> ^{1,10} <i>R. rubiginosa</i> ⁴ <i>R. synaptopoda</i> ⁴
Cream	<i>R. caulifloriformis</i> ⁸ <i>R. magnipes</i> var. <i>albidior</i> ^{1,5,6} <i>R. rasilispora</i> var. <i>scatesiana</i> ^{1,5} <i>R. rubricarnata</i> var. <i>pallida</i> ^{1,6} <i>R. thiersii</i> ⁶ <i>R. velocimutans</i> ^{2,3,7} Subg. <i>Ramaria</i> : <i>R. subviolacea</i> ^{1,6,8,9}	<i>R. acrisiccescens</i> ⁸
Cream with red to orange apices	Subgenus <i>Ramaria</i> : <i>R. botrytis</i> ^{1,6,8,9} <i>R. rubrievanesens</i> ^{1,6,8,9} <i>R. rubripermanens</i> ^{1,6,8,9}	Subgenus <i>Laeticolora</i> : <i>R. botrytoides</i> ⁷ <i>R. coulterae</i> ³
Brown	<i>R. caulifloriformis</i> ⁸ <i>R. testaceoflava</i> ^{2,8}	<i>R. acrisiccescens</i> ⁸ <i>R. marrii</i> ⁸ <i>R. spinulosa</i> var. <i>diminutiva</i> ^{7,8}
Purple	<i>R. purpurissima</i> var. <i>purpurissima</i> ⁸ <i>R. violaceibrunnea</i> ⁸	<i>R. fumosiavellanea</i> ⁸

¹ Stipe tissue amyloid.

² Stipe flesh turning 'green' in ferric sulfate.

³ Stipe context with a 'rusty-root'.

⁴ Wine-red stains on stipe when collected.

⁵ Spores smooth at 1000×.

⁶ Average spore length $\geq 11.5 \mu\text{m}$.

⁷ Average spore length $\leq 9.0 \mu\text{m}$.

⁸ Average spore width $\geq 4.5 \mu\text{m}$.

⁹ Spores striate.

¹⁰ Clamps rare.

Marr and Stuntz key to species of subgenus *Laeticolora*.

(*Ramaria* of Western Washington, 1973).

- 1A. Basidia basally clamped, true clamps frequent in the subhymenial and contextual hyphae of branches.....2
- 1B. Branches without basal clamps, true clamps rare in the subhymenial and contextual hyphae of branches...
.....24
- 2A. Average spore length > 12.5 μ , branches bright orange..... *R. largentii*
- 2B. Average spore length < 12 μ , branches variously colored.....3
- 3A. Primordial branches violet, maturing brown; the violet areas of either fresh or dried specimens turning "Venetian red" (8D8) on application of 20% KOH or "maize yellow" (4A6) with 10% H₂SO₄.....
.....*R. fennica* var. *violaceibrunnea* [*R. violaceibrunnea*]
- 3B. Not as above4
- 4A. Fruiting bodies with all of the following characteristics: (1) average spore width 4.4 μ or greater, (2) spores coarsely ornamented, and (3) branch sections reacting with α -naphthol and guaiac5
- 4B. Fruiting bodies without the above combination of characteristics8
- 5A. Consistency of the fruiting body gelatinous or cartilaginous-brittle; not bruising noticeable with handling6
- 5B. Consistency fleshy-fibrous, slightly punky or pliable; bruising noticeably with handling7
- 6A. Basidiocarp brownish orange, consistency very gelatinous, basidia containing cyanogranular protoplasm*R. gelatinosa* var. *oregonensis*
- 6B. Basidiocarps tannish yellow, consistency cartilaginous, basidial content not conspicuously granular when stained with cotton blue..... *R. cartilaginea*
- 7A. Branches yellow to brown; spore E about 2.5 (E= avg. spore length/avg. spore width)
..... *R. testaceoflava* var. *brunnea* [*R. testaceoflava*]
- 7B. Branches about "peach" (7A3-5) or slightly more reddish, apices yellow; spore E about 1.9 *R. formosa*
- 8A. Context instantly turning blue-green on application of 10% Fe₂(SO₄)₃; a band of brown contextual hyphae visible in a radially sectioned stipe.....9
- 8B. Not with the above combination of characteristics10
- 9A. Branches about "salmon" (6A4); context of the stipe amyloid when fresh, in dried specimens the context immediately turning dark brown on application of Meltzer's reagent*R. amyloidea*
- 9B. Branches white to pale yellow; context non-amyloid, not turning dark brown on application of Melzer's reagent to dried specimens*R. velocimutans*
- 10A. Spores narrowly cylindrical, smooth or nearly so; branches pale yellow, yellow, brownish or orange-yellow; context of the stipe often weakly amyloid11
- 10B. Spores distinctly ornamented, although ornamentation may be fine; branches variously colored, yellow in some species13
- 11A. Average spore length greater than 10.5 μ ; stipe very large (7-14 \times 4-6 cm); context of the stipe usually turning blue after direct application of guaiac.....*R. magnipes*
- 11B. Average spore length less than 10 μ ; stipe 3-6 \times 2.5-5.5 cm; context of the stipe usually not turning blue after direct application of guaiac.....12

12A.	Young branches dull "light orange" (5A4-5), maturing pale "grayish orange" (5B4-6)	<i>R. rasilispora</i> var. <i>rasilispora</i>	
12B.	Young branches "yellow white" (4A2) to "light yellow" (4-5A3-4).....	<i>R. rasilispora</i> var. <i>scatesiana</i>	
13A.	Tomental covering of stipe well developed, white; branches yellow; acantho-dendroid gloeoplerous hyphae present in the peripheral context of the stipe.....		14
13B.	Not with the above combination of characteristics		17
14A.	Consistency cartilagino-gelatinous, hyphal walls in the base gelatinizing; basidiocarps not bruising or staining.....		15
14B.	Consistency fleshy-fibrous; basidiocarps brunnescent, rubribrunnescent, or scarcely bruising		16
15A.	Odor strongly sweet, similar to anise; average spore length less than 8.5 μ	<i>R. cystidiophora</i> var. <i>cystidiophora</i>	
15B.	Odor fabaceous; average spore length greater than 9.0 μ	<i>R. cystidiophora</i> var. <i>fabiolens</i>	
16A.	Basidiocarps brunnescent if bruising; average spore length less than 11 μ	<i>R. cystidiophora</i> var. <i>citronella</i>	
16B.	Basidiocarps rubribrunnescent; average spore length greater than 11 μ	<i>R. cystidiophora</i> var. <i>maculans</i>	
17A.	Context of the stipe amyloid; branches with light reddish coloration about "salmon" (6A4), apices yellow, at least in youth.....		18
17B.	Context of the stipe non-amyloid; branches variously colored		19
18A.	Base and lower branches distinctly rubribrunnescent; branch sections not reacting with pyrogallol, α -naphthol, guaiacol, phenol, and aniline.....	<i>R. maculatipes</i>	
18B.	Basidiocarps not bruising or staining; branch sections reacting with pyrogallol, α -naphthol, guaiacol, phenol, and aniline.....	<i>R. rubricarnata</i>	
19A.	Fruiting bodies with distinct orange to light red coloration		20
19B.	Fruiting bodies white, yellow or brownish yellow but lacking conspicuous orange to reddish colors.....		23
20A.	Average spore length greater than 10 μ ; branch sections reacting with α -naphthol, guaiac, guaiacol, phenol, and aniline.....	<i>R. leptiformosa</i>	
20B.	Average spore length less than 9 μ ; branch sections not reacting with α -naphthol, guaiac, guaiacol, phenol, and aniline.....		21
21A.	Odor sweet, fragrant; apices distinctly yellow	<i>R. sandaracina</i> var. <i>euosma</i>	
21B.	Odor when noticeable, fabaceous; apices concolorous with the branches, orange		22
22A.	Basidiocarps broad, commonly wider than 8 cm, numerous elongated primary branches arising from a broad, compound, subgelatinous base, small basal primordial branch systems common	<i>R. sandaracina</i> var. <i>chondrobasis</i>	
22B.	Basidiocarps slender, usually less than 8cm wide, several primary branches arising from a single stipe, basal primordial branch systems infrequent	<i>R. sandaracina</i> var. <i>sandaracina</i>	
23A.	Basidiocarp vinescent or rubribrunnescent; branches white or light colored; average spore length greater than 11 μ	<i>R. vinosimaculans</i>	
23B.	Basidiocarps not vinescent or rubribrunnescent; branches yellow; average spore length 11 μ or less	<i>R. flavobrunnescens</i> var. <i>aromatica</i>	
24A.	Average spore length 12 μ or greater; branches orange to red, apices concolorous or yellow.....		25
24B.	Average spore length 11.5 μ or less, branches variously colored.....		26

- 25A. Base and lower branches rubribrunnescent; odor faintly sweet; spores finely ornamented to nearly smooth*R. rubribrunnescens*
- 25B. Base and lower branches not staining or bruising; odor not distinctive; spores distinctly ornamented with small cyanophilous warts *R. longispora*
- 26A. Branches darkly colored, "violet gray" (15-18D3) with a brownish component, apices light brown *R. fumosiavellanea*
- 26B. Branches colored differently27
- 27A. Context instantly turning blue-green with 10% Fe₂(SO₄)₂, the treated area turning "dark violet" (18F6) during drying; context weakly amyloid; superficial hyphae of the stipe brunnescent to rubribrunnescent; branches light orange, apices yellowish.....*R. celerivirescens*
- 27B. Not with the above combination of characteristics28
- 28A. Branches predominantly yellow, cream or pale brown.....29
- 28B. Branches predominantly orange or red36
- 29A. Base fasciculate, primary axes numerous, slightly flattened, generally 1 cm diam or less, basal tomentum well developed, branching sparse, rarely more than 3 ranks; odor pungently sweet.....*R. synaptopoda*
- 29B. Base single or fasciculate, primary axes never numerous, frequently greater than 1 cm diam, more profusely branched than 3 ranks; odor when sweet rarely pungent30
- 30A. Branches cream, flesh color, or pale brown, sometimes with a very faint pinkish tinge near the apices, base often brunnescent; apiculus often prominent31
- 30B. Branches predominantly bright yellow, base rubribrunnescent or vivescent if staining; apiculus usually less than 1.5μ long.....32
- 31A. Terminal branches club-shaped; the hymenium and subhymenium thickening; context instantly turning blue-green with 10% Fe₂(SO₄)₂; gloeoplerous hyphae abundant..... *R. claviramulata* [*R. celerivirescens*]
- 31B. Terminal branches cylindrical; hymenium and sub-hymenium not thickening; context not reacting immediately with 10% Fe₂(SO₄)₂; gloeoplerous hyphae abundant*R. acrisiccenscens*
- 32A. Conspicuous "oxblood (9E7) stains on base; consistency fleshy-fibrous; context [branch] reacting rapidly with 10% Fe₂(SO₄)₂.....*R. rubiginosa*
- 32B. Base not rubribrunnescent; consistency cartilagino-gelatinous; context not immediately reacting with 10% Fe₂(SO₄)₂.....33
- 33A. Context of the branches "salmon" (6A4) giving a pinkish cast to the yellow surface *R. flavigelatinosa* var. *carnisalmonea*
- 33B. Context of the branches yellow34
- 34A. Odor slightly sweet; average width of spores greater than 4.5 μ.....*R. flavigelatinosa* var. *fragrans*
- 34B. Odor fabaceous or not distinctive; average width of spores less than 4.5 μ35
- 35A. Average spore length greater than 10.5 μ *R. flavigelatinosa* var. *megalospora*
- 35B. Average spore length 10 μ or less.....*R. flavigelatinosa* var. *flavigelatinosa*
- 36A. Young branches and apices scarlet; context of stipe strongly amyloid..... *R. stuntzii*
- 36B. Not as above.....37
- 37A. Average spore length less than 8.5 μ; base fasciculate, consisting of several to numerous, slender, primary axes38
- 37B. Average spore length greater than 9μ; habit of the basidiocarp not as above.....39

- 38A. Mature fruiting bodies up to 18 cm tall, branching in subequal intervals from 3-6 times from the several to numerous stipes in a fascicle *R. conjunctipes* var. *tsugeensis*
- 38B. Mature fruiting bodies rarely taller than 10 cm, consisting of a dense fascicle of elongated, slender stipes, sparsely branching 1-3 times near the apices..... *R. conjunctipes* var. *sparsiramosa*
- 39A. Odor when distinctive fabaceous; consistency gelatinous or gelatino-cartilaginous; bruising dull violet or not at all.....40
- 39B. Odor when distinctive musty or sweet; consistency fleshy fibrous; not bruising dull violet42
- 40A. Branches yellowish salmon; lower nodes polychotomous, connation of branches common; average spore width greater than 4.5 μ *R. verlotensis*
- 40B. Branches more intensely colored; nodes more commonly dichotomous; average spore width less than 4.5 μ 41
- 41A. Branches bright orange, apices concolorous; base compound, broad, gelatinous; gloeoplerous hyphae present but not abundant [rare]; not vinescent*R. gelatiniaurantia* var. *gelatiniaurantia*
- 41B. Branches salmon, apices yellow; base slender, tapered, subgelatinous; gloeoplerous hyphae abundant [prominent in base, rare in branches]; vinescent *R. gelatiniaurantia* var. *violeitingens*
- 42A. Average spore width greater than 4 μ ; branch sections turning reddish or violet brown with phenol and aniline.....43
- 42B. Average spore width less than 4 μ ; branch sections not reacting significantly with phenol and aniline.....46
- 43A. Basidial content granular and densely cyanophilous; branches peach, salmon, or red, apices concolorous or yellow44
- 43B. Basidial content not conspicuously granular when stained with cotton blue; branches and apices intensely yellow-orange..... *R. aurantiiscescens*
- 44A. Mature apices concolorous with branches, primordial apices more intensely reddish; internodes and general habit slender and conspicuously elongated *R. cyaneigranosa* var. *elongate*
- 44B. Mature apices dotted with yellow; internodes and general habit not conspicuously elongated....45
- 45A. Base thick or slightly bulbous; branches light red*R. cyaneigranosa* var. *cyaneigranosa*
- 45B. Base steeply tapered, slender; branches salmon or peach..... *R. cyaneigranosa* var. *persicina*
- 46A. Mature apices yellow *R. araiospora* var. *araiospora*
- 46B. Mature apices red.....*R. araiospora* var. *rubella*

Marr and Stuntz key to species of subgenus *Ramaria*.

(*Ramaria* of Western Washington, 1973).

- 1A. Average spore length of 20 spores rarely less than 13μ , range $11-24 \times 3-6\mu$ 2
- 1B. Average spore length of 20 spores rarely exceeding 12.5, range $9-14 \times 3.5-6\mu$ 4
- 2A. Terminal branches white, pale yellow, to light tan; branches compact or spreading; aroma pungent, sweet; context of stipe strongly amyloid *R. strasseri* [*R. subviolacea*]
- 2B. Terminal branches orange, reddish, or purplish; usually upper branches densely tufted on large primary branches or stipe; aroma faint or slightly sweet; context of stipe weakly amyloid 3
- 3A. Terminal branches "light orange" (6A3-5) or a shade more brown *R. botrytis* var. *aurantiiramosa*
- 3B. Terminal branches "grayish magenta" (8-13B2-3) *R. botrytis* var. *botrytis*
- 4A. Primordial apices "shell pink" (6-8A3), coloration lost during maturation and soon after collecting; fruiting bodies bruising "reddish brown" (9D4-5); average spore size $11.7 \times 4.9\mu$, range $11-13 \times 4-6\mu$ *R. rubrievanescens*
- 4B. Mature apices "dull red" (8-9B2-3), fruiting bodies not rubribrunnescent; average spore size $10.3 \times 3.8\mu$, range $8-13 \times 3.5-4.5\mu$ *R. rubripermanens*

Ronald H. Petersen and Catherine Scates key to spring *Ramaria* species of subgenus *Laeticolora*.

(Vernally Fruiting Taxa of *Ramaria* from the Pacific Northwest, 1988).

- 1A. Basidia without clamp connections2
- 1B. Basidia with clamp connections4
 - 2A. Fruitbodies cinnamon tan to light chocolate brown; spores obscurely roughened *R. marrii*
 - 2B. Fruitbodies not tan or brown.....3
- 3A. Young apices fleshy buff to dull red, fading to fleshy pink, with very tips often brown were exposed or bruised; branches ivory to fleshy-buff;.....*R. coulterae*
- 3B. Branches and apices orange to bright orange; stipe flesh white, homogeneous; spores 8.6-11.5 (12.6) × 3.6-4.3 μm; northern Idaho [western Oregon]*R. armeniaca*
 - 4A. Spores smooth at 1000x5
 - 4B. Spores rough at 1000x.....8
- 5A. Stipe surface weakly brunnescent; stipe massive, usually with abortive branchlets6
- 5B. Stipe surface not brunnescent; stipe large to massive; apices usually knobby, dilated7
 - 6A. Branches white to very pale yellow; apices greenish yellow, often with blush of pink where exposed; stipe massive, white, with abortive stumps; hymenium not reactive (except in iron salts); northern California. *R. magnipes* var. *albidior*
 - 6B. Branches light clear yellow when young; apices bright yellow to chartreuse yellow, often pallid rosy pink where exposed; spores 9.4-13.3 × 3.2-5.0 μm (Lm = 11.5 μm) *R. magnipes* [var. *magnipes*]
- 7A. Branches buffy yellow, pale ochraceous yellow to fleshy buff when young; apices pastel chartreuse yellow; spores 8.3-11.5 × 3.6-4.3 μm (Lm = 9.95 μm) *R. rasilispora* var. *rasilispora*
- 7B. Branches ochraceous cream colored; apices pastel greenish when young; spores 9.4-11.9 × 3.2-4.3 μm (Lm = 10.6)*R. rasilispora* var. *scatesiana*
- 8A. Branch sections positive in FCL, PYR, ANO, GUA.....9
- 8B. Branch sections not macrochemically reactive (except FCL); stipe base rubescent; branches and branch flesh pale yellow; spores 11.2-14.0 × 4.3-5.0 μm (Lm = 12.4 μm)..... *R. vinosimaculans*
- 9A. Branches and apices buffy cinnamon to fleshy tan; apices often discolored to brown; hymenium slowly brownish where cut; stipe flesh brittle, IKI negative; branch sections positive in FCL, PYR, ANO, GUA*R. caulifloriformis*
- 9B. Branches light yellow, often with pale salmon tint; apices yellow; hymenium brunnescent or not; branch sections macrochemically reactive or not.....10
 - 10A. Branches cream color to light salmon; branch flesh bright to pallid salmon; spores 10.4-12.2 μm long (Lm = <11.5 μm); IKI weakly positive; SYR reaction slow.....11
 - 10B. Branches dull pale yellow-ochre; apices clear yellow; spores 12-15 μm long (Lm = 13.5 μm); often under humus in gritty soil; stipe flesh IKI negative; SYR reaction rapid *R. thiersii*
- 11A. Spore L^m ca. 10 μm; branches pallid cream to salmon yellow; apices pale to light yellow *R. rubricarnata* [var. *rubricarnata*]
- 11B. Spore L^m = >11 μm; branches as above or more pallid12

- 12A. Branches salmon to salmon-yellow; branch flesh bright salmon; branches short, stocky
..... *R. rubricarnata* var. *verna*
- 12B. Branches cream-colored to pinkish buff; branch flesh muted pinkish buff; branches elongate
..... *R. rubricarnata* var. *pallida*

Synonyms

Currently Accepted Name

=recent synonym(s)

Echinoramaria

Ramaria abietina (Pers.) Quél. 1888, Fl. Myc. Franc.: 467.

=*R. ochraceovirens* (Jungh.) Donk 1933, Rev. Niederl. Homob. Aphyll. 2: 112.

Ramaria curta (Fr.) Schild 1994, Z. Mykol. 60(1): 125

=*R. myceliosa* var. *microspora* R.H. Petersen 1981, Bibl. Mycol. 79: 157

=*R. pusilla* (Peck) Corner 1950, Ann. Bot. Mem. 1: 617

Ramaria eumorpha (P. Karst.) Corner 1950, Ann. Bot. Mem. 1: 575.

=*R. invalii* (Cotton & Wakef.) Donk 1933, Mededeel. Bot. Mus. Univ. Utrecht 9: 113.

Lentoramaria

Ramaria concolor (Corner) R.H. Petersen 1975, Bibl. Mycol. 43: 54.

= *R. stricta* var. *concolor* Corner 1950, Ann. Bot. Mem. 1: 623, 700.

Ramaria rubella var. *rubella* (Schaeff.) R.H. Petersen

=*R. acris* (Peck) Corner

Ramaria suecica (Fr.) Donk 1933, Mededeel. Univ. Utrecht 9: 105.

=*R. circinans* (Peck) Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 130.

R. tsugina (Peck) Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 150

=*Clavaria tsugina* Peck. 1903. Bull. N.Y. St. Mus. 67: 27-285.

=*R. concolor* f. *tsugina* (Peck) R.H. Petersen 1975, Bibl. Mycol. 43: 64.

=*R. tsugina* var. *prasina* Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 150

Laeticolora

Ramaria celerivirescens Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 61.

=*R. claviramulata* Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 63.

Ramaria fennica var. *griseolilacina* Schild, 1995. Z. Mykol. 61(2):160.

=*R. versatilis* var. *versatilis* Quél. 1893. Comptes Rendu Assoc. Franc. Avanc. Sci.: 6.

Ramaria raveneliana (Coker) R.H. Petersen 1982. Sydowia 35: 195.

=*R. conjunctipes* var. *raveneliana* (Coker) Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 66.

Ramaria testaceoflava (Bres.) Corner 1950. Ann. Bot. Mem. 1: 630.

=*R. testaceoflava* var. *brunnea* (Zeller) Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 122.

Ramaria violaceibrunnea (Marr & D.E. Stuntz) R. H. Petersen

=*R. versatilis* var. *violaceibrunnea* (Marr & D.E. Stuntz) R.H. Petersen

=*R. fennica* var. *violaceibrunnea* Marr & D.E. Stuntz. 1973. Bibl. Mycol. 38: 78.

Ramaria species known from the Pacific Northwestern United States

Subgenus *Echinoramaria*

- Ramaria abietina* (Pers.) Quél.
- Ramaria argentea* R.H. Petersen
- Ramaria curta* (Fr.) Schild
- Ramaria eumorpha* (P. Karst.) Corner
- Ramaria flaccida* (Fr.) Bourdot
- Ramaria glaucoaromatica* R.H. Petersen
- Ramaria incognita* R.H. Petersen
- Ramaria mutabilis* Schild & R.H. Petersen
- Ramaria myceliosa* (Peck) Corner

Subgenus *Lentoramaria*

- Ramaria apiculata* var. *apiculata* (Fr.) Donk
- Ramaria apiculata* var. *brunnea* R.H. Petersen
- Ramaria apiculata* var. *brunnea* f. *compacta* (Bourdot & Galzin) R.H. Petersen
- Ramaria concolor* f. *concolor* (Peck) R.H. Petersen
- Ramaria concolor* f. *fumida* (Peck) R.H. Petersen
- Ramaria concolor* f. *marrii* R.H. Petersen
- Ramaria gracilis* (Pers.) Quél.
- Ramaria rainierensis* Marr & D. E. Stuntz
- Ramaria rubella* var. *blanda* R.H. Petersen
- Ramaria rubella* var. *rubella* (Schaeff.) R.H. Petersen
- Ramaria stricta* (Pers.) Quél.
- Ramaria suecica* (Fr.) Donk
- Ramaria tsugina* (Peck) Marr & D.E. Stuntz

Subgenus *Ramaria*

- Ramaria botrytis* var. *aurantiiramosa* Marr & D.E. Stuntz
- Ramaria botrytis* var. *botrytis* (Pers.) Ricken
- Ramaria rubrievanescens* Marr & D.E. Stuntz
- Ramaria rubripermanens* Marr & D.E. Stuntz
- Ramaria subviolacea* R.H. Petersen & Scates

Subgenus *Laeticolora* — species with clamped basidia

- Ramaria amyloidea* Marr & D.E. Stuntz
- Ramaria cartilaginea* Marr & D.E. Stuntz
- Ramaria caulifloriformis* (Leathers) Corner
- Ramaria cystidiophora* var. *anisata* R.H. Petersen
- Ramaria cystidiophora* var. *citronella* Marr & D.E. Stuntz

Ramaria cystidiophora var. *cystidiophora* Marr & D.E. Stuntz
Ramaria cystidiophora var. *fabiolens* Marr & D.E. Stuntz
Ramaria cystidiophora var. *maculans* Marr & D.E. Stuntz
Ramaria distinctissima var. *americana* R.H. Petersen
Ramaria flavobrunnescens var. *aromatica* Marr & D.E. Stuntz
Ramaria formosa (Pers.) Quel.
Ramaria gelatinosa var. *oregonensis* Marr & D.E. Stuntz
Ramaria largentii Marr & D.E. Stuntz
Ramaria leptiformosa Marr & D.E. Stuntz
Ramaria maculatipes Marr & D.E. Stuntz
Ramaria magnipes var. *albidior* R.H. Petersen
Ramaria magnipes var. *magnipes* Marr & D.E. Stuntz
Ramaria purpurissima var. *purpurissima* R.H. Petersen & Scates
Ramaria rasilispora var. *rasilispora* Marr & D.E. Stuntz
Ramaria rasilispora var. *scatesiana* Marr & D.E. Stuntz
Ramaria rasilisporoides R.L. Exeter Nov. Prov.
Ramaria rubricarnata var. *pallida* R.H. Petersen & Scates
Ramaria rubricarnata var. *rubricarnata* Marr & D.E. Stuntz
Ramaria rubricarnata var. *verna* R.H. Petersen & Scates
Ramaria sandaracina var. *chondrobasis* Marr & D.E. Stuntz
Ramaria sandaracina var. *euosma* Marr & D.E. Stuntz
Ramaria sandaracina var. *sandaracina* Marr & D.E. Stuntz
Ramaria testaceoflava (Bres.) Corner
Ramaria thiersii R.H. Petersen & Scates
Ramaria velocimutans Marr & D.E. Stuntz
Ramaria violaceibrunnea (Marr & D.E. Stuntz) R. H. Petersen
Ramaria vinosimaculans Marr & D.E. Stuntz

Subgenus *Laeticolora* — species with non-clamped basidia

Ramaria acrisiccescens Marr & D.E. Stuntz
Ramaria araiospora var. *araiospora* Marr & D.E. Stuntz
Ramaria araiospora var. *rubella* Marr & D.E. Stuntz
Ramaria armeniaca R.H. Petersen & Scates
Ramaria aurantiisiccescens Marr & D.E. Stuntz
Ramaria botrytoides (Peck) Corner
Ramaria celeriviresceus Marr & D.E. Stuntz
Ramaria conjunctipes var. *sparsiramosa* Marr & D.E. Stuntz
Ramaria conjunctipes var. *tsugensis* Marr & D.E. Stuntz
Ramaria coulterae Scates
Ramaria cyaneigranosa var. *cyaneigranosa* Marr & D.E. Stuntz
Ramaria cyaneigranosa var. *elongata* Marr & D.E. Stuntz
Ramaria cyaneigranosa var. *persicina* Marr & D.E. Stuntz
Ramaria flavigelatinosa var. *carnisalmonea* Marr & D.E. Stuntz

Ramaria flavigelatinosa var. *flavigelatinosa* Marr & D.E. Stuntz
Ramaria flavigelatinosa var. *fragrans* Marr & D.E. Stuntz
Ramaria flavigelatinosa var. *megalospora* Marr & D.E. Stuntz
Ramaria foetida R.H. Petersen
Ramaria fumosiavellanea Marr & D.E. Stuntz
Ramaria gelatiniaurantia var. *gelatiniaurantia* Marr & D.E. Stuntz
Ramaria gelatiniaurantia var. *violetingens* Marr & D.E. Stuntz
Ramaria hilaris var. *olympiana* R.H. Petersen
Ramaria longispora Marr & D.E. Stuntz
Ramaria marrii Scates
Ramaria raveneliana (Coker) R.H. Petersen
Ramaria rubiginosa Marr & D.E. Stuntz
Ramaria rubribrunescens Marr & D.E. Stuntz
Ramaria spinulosa var. *diminutiva* R.H. Petersen
Ramaria stuntzii Marr
Ramaria synaptopoda Marr & D.E. Stuntz
Ramaria verlotensis Marr & D.E. Stuntz

Glossary

Definitions were taken from the 9th edition of Dictionary of the Fungi (Kirk et al. 2001) or A Glossary of Mycology (Snell & Dick, 1971) and simplified or adapted as needed for *Ramaria*.

- abaxial** — the side of the basidiospore away from the long axis of the basidium.
- acanthodendroid pleoplerous hyphae** — narrow, thin-walled hyphae that are freely branched and studded with lateral spurs, multi-directional and that contain a densely cyanophilous, granular protoplasm. Found in *R. cystidiophora* within the outer regions of the stipe context.
- adaxial** — the side of the basidiospore toward the long axis of the basidium (usually in line with the apiculus).
- amphigenous hymenium** — in *Ramaria*, a hymenium that grows all around each branch and tip (apex) in a uniform fashion.
- ampulliform** — flask-shaped, usually swollen below.
- amyloid** — staining grayish- to blackish violet in Melzer's reagent (or other iodine based solutions), generally due to the presence of starch in spore or hyphal walls.
- apex** (apices, pl.) — in *Ramaria*, the outermost tip of each branch and branchlet.
- areolate** — a surface marked out in little areas, usually by cracks or crevices.
- ascendant, ascending** — curving or slanting upward to more or less vertical (rather than horizontal).
- avellaneous** — a color variously interpreted from drab (pale vinaceous, pale pinkish gray) to hazel.
- basidium** (basidia, pl.) — a cell that produces basidiospores.
- basidiocarp** (basidioma) — the basidium-producing fruitbody (in the Basidiomycota).
- belly band** — a distinct color band on the upper stipe and lower branches that is a different color than the upper branches.
- binding hyphae** (ligative hyphae) — thick-walled, highly branching, aseptate hyphae that bind the thick-walled skeletal hyphae and generative hyphae together.
- brunnescent** — bruising or turning brown to yellow-brown.
- buff** — a pale creamy gray to creamy yellow.
- cartilaginous** — (generally referring to a stipe or cuticle) firm and tough but readily bent; breaking like cartilage or with a snap.
- caespitose** (cespitose) — aggregated in tufts (like grass) but not grown together.
- chartreuse** — a color averaging a brilliant yellow green.
- connate** — cone shaped, joined by growth, fused.
- context** — the inner or body tissue (flesh) in a fruit body beneath the surface layer; the trama.
- clamp connections** (clamps) — in basidiomycetes, the small, semicircular, hollow outgrowth, laterally attached to the walls of two adjoining cells and arching over the cross-wall (septum) between them. This hyphal outgrowth grows backwards after cell division to connect the new cell to the older cell.
- compound stipe** — made up of a number of stipes.
- conifer** — an individual belonging to the order (Coniferales). Primarily evergreen trees and shrubs.
- cyanophilous** — readily absorbing a blue dye (stain) such as cotton blue or gentian violet.

deciduous — (trees or shrubs) vascular plants that shed their leaves seasonally.

dimitic — having two systems or series of hyphae: 'generative' and 'skeletal.'

duff — partly decayed organic on the forest floor.

Em — mean ratio of length to width.

E spore value — in spore measurements, the ratio of length to width.

echinate (derived from *echinus*, hedgehog) — having sharply pointed spines, spinulose.

echinulate (diminutive of echinate) — covered with small pointed processes or finely pointed spines.

evanescent — transitory, lasting only a short time; in *Ramaria* generally referring to loss of color.

extralimital — occurring outside a given area of study; here outside the Pacific Northwest United States and Canada.

fabaceous — having an odor of "green beans."

fascicle — a little group or bundle.

fasciculate — crowded in bundles, growing in fascicles.

fenugreek — referring here to the odor similar to that of maple syrup or the 'candy-cap' *Lactarius*. Fenugreek is a legume (sometimes called 'Greek hay') with an odor variously regarded as sweet and pleasant or heavy and sometimes nauseating.

flaccid — flabby and limp; soft and limber; without firmness or elasticity.

FSW — here referring to a 10% aqueous solution of ferric sulfate.

gelatinous — jelly-like, applied to tissues where the hyphae become partly dissolved or glutinous in wet weather or with moisture; when mounted in water under the microscope, such hyphae appear more transparent, wider, aligned more loosely than in normal tissue.

generative hyphae — septate hyphae of indeterminate length that give rise to other hyphal types (including those in the hymenium). Such hyphae may be branched or unbranched, with or without clamp connections, and thin- or thick-walled.

geniculate — bent at an angle.

gleoplerous [gloeoplerous] **hyphae** (oil hyphae) — hyphae with very long cells (or unicellular), with numerous oil drops in the plasma.

gregarious — in companies or groups but not joined together; scattered loosely in a small area.

hilar appendix [appendage] — the small wart-like or cone-like projection at the bottom of a basidiospore that connects the spore with the sterigma.

holotype — the single specimen or other element used or designated by an author as the element to which the name of a taxon is permanently attached.

humicolous — living in or on soil and decaying matter.

hyaline — transparent or nearly so; translucent; frequently used in the sense of colorless.

hymenium (hymenia, pl.) — the spore-bearing layer of a fruiting body; in coralloid fungi such as *Ramaria*, the hymenium is found on the branches and branch tips (apices). *See also amphigenous, unilateral.*

hypha (hyphae, pl.) — a fungus filament within the mycelium and fruitbody.

IKI — abbreviation for potassium iodine solution.

- isotype** — one of the specimens of the 'type collection' of a species or variety, other than the single specimen or element designated as the holotype.
- jonquil, jonquilleous** — the color bright yellow; considered by some the same as 'luteous.'
- KOH** — abbreviation for potassium hydroxide solution.
- lacrymiform** — shaped like a tear drop.
- lax** — weak, not stringent.
- lignicolous** — living on or in wood.
- Lm** — abbreviation for mean length; used for spore measurements
- Melzer's reagent** — a mixture originally designed for testing for the 'amyloid' nature of the spore wall but now widely used in studies of cells and tissues; made up by dissolving 1.5 grams of potassium iodide and 0.5 grams of iodine in a mixture of 20 ml of water and 20 ml of chloral hydrate.
- monomitic** — having one system or series of hyphae, the generative.
- mycelium** — the collective term for a group or mass of hyphae or fungus filaments.
- neotype** — a specimen or other material selected to replace a holotype when all the original material is lost or destroyed.
- obconic** — inversely cone shaped.
- oblique** — neither perpendicular nor; having no right angle.
- ochre, ochraceous** — the color of yellow from between warm buff to yellow orange.
- olivaceous** — of an olive green shade or tint.
- pallid** — of an indefinite pale or whitish appearance; light colored.
- phylogenetic** — pertaining to the history of the evolution of a group of organisms through time.
- primordial** — pertaining to the earliest stages of development; in *Ramaria*, specifically branches and apices that are tightly clustered and just emergent.
- pruinose** — having a frost-like or powdery surface covering (of 'pruina').
- punctate** — marked with very small structures, such as small points, dots, spots, minute scales, glandules, or hollows.
- recurved** — curved backward or downward.
- rhizomorph** — a root-like aggregation of hyphae having a well-defined mycelial cord; a visible strand or cord of compacted mycelium.
- rhomboidal** — resembling an equilateral (but not right-angled) parallelogram (a rhombus); quadrangular.
- rubribrunnescent** — staining or becoming reddish brown.
- rufescent** — bruising or becoming reddish to brownish-red.
- rugose** — wrinkled.
- rusty root** — a band of brown contextual hyphae occurring in the flesh of the lower stipe visible in a radially sectioned stipe.
- skeletal hyphae** — hyphae that are thick-walled, aseptate, and of limited length, with thin-walled apices, generally unbranched but which can develop tree-like branches or taper at the hyphal tips.
- striate** — having longitudinal lines or minute furrows.

strict — referring to branches that are straight and upright in habit with little branching; erect.

terrestrial — growing on the ground.

terricolous — living on the soil.

tomentose — densely matted and woolly like a wool blanket; covered with tomentum; having a covering of soft, matted hairs.

tomentum — a clothing of stipe composed of long, soft, hairy filaments or fibrils with thick walls, interlaced and tangled or matted, like wool.

type (in nomenclature) — the element on which the descriptive matter fulfilling the conditions of valid publication of a scientific name is based, or is considered to have been based, and which fixes the application of the name.

tubercles (tubercule) — a small wart-like or knob-like outgrowth.

unilateral hymenium — in *Ramaria*, a hymenium that grows unevenly around the branches interspersed among decurrent sterile patches. Corner (1950) noted that in some coral fungi, when branches are oblique, the hymenium develops only on the underside and on the upper side a sterile hymenium is 'visible under a hand-lens as a finely ... subtomentose surface.'

verrucose — covered or marked with small rounded processes or 'warts.'

vinescent — bruising or turning the color of red wine.

virescent — bruising or staining grass-green.

Wm — the abbreviation for 'mean width.'

\bar{x} — average.

≡ — used to denote the basionym of the name in current use.

= — used to denote a nomenclatural synonym in formal nomenclators (list of synonymies.)

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Bottom: *R. araiospora* var. *rubella*, *R. longispora*, *R. acrisiccessens*.

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