Studies on North American Cortinarii. III. The *Cortinarius* flora of dwarf and shrubby *Salix* associations in the alpine zone of the Windriver Mountains, Wyoming, USA*)

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Moser, M. (1993). Studies on North American Cortinarii. III. The *Cortinarius* flora of dwarf and shrubby *Salix* associations in the alpine zone of the Windriver Mountains, Wyoming, USA. – Sydowia 45 (2): 275–306.

Cortinarii of two observation areas in the Windriver Mountains have been studied. Twenty five species or varieties are treated in the paper. Eighteen species have been recorded from Two Ocean Mtn., fourteen from Union Peak. Five species occurred in both areas, ten were confined to Two Ocean Mtn. and nine to Union Peak only. Nine were associated only with dwarf willows, five with shrubby willows and five both with dwarf and shrubby willows. *C. atroalbus*, *C. expallens*, *C. paraphaeochrous*, *C. ferrugineifolius* and *C. hybospermus* are described as new species, *C. atroalbus* var. *nigripes* as a new variety.

Keywords: Agaricales, Basidomycetes, alpine fungi.

During studies in the Greater Yellowstone Area observations on the alpine *Cortinarii* associated with alpine *Salix* species have been made in several places. First results from Mt. Washburn within the Yellowstone National Park and the Beartooth Pass area have been published by Moser & McKnight (1987). In the subsequent years the Windriver Mountains have been extensively studied and results from these investigations are summarised in this paper.

Materials and methods

Study area

The Windriver Mountains in Wyoming reach elevations of more than 4000 m a.s.l., and timber line occurs at around 3000 m a.s.l. Two areas, Union Peak and Two Ocean Mountain, have been selected for this study.

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*) Parts I and II in preparation.

The Union Peak is situated in Sublette Co., Wyoming. The western part is located in the Teton National Forest and the eastern part in Shoshone National Forest. On the western side a long, shallow mountain valley ascends almost to the top of Union Peak. In this valley a large area covered with shrubby willows (e.g., *Salix glauca* L., *S. phylicifolia* L., *S. brachycarpa* Nutt., *S. farriae* Ball) starts at Flat Lake at about 3000 m a.s.l. and extends over about 3 km up to an elevation of 3350 m a.s.l. The willows in the lower part are 1 to 1.5 m high but only 20–30 cm in the upper part. The area is criss-crossed by small streamlets and seepage areas, and at least in some parts is rather moist. The upper part, however, can dry out in some years, when there is insufficient snow cover during the winter. Dwarf willow communities start at about 3200 m a.s.l. and reach the top area of Union Peak. Thus, this area offers an excellent opportunity for comparisons between the fungus flora associated with dwarf willows (*Salix arctica* R. Br., *S. nivalis* Hook.) and that associated with the shrubby willows at lower elevation. The geological substrate in the Union Peak area consists of gneissic-granitic rocks, and pH values reach 5.2–5.4.

Two Ocean Mtn., near Togwotee Pass, is a continuation of the Windriver Mountains and represents the southernmost end of the Absaroka Range, to which it also belongs geologically. It is situated at the border between Teton and Shoshone National Forests but the study area on the north-west slopes belongs to the latter. Two Ocean Mountain consists of volcanic breccias and conglomerates. The soils are very clayey and slippery when wet, with pH values between 5.4 and 5.8. Large communities of dwarf willows (*S. arctica* and *S. nivalis*) start below timberline and reach about 3200 m a.s.l. just below the uppermost top rocks. The occurrence of a few plants of *Dryas octopetala* L. indicate some calcareous admixtures. So far, however, no *Cortinarius* species have been found in association with *Dryas* in this area.

Sampling

Material was collected during the second half of August in the years 1987, 1989 and 1991 for taxonomic purposes but several ecological observations were also included in the collecting protocols. All specimens were wrapped separately and in most cases kept in cool boxes until examination. Color photographs were taken and detailed descriptions were prepared in the laboratory. A preliminary microscopic examination was undertaken at the University of Wyoming National Park Service Research Center in Moran, followed by a detailed study at Innsbruck University. The microscopic data were documented by video prints produced with a Sony video camera

SSC–C350P and a Sony video printer UP 910. Spores were mounted in 3% KOH and measured at 1000x magnification. For statistical evaluation 30–35 spores were measured on videoprints. Measurements in parentheses are given in the form mean ± standard deviation.

For the KOH–reaction a 30% KOH solution was used. In the majority of *Telamonia* this reaction is not very important, but in cases where it is negative or only brown it has some significance. Observations of the material under UV–light was performed at a wave length of 360 nm.

Color codes were taken from Cailleux (Caill), Munsell (Mu) and Ridgway (R).

Results

Twenty–five taxa are treated in this study (Tab. 1). Of the species reported here some are apparently rather widely distributed and occur in all study areas with dwarf or shrubby willows. One example of such an ambivalent species is *Cortinarius chrysomallus*, which occurs both at Two Ocean Mtn. and Union Peak associated with darf willows and shrubby willows. This species can be abundant in the alpine zone but has also been observed in subalpine areas with different species of shrubby willows also in the Greater Yellowstone area. Ricek (1989) reports a similar record from Upper Austria. Moreover, a collection from willows in the coastal sand dunes of California indicates that the association with willows is more important than the actual altitude of the location. Similar observations have been made for *Cortinarius rufoannuliferus*, which was also collected in the alpine zone and in coastal dunes (Moser, unpublished data). In contrast, *Cortinarius stenospermus* occurs apparently not only with *Salix* but also in subalpine habitats with conifers (*Picea engelmannii* Parr., *P. pungens* Engelm., *Abies lasiocarpa* (Hook.) Nutt., *Pinus albicaulis* Engelm.).

The *Cortinarius* flora of shrubby willow associations in the alpine zone does not differ very much from that of dwarf willow communities, although the total number of taxa collected is higher in *Salix arctica* and *S. nivalis* associations. We found five species in both types, five associated with shrubby willows only, and nine with dwarf willows only. However, no final conclusion can be drawn from these observations because of the small number of visits to the study areas, at least in the case of Union Peak, and because of the short period of study (1987, 1989, 1991).

Cortinarius absarokensis is characteristic for shrubby willow associations. This species occurs abundantly in the Absaroka Range and in the Windriver Mts. On Union Peak it has been observed during all three observation years in great abundance. Sporophores normally

Tab. 1. – Distribution of the *Cortinarius* species recorded. SW: Shrubby willows; DW: dwarf willows.

	Union Peak		Two Ocean Mt.	outside alpine zone
	SW	DW	DW	
Myxacium				
absarokensis	+			+
favrei		+	+	
favrei var. *pallidus*			+	
Sericeocybe				
caninus		+	+	+
Telamonia				
adalberti f. *alpinus*			+	
atroalbus		+		
atroalbus var. *nigripes*	+			
chrysomallus	+	+	+	+
expallens	+	+		
ferrugineifolius	+	+		
galerinoides	+			
hinnuleus var. *favreanus*			+	
hybospermus			+	
inops			+	
laetus			+	+
minutalis			+	
paraphaeochrous	+			
pauperculus			+	
phaeochrous	+			
phaeopygmaeus			+	
inops			+	
rufoannuliferus	(+)?	+	+	+
stenospermus			+	+
subrigidipes		+		
subtorvus			+	
vulpicolor	+	+	+?	

are 10–12 cm in size, but reach in some cases 15 cm. In 1987 and 1989 it occurred all over the large area from Flat Lake to the uppermost areas of shrubby willows. In 1991 the upper part was rather dry and springs and seepage areas had dried out. Below 3150 m a.s.l., however, thousands of sporophores have been observed. This taxon has also been found in the subalpine zone under shrubby willows at Union Pass, at about 2700 m a.s.l., but never associated with dwarf willows. In the dwarf willow associations it is replaced by *Cortinarius favrei*

which can be regarded as the dominant species in *S. arctica* associations, occurring, however, also with *S. nivalis*.

To a certain degree, the geological substrates may influence the *Cortinarius* flora. The Two Ocean Mtn. area has at least locally calcareous, strongly clayey soil, rather different from that of Union Peak. In fact, ten species or varieties of *Cortinarius* have not been observed on Union Peak and on the other hand nine species have been found hitherto only in the Union Peak area (Tab. 1). The total number of species in the two areas is eighteen versus fourteen. At first glance, the difference seems not to be significant, but the Union Peak area is much larger and much more diverse than the Two Ocean Mtn. area. In fact, the Two Ocean Mtn. has the higher number of *Cortinarii*: their growth was also more vigorous and often they tended to occur in large clusters.

Overall only few species are specific for one of the two association types. *C. absarokensis* occurring only in the shrubby willow communities and *C. favrei* in dwarf willow associations only are the best exemples. The shrubby willow communities are in general much moister, being partly seepage areas or swampy. This higher humidity should favour a fungus of the size of *C. absarokensis*. *C. atroalbus* was only observed associated with *S. arctica* but its variety *nigripes* occurs in the moister *S. glauca–phylicifolia* community.

Descriptions and comments on reported taxa

SUBGENUS *MYXACIUM* (FR.: FR.) J.G. TROG

C. absarokensis Mos. & McKnight (1987).

Material examined. – Very abundant under shrubby willows (*S. glauca, S. phylicifolia*) in the Union Peak area. (IB 87/309, 23 Aug. 1987; 89/309 21 Aug. 1989; 91/302, 23 Aug. 1991). It has also been observed in subalpine altitudes on Union Pass (at about 2700 m) under *Salix phylicifolia*. (IB 91/376, 30 Aug. 1991, leg. J. Ammirati). Moreover, it has also been collected in a subalpine habitat in Washington, in the North Cascades, at Lake Ann, above Rainy Pass, 29 Aug. 1989.

Cortinarius favrei Mos. ex Henderson (1958).

Material examined. – Very abundant both on Union Peak and Two Ocean Mtn. (87/247, 16 Aug. 1987, with *Salix arctica*). On Union Peak up to 3500 m.

Cortinarius favrei f. *pallidus* Mos. & McKnight (1987).

Material examined. – Collected only on Two Ocean Mtn. (IB 91/386, among *Salix arctica*, 20 Aug. 1991). A small-spored form is known from the European Alps and from Two Ocean Mtn. (IB 91/293, 20 Aug. 1991) and Union Peak (3400 m, IB 91/312, 22 Aug 1991).

SUBGENUS *SERICEOCYBE* P.D. ORTON

Cortinarius caninus Fr. f.

Material examined. – IB 91/283, Two Ocean Mtn., Shoshone Nat. Forest, at 3150 m, among *Salix arctica*. A further collection IB 91/335 from Union Peak among *Salix nivalis* is very likely the same taxon but the sporophore was immature.

SUBGENUS *TELAMONIA* (FR.: FR.) J.G. TROG

Cortinarius adalberti Favre ex Mos. f. *alpina* M. Moser, f. nov. – Fig. 9.

Differt a typo statura minore et habitatione in zona alpina cum Salice arctica.

Holotypus IB 91/348, USA, Wyo., Two Ocean Mtn., Shoshone Nat. Forest, 28 Aug 1991.

Pileus 13–28 mm broad, hemispherical, then convex, sometimes the centre slightly depressed, hygrophanous, when moist not translucently, striate and color dark chestnut–brown (Caill 35S, 35T), in young stages with a whitish margin from the veil, in older specimens veil only visible in a narrow zone, fading centripetally and becoming yellow–brown (close to Caill 57N), some parts, particularly the disc, changing relatively little and remaining dark and dingy brown when dry. – Lamellae rather pale and in contrast to the dark pileus, Cinnamon (R), adnate to emarginate, subdistant, L=32, l=1–3, 11–12/cm at the margin, 3–4 mm broad (= 4x thickness of the pileus context). – Stipe 15–28 mm long, 3–7 mm above, 4–9 mm at the base, mostly clavate, some equal, whitish at first from the covering of the veil, in age umber–brownish colors showing through in spots and streakes. – Veil white, abundant. – Context in moist condition dark umber–brown, almost blackish–brown in the pileus, umber-brown in the stipe, fading to Light Pinkish Cinnamon (R). – Odor slightly earthy or none. – Taste mild. – KOH dark gray–brown on pileus cuticle and context (not black). – UV: pileus and gills dark purple, stipe blue. – Basidiospores 7.0–8.7 x 4.3–5.5 µm (7.7±0.43 x 4.7±0.19), Q=1.5–1.8 (1.65±0.09), V=72–129 (88.26±10.81), ellipsoid, punctate; Edges fertile with basidia and basidioles. – Basidia 32–35 x 7–8.5 µm, 4–spored, clavate, with basal clamp connection. – Cheilocystidia absent. – Hyphae of the veil 3.5–4 µm thick. – Hyphae of the epicutis 6–9 µm wide, walls yellow–brown, hypodermium subcellular of 8–15 µm thick and 30–40 µm long segments. – Clamp connections present.

Habitat. – Among *Salix arctica*.

Material examined. – At about 3150 m, IB 91/348 (holotype), Two Ocean Mtn., Shoshone Nat. Forest, 28 Aug. 1991.

This taxon is similar in colors to *C. adalberti* from subalpine forests (dark pileus color, pale lamellae, white veil). The spores are identical. The habit is smaller and the habitat among dwarf willows differs from *C. adalberti*, which is otherwise common in spruce forests in the Rocky Mountains of Wyoming. In Europe it occurs in spruce and pine forests. The habitat among alpine dwarf *Salix* indicates a distinct ecological form.

There are older names for this widespread species. Melot (1986) and Brandrud & al. (1992) consider *C. adalberti* Favre ex Mos. as a synonym of *C. depressus* Fr. Melot (pers. comm.), however, is no longer of this opinion. I can not accept this synonymy as there are some inconsistencies between the protologues. The unpublished plate, painted by Petterson and approved by Fries, as well as the descriptions by Fries, agree more or less with the habit, colors and rigidity of the stipe of *C. adalberti*. Fries, however, places this fungus in his subgenus *Hydrocybe* and does not at all mention a white veil. He calls even the cortina "vix conspicua". All our collections both from Europe and North America show a rather strongly developed white veil which forms at least one distinct belt. There are other names which may apply to this fungus. The description of *C. umbilicatus* Karst. suggests this and a study of the type confirmed this view. *C. nitens* Karst. may also be the same species (Melot, pers. comm.). Until the nomenclatorial problems are settled, it is preferable to use the current name to avoid further confusions.

This fungus is widely distributed in North America. We have many collections from Wyoming, Washington, California and Michigan. C.H. Kauffman has collected it in Colorado under the name '*C. nigrelloides* sp. n.', a name that was never published.

Cortinarius phaeochrous Favre complex

Key to species and varieties

1. Pileus 25–35 mm, dark red-brown in moist condition, stipe pale fuscous, striate, with a thin covering from white veil. Spores 6.3–9.3 x 5–7 µm, broadly ellipsoid ..... *C. paraphaeochrous*

1*. Pileus larger, up to 50–65 mm. Color of pileus or stipe different or spores different 2

2. Stipe at first more or less white and compact. Pileus 25–65 mm, in moist condition nearly black, blackish-brown. Spores (6–)7–9(–10) x 4–5(–5.5) µm ..... *C. atroalbus*

2* Stipe at first pale brown to dark brown 3

3. Pileus 25–65 mm, in moist condition dark and dingy red-brown, stipe pale brownish at first, spores 8–10.7 x 4.7–6 µm ..... cf. *C. phaeochrous*

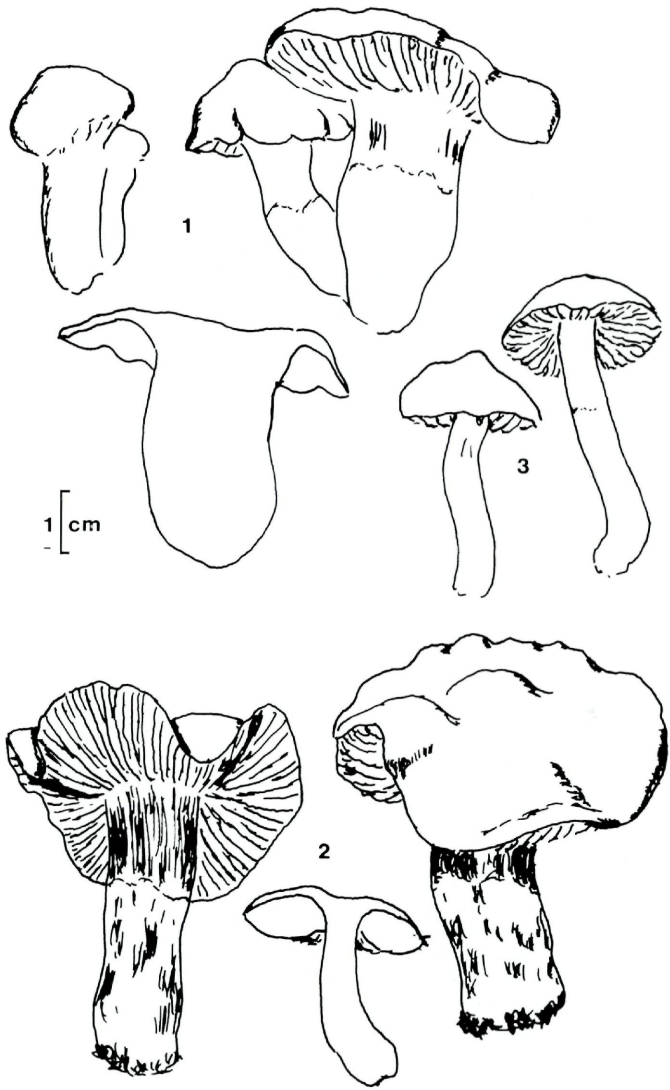
3*. Stipe in young specimens dark umber-brown, but peronately covered by white veil. Cap 20–50 mm, very dark red-brown, at first center, in age blackish all over. Spores 6–9(–9.2) x 4.3–5.7 µm ..... *C. atroalbus* var. *nigripes*

Cortinarius atroalbus M. Moser, sp. nov. – Figs. 1, 10, 11.

Pileo 10–60 mm lato, conico-convexo ad applanato, hygrophano, non striato, obscure castaneo ad atro-brunneo, sicco sordide brunneo, iuventute margine obtecto e velo albo, lamellis pallide flavo-brunneis, aetate flavoferrugineis, subconfertis, stipite 20–35 mm longo, 5–18 mm crasso, albido, velo peronato, interdum subannulato, aetate brunnescenti, carne pallide bubalina, sapore miti absque odore. Sporis 6–9(–10) x 4.0–5.3 µm, ellipsoideis, verrucosis.

Habitat in tundra alpina, inter Salicem arcticam. Holotypus IB 91/298, USA, Wyoming, Union Peak, Windriver Mts., Shoshone Nat.Forest, 3250 m altitudine, 22. Aug. 1991.

Pileus 10–60 mm broad, in small specimens more or less conic, then obtusely conic to convex, finally applanate, larger specimens more convex from the beginning, hygrophanous, not translucent-striate when moist, very dark chestnut brown, sometimes almost blackish brown (Caill 38T, 35T), margin paler, fading only slightly on drying, center remaining dark, margin becoming dingy brown (Caill 49P), margin in young specimens covered by silky white veil remnants, in age sometimes becoming radially cracked. – Lamellae rather pale yellow-brown (Caill 57N), in age becoming yellow-rust-brown (Caill 59P), adnate to nearly arcuate, edge eroded, close, L about 60, l=1–3, 2–7 mm broad (= 5–6x pileus context). – Stipe 20–35 mm long, 5–18 mm thick, equal or slightly tapered at the base, compact, hard, white and silky from the peronate veil, which can form a sheath or a ring, in age upper part becoming very pale brownish. – Context pale brownish (some shade of buff). – Odor not distinctive. – Taste mild. – KOH black on cuticle and context. – UV: purplish violet in all parts. – Basidiospores 6–9(–10) x 4–5.3 µm (7.9±0.39 x 4.6±0.27); Q=1.5–2.0 (1.71±0.11); V=58.6–119.2 (88.3±12.39), ellipsoid, verrucose. – Basidia 26–30 x 7–8 µm, 2– to 4-spored, clavate, some with brownish content. – Hyphae of the lamellae trama 7–8 µm diam., walls pale brownish. – Cheilocystidia absent. – Pileus with a rather strongly developed hypodermium, consisting of elongate, cellular elements, 20–40 x 10–20



Figs. 1–3. – 1. *Cortinarius atroalbus* (coll. 91/298, holotype). – 2. *C. atroalbus* var. *nigripes* (coll. 87/317 and 317a, holo– and paratype). – 3. *C. paraphaeochrous* (coll. 91/323, holotype). – Scale bar: 1 cm.

µm, hyphae of the epicutis radially arranged, 5–7 µm wide, walls brown. – Clamp connections present.

Material examined. – Alpine zone of Union Peak, Windriver Mts., Shoshone Nat. Forest, at 3250–3300 m with *Salix arctica* and *S. nivalis*. Coll. 91/298 (Holotype), 91/299, 91/297, 91/311, all 22 Aug. 1991.

This is one of the most remarkable species of alpine habitats. It reaches and even exceeds *C. subtorvus* in size, usually occurs in large groups both with *S. arctica* and *S. nivalis*. In moist condition the contrast between the convex, almost blackish pileus and the white stipe is very striking. The sporophores are relatively robust. There are two taxa which seem to be closely related. One is a taxon which comes very close to *C. phaeochrous* Favre and may be even identical. Mostly it is smaller in size, but some specimens are the same size as those of *C. atroalbus*. The colors are paler and the spores are distinctly longer. *C. paraphaeochrous* is smaller and has broader spores. *C. atroalbus* var. *nigripes* has a dark brown stipe with white veil already in young specimens and similar spores. To date, it is known only associated with shrubby willow. *C. percavus* Favre has similar colors but is smaller in size and has larger spores.

Cortinarius atroalbus var. *nigripes* M. Moser, var. nov. – Figs. 2, 12.

Pileo 15–50 mm lato, convexo ad undulato, glabro, hygrophano, nec striato, obscure castaneo, disco fere atrobrunneo, aetate omnino atro-brunneo, sicco obscure castaneo, lamellis flavo-brunneis, aetate ferrugineis, subdistantibus, stipite 15–35 mm longo, 3–10 mm crasso, iuventute obscure umbrino e velo albo obtecto, aetate obscure atro-brunneo, carne obscure brunnea, sicco pallida, miti, odore nullo. Sporis 6.7–9 x 4.7–5.7 µm, Q=1.5, ellipsoideis, leviter verrucosis.

Habitat sub salicibus fruticosis (*S. phylicifolia*, *S. brachycarpa*, *S. glauca*, *S. farriae*), in 3100–3200 m altitudine. Holotypus IB 87/317, USA, Wyoming, supra montem dicto Union Peak, Windriver Mts., Teton Nat. Forest, 26 Aug. 1987.

Pileus 15–50 mm broad, convex to somewhat undulate, smooth, hygrophanous, not translucent-striate, in moist condition very dark red-brown (Caill 25P to 25R) in the marginal half, center almost blackish brown (Caill 30T), older specimens blackish brown over all, young specimens with some traces of a white veil at the margin, in dry condition becoming dark red-brown (Caill 25S to 35S). – Lamellae when young contrasting remarkably with the dark pileus due to their relatively bright yellow-brown (Caill 57N) color, in age becoming dark rusty brown (Caill 45R to 47R), emarginate, edge entire to slightly eroded, subdistant, L=28–30, l=1–2, 2–6 mm broad (=5–6x thickness of pileus context). – Stipe 15–35 mm long, 3–10 mm thick, relatively short and stout, more or less equal, in young specimens dark umber

brown (Caill 69S, 53S), apex paler and silky, below the cortina peronately covered by a white veil which soon disappears in the lower part but leaves a more or less distinct belt (1–5 mm broad) which is often more or less persistent even in old specimens, in age the color of the stipe becomes very dark blackish brown (Caill 29T to 30T), even at the apex; hollow. – Context dark brown (Caill 20T to 29T), somewhat paler in the center, pale brownish when dry (Caill 69M in the pileus, 55N in the stipe). – Odor not distinctive. – Taste mild. – KOH: young specimens blackish brown on the pileus cuticle and context. – UV: dark, lamellae dark purplish. – Basidiospores 6–9.0 x 4.3–5.7 µm (7.8±0.55 x 5.1±0.34); Q=1.4–1.7 (1.53±0.09); V= 76.0–151.3 (107.8±20.13), ellipsoid, slightly verrucose. – Basidia 30–34 x 8.5–9 µm, 4–spored, (some 1–, 2– and 3–spored occurring). – Epicutis hyphae 6–8 µm near the surface, 9–13 µm in a deeper layer. – Hypodermium hyphae with 40–70 x 20–23 µm large segments. Other microscopical characters as in the type variety.

Habitat. – Under shrubby willows (*Salix phylicifolia*, *S. glauca*, *S. brachycarpa*, *S. farriae*) at about 3100–3200 m in a seepage area.

Material examined. – Holotype IB 87/317, below Union Peak, Windriver Mts., Sublette County, Teton Nat. Forest, 26 Aug. 1987. Further collection from the same area 87/317a.

This variety is also one of the larger taxa in the alpine zone. In contrast to *C. atroalbus* this variety is much more brittle. The colour of moist sporophores is almost black, both on the pileus and stipe, already in young specimens. The color of the lamellae and the microscopical characters are practically identical with var. *atroalbus*. So far this variety has only been found in association with shrubby willows.

Cortinarius paraphaeochrous M. Moser, sp. nov. – Figs. 3, 13.

Pileo 25–35 mm lato, conico–convexo, umbonato, saepe undulato, hygrophano, estriato in aetate humido, obscure rufo–brunneo, sicco brunneo [Cinnamon usque Clay Color (R)], lamellis fere obscure brunneis, adnatis, emarginatis, ventricosis, subdistantibus ad distantibus, stipite 30–40 mm longo, 5–6 mm crasso, brunneo, pallide umbrino, striato, parte inferiore e velo albo subtiliter obtecto, saepe cum annulo, carne pallida, aquose brunnea, odore nullo vel leviter terrae similis, sapore miti. Sporis 6.3–9.3 x 5–7 µm, late ellipsoideis usque subglobosis, verrucosis, basidiis 35–42 x 8.5–9.5 µm, 4–sporis, clavatis.

Habitat sub Salice phylicifolia, 3200 m. Holotypus IB 91/323, USA, Wyoming, Union Peak, Windriver Mts., Teton Nat. Forest, 23 Aug 1991.

Pileus 25–35 mm broad, conico–convex with a small umbo, often becoming irregular and undulate, hygrophanous, not translucent–striate when moist, rather dark red–brown (Caill 47S) when fresh, fading centripetally and in radial streaks, then becoming grayish brown, fawn colored, between Cinnamon and Clay–Color (R). – Lamellae rather dark, Tawny to Russet (R), adnate to deeply emarginate, ventricose, edges entire to uneven, 5–6 mm broad (6–7x thickness of the pileus context), close to distant, L=30–32, l=1–3, 10–14/cm at the margin. – Stipe 30–40 mm long, 5–6 mm thick, brown, pale umber brown, longitudinally innately striate, silky and shining in the upper part, lower part with a thin covering from a white veil, which usually leaves a white belt. – Context pale watery brown in moist condition (Caill 57P). – Odor none or slightly earthy. – Taste mild. – KOH: black on pileus cuticle and context. – UV: pileus purple, occasionally with some yellow areas, stipe violet, veil bluish. – Basidiospores 6.3–9.3 x 5.0–7.0 µm (7.8±0.68 x 5.9±0.44); Q=1.2–1.5 (1.3±0.08); V=94.3–239.5 (142.5±33.33), broadly ellipsoid to nearly subglobose, verrucose. – Basidia 35–42 x 8.5–9.5 µm, 4–spored, clavate. – Cheilocystidia absent. – Hyphae of the epicutis 6–12 µm, walls strongly incrusted with brown clumps of pigment, hyphae of hypodermium up to 20 x 60–120 µm. – Clamp connections present.

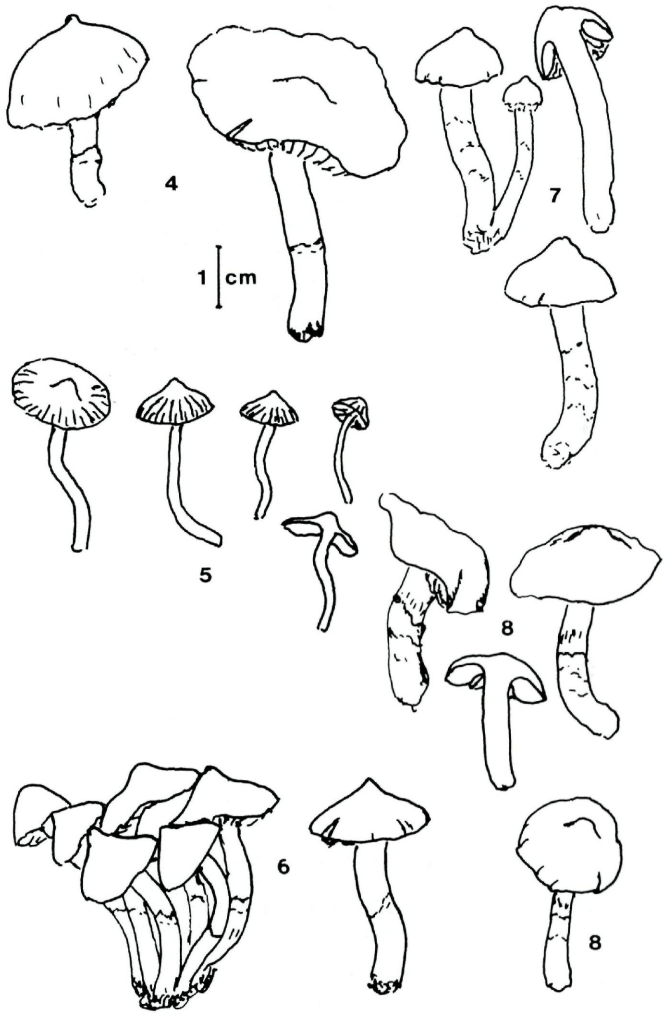
Habitat. – Under shrubby willows (*Salix phylicifolia*) at about 3200 m.

Material examined. – Holotype IB 91/323, below Union Peak, Windriver Mts., Teton Nat. Forest, 23 Aug 1991.

This also is one of the larger alpine species. It differs from *C. phaeochrous* by the more conic–umbonate pileus, more red–brown colors, and particularly the broader and shorter spores which are sometimes almost subglobose. It differs from *C. atroalbus* by a brown stipe in young specimens, darker gill colour and the broader spores.

Cortinarius phaeochrous Favre (1955). – Fig. 14.

Pileus 25–65 mm broad, mostly plano-convex and somewhat umbonate, hygrophanous, in moist condition not translucent–striate, dark and dingy red–brown (Caill 47R), sometimes larger portions covered by white veil remnants which appear gray-brown (canescent) or marbled, (Caill 50M to 50N), drying centrifugally and slightly in radial streaks and becoming pale reddish yellow-brown (Caill 57M,45M). – Lamellae dark rust–brown [Caill 45R, between Mika-



Figs. 4–8. – 4. *C. expallens* (coll. 91/322, holotype). – 5. *C. galerinoides* (coll. 91/324). – 6. *C. stenospermus* (coll. 91/350). – 7. *C. hybospermus* (coll. 91/289, holotype). – 8. *C. subrigidipes* (coll. 91/309, holotype). – Scale bar: 1 cm.

do Brown and Verona Brown (R)], edges entire to eroded, deeply emarginate, distant, L=35, l=1–3, 9–10/cm at the margin, up to 10 mm broad (=5x thickness of the pileus context). – Stipe 40–70 mm long, 5–10 at apex, base 7–18 mm thick, equal to slightly clavate, apex silvery in the uppermost part, otherwise pale brownish, with fine innate longitudinal fibrils, the lower third mostly covered by a white veil that can sometimes form a belt. – Context paler umber-brown when moist, in dry condition pale, Light Buff (R) in the center, in the stipe remaining watery marbled for a long time. – Odor not distinctive. – Taste mild. – KOH: dark brown in the context and on the pileus cuticle. – UV: purplish red in all parts, only veil paler ("moonlight"). – Basidiospores 8.0–10.7 x 4.7–6.0 µm (9.3±0.61 x 5.1±0.35); Q=1.6–2.1 (1.82±0.12); V=98.8–201.0 (129.6±24.19), ellipsoid, verrucose. – Basidia 30–32 x 8–9 µm, 4-spored. – Cheilocystidia absent. – Epicutis hyphae 5–8 µm thick with brown walls. – Hyphae of the hypodermium 10–17 µm thick. – Clamp connections present.

Habitat. – Under shrubby willows (*Salix glauca*, *S. phylicifolia*, *S. brachycarpa*) in a seepage area at about 3200 m.

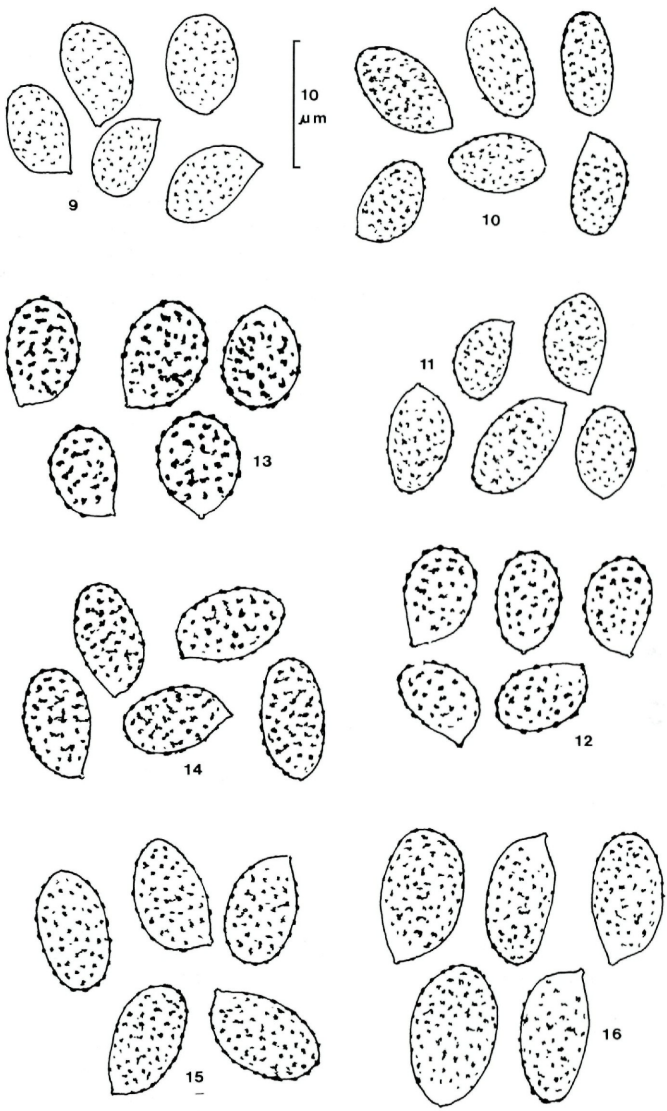
Material examined. – IB 89/301, below Union Peak, Teton Nat. Forest, 21 Aug. 1989.

This taxon reminds at first of *C. subtorvus*, but none of the specimens has any trace of violaceous color on the stipe. In addition, the color of the pileus and spore shape and size exclude *C. subtorvus*. It agrees in macro- and microscopical characters rather well with *C. phaeochrous* but the determination remains uncertain because of the ecological characters. Favre (1955) has described *C. phaeochrous* from calcareous soils, associated with *Dryas octopetala*. Also Lamoure (1978) lists similar habitats. On the other hand several collections from Europe agree with *C. phaeochrous* but have been collected on siliceous soils, one with *Arctostaphylos uva-ursi*, one with *Salix herbacea*.

Cortinarius hinnuleus complex

Cortinarius hinnuleus Fr. var. *favreanus* Bon (1992). – Fig. 17.
= *Cortinarius hinnuleus* Fr. var. *gracilis* R. Maire. ss. Favre (1955).

Pileus 17–42 mm broad, convex and often with a distinct umbo, hygrophanous, not translucent-striate or only at the margin with an indistinct striation, smooth and glabrous, in age sometimes cracking and becoming squamulose, in moist condition mostly uniformly deep rusty brown or deep red-brown (Caill 45R, 40R, 37S),



Figs. 9–16. – 9. *C. adalberti* f. *alpinus* (coll. 91/348, holotype). – 10. *C. atroalbus* (coll. 91/299). – 11. *C. atroalbus* (coll. 91/298, holotype). – 12. *C. atroalbus* var. *nigripes* (coll. 87/317, holotype). – 13. *C. paraphaeochrous* (coll. 91/327, holotype). – 4. *C. phaeochrous* (coll. 91/301). – 15. *C. expallens* (coll. 91/308). –16. *C. expallens* (coll. 91/322, holotype). – Scale bar: 10 µm.

sometimes the center darker, fading in radial streaks and becoming bright yellow-brown, nearly orange-brown (between Caill 59N and 59P). – Lamellae deep rusty brown (Caill 40R), to yellow-rust-brown (Caill 59P), adnate to emarginate or slightly arcuate, edges entire to uneven or finally eroded, rather thick, distant, L=25–28, l=1, at the margin 8–9/cm, 3–5 mm broad (=4–5x thickness of the pileus context). – Stipe 25–40 mm long, 4–7–(10) mm thick, equal or base somewhat tapered, yellow-rust-brown, but more dingy than the pileus or apex pale brown and the base dark umber brown, lower third or half covered by white to ochraceous universal veil which can disappear in the lower part but leaves a distinct fibrillose to submembranaceous, sometimes funnel-shaped ring, rather stiff and hard, hollow at least in the upper part. – Context pale umber brown when moist, fading to Light Ochraceous Buff or Ochraceous Buff (R) from the pith outward. – Odor strongly earthy or green corn in some specimens, in others rather somewhat sweetish. – Taste mild. – KOH: black on pileus cuticle, dark umber brown on context. – UV: all parts dark purple, veil yellowish. – Basidiospores 8.7–10.3 x 5.3–6.7(7.3) µm (9.5±0.43 x 5.9±0.33); Q=1.3–1.8 (1.6±0.10); V=129.1–232.7 (175.6±24.6), broadly ellipsoid, coarsely verrucose.

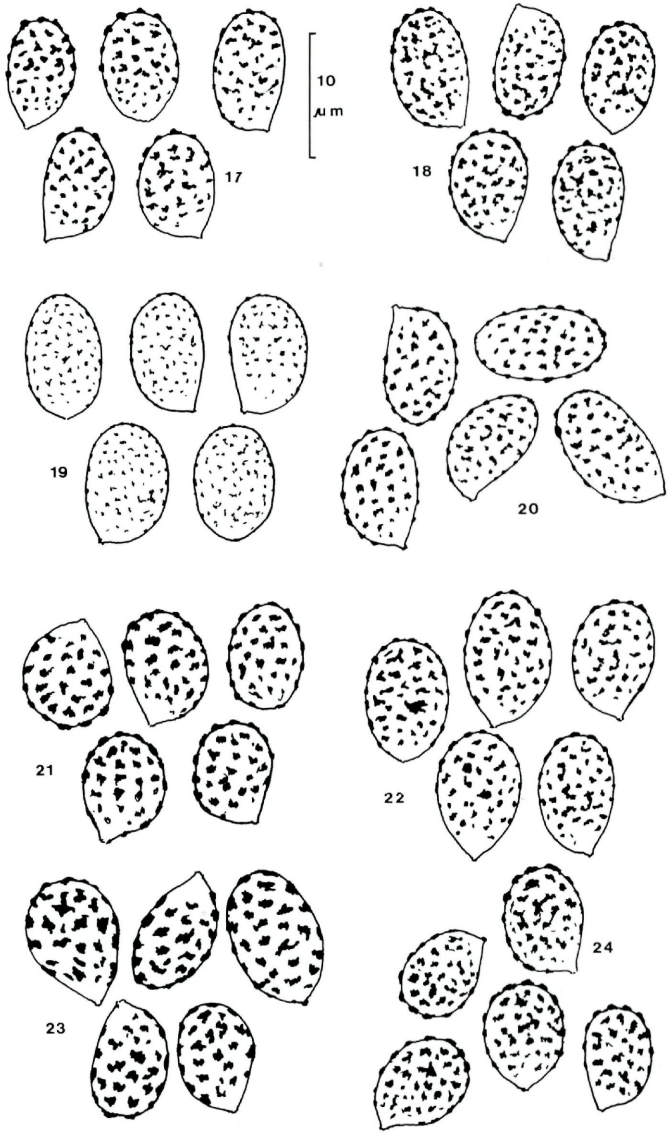
Habitat. – Two Ocean Mtn., Shoshone Nat. Forest, in many localities among *Salix arctica* at 3000 to 3150 m. Growing in large groups and often dense clusters.

Material examined. – Collections 91/281 and 91/282, 20 Aug. 1991, 91/354 and 91/354a, 28 Aug. 1991.

This taxon was very common on Two Ocean Mtn. growing in large clusters of 10 to 30 sporophores, a feature which elsewhere has not been observed. The odor is variable, sometimes strongly earthy, sometimes more sweetish.

Cortinarius minutalis Lamoure (1977). – Fig. 18.

Pileus 7–10 mm broad, strongly convex, later applanate, hygrophanous, not translucent-striate, in moist condition dark red-brown (Caill 49S, 53S), fading centrifugally and becoming bright red-brown (Caill. 40P, 45P). – Lamellae dingy rust-brown, (Caill 47R), edges entire to uneven, adnate, close to distant, L about 20, l=0–1, 10–19/cm at the margin, 2–3 mm broad, (5–6 x thickness of the pileus context), ventricose. – Stipe 12–15 mm long, 1.5–2 mm thick, equal but often curved, yellowish to yellowish-brown, toward the base with fibrillose veil remnants. – Veil ochre-yellowish, in age



Figs. 17–24. – 17. *C. hinnuleus* var. *favreanus* (coll. 91/281). – 18. *C. minutalis* (coll. 91/294). – 19. *C. galerinoides* (coll. 91/303). – 20. *C. galerinoides* (coll. 91/324). – 21. *C. pusillus* (coll. 91/358). – 22. *C. ferrugineifolius* (coll. 91/319). – 23. *C. subrigidipes* (coll. 91/309, holotype). – 24. *C. hybospermus* (coll. 91/289, holotype). – Scale bar 10 µm.

sometimes disappearing. – Context umber brown in stipe and also at first in the pileus, fading to pale brown. – Odor not distinctive. – Taste mild. – KOH: black on pileus cuticle and context. – UV: purple in all parts. – Basidiospores 7.3–9.3 x 5.3–6.3 µm (8.68±0.43 x 5.9±0.22); Q=1.3–1.6 (1.5±0.07); V=109.2–196.0 (155.49±16.55), broadly ellipsoidal, coarsely verrucose. – Basidia 34–36 x 8.5–9.5 µm, base 3–4.5 µm, 4–spored, clavate. – Cheilocystidia absent, edges fertile. – Epicutis hyphae of pileus 6–10 µm, incrusted with flat brown clumps of pigment, hyphae of the hypodermium 12–18 µm thick, with similar incrustation.

Habitat. – Among *Salix nivalis*, 3200 m.

Material examined. – Two Ocean Mtn., Shoshone Nat. Forest, 20 Aug. 1991, IB 91/294.

The veil was not as strongly developed as illustrated by Lamoure (1977).

Cortinarius expallens M. Moser, sp. nov. – Figs. 4, 15, 16.

Pileo 13–40 mm lato, convexo ad convexo-umbonato, postremo plus minusve depresso, saepe margine undulato, hygrophano, estriato, obscure sordideque rufo usque fere umbrino, decolorante sordide rufo, margine e velo albido obtecto et magis pallide fusco, lamellis pallide brunneis deinde ferrugineis, adnatis vel emarginatis, 3–7 mm latis, plus minusve distantibus, stipite 25–45 mm longo, 3–5 mm crasso, aequali, pallide brunneo variegato, infra obtecto e velo albo peronatoque, interdum annulo fere submembranaceo praedito, carne umida umbrino-variegata, in parte inferiore stipitis obscuriore, sicco pallida, odore nullo, sapore miti. Sporis 8.7–10.7 x 5–6.7 µm, ellipsoideis, saepe elongatis, plus minusve verrucosis, basidiis 28–35 x 7.7–9.3 µm, (2–) vel 4–sporigeris. Absque cystidiis.

Habitat supra Salice glauca. Holotypus IB 91/322, USA, Wyoming, supra montem dicto "Union Peak", Teton Nat. Forest, altitudine 3150 m, 23 Aug. 1991.

Pileus 13–40 mm broad, convex, convex-umbonate to depressed or depressed only around the umbo, margin often undulate, hygrophanous, not translucent-striate when moist, dark and dingy red-brown to nearly umber brown, fading centripetally and becoming dingy red-brown, between Cinnamon Buff and Clay (R), toward the margin more grayish brown and covered by white veil remnants when young. – Lamellae at first rather pale, Cinnamon Buff to Ochraceous Tawny (R), in age becoming rusty brown (Tawny, R), edges at first entire, then serrulate or even slightly fimbriate, adnate to broadly and deeply emarginate, rather broad, in mature specimens 3–7 mm broad, subdistant to distant, L=25–36, l=1–3, 9–10/cm at the margin. – Stipe 25–45 mm long, 3–5 mm thick, equal, pale brownish above, then pale umber brown but variegated with silvery streaks, lower part

covered by a peronate white veil which leaves a more or less broad belt in older specimens, sometimes with an almost submembranaceous ring; becoming hollow. – Context of the pileus and upper stipe in moist condition pale to dark umber brown, darker in the base of the stipe, in dry condition pallid, (Light Ochraceous Buff or Light Pinkish Buff, R). – Odor not distinctive. – Taste mild. – KOH: blackish brown, then black on the pileus cuticle and context. – UV: pileus and lamellae purple (in young specimens pileus also with some yellowish areas), stipe and veil bluish, context bluish but duller then the veil. – Basidiospores 8.7–10.7 x 5.0–6.7 µm (9.7±0.52 x 5.8±0.38); Q=1.4–2.0 (1.68±0.12); V=113.45–232.71 (172.97±25.99). In other collections they are slightly more slender: 4.7–6 µm broad (91/308), 7.7–11 x 4–6 µm (91/313), ellipsoid to slightly elongate, finely verrucose to verrucose. – Basidia 28–35 x 7.7–9.3 µm, 2–4-spored. – Hyphae of the pileus epicutis 5.5–16 µm, walls pale brown. – Hypodermium more or less subcellular, hyphae up to 25 µm wide. – Hyphae of the veil (4)–6–8.5 µm wide. – Clamp connections present.

Habitat. – Under *Salix glauca* and *S. arctica*.

Material examined. – Holotype IB 91/322, below Union Peck, Windriver Mts., Teton Nat. Forest, at about 3100 m, with *S. glauca*, 23 Aug. 1991. Additional collections: 91/308, same area and date; 91/313, Union Peak, at about 3250 m, with *S. arctica*, 22 Aug. 1991.

This species comes closest to *C. rufostriatus* Favre (1955). The sporophores are somewhat larger and the spores are more narrow. Transparent striations have not been observed on the pileus margin and the pileus is not conic as in *C. rufostriatus*, which in addition has a radish odor, unlike *C. expallens*, which occurs both with dwarf and shrubby *Salix* species.

Key to small red-brown alpine *Telamonia* species

1. At least the stipe paler brown, buff to pale brownish, lower part peronately covered by white veil at first, forming a belt. Spores 7.3–11.3 x 4.3–6.3 µm ..... *C. ferrugineifolius*
1*. Sporophores red-brown in all parts, at least when faded 2

2. Small, pileus 6–17 mm, conic, transparently striate when moist, with the appearance of *Galerina*. Spores (7.3)–8–10.7 x 4.7–6.3 µm ..... *C. galerinoides*
2*. Pileus becoming larger and/or convex, umbonate etc. 3

3. Spores relatively small, 6–8 x 4.5–5.4 µm. Veil forming one white ring on stem ..... *C. rufoannuliferus*
3*. Spores larger 4

4. Sp. 7.7–10(11) x 5.1–7 (8) µm. Pileus convex, striate when moist, dark red–brown, fulvous–brown when dry ..... *C. vulpicolor*
4*. Sp. 7.5–11.5 x 4–6 µm. Pileus rather dark brown when moist, becoming dingy red–brown on drying ..... *C. pauperculus*

Cortinarius galerinoides Lamoure (1977). – Figs. 5, 19, 20.

Pileus 11–17 mm broad, convex to conic, later applanate and often with a slight umbo, hygrophanous, in moist condition translucent–striate, up to 2/3 of the diameter, rather dark red–brown (Caill 35S, 35T), glabrous and smooth, no recognizable veil remnants, fading centripetally and becoming grayish–brown, hazel brown, between Sayal Brown and Tawny Olive (R). – Lamellae in young specimens milk coffee–brown, [Sayal Brown (R)], then soon becoming deep rust brown, (Caill 40R to 45R), edges entire, adnate, distant, L=20, l=0–1, 8–9/cm at the margin, relatively broad, 2–3–(4) mm (=5–6x thickness of the pileus context). – Stipe 18–30 mm long, 1.5–2.5 mm thick, equal, dark red–brown (concolorous with the pileus), only the apex paler, only some specimens with a few white fibrils from the veil, and rarely with an indistinct ring. – Context dark red–brown when moist. – Odor not distinctive. – Taste mild. – KOH black on the pileus cuticle and context. – UV: dark purple in all parts, only young specimens show a bluish tinge over the pileus. – Basidiospores 8.7–10.7 x 5.2–6.3 µm (9.4±0.52 x 5.7±0.29); Q=1.5–1.8 (1.7±0.07); V=129.08–210.02 (162.04±23.09; Collection 91/324: 8–10.7 x 4.7–6.2 µm, 91/325: 7.3–10 x 5.2–6.3 µm), rarely some giant spores 13.5 x 6.7 µm, ellipsoid, slightly to moderately verrucose with isolated warts. – Basidia 28–30 x 7–9.5 µm, 4–spored, clavate, basal clamp connection present. – Cheilocystidia none, edge of lamellae with clavate sterile cells (basidioles). – Clamp connections present.

Habitat. – Under shrubby willows (*Salix glauca* and *phylicifolia*) between litter.

Material examined. – IB 91/303, below Union Peak, Windriver Mts., Teton Nat. Forest, Wyo, in about 3150 m. 23 Aug. 1991, IB 91/324, same area and date, under *Salix phylicifolia*.

This taxon has the habit of a *Galerina* but the colors are deep red-brown. The spores vary in size somewhat more than reported by Lamoure (1977) and all our collections have been found under *Salix glauca* and *S. phylicifolia*.

Cortinarius rufoannuliferus Mos. & McKnight (1987).

This taxon was described from Mt. Washburn in the Yellowstone Nat. Park and was also recorded from the Beartooth Pass area. It was found among *Salix arctica* on Two Ocean Mtn. and Union Peak and one collection in the Union Peak area was under *S. glauca*. It is distinguished from other red-brown species by relatively small spores (6–8 x 4–4.7–5.4 µm). Like *C. chrysomallus* Lam., it is a taxon apparently not restricted to alpine habitats. Several collections have been reported from the coastal dunes in California in association with shrubby *Salix* species.

Material examined. – IB 91/357, Two Ocean Mtn., Shoshone Nat. Forest, Wyo., 3100 m, with *Salix arctica*, 28 Aug. 1991 ; IB 91/599, 91/600 and 91/601, on coastal dunes with *Salix hookeriana*, Samoa Peninsula near Eureka, California, 29 Nov. 1991.

Two additional collections also seem to belong here, but have slightly larger spores : IB 91/321 and 91/326, both from the Union Peak area at about 3100 m under *Salix glauca*, 23 Aug. 1991. Spores in coll. 91/321 7.3–10 x 4.6–6 µm, in coll. 91/326 7–9.3 x 4–5.3µm. These two collections were growing only a few meters apart.

Cortinarius ferrugineifolius M. Moser, sp. nov. – Figs. 22, 29.

Pileo 12–40 mm lato, obtuse conico, semiglobato, deinde convexo, applanato, interdum disco depresso, hygrophano, estriato in statu humido, obscure rufo-brunneo vel castaneo, sicco pallide rufo-brunneo, aurantio-brunneo, glabro, margine iuventute e velo albido obtecto, lamellis obscure ferrugineis, plus minusve distantibus, stipite 15–45 mm longo, 4–7 mm crasso, aequali vel subclavato, sericeo, pallide fusco, parte inferiore e velo albido obtecto, interdum cum annulo tenue. Sapore miti, odore nullo vel leviter terrae simili. Sporis 7.3–11.3 x 4.3–6.3 µm, late ellipsoideis, verrucosis, basidiis 28–32 x 8–9 µm, clavatis.

Habitat inter Salice arctica et nivali, in altitudine 3250–3300 m. Holotypus IB 91/305, Union Peak, Windriver Mts., Teton Nat. Forest, 1991 Aug. 22.

Pileus 12–40 mm broad, obtusely conic, hemispheric, then convex to applanate, the center sometimes depressed, hygrophanous, not translucent-striate when moist, dark and dingy red-brown to chestnut-brown (Caill 47R, 53S), in dry condition pale red-brown to orange-brown or fawn coloured (Caill 40N to 59N), smooth and glabrous, sometimes becoming lacerate (depending on weather conditions), young specimens with dingy white veil remnants at the margin, in old specimens such remnants are few. – Lamellae deep rust-brown in young and old specimens, Tawny to Russet (R), in age perhaps slightly darker, deeply emarginate, ventricose, 2–6 mm broad (=6–7-times thickness of pileus context), edges uneven, subdistant to distant,

L=25–28, l=1–3, 7–9 cm at the margin. – Stipe 15–45 mm long, 4–7 mm thick at the apex, equal to slightly clavate, silky shining, pale gray-brown and finely innate fibrillose, lower half with a peronate covering from the whitish veil which disappears with age but leaves often a thin belt. – Context in dry condition Light Ochraceous Buff to Light Pinkish Buff (R), in stipe more brownish. – Odor not distinctive or slightly earthy. – Taste mild. – KOH black or almost so on pileus cuticle and context. – UV: deep purple on pileus, lamellae and stem, sometimes pileus with yellow areas, veil bluish to yellowish. – Basidiospores 7.3–11.3 x 4.3–6.3 µm (8.9±0.95 x 5.5±0.55); Q=1.4–1.8 (1.62±0.09), V=72.1–238.0 (143.9±42.56), ellipsoid, moderately to strongly verrucose. Lamellar edges with basidia and basidioles. – Basidia 28–32 x 8–9 µm, clavate, basal clamp connection present. Hyphae of the lamellar trama 3.5–7 µm, some with brown content. – Epicutis hyphae 5.5–8 µm wide, fulvous brown incrusted. – Hyphae of the hypodermium 14–23 µm wide. – Clamp connections present.

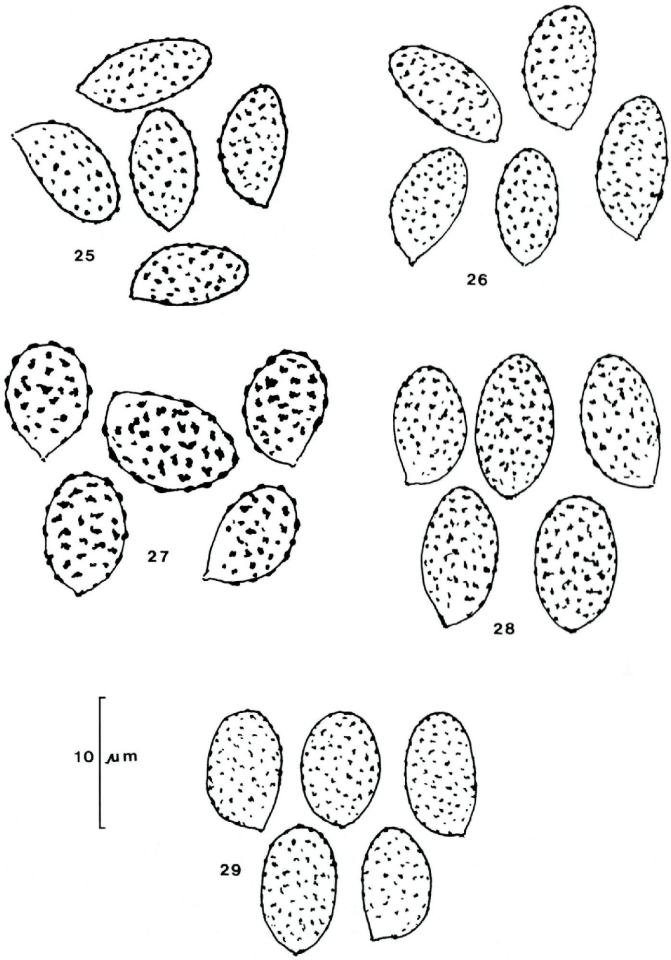
Habitat. – Among *Salix nivalis* and *S. arctica* at 3250–3300 m.

Material examined. – Holotype 91/305, Union Peak, Windriver Mts., Teton Nat. Forest, 22 Aug 1991, among *Salix nivalis*. Additional coll. IB 91/319, same area and date, among *Salix arctica*. Coll. 91/300, same area and date also seems to belong to this taxon although the lamellar colour is somewhat paler.

In collection 91/319 the sporophores are slightly larger and the spores somewhat shorter than in the holotype, but all other characters agree rather well with the other two collections. *Cortinarius expallens* Mos. has rather pale lamellae in younger stages.

Cortinarius pauperculus Favre (1955). – Fig. 27.

Pileus 4–14 mm, convex to somewhat irregularly undulate, hygrophanous, not translucent-striate, in moist condition rather dark red-brown (Caill 49R, disc 45R), margin in young specimens paler, fading to paler red-brown (Caill 40P to 45N). – Lamellae dark red-brown (Caill 35R), adnate, rounded behind, edges entire, rather thick, distant, L=16–18, l=1, at the margin 9/cm, 1–2 mm broad (4–5x pileus context). – Stipe concolorous with the pileus, dark red-brown, lower part often peronately covered by whitish veil which can form a ring, but is often fugacious. Context dark red-brown. – Odor none. – Taste mild. – Basidiospores (6)–7.5–11.5 x (4)–6 µm (8.8±0.93 x 4.7±07); Q=1.3–2.7 (1.92±024); V=59–175.9 (99±21), ellipsoid to nearly subfusiform or cylindric, with fine isolated warts, puncta-



Figs. 25–29. – 25. *C. stenospermus* (coll. 91/350). – 26. *C. stenospermus* (coll. 91/336). – 27. *C. pauperculus* (coll. 91/314). – 28. *C. laetus* (coll. 91/364). – 29. *C. ferrugineifolius* (coll. 91/305, holotype). – Scale bar: 10 µm.

te. – Basidia 30–38 x 8.5–9 µm, 4–spored, clavate. – Clamp connections present.

Habitat. – Among *Salix arctica*, Two Ocean Mtn., 3150 m, 28 Aug. 1991, IB 91/356.

This species has been recorded before (Moser & McKnight, 1987) from the Beartooth Pass area, northern Absaroka Range, Rocky Mountains. The description refers to the new record from Two Ocean Mtn. The spores in this collection are highly variable in size, but the majority corresponds with the typical range of *C. pauperculus*.

Cortinarius vulpicolor Mos. & McKnight (1987).

Material examined. – Several collections, from both Two Ocean Mtn. and the Union Peak area belong to this taxon. Below Union Peak: IB 87/281, 3100 m, under *Salix glauca*, *S. phylicifolia*, *S. farriae*, *S. brachycarpa*, 21 Aug. 1987; IB 87/318 and 318a, same area, 26 Aug. 1987; IB 87/321, same area, 26 Aug. 1987; IB 91/306 and 91/307, same area, at about 3150 m under *Salix glauca* and *S. phylicifolia*. Two Ocean Mtn., Shoshone Nat. Forest, Wyoming, among *Salix arctica*, 20 Aug. 1991.

Collection IB 91/287 seems to belong here although the pileus was not translucently striate in moist condition as in typical *C. vulpicolor*.

The variability of this species is certainly greater than given in the original description. The pileus can reach up to 22 mm, and in two collections the stipe was thicker, reaching 3–5 mm. The spores also are somewhat variable even on the same sporophore and have a rather strong ornamentation with isolated but irregular warts. The spore shape varies from broadly ellipsoid to cylindric.

Cortinarius inops Favre (1955). – Fig. 21.
Syn: *C. pusillus* Moell. (1945) non Murrill (1944).

Pileus 12–18 mm broad, convex, applanate or with a small umbo, hygrophanous, in moist condition very dark, almost blackish brown, not translucent-striate, in dry condition still rather dark brown, glabrous, smooth. – Lamellae dark rust-brown, Russet (R), adnate to emarginate, subdistant. – Stipe 20–25 mm long, 3–4 mm broad, grayish-brown with a purplish tinge, shining, no veil visible, becoming hollow. – Context almost blackish-brown in pileus, umber brown in the stipe, but the pith paler. – KOH black on context and pileus cuticle. – UV: dark on pileus and lamellae, stipe deep violet. – Basidiospores 7.7–10.0 x 5.2–6.3 µm (8.6±0.5 x 5.7±0.3); Q=1.4–1.7 (1.5±0.08); V=114.2–210.0 (142.6±21.27), short ellipsoid to

nearly subglobose, strongly verrucose particularly in the apical part. – Basidia 30–35 x 8–8.5 µm, 4–spored, clavate. – Cheilocystidia vesiculose to clavate, septate. – Epicutis hyphae 5.5–8 µm wide, walls brown with parietal pigment. – Hypodermium subcellular, segments 40–60 x 18–25 µm. – Clamp connections present.

Habitat. – Among *Salix arctica*, Two Ocean Mtn., Shoshone Nat. Forest, at about 3100 m.

Material examined. – IB 91/290, 20 Aug. 1991 ; IB 91/358, 28 Aug. 1991.

This taxon has only been recorded from Two Ocean Mtn. It is the first record for the western United States and is apparently rare in Wyoming.

Bon (1992) thinks that *C. pusillus* Moeller and *C. inops* Favre are different species. I have seen this taxon in numerous places, including in the Alps, northern Scandinavia, the Rocky Mountains and I am convinced that the descriptions of both species fall within the range of variability of one taxon.

Cortinarius paleaceus group

Cortinarius stenospermus Lamoure (1987). – Figs. 6, 25, 26.

Pileus 8–25 mm broad, conic to obtusely conic, later applanate with a small umbo, hygrophanous, not translucent–striate, glabrous and smooth from the beginning, the marginal area only in young stages with a covering from the white veil, in moist condition dark brown, chocolate brown, (Caill 49S,47S) to Warm Sepia (R) or umber brown (Caill 70S, 60S), margin paler, Cinnamon to Pinkish Cinnamon (R), fading radially in streaks or centrifugally and becoming dingy reddish brown to grayish brown, nearly Sayal Brown (R, Caill 47P to 49P), or more yellow–brown (Caill 60N). – Lamellae grayish brown (Caill 53N), later darker, (Caill 55P), adnate, relatively thick, edges uneven, subdistant, L about 20, l=1, at the margin 11–12/cm, 2–3 mm broad (= 4–5x thickness of the pileus context). – Stipe equal, 15–30 mm long, 1–4–(5) mm thick, dark umber brown, covered by a white veil which normally forms a belt and often white patches below, hollow. – Context dark umber brown when moist, fading to Pinkish Buff (R) starting under the disc and in the pith. – Odor slightly fruity but not of *Pelargonium* when moist; taste mild. – Basidiospores somewhat variable in size, coll. 91/350 7.7–10.0 x 4.0–6.0 (8.6±0.5 x 5.0±0.25), Q= 1.7–1.8 (0.11), V=114 (14.53); coll.91/355 8.7–12 x 4.3–5.3, coll. 91/336 7.3–9.3 x 4.3–5.3, coll. 91/291 8.3–10.7 x 4.3–5.9, ellipsoid–subfusoid, with fine verrucosity. – Basi-

dia 33–42 x 7.5–8.5 µm, 4–spored, clavate, basal clamp connection present. – Hyphae of the pileus epicutis 5.5–7 µm thick, dark brown and strongly incrusted with large clumps of brown pigment. – Hyphae of the hypodermium up to 15–20 µm thick, also strongly incrusted but slightly less then the epicuticular hyphae.

Habitat. – Among *Salix arctica* in the alpine zone, but also in subalpine conifer forests, growing often in dense clusters of 20–30 sporophores together.

Material examined. – IB 91/291, Two Ocean Mtn. at about 3150 m among *Salix arctica*, 20 Aug. 1991; IB 91/350, Two Ocean Mountain, about 3100 m, among *Salix arctica*, Shoshone Nat. Forest, Wyoming. 28 Aug. 1991. IB 91/359, same area and date but at 3150 m; IB 91/355 same area and date but in subalpine forest with *Abies lasiocarpa, Picea engelmannii, Pinus albicaulis* among mosses; IB 91/375 Union Pass, 2700 m, 30 Aug. 1991; IB 83/169, near Snake River SE of Signal Mtn. under *Picea pungens* at about 2000 m. An earlier record from the Beartooth Pass area was tentatively assigned to this species (IB 83/353) by Moser & McKnight (1987).

This species is characterized by relatively slender, subfusoid spores. It seems not to be typically alpine but it has been seen predominantly among *Salix arctica* in the alpine zone, although some collections are from subalpine spruce forests. Particularly in the alpine habitat the fasciculate growth is typical. In our first collection the spores were somewhat shorter than given by Lamoure (1987). Later, however, a wider variability was seen in spore size.

Cortinarius subrigidipes M. Moser, sp. nov. – Figs. 8, 23.

Pileo 13–28 mm lato, convexo vel obtuse conico, leviter umbonato, hygrophano, estriato in statu humido, plus minusve obscure castaneo, sicco pallide rufo, margine primo e velo obtecto, pallidiore, lamellis obscure ferrugineis, emarginatis, ventricosis, 3–5 mm latis, crassiusculis, subdistantibus usque distantibus, stipite aequali vel deorsum gradatim attenuato, 20–30 mm longo, 3–5 mm crasso, parte superiore viridulo vel olivaceo–brunneo, aetate umbrino, parte inferiore primo obtecto e velo albido peronato, plus minusve rigido, carne obscure umbrina. Sporis 8–9.3(–10.7) x 6–6(–6.5) µm, late ellipsoideis, verrucosis, basidiis 35–40 x 85–9 µm, tetrasporigeris, clavatis, absque cystidiis.

Habitat cum Salice arctica in zona alpina. Holotypus IB 91/309, USA, Wyoming, Union Peak, Teton Nat. Forest, altitudine 3250 m, 22 Aug. 1991.

Pileus 13–28 mm broad, convex or obtusely conic, with a slight umbo, hygrophanous, in moist condition not translucent–striate, relatively dark chestnut brown or chocolate brown when moist (Caill 50S), fading centrifugally to reddish brown or the margin more grayish brown (Caill 47P, 49P), in young specimens margin slightly covered by the veil. – Lamellae deep rusty brown, tawny (R), deeply

emarginate, ventricose, 3–5 mm broad (4–5 x thickness of the pileus context), rather thick, subdistant to distant, L=30, l=1–(3), 9/cm at the margin. – Stipe 20–30 mm long, 3–5 mm thick at the apex, equal or base slightly tapered, upper part with a greenish tinge, olivaceous brownish, silky shining, later umber brown, lower half often peronately covered by whitish veil, relatively stiff, in age entire stipe becoming umber brownish. – Context dark umber–brown when moist, brown in stipe when dry, in pileus and parts of the stipe becoming Light Ochraceous Buff (R). – Odor not distinctive. – Taste mild. – KOH: black on pileus cuticle and context. – UV: dark purple on pileus and lamellae, stipe bluish. – Basidiospores 8.0–9.3(–10.7) x 5.0–6.0(–6.5) µm, (8.6±0.42 x 5.6±0.31); Q=1.4–1.7 (1.5±0.07); V=113.4–175.9 (143.9±20.94), broadly ellipsoid, verrucose. – Lamellae edges fertile with basidia and basidioles. – Basidia 35–40 x 8.5–9 µm, 4–spored, content sometimes brown. –Cheilocystidia absent, no phaeobasidia observed. – Epicuticular hyphae 4–7 µm wide, brown, incrusted, hypodermium hyphae up to 20 µm wide, walls pale brownish, slightly incrusted. – Clamp connections present.

Habitat. – Among *Salix arctica* in the alpine zone.

Material examined. – IB 91/309 (holotype), Union Peak at about 3250 m, Windriver Mts., Teton Nat. Forest, 22 Aug. 1991.

This species resembles *C. rigidipes*, but differs by smaller sporophores, the presence of a peronate veil, lack of cheilocystidia, lack of phaeobasidia and the alpine habitat in association with dwarf *Salix*. The constancy of cheilocystidia and phaeobasidia in *C. rigidipes*, however, needs further study.

Cortinarius subtorvus Lamoure (1969).

Pileus 25–35 mm, mostly applanate and margin curved, in age often upturned and undulate, when young dark brown, the margin covered by white veil, later more hazel brown and sometimes surface cracked. – Lamellae milk coffee brown, between Sayal and Wood Brown (R), edges paler, uneven, emarginate, close to subdistant, 4–5 mm broad (5–6x thickness of the pileus context). – Stipe 20–40 mm long, 8–15 mm thick, equal, in young specimens with violaceous colors, later fading to dingy white, lower half covered by a white veil. – Context pallid in the pileus, in the stipe at first with bluish tinges, later white. – KOH: dark brown to almost black on pileus cuticle and context. – UV: pileus red, lamellae dark purple, stipe more violet. – Basidiospores 7.3–8.7 x 4.3–5.3 µm (7.98±0.44 x

4.7±0.25); Q=1.6–1.8 (1.7±0.09); V= 72.1–129.1 (92.3±13.42), ellipsoid, verrucose. – Cheilocystidia cylindric, clavate, not very conspicuous.

Habitat. – Among *Salix arctica*, Two Ocean Mtn., Shoshone Nat. Forest, Wyoming, between 3100 and 3200 m.

Material examined. – IB 91/284, 91/284b, 91/284c, 91/284d, all 20 Aug. 1991, IB 91/349, same area but 29 Aug. 1991.

This species, otherwise a rather common alpine taxon, seems to be rather rare in the Rocky Mountains, at least in Wyoming. So far it was only observed on Two Ocean Mtn. but there it was rather common. This seems to be the first record from the USA, except Alaska (Ammirati & Laursen, 1982), and therefore a short description has been given.

Species with ochre to yellow veil

Sect. Laeti Melot

Key to alpine and subalpine species of sect. Laeti

1 Pileus acutely conic, 15–35 mm broad, pale ochraceous. Veil pale ochraceous. Sp. 9–11 x 4.5–6 µm. Subalpine spruce forests. Europe ..... *C. ceraceus* Mos.

1* Pileus convex to umbonate, only in young stages sometimes conic 2

2. Pileus chestnut brown, fading to red-brown. Veil ochraceous. Sp. 7–9.7 x 5–6.3 µm, broadly ellipsoid, strongly verrucose. Among *Salix arctica*. Wyoming..... *C. hybospermus* spec. nov.

2* Pileus red-brown, ochraceous orange to ochraceous when dry ... 3

3 Sp. 6.6–8 x 5.5–6.5 µm. Montane to subalpine conifer forests. Europe..... *C. laetissimus* Hry.

3*. Sp. 9–11(–13) x 5.3–6(–6.5) µm. Subalpine conifer forests and alpine tundra with dwarf *Salix*. Europe, Wyoming ..... *C. laetus* Mos.

Cortinarius laetus Moser (1967). – Fig. 28.

Pileus 10–20 mm broad, hemispheric to convex, hygrophanous, not translucent-striate, in moist condition dingy red-brown (Caill 55P), drying centripetally, becoming yellow-brown (Caill 57N to

nearly 60N), in dry condition mat and finely fibrillose under a lens. – Lamellae yellow-brown [Caill 57N, Ochraceous Tawny (R)], adnate to emarginate, edge entire, 2 mm broad (=4x thickness of pileus context), close, L=30, l=1–3, at the margin 20–21/cm. – Stipe 20–40 x 2.5–4 mm, pale yellow-ochre, yellowish, apex pallid, toward the base with ochre-yellowish veil fibrills, base white. – Context rather pale watery umber-brown when moist, buff when dry, Ochraceous Buff (R). – KOH: dark brown on the pileus cuticle and context. – UV: purplish red in all parts, stipe paler. – Basidiospores 7.6–11.7 x 5.3–6.2 µm (9.5±1.03 x 5.7±0.22); Q=1.4–2.1 (1.66±0.16); V=113.5–210.9 (165.3±25.69), ellipsoid, verrucose with distinct but small and dense warts. – Basidia 38–42 x 9–9.5 µm, 4-spored, clavate, with basal clamp connection. – Cheilocystidia none. – Epicuticular hyphae 6–8 µm, hypodermium of inflated hyphae, 15–18(–20) µm thick, elongate, both layers with yellowish parietal and incrusting pigment.

Habitat. – Among *Salix arctica*.

Material examined. – IB 91/364, Two Ocean Mtn., Shoshone Nat. Forest, at 3100 m, 28 Aug. 1991.

This is not a typical alpine fungus. It occurs in Europe in montane and subalpine conifer forests, and also in Wyoming in subalpine spruce forests.

Cortinarius hybospermus M. Moser, sp. nov. – Figs. 7, 24.

Pileo conico, margine incurvato, dein convexo-umbonato, 10–14 mm lato (probabiliter etiam latiore), hygrophano, estriato, in conditione humido obscure castaneo, decolorante pallide sordideque rufo, margine subtiliter obtecto e velo ochraceo, lamellis ferrugineis, adnatis, confertis, 2–3 mm latis; stipite 27–30 mm longo, 3–5 mm crasso, plus minusve ochraceo obtecto e velo ochraceo, nitente, carne ochracea, odore nullo, sapore miti. Sporis 7–9.7 x 5–6.3 µm, late ellipsoideis, valde verrucosis, basidiis 4-sporigeris, clavatis, 34–37 x 8.5–9 µm, absque cystidiis.

Habitat inter Salice arctica in zona alpina. Holotypus IB 91/289, Two Ocean Mtn., altitudine 3150 m, Shoshone Nat. Forest, Wyoming, USA, 20 Aug. 1991.

Pileus 10–14 mm broad (likely becoming larger), conic with incurved margin at first, then convexo-umbonate, hygrophanous, not translucent-striate when moist, in moist condition dark chestnut-brown (Caill 37S, 35T), margin paler due to a thin ochraceous veil covering, fading centrifugally to pale and dingy red-brown, (Caill 40N, but slightly more dingy). – Lamellae rusty brown, Tawny (R), edges somewhat paler in young specimens, adnate, edges entire, close, 2–3 mm broad. – Stipe equal, 27–30 x 3–5 mm, with more or less

ochraceous color due to a covering from the pale ochraceous veil, Warm Buff to Light Ochraceous Buff (R), silky shining. – Context Light Ochraceous Buff (R). – Odor not distinctive. – Taste mild. – KOH: blackish brown on pileus cuticle and context, becoming almost black. – UV: pileus purple, stipe bluish (from veil covering?). – Basidiospores 7–9.7 x 5–6.3 µm (8.1±0.61 x 5.7±0.32); Q=1.3–1.6 (1.4±0.07); V=91.6–203 (139.79±24.43), broadly ellipsoid, rather coarsely verrucose. – Basidia 34–37 x 8.5–9 µm, clavate, with basal clamp connection. – Edges of lamellae with some cylindrical sterile cells. – Epicuticular hyphae 5–8 µm wide, partly brown incrusted. – Hyphae of the hypodermium 11–15 µm wide, those of the veil 3–4.5 µm thick. – Clamp connections present.

Habitat. – Among *Salix arctica* at 3150 m.

Material examined. – IB 91/289, Two Ocean Mtn., Shoshone Nat. Forest, 20 Aug. 1991.

The habit and ochraceous veil suggest a position within section Laeti. It differs from other species of this group by the rather dark colors of the pileus and the broadly elliptical spores. *C. laetissimus* Henry (1957), from montane spruce forests, has similar spores but is a larger species with more orange–ochre colors.

Cortinarius chrysomallus Lamoure (1977).

This is a widely distributed species in the western United States. There are many records from Wyoming. It has been observed both on Two Ocean Mtn. and in the Union Peak area, in the latter with *Salix arctica* as well as with *Salix phylicifolia* and *S. glauca*. It also occurs in the northern Cascade Mts., Washington, and it has been recorded from the coastal dunes in California in association with shrubby *Salix hookeriana*.

Material examined. – In addition to the collections mentioned in Moser & McKnight (1987): IB 91/288, with *Salix arctica*, Two Ocean Mtn., 3050 m, 20 Aug. 1991, IB 91/340 same area, 3000 m, 28. Aug 1991, IB 91/304, below Union Peak, at about 3200 m under *Salix phylicifolia* and *S. glauca*, 23 Aug. 1991. IB 89/356, Washington, Chelan Co., North Cascades, Lake Ann, above Rainy Pass, under shrubby willow (*S. latifolia*?), 29 Aug. 1989, IB 91/596, sand dunes on Samoa peninsula near Eureka, California, under *Salix hookeriana*, 29 Nov. 1991, leg. R. Halling, det. M. Moser, same area 15 Nov. 1990, det. J. Ammirati.

Cortinarius phaeopygmaeus Favre (1955).

Pileus 5–16 mm broad, convex, convex–umbonate, some specimens indistinctly conic, hygrophanous, not translucent–striate or

striate up to half of the radius, dark red–brown when moist (Caill 35S), glabrous, drying centrifugally and becoming rather bright red–brown, rufous (Caill 40P). – Lamellae red–brown, rufous, (Caill 40S), emarginate, edges uneven, 2–3 mm broad, (4–5x the thickness of the pileus context), subdistant, L=24, l=1, at the margin 10/cm. – Stipe 12–15 mm long, 1–2.5 mm thick, equal, dingy red–brown (Caill 45P or paler), lower part covered by veil which varies from dingy whitish to ochraceous yellow. – Context umber–brown when moist, fading under the disc to Light Cinnamon (R). – Odor none. – Taste mild. – KOH: pileus cuticle and context immediately black. – UV: all parts purple, on pileus sometimes yellow areas. – Basidiospores 8.5–11 x 5.3–6 µm, ellipsoid, rather variable in shape.

Habitat. – Among *Salix arctica*, at about 3150 m.

Material examined. – IB 91/362, Two Ocean Mtn., Shoshone Nat. Forest, Wyoming, 28 Aug. 1991.

This is the first record for the Rocky Mountains and possibly for North America.

Acknowledgments

I owe my sincere thanks to Dr. Kent and Vera McKnight for their help in my studies on *Cortinarii* in Wyoming and during all my stays in this area. Prof. Joe Ammirati has critically read the manuscript. The University of Wyoming NPS Research Center at Moran has kindly provided working facilities.

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(Manuscript accepted 10th December 1992)