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CORTINARII OF NOVA SCOTIA. I. TAXA IN THE SUBGENUS DERMOCYBE (FR.) FR.

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This is a preliminary report following 2 years' collecting of the subgenus Dermocybe of the genus *Cortinarius*. It has proved to be a large and complex group in Nova Scotia. Only 8 taxa are treated in detail, with *C. rubeus* and *C. pseudotubarius* described as new species. A surprising number of variants obtained during this study remain to be described in detail, but further collections are needed before their exact position in the subgenus *Dermocybe* can be established firmly.

Deux années de prélèvement du sous-genre *Dermocybe*, genre *Cortinarius*, amènent les auteurs à présenter un rapport préliminaire sur ce groupe s'avérant vaste et complexe en Nouvelle-Écosse. Deux nouvelles espèces, *C. rubeus* et *C. pseudotubarius*, sont décrites parmi les huit seuls taxons exposés en détail. Une quantité surprenante d'autres variations a été recueillie et celles-ci demeurent encore à décrire. Cependant, d'autres prélèvements sont nécessaires avant d'établir avec certitude leur position à l'intérieur du sous-genre.

Introduction

Dermocybe is a difficult subgenus of the large, complex genus *Cortinarius*, which is not well known east of the Great Lakes. The subgenus has rather small basidiocarps with slender, equal, or slightly clavate stipes. The pilei, when young, are globose to subglobose, expanding to campanulate, often sub-hygrophanous (darker after heavy rains), and their surfaces are silky, and glabrescent. Pileal colors are reddish, yellowish, olivaceous, or cinnamon brown. The lamellae are yellow, orange, red, greenish olive or olive-brown. The stipe apex is frequently concolorous with the young lamellae. Buttons are enclosed by a universal veil that may or may not be concolorous with the cortina and may persist on the pileus and stipe. The context is pigmented and, when tested with KOH, will give either a red, brown, or black reaction. All species have been found to contain various combinations of anthrachinonic pigments that are either vacuolar or in interhyphal granules. Moser *in* Singer (1975) says "The presence of endocrocin is characteristic and diagnostic for all *Dermocybes*" and admits some 50 species when treating the group as a genus. He mentions 13 other pigments found in the various stirpes. Scientifically it is of great interest to base a genus on the presence of a group of chemicals, but it is doubtful if such procedures will stand the test of time. Such chemical tests are useless for practical identification under normal field conditions.

Kauffman (1918; 1932) was the first to provide a concept for species of *Cortinarius* in North America, which was based on the works of E.M. Fries (1821; 1838; 1874). Wehmeyer (1950), following Kauffman, identified his *Dermocybe* collections from Nova Scotia as *Cortinarius cinnamomeus*, *C. sanguineus*, *C. semisanguineus* and *C. malicorius*.

Ammirati (1972; 1975; 1977) critically studied various taxa from the Pacific Northwest and the Great Lakes, and also included a few collections from Nova Scotia. We have been closely following his publications during our studies. The collections of *Dermocybe* from Nova Scotia indicated that the flora of the region

warranted further study, and this paper is based on collections obtained during two fruiting seasons. In 1978 there were few dermocybes but in 1979 they were abundant and considerable data became available. Inconsistent and unpredictable production of basidiocarps from year to year, and the relatively short fruiting period of some species limits the amount of information that can be obtained in any one season. We also found that the time required to make critical descriptions, color notes, macrochemical tests and comparative studies of young and mature specimens limit the number of collections that can be studied during a fruiting season.

There is 1 collection of *C. sanguineus* from Nova Scotia in the E.C. Smith Herbarium at Acadia University. This species was not found during the 1978 and 1979 collecting seasons. We have included the species description given by Ammirati (1972), but the microscopic features given are from the Nova Scotian collection.

History and Nomenclature

Fries (1821) named *Dermocybe* as a tribe in the series *Cortinaria* of the genus *Agaricus*. The tribe consisted of variously colored species with dry, cobwebby veils, and dry, fibrillose, more or less fleshy (rarely viscid) pilei that were convex, subumbonate, or conically expanded, with stipes hollowed, firm and subequal. The original tribe was divided into 4 subtribes based on the nature of the pileal surface, attachment of the lamellae, the color of the basidiocarp, and the habitat. These subtribes were: (I) *Raphanoidei* Fr. with 16 species, (2) *Leucopodii* Fr. with 9 species, (3) *Lysiophylli* Fr. with 6 species, and (4) *Lignatiles* Fr. with 2 species. Later, Fries (1838) revised the tribe *Dermocybe,* deleting the subtribal names and dividing the tribe into 4 groups based on the color of the lamellae.

Wünsche (1883) elevated the tribe *Dermocybe* to the rank of genus and recognized the limits of the tribe established by Fries (1838). Cooke (1871), Rabenhorst (1884), DeBary and Rehms (1884), Saccardo (1887), Smith (1893), Massee (1902), Rea (1922), Kauffman (1918; 1932), and Henry (1935) recognized the subgenus *Dermocybe* (Fries) Fries of *Cortinarius,* and for the most part followed the limits of the tribe established by Fires (1838).

Singer (1951) recognized the subgenus *Dermocybe* (Fries) Fries, and accepted the limits of the tribe *Dermocybe* in Fries, (1838), and, at the same time, selected *C. cinnamomeus* (L. ex Fries) Fries as the type species of the subgenus. Ammirati (1972) suggested that the correct author citation for the type species should be *C. cinnamomeus* (Fries) S.F. Gray, as Gray (1821) placed *'cinnamomeus'* in *Cortinaria* in 1821.

Kühner and Romagnesi (1953) recognized a subgenus *Dermocybe* and subdivided it into several groups ("groupe") on the basis of the basidiocarp pigmentation and spore shape. Two of the groups, *Sanguinei* and *Cinnamomei,* were separated in part on the basis of interhyphal pigment granules.

Moser *in* Singer (1975) separated *Dermocybe* (Fries) Wünsche from *Cortinarius* Fr. as a genus on the basis of the presence of anthrachinonic pigments, with *D. cinnamomeus* (L. ex Fr.) Moser as the type. He divided the genus into 2 subgenera *Icterinula* Moser & Horak and *Dermocybe.* The first subgenus was divided into section *Icterinula* with 3 stirpes, and section *Pauperae* with 2 stirpes. The subgenus *Dermocybe* was divided into 4 sections, *Holoxanthae, Dermocybe, Malicoriae,* and *Sanguinea.* Section *Dermocybe* had 3 stirpes and *Sanguinea* had 4, while the other 2 sections were not divided.

Shaffer (1968) did not recognize a subgenus *Dermocybe.* He described a subgenus *Cortinarius* with 4 sections. Species previously included in *Dermocybe*

were listed in the sections *Sanguinei* and *Annulati*. Shaffer did not give author citations for any of the subgenera or their respective subsections.

Ammirati (1972, 1977) made the most recent and comprehensive study of the group in North America, and recognized *Dermocybe* (Fr.) Fries as a subgenus of the genus *Cortinarius* Pers. ex S.F. Gray. His work was based on a thorough study of macro- and microscopic features, a critical hyphal analysis, and macrochemical color reactions with various chemical reagents. *Dermocybe*, in his treatment, corresponds with Fries' (1838) third group: species with shiny cinnamon, red or yellow lamellae. Ammirati did not divide the subgenus *Dermocybe* into formal taxonomic groups; rather, he considered the divisions as "stirpes", a system of natural classification to be refined when the taxon is monographed for North America.

Habit, Habitat, and Distribution

Many dermocybes occur singly to gregariously along the edges of forest paths or woods roads. The basidiocarps are terrestrial; however, some species (*C. semisanguineus* and others) are rarely found growing on well-decayed conifer wood. *C. huronensis* occurs in *Sphagnum*-conifer bogs, and other species, such as *C. malicorius* and *C. semisanguineus*, may also occasionally grow in this habitat.

Many species of *Dermocybe* are considered to form mycorrhizae with forest trees. The taxa considered in this study are associated with the coniferous genera *Abies, Larix, Picea, Pinus,* and *Tsuga*. *C. semisanguineus* and *C. huronensis* grow with several genera, while others may have more restricted habitats. Two species are known to occur with broad-leaf trees: *C. uliginosus* Berkley with *Salix* and possibly *Alnus,* and *C. purpureus* (Fries) Maire with the genus *Quercus;* however these were not collected in Nova Scotia during the course of this study.

Dermocybes fruit from late August to early November, but dry weather may cause a poor fruiting season, as happened during the late summer and autumn of 1978. Abundant moisture can cause species such as *C. semisanguineus* and *C. huronensis* to appear earlier than normal.

Dermocybes have been collected throughout North America, South America, Europe, and Australia, but it is impossible to give meaningful distributions for them. For some taxa, there are only a few collections, and this indicates only where mycologists have collected, rather than an actual distribution of the species.

Materials and Methods

Field notes and photographs were taken as soon as possible for each collection. Kodachrome color transparencies were usually taken in the field in full sunlight, with a Pentax single lens reflex camera fitted with a 55 mm Super-Takumar lens.

The color of the pileus, lamellae and fibrils on the stipe base are important characters in the taxonomy of *Dermocybe*. Specific color designations that are capitalized and placed in parentheses are from R. Ridgway, *Color Standards and Color Nomenclature* (1912). Spore prints on white paper were given collection numbers, placed in envelopes, and refrigerated over silica gel to prevent the spores from collapsing.

The macrochemical color reactions of 2.5% KOH and 10% $FeSO_4$ w/v aqueous solution, were recorded on fresh and dried material. A drop of each reagent was placed directly on the pileal surface or context, and occasionally on the lamellae or stipe. Any color change or lack of one was recorded after 5 minutes. For many of the collections, both young and mature basidiocarps were tested.

Microscopic characters were obtained from sections prepared from dried specimens. The basidiocarps were saturated with 70% ethanol for a few minutes, then placed in distilled water for about ten minutes until the tissues were pliable.[1] Microscopic examinations of the pileus and stipe were made from thin sections mounted in H_2O, 2.5% KOH, and Melzer's Reagent. Sections cut tangentially from the pileus were used to study the hyphal arrangements of the pileal surface and lamellae. Longitudinal sections were used to study the stipe trama. Tissues of the lamellae were also examined by crushing a small section of the gill under a coverslip and the shape, measurements and color of the individual cells determined. These tissues were hydrated in 2.5% KOH and stained with 1% aqueous solution of phloxine.

Interhyphal pigment deposits were examined in 2.5% KOH, H_2O, and in Melzer's Reagent (hereafter referred to as Melzer's). Color reactions of the hyphae in KOH occur rapidly and were recorded immediately; no reactions to Melzer's were noted even after 10 minutes.

Measurements of the hyphal elements of the pileus, lamellae and stipe were made at a magnification of 400X. Spores, basidia, basidioles, and cystidia were measured at 900X, using oil immersion. The drawings for the text figures were made using a camera lucida, and collections used for text figures are marked with an asterisk (*).

The scanning electron microscope (SEM) used in this study was a JEOL J.S.M. 25. Spores from spore prints were mounted on adhesive copper tape (3-M) glued to a JEOL mounting stub with Duco cement (Dupont). The spores were coated in a Hummer II sputter coater with gold and palladium at approximately 20 nm thickness, in an Argon atmosphere at 10.5-13.5 Pa (80-100 millitorr) pressure, at 10 mA A.C. pulser for 2.5 minutes. The photo-micrographs were recorded on Polaroid Land Type PN 55 film, 4 in x 5 in, at magnification of 10,000X and 15,000X.

Macroscopic Features

Detailed field notes were obtained for all collections with particular attention to the color of the pileus, lamellae and stipe of both young and mature specimens. The following discussion outlines the nature and significance of the macroscopic features recorded.

Pileus

The diameter of the pileus varies from 1.5-7 cm but size is not a significant taxonomic character.

The pileus shape is subglobose, conic, to obtusely conic in the immature stage and usually expands to convex, plano-convex, to campanulate, and there may be a slight depression around the disc area. The margin is often incurved when young, and usually becomes decurved or plane when mature.

The surface is characteristically appressed fibrillose, in some becoming innately fibrillose or almost smooth and in others fibrillose scaly. Occasionally the surface becomes roughened or lacerate in age.

Color of the pileus is extremely important and there are diagnostic changes within a species which occur as the basidiocarp matures. By using the color of the mature pilei, the species in *Dermocybe* can be divided roughly into two groups: (1) those with an ochraceous to brownish surface and (2) those with a red

[1] This paper, in an earlier form, was reviewed by J. Ammirati who suggests that some intrahyphal pigmentation could be lost by the use of ethanol. Herbarium material for sectioning should be hydrated slowly in a moist chamber.

to reddish orange surface. Among those with brownish pilei, there is a group of strongly olivaceous species. In these the pileus is yellow-olive when young, and becomes olive-brown or darker at maturity. The color of the pileus after a rain is usually a darker shade owing to the presence of water in the tissues.

The context of pilei in the different species varies from firm, to solid, moist, spongy, thin or moderately thick, and the color in most taxa is pale yellowish or rarely, yellow-olive, olivaceous or drab (e.g. *C. malicorius).* In age the color may be sordid or nearly concolorous with the surface of the pileus. Odor and taste vary and may be raphanoid, pungent, fragrant, or indistinctive, but are usually too indefinite to be useful for identifying species.

Lamellae

The lamellae are attached and most frequently adnate, sinuate, adnexed, or emarginate, and in age may secede. They are crowded, close to subdistant, and are moderately thin with edges even to serrate. These features are not particularly significant taxonomically.

The color of the young lamellae and the color changes that take place as the pilei mature are extremely important for the proper identification of *Dermocybe* species. Colors include cinnamon to cinnamon-orange, yellow, olive-yellow to olive, light orange, reddish orange, pink-orange, and bright to deep red. Changes in color with maturity are partly due to the development of the brown spores. One of the most striking color changes occurs in the species *C. subcroceofolius* Ammirati & Smith where the lamellae are at first yellow to dull olivaceous yellow and pass through yellow-orange to orange stages as they mature to brownish orange. The *C. subcroceofolius* complex is not treated in this paper but is present in Nova Scotia.

Stipe

Stipes in the section are usually slender (3-8 mm thick), and are equal or somewhat thickened near the base. The stipe length varies within species with recorded ranges of 3-10 (12) cm.

The stipe surface is characteristically appressed fibrillose, and often satiny or silky at the apex. It may also be sparsely fibrillose, or have patches or zones of dense fibrils from the universal veil.

The ground color is important at the levels of species and variety, especially in young specimens. The color is yellowish to olivaceous in most species, but a few are brownish olivaceous, reddish to rusty orange or deep red. In some the color changes as the basidiocarps mature. *C. incognitus,* for example, at first has a yellowish stipe which later becomes olivaceous, then brownish to dull reddish brown on the lower portion.

The color of the stipe base varies within some species. In *C. huronensis* var. *huronensis* it may be either olivaceous or tinted orange. In *C. semisanguineus* the base may be dull yellowish or shaded orange-pink to reddish.

The stipe context is usually solid when young, but often hollows in age. It is usually concolorous with the pileal trama, the stipe apex, or lower stipe surface, although it may differ from all 3. In age the context often discolors from the base upward. The interior color can be taxonomically important, but it is not a major character.

Universal Veil and Cortina

The cortina (partial veil) and universal veil are usually, but not always, similar in color. They may be inconspicuous but can be found on all taxa, especially when young. The hyphae of the cortina are cylindrical, usually 2.5-8 (10) μm wide,

and are irregularly appressed on the stipe apex. The universal veil hyphae are similar though usually wider (3-12 μm), and slightly inflated. They are arranged longitudinally over the surface of the stipe, but may be interwoven. Their pigments and color reactions are similar to those of pileal cuticle and stipe cortex.

Microscopic Features

Pileus

Surface: The hyphae of the pileal surface are uniform throughout the subgenus. They are interwoven, more or less radially arranged, of cylindrical to broadly inflated cells 4-18 (23) μm wide and with walls to 1 μm thick. The end-cells are either rounded or tapered. Pileocystidia are lacking. In KOH, the hyphae may be hyaline, pale brownish, dark brown, to reddish-brown. This pigmentation and the microscopic color reactions are important characteristics of the surface hyphae. Often the microscopic color reaction is similar to the macrochemical color reaction.

Trama: The hyphae of the pileal trama are interwoven and more or less radially arranged, cylindrical to inflated, 2.5-20 μm wide, with walls 1. μm thick. The reactions of the tramal tissue of the pileus are usually similar to those of the basidia (q.v). In KOH they vary little among species the hyphae being usually hyaline with occasional colorless refractive granules or droplets, or slightly pigmented. In Melzer's the hyphae are hyaline, pale yellow or brownish-yellow from the color of the reagent.

Lamellae

Spores: The spores in *Dermocybe* are 5-12 x 3-6 μm. The adaxial view is elliptic to ovate with the surface finely to coarsely roughened but surface details cannot be seen under the light microscope. Under the SEM the ornamentation is of various patterns of irregular low warts, some of which are quite broad and connected by ridges of varying heights. The patterns are difficult to describe but show distinct differences in the area covered, the pattern around the apiculus and the minor roughening of the surface of the spores between the larger ornamentation. In 2.5% KOH the spores are yellowish to light brown, or ochraceous brown. Amyloid and dextrinoid reactions in Melzer's are absent.

Basidia: Basidia are 20-40 x 5-10 μm, with walls hyaline, thin, usually under 1 μm. In KOH they may be slightly brownish with a few refractive granules or droplets. In Melzer's they take on the color of the reagent and are pale yellow to brownish-yellow. Basidioles are similar to the basidia except they rarely contain particles or pigments.

Cystidia: Pleurocystidia are lacking but cheilocystidia usually 12-25 x 6-18 μm present in some species. They are clavate to broadly clavate and usually wider and shorter than the basidia, with similar reactions in KOH and Melzer's.

Subhymenium: The hyphae of the subhymenium are compactly interwoven of flattened or cylindrical cells, 1.5-5.5 μm wide, with walls to 1. μm thick.

Trama: The lamellar trama throughout *Dermocybe* is uniform in structure, and is composed of subparallel to interwoven hyphae, of cylindrical to inflated cells, 2.5-23 μm wide, with walls up to 1. μm thick. Reactions of tramal hyphae to KOH and Melzer's are similar to those of the basidia.

Stipe

The hyphae of the stipe are parallel to interwoven, of cylindrical to inflated thin-walled cells, 2.5-20.5 μm wide. The pigmentation and color reactions in KOH

and Melzer's are similar to those of the pileal and lamellar tramae. In some species the hyphae contain yellowish to yellow-orange or yellow-brownish droplets or refractive granules.

Basal Mycelium

The basal mycelium is a layer of irregularly interwoven and branched hyphae attached to the stipe base. Cells are cylindrical, 2-6.5 μm wide, and thin-walled. Pigmentation and color reactions in KOH and Melzer's are usually similar to but darker than in the pileus.

Universal Veil

Hyphae of the universal veil are usually longitudinally arranged and vary from subparallel to interwoven. The cells are cylindrical and occasionally are slightly inflated. Generally the pigmentation and color reactions in KOH and Melzer's are similar to those of the pileus surface.

Clamp Connections

Clamp connections are found in all the species described in this study, occurring in all parts of the basidiocarp, and are of the normal type.

Oleiferous Hyphae

These are distinctive hyphae containing oily refractive substances, and are found in most of the species described in this study. They appear to differentiate from the generative hyphae, but do not form a continuous system in any part of the basidiocarp. They occur in the pileal and lamellar tramae, stipe cortex, and basal mycelium. The pigmentation and color reactions in KOH are hyaline, grayish or yellowish. Oleiferous hyphae occur in most fleshy fungi and are not taxonomically significant in this study.

Interhyphal Pigment Deposits

Interhyphal pigment deposits are a distinctive feature of the section *Dermocybe,* but are not exclusively characteristic as they are present in other species of *Cortinarius* (Moser 1972). The deposits are granules of anthraquinone pigments (Gabriel 1959-1960). They are found in the pileus, lamellar trama, stipe cortex, and occasionally in the basal mycelium. The interhyphal deposits were observed in H_2O, KOH, and Melzer's, and are refractive, colored yellow to greenish, orange, red, red-orange, red-brown, and brownish. In KOH the deposits in some species give an initial reddish reaction, but this color diffuses and soon fades. KOH and Melzer's tend to dissolve portions of the deposits when studying dried specimens and the pigments are often more easily seen when mounted in H_2O.

The interhyphal deposits in the species described in this study were found to be of normal globular or particulate type (Ammirati, 1972). *C. cinnamoneoluteus* contained globular pigments as well as granules that exhibited a spiny or crystalline shape. These pigments were olivaceous and occurred throughout the stipe cortex and basal mycelium.

Macrochemical Reactions

KOH-Fresh Basidiocarps:

The color reactions with KOH are useful in grouping species but only when considered with other characteristics of the basidiocarp. There are three general categories of color reactions: (1) red, vinaceous, or reddish brown (2) violet-brown, purple, or blackish (3) olive-fuscous, fuscous brown and no reaction. The red to reddish brown reaction is the most common.

KOH-Dried Basidiocarps:

The KOH reactions of fresh and dried pilei were usually similar, except for *C. humboldtensis,* Ammirati & Smith (not discussed here), which gave a purple-brown reaction when fresh, and a deep brown to reddish reaction when dried.

$FeSO_4$ - Fresh Basidiocarps:

Usually the reactions on the pileal surface were negative or rarely watery brown. The pileal context, when tested, usually turned drab or olivaceous. *C. tilamookensis* Ammirati, nom. prov., is known to exhibit a green reaction (Ammirati 1972).

$FeSO_4$ - Dried Basidiocarps:

The reactions on the pileus and lamellae on those species tested were negative (no change) or gave a slight brownish reaction.

Cortinarius huronensis Ammirati & Smith var. huronensis
Mich. Bot. 11: 20-21. 1972

Figs 1, 7, 14

Basidiocarp: Pileus (0.5) 1.5-4.5 cm broad, convex to plano-convex, umbonate, slightly depressed around the disc; margin incurved to decurved, appressed fibrillose, dark yellow-brown (Yellow Ocher to Raw Sienna), dark brownish (Snuff Brown to Chestnut-Brown) to a grayish brown, or ochraceous tint, brownish overall in age and when moist, often streaked dull brown; context 0.5-0.25 cm thick at the disc, solid, firm to moist, light yellow (Picric Yellow to Buff-Yellow) becoming drab, watery and olivaceous, especially over the lamellae; odor and taste raphanoid to not distinctive; KOH reddish to dark reddish on surface, brownish black on surface and lamellae when dried. Lamellae 0.4-0.6 cm broad, sinuate or emarginate, seceding in age, close to subdistant, ventricose when mature, edges uneven and wavy; light golden yellow near (Strontian Yellow) to darker yellow-brown (Primuline Yellow to Yellow Ocher) and finally rusty golden with maturity of spores. Stipe 4.5-7.5 (8.5) x 0.3-0.6 cm, equal to slightly enlarged at the base, appressed fibrillose; apex satiny, light yellow (Mustard Yellow) to light olivaceous yellow, becoming duller yellow below; surface fibrils reddish brown to dark brown (Tawny to Cinnamon), tinted darker reddish brown on the lower stipe, above base brownish to olivaceous, often watery, light yellowish to creamy buff (Naples Yellow) at the base; context firm, slightly fibrous, stuffed becoming hollowed, at first yellow (Mustard Yellow to Amber Yellow), becoming drab or olivaceous toward the base, cavity tinted rust in some mature specimens.

Microscopic Features: Spores (7.7) 8.2-11(12) x (4.5)5-6 (6.6) μm, in face view ovate to elliptic, verruculose to rugose, in KOH light golden brown; under the SEM ovate to broadly elliptic, ornamentation of large irregular-sized warts fused into many patterns, spaces between with smaller warts and roughenings; apiculus base of a cone, 0.6 μm wide, 0.5 μm long, tip rounded with a depression, sides smooth, plagelike base. Basidia 25-28 x 6-8 μm, 4-spored, some quite long, clavate to broadly clavate, in KOH hyaline to yellowish, occasionally having colorless refractive granules and droplets; basidioles 18-24 x 6.6-8.8 μm, clavate, similar to basidia in details of contents. Cheilocystidia 17-20 x 11-13 μm, clavate to broadly clavate, hyaline to pale yellowish in KOH, often containing colorless refractive granules or droplets. Subhymenial hyphae compactly interwoven, of tubular to inflated cells 1-5 μm wide, walls 0.5-0.8 μm, in KOH hyaline, in Melzer's pale yellowish; tramal hyphae parallel to subparallel to slightly interwoven, of tubular

to inflated cells 5.2-16 μm wide, walls 0.5-0.8 μm, in KOH hyaline to light brownish, in Melzer's pale yellow to light yellowish brown. Surface hyphae of pileus interwoven, radially arranged, of tubular to inflated cells, 5.2-13 μm wide, walls 0.1 μm, in KOH hyaline to light brownish, or with a reddish brown or orange-brown pigment, in Melzer's hyaline to light yellowish brown. Stipe cortex hyphae parallel to subparallel, to somewhat interwoven, cells tubular to inflated, 5.2-18.4 μm wide, in KOH hyaline to yellowish, in Melzer's yellowish to pale reddish; basal hyphae irregularly interwoven, narrowly tubular cells, branched, 3-10 μm wide, in KOH hyaline, often containing a yellowish or yellow-brown pigment. Oleiferous hyphae not observed. Interhyphal pigment deposits present in the trama of the pileus, the lamellae and the stipe cortex; in KOH yellow, orange, reddish to brownish, some dark brownish or brownish black granular pigments, in H_2O yellow-golden to reddish brown, in Melzer's yellow, yellow-orange, orange to reddish.

Habit and Habitat: Scattered to gregarious in *Sphagnum* and other mosses, in boggy areas or humus under conifers. September to October.

Material Examined: 13194, 1/10/78, Lake George, Kings Co.; 13197, Harrison, 14/10/78, Monastery, Antigonish Co.; 13198A, 2/9/79, Lake George, Kings Co.; 13201, 3/10/79, Aylesford, Kings Co.; 13275* 2/9/79, Lake George, Aylesford Road, Kings Co.

Observations: C. huronensis is a common species of conifer - *Sphagnum* bogs and moist or mossy coniferous woods. It was described from Michigan and possibly will be found throughout the northeastern parts of North America. The stipe base is often tinted dull orange or olivaceous, and is variable (Ammirati 1972). The collections in this study, especially those occurring in *Sphagnum,* were darker reddish brown but the slight color differences in the Nova Scotia material are considered within the variability of this species.

Cortinarius incognitus Ammirati & Smith

Mich. Bot. 11: 18 - 20, 1972

Fig 15

Basidiocarp: Pileus (0.7)1.5-4(6) cm broad, conic to convex, becoming plano-convex, umbonate to subumbonate, slightly depressed around the disc; margin incurved to decurved, thin, fragile, somewhat lacerate; surface dry to moist, velvety, appressed fibrillose to fibrillose-scaly, especially on the upper margin, having an ochraceous sheen from a thin coating of fibrils yellow-brown to golden brown (Yellow Ocher to Raw Sienna) to light medium brown (Buckthorn Brown) on the margin, medium dark brownish (Snuff Brown or Light Brownish Olive) to dark red-brown or dark olivaceous brown (Cinnamon-Brown to Sepia) on the disc, often dull to dark brown fibrils overall; context 0.2-0.7 cm thick, firm to soft, moist, pale yellowish to drab whitish buff (Maize Yellow to Baryta Yellow) becoming watery and darker yellowish or olivaceous in some specimens; taste and odor somewhat raphanoid to not distinctive; KOH reddish brown to dark reddish brown on pileus surface, on dried material deep red to blackish on pileus and lamellae. Lamellae 0.5-0.7 cm broad, sinuate, uncinate or emarginate to seceding in age, close to subdistant, ventricose, edges even to wavy; at first yellow (Light Cadmium to Primuline Yellow) becoming duller yellow or olivaceous (Yellow Ocher to Olive-Ocher) and finally brownish rusty, light (Cinnamon) as spores mature. Stipe 2-7 (8.5) x 0.3-0.6(0.7) cm, equal or enlarging slightly toward the base; apex satiny pale olivaceous to pale drab yellowish (Martius Yellow, Empire Yellow to Light Cadmium), ground color similar or duller,

deep yellow-orange (Primuline Yellow), lower portions overlaid with rusty brown (Ferruginous) to dark brown (Cinnamon-Brown, Brownish Olive) to light brownish olive (Buffy Citrine) appressed fibrils; base dull, often watery, reddish orange (Orange Cinnamon) to more or less olivaceous or brownish drab (Cinnamon-Brown Sepia); context firm, slightly fibrous, stuffed becoming hollowed, often watery when mature, dull yellowish to yellow-orange, near (Martius Yellow to Empire Yellow) becoming dull to reddish-tinted at the base; cortina pale to dull yellow.

Microscopic Features: Spores (7.2)7.7-8.8(11) x 4.4-5(5.5) μm, in adaxial view long-ovate to elliptic, verruculose, in KOH hyaline to light brownish, in Melzer's pale yellowish to pale yellowish-brown; under the SEM, long-ovate to elliptic, ornamentation subdistant of variously fused warts and irregular ridges in complex patterns, a few small warts in some spaces between; apiculus 0.5 μm wide, 0.5 μm long, a broken cone with a projecting tab. Basidia 27-33 x 6-7 μm, 3- and 4-spored, clavate to broadly clavate, in KOH hyaline, pale yellowish, often with colorless refractive particles and droplets; basidioles 18-28 x 6-7 μm, similar to basidia. Cheilocystidia 10-14 x 6-9 μm, clavate to broadly clavate, in KOH hyaline to pale yellowish, in Melzer's pale yellowish. Subhymenial hyphae compactly interwoven, cells tubular to inflated, 2.6-7.8 μm wide, in KOH hyaline to light brownish, in Melzer's pale yellowish; tramal hyphae subparallel to interwoven, cells tubular, inflated, 4-13 μm wide, walls 1 μm, in KOH hyaline, pale yellowish or light reddish brown, in Melzer's yellowish. Surface hyphae of pileus interwoven, radially arranged, of tubular to inflated cells, 5-15 μm wide, walls 0.5-1 μm, in KOH hyaline to pale brownish or containing a reddish brown pigment, in Melzer's yellowish to yellowish orange-brown; tramal hyphae similar in size and arrangement of cells, hyaline to light brownish in KOH, in Melzer's pale yellowish. Cortical hyphae of stipe parallel to subparallel to interwoven, of tubular to inflated cells, 5-13 μm wide, walls 1 μm, in KOH hyaline, pale yellowish, or light brownish, in Melzer's yellowish; basal hyphae irregularly interwoven, branched, of tubular cells, 2-6.5 μm wide, walls 1 μm, in KOH hyaline to pale yellowish. Oleiferous hyphae present in the pileal trama, in KOH hyaline to grayish. Interhyphal pigment deposits present in the pileus, lamellar trama and the stipe cortex; in KOH orange-reddish to reddish brown, in Melzer's yellow-orange, orange to reddish.

Habit and Habitat: Single, scattered to gregarious in moss and leaf litter, under conifers, or in sandy pine areas. September to October.

Material Examined: 13212, 16/9/79, Aylesford Lake Road, Kings Co.; 13214, 28/9/79, Baxter's Harbour Road, Kings Co.; 13216*, 7/10/79 Millville, Kings Co.; 13217 and 13218, 14/10/79, Monastery, Antigonish Co.

Observations: C. incognitus is characterized by a yellowish to ochraceous pileus that becomes darker ochraceous to reddish-brown in age. The lamellae when young are distinctly yellow, but become duller yellow and finally rusty brown in age. The stipe is yellowish to brownish on the lower portions with reddish to dark brown surface fibrils. The stipe base is yellowish to olivaceous, and has not been observed with orange tones (Ammirati 1972). However, many of the collections in this study have reddish brown to rust tints at the base. *C. incognitus* in eastern North America may be confused with *C. huronensis* var. *huronensis,* but can be distinguished from the latter by its smaller spores. In most collections of this species the spores are 7-9.5 μm long, but a few larger ones may be present. There is also a slight variation in spore width. *C. incognitus* may also be confused with

C. wyomingensis Ammirati, nom. prov., which was described from the west (Ammirati 1972). The latter has smaller spores, and the lamellae, yellow at first, change to dull orange and then to rusty brown from the color of the spores.

Cortinarius malicorius Fries

Epicr. Syst. Mycol. 289. 1838

Dermocybe malicoria (Fries) Ricken, Die Blätterpilze. 160. 1915

Figs 2, 8, 16

Basidiocarp: Pileus 2.0-4.5 cm broad, conic to convex, becoming planoconvex, umbonate to subumbonate, slightly depressed around the disc; margin incurved to decurved, thin, more or less fragile, becoming lacerate in age; surface moist to dry, appressed fibrillose, having a reddish-ochraceous sheen from thin coating of fibrils, red-golden to reddish or rusty brown (Cinnamon-Rufous) to (Ferruginous) on the margin and disc when wet; dark reddish brown to dark brown (Russet to Chestnut) on the disc; context soft to firm, 0.3-0.8 cm thick at the disc, dull pale yellowish buff to dull olivaceous, (Tawny Olive); taste and odor slightly raphanoid to not distinctive; KOH deep red (Brick Red) to dark brownish red on the pileus context when fresh; on dried specimens, dark red brown to dark brown on surface and lamellae; $FeSO_4$—only specimen tested fresh gave a dark greenish olive color on the context. Lamellae 0.3-0.7 cm broad, adnexed, adnate to emarginate, close to subdistant, ventricose, ridges showing on the stipe apex when the lamellae are broken away, edges even to wavy; bright orange (Cadmium Yellow, Orange to Cadmium Orange), becoming rusty orange (Ochraceous-Orange) when spores mature. Stipe 3.3-7 x 0.4-0.8 cm, equal to clavate, becoming sub-bulbous at the base; surface appressed fibrillose, satiny to dull or deep yellow-orange, light (Primuline Yellow) having an ochraceous sheen overall; apex light yellow (Mustard Yellow), ground color similar, overlaid with rusty fibrils (Cinnamon) becoming slightly darker in older specimens; base pale to dull reddish orange, becoming more or less olivaceous in age in some specimens; context firm, somewhat fibrous, stuffed becoming hollowed, drab olivaceous to light brownish olivaceous at the base; cortina light to medium yellow. Universal veil remnants rusty (Orange-Cinnamon).

Microscopic Features: Spores 6-7 x 3.5-4.5 μm, in face view, elliptic to long-ovate, verruculose, in KOH light brownish, many having a large central guttula; under the SEM, ovate to elliptic, ornamentation sub-distant of irregular fused warts in complex patterns, interspersed with small ones, plage-like for 1 μm around apiculus; apiculus a very short base of cone, 0.5 μm wide. Basidia 25-28 x 5-5.5 μm, 4-spored, narrowly clavate, clavate to broadly clavate, in KOH hyaline, pale yellowish, to pale brownish, often having colorless refractive granules or droplets; basidioles 13-22 x 5.5-7.7 μm, clavate, similar in shape to the basidia, in KOH hyaline to light brownish. Subhymenial hyphae compactly interwoven, cells tubular, irregular to inflated, 2.2-4.4 μm wide, walls 0.5 μm, in KOH hyaline to light brownish or pale yellowish; tramal hyphae subparallel to interwoven, cells tubular to inflated, 6.5-17 μm wide, walls 1 μm, in KOH hyaline to light brownish or pale yellowish, in Melzer's yellowish. Surface hyphae of pileus interwoven, more or less radially arranged, of tubular to inflated cells, 5-13 μm wide, walls 1 μm, in KOH hyaline, light brownish, to pale vinaceous, in Melzer's yellowish to light yellow-brown; tramal hyphae interwoven, radially arranged, more so toward the surface, cells tubular, broadly inflated or irregular, 6.5-15.5 μm wide, in KOH hyaline to pale reddish brown, in Melzer's light yellow to light brownish. Cortical hyphae of stipe parallel to subparallel to slightly interwoven, cells tubular to in-

flated, 5.2-15.6 μm wide, walls 1 μm, in KOH hyaline, pale yellowish or light brownish, in Melzer's pale yellowish to light brownish; basal hyphae irregularly interwoven, branched, cells tubular, 1-4 μm wide, in KOH hyaline, pale brownish to reddish vinaceous. Oleiferous hyphae present in the basal mycelium, in KOH hyaline to pale yellowish. Interhyphal pigment deposits present in the pileus, lamellar trama, and the stipe cortex; in KOH dull yellow to orangeish, in H_2O yellow, orange to reddish brown, in Melzer's yellowish, orange, to brownish orange.

Habit and Habitat: Scattered, solitary to gregarious in moist conifer woods, leaf litter and moss. Late August to October.

Material Examined: 13191 and 13195*, 25/8/79, Caribou, Pictou Co.; 13219, 25/9/78, Caribou, Pictou Co.; 13220, 26/9/78, Caribou, Pictou Co.; 13221, 25/8/79, Caribou, Pictou Co.; 13223, 19/10/79, Canaan, Kings Co.

Observations: C. malicorius was one of the first dermocybes described by Fries (1838). The specimens as described by Ammirati (1972) are close to what Fries described although the general color is more orange and the pileus more reddish brown. Since no type specimen for *C. malicorius* has been selected (Ammirati 1972), and Fries gave no spore measurements, a problem arises in determining a spore size for this species. Kauffman (1932) and Moser (1967) closely follow the description as given by Fries, and agree on a small spore size for the species (5-7 x 3.5-4.5 μm). Other authors (Ricken 1915; Orton 1958) suggest a somewhat larger size.

Cortinarius rubeus sp. nov.

Figs 3, 9, 17

Pileus 2-3 cm latus, convexus vel plano-convexus, ad marginem incurvus vel decurvus et integer; siccus, appresso-fibrillosus demum fibrilloso-squamulosus, cinnamomeo-brunneus vel rufus; contextus 2-3 mm crassus, incarnatus; odor et sapor pungentes vel indistincti. Lamellae 3-6 mm latae, adnatae vel adnexae, confertae; aurantiacae demum brunneo-aurantiacae. Stipes 1.5-4.5 cm longus, 2-4 mm crassus, aequalis, pallido-ochraceus, rubiginosus fibrillosus; contexus firmus, excavescens. Sporae 6-8 x 4-4.5 μm ovatae vel ellipticae, verruculosae. Holotypus ACAD 13241, in sylva prope Aylesford, comitato Kings Nova Scotia lectus; in herbario E.C. Smithii, Universitatis Acadiae (ACAD) conservatus.

Basidiocarp: Pileus 1-3 cm broad, convex to plano-convex, somewhat depressed around the disc; margin incurved to decurved, thin, entire, becoming lacerate in age; surface dry, appressed fibrillose to fibrillose-scaly, especially on the upper margin, brown to deep reddish brown (Sayal Brown, Burnt Sienna, to Brick Red) on the margin, dark golden brown to dark rusty brown (Amber Brown, Clay Color to Cinnamon) on the inner margin, dark red-brown (Chestnut, Bay, to Mahogany) on the disc; context 0.2-0.3 cm thick at the disc, soft to firm, light brownish to brownish pink (Cream Color to Salmon Color); taste and odor pungent to not distinctive; KOH dark red-brown to dark brown (Chocolate) on pileus, deep red on context and lamellae, in dried material dark reddish brown on pileus, deep red on lamellae. Lamellae 0.3-0.6 cm broad, adnate, uncinate to sinuate or adnexed, close to subdistant, edges even to wavy; at first deep orange (Salmon-Orange) to brownish orange (Ochraceous-Orange), becoming rusty orange to reddish-shaded to brownish orange (Orange-Rufous to Orange-Cinnamon) when spores mature. Stipe 1.7-4.3 x 0.2-0.4 cm, equal, enlarging somewhat toward the base; apex satiny, light grayish brown (Ochraceous-Buff to Cinnamon-Buff); ground color

similar, becoming more reddish (Vinaceous-Tawny), overlaid with scattered to dense rust-brown to deep reddish brown (Burnt Sienna, Morocco Red, Brick Red) fibrils concentrated toward the base; base drab buff to pinkish (Pale Orange-Yellow to near Cream-Buff to Vinaceous-Tawny) often tinted with bright red streaks (Rufous to Brazil Red); context firm, stuffed, sometimes hollow, light grayish brown to pale rusty (Light Ochraceous-Buff to near Cinnamon-Buff) or reddish at the base, near the surface reddish rust-brown (Burnt Sienna) to watery reddish orange (Vinaceous-Rufous). Cortina dull buff-yellowish (Ochraceous-Buff). Universal veil remnants reddish brown to rusty red (English Red).

Microscopic Features: Spores 6-8 x 4-4.5 μm, in adaxial view long-ovate to elliptic, verrucose, in KOH hyaline to light brownish; under the SEM long-ovate to elliptic, ornamentation close, of irregular fused warts in complex patterns, a few small warts in interspaces, slightly smoother toward the apiculus; apiculus base of an irregularly broken cone, 0.6 μm wide. Basidia 22-29 x 5-6 μm, 4-spored, clavate, in KOH hyaline, often containing colorless refractive particles or droplets. Subhymenial hyphae compactly interwoven, cells tubular to inflated, 2.2-4.4 μm wide, walls 0.5-1.1 μm, in KOH hyaline to light brownish, in Melzer's yellowish; tramal hyphae parallel, subparallel, to interwoven, cells cylindrical to inflated, 4.0-15.5 (19.5) μm wide, walls 0.5-1.1 μm, in KOH hyaline to light brownish, in Melzer's yellowish. Surface hyphae of pileus interwoven, of tubular to inflated cells, 3-18 μm wide, walls 0.5-1.1 μm, in KOH hyaline to brownish, dark brownish red, in Melzer's yellowish to orange-brown; tramal hyphae interwoven, of cylindrical to inflated cells, 4-16.5 μm wide, walls 0.5-1.1 μm, in KOH hyaline to light brownish, in Melzer's light yellow. Cortical hyphae of stipe parallel to subparallel, occasionally interwoven, cells tubular, inflated, 4-16.5 μm wide, in KOH hyaline to light reddish brown, in Melzer's hyaline, yellowish to golden yellow; basal hyphae irregularly interwoven, branched, cells tubular, 1.3-4 μm wide, in KOH hyaline to light reddish brown, having scattered red to reddish brown pigments. Oleiferous hyphae not observed. Interhyphal pigment deposits present in the stipe cortex and pileus trama; in KOH red to reddish brown, in Melzer's yellow, golden yellow, and orange.

Habit and Habitat: Scattered to gregarious in moss (*Polytrichum* sp.) on a sandy woods trail in October.

Material Examined: 13239, 3/10/79, Aylesford, Kings Co.; 13240, 7/10/79, Aylesford, Kings Co.; 13241*, 16/10/79, Aylesford, Kings Co.

Observations: C. rubeus is placed on the stirps Malicorius (Ammirati 1972) on the basis of spore size and KOH reaction. It is characterized by the reddish tones on the pileus and stipe, pink-red to orange-red lamellae, and distinctive red streaks and fibrils on the stipe surface.

Cortinarious sanguineus (Fries) S.F. Gray

A Natural Arrangement of British Plants. I. 629. 1821

Agaricus sanguineus Fries, Syst. Mycol. I: 229. 1821.
Cortinarius sanguineus (Fries) Fries, Epicr. Syst. 288. 1838.
Dermocybe sanguinea (Fries) Wünsche, Die Pilze. 125. 1877.

Figs 10, 18

"Pileus 1.8-4.5 cm broad, somewhat obtuse to convex or plane, disc more or less depressed, with the margin incurved to decurved, appressed fibrillose to

minutely squamulose, sometimes splitting radially on the margin, disc rich red (Garnet Brown) to deep red (Maroon to Deep Garnet Brown) or tinted with colors of the margin, margin rich red (Garnet Brown to Ox-Blood Red) or duller red (Coral Red), sometimes streaked deep red to fuscous-red (Maroon to Victoria Lake). Context watery deep red (Maroon to Garnet Brown), where faded or beneath cuticle lighter red (near Coral Red); odor fragrant to mild or raphanoid, taste mild to raphanoid".

"Lamellae sinuate to broadly depressed with a more or less decurrent tooth, close, more or less ventricose when mature, edges uneven, at first rich red (Ox-Blood Red, dull Carmine, or Garnet Brown), becoming shaded rusty brown to dusky brown from the spores.

"Stipe 4.5-8.5 cm long, apex 3-9 mm, equal to a slightly enlarged base, fibrillose, shiny, rich red (Garnet Brown, Ox-Blood Red) or duller red (Coral Red), sometimes with watery deep red (Maroon) streaks, base or lower third dull ochraceous (Ochraceous Buff) or slightly tinted orange to reddish. Context stuffed to narrowly hollowed, rich red (Garnet Brown to Ox-Blood Red) throughout or deeper red (Maroon) in the lower portion, where faded paler red."

"KOH. Fresh basidiocarps: deep purplish red on the pileus surface. Dried basidiocarps: deep red to purplish red on the surface of the pileus, lamellae and stipe." (Ammirati 1972, p. 72-73).

Microscopic Features: Spores 7-9 x 4-5 μm, in adaxial view long-ovate to elliptic, verrucose to verruculose, in KOH golden brown, in Melzer's yellow-brown to orange-brown; under the SEM, ovate to broadly elliptical, ornamentation close, irregular-sized warts fused into various patterns; apiculus a diagonally broken cone 0.6 μm wide arising from a smooth plage-like area. Basidia 23-30 x 5-6.5 μm, 4-spored, clavate, broadly clavate to slightly ventricose, in KOH pinkish-red-pigmented, hyaline or containing colorless refractive granules or droplets; basidioles 12-25 x 5.0-7.7 μm, similar to basidia. Subhymenial hyphae compactly interwoven, cells tubular to inflated, 2.2-5.5 μm wide, walls 0.5 μm, in KOH pinkish red, in Melzer's yellow to golden yellow; tramal hyphae subparallel to interwoven, of tubular to inflated cells, 5-15.5 (20.5) μm wide, walls 0.5-1.1 μm, in KOH hyaline, light pinkish, pinkish red, or light vinaceous, in Melzer's deep yellow to orange-yellow. Pileal surface hyphae interwoven, more or less radially arranged, of tubular to inflated cells, 5-13 μm wide, walls 0.5-1.1 μm, in KOH hyaline, pinkish red to reddish brown, in Melzer's yellow to orange-brown; tramal hyphae interwoven, radially arranged toward surface, of tubular to inflated cells, 5-20.5 μm wide, in KOH light pinkish red, in Melzer's yellow to yellow-orange. Cortical hyphae of stipe longitudinally arranged, subparallel to interwoven, of tubular to inflated cells, 2.5-15.5 μm wide, in KOH hyaline to pinkish red or pale vinaceous, in Melzer's yellowish to yellow-orange to orange; basal hyphae interwoven, branched, of tubular cells, 2.5-5 μm wide, in KOH hyaline, deep pink, vinaceous, or red, with reddish globular pigments throughout. Oleiferous hyphae present in the basal mycelium. Minute pigment deposits present in the stipe cortex, basal mycelium, pileus, and lamellar trama; in KOH orange, red to red-brown, in Melzer's yellow, orange, red to red-brown.

Habit and Habitat: Single to scattered, conifer woods. September.

Material Examined: 2580, 30/9/53, Casey's Corner, Kings Co.

Observations: C. sanguineus is characterized by a deep red pileus, lamellae, and stipe. It has been collected previously in the province, but complete information is not available for the specimens. Further collecting and a detailed description

of the color and macrochemical reactions of fresh specimens are needed. Cheilocystidia are reported from collections examined by Ammirati (1972); however, none were observed from the collection examined in this study.

Cortinarius semisanguineus (Fries) Gillet

Les Hyménomycètes. 486. 1874.

Agaricus cinnamoneus var. *semisanguineus* Fries, Syst. Mycol. I: 229. 1821.
Cortinarius semisanguineus (Fries) Kauffman, Bull. Torrey Bot. Club 32: 320. 1905.
Dermocybe semisanguinea (Fries) Moser, Die Röhrlinge und Blätterpilze. In Gams, Kleine Kryptogamenflora. 1: 174. 1955.
Dermocybe semisanguinea (Fries) Moser var. *alpina* Horak, Mitt. Schweiz. Anst. Forstl. Versuchswesen. 39: 80. 1963.

Figs 4, 11, 19

Basidiocarp: Pileus 0.7-5.5 (8.3) cm broad, conic to rounded-conic becoming convex, umbonate to subumbonate, often depressed around the disc; margin inrolled when young, becoming incurved to decurved, some uplifted and irregular, entire to lacerate or splitting radially; surface appressed fibrillose, dry-satiny, having an ochraceous sheen, golden ochraceous brown to yellow-brown (Yellow Ocher) on the margin, dark golden brown (Amber Brown), honey brown to deep yellow-brown (Ochraceous-Tawny) on the disc, in age becoming ochraceous brown to reddish brown fibrillose-streaked, young specimens often buff to golden yellow-tinted on the incurved margin; context 0.3-1.2 cm thick, firm, solid, dull light beige (Cream-Buff) to pale yellowish, becoming ochraceous under the cuticle; odor and taste pungent to not distinctive. Lamellae 0.5-0.8 cm broad, adnate to adnexed to emarginate, seceding in age, close to subcrowded, edges somewhat wavy, when mature ventricose; bright red (Carmine) to dull red (Brick Red) or deep red (Maroon), becoming rusty red-brown to cinnamon when spores mature. Stipe 2-8.5 x 0.3-1.4 cm, equal, tapered upwards, or clavate at the base, often covered with ochraceous to rust brownish appressed fibrils; apex satiny dull yellowish buff to light beige (Cream-Buff to Light Ochraceous-Buff), becoming darker to ochraceous at the base; base pale buff, often pinkish to orange-reddish-tinted (Grenadine to Apricot Orange), becoming sordid to olivaceous in age in some specimens; context stuffed or fibrous becoming hollowed, dull yellowish buff (Light Ochraceous-Buff) darkening toward the base; cortina (Pale Yellow). KOH inky black to vinaceous black on the fresh pileal surface, on dried material blackish on pileus and lamellae. $FeSO_4$ blackish on the pileal surface and lamellae of dried material.

Microscopic Features: Spores 7-8.5 x 4-5 μm, finely roughened to verruculose, in face view long-ovate to elliptic, blunt at the basal end, in KOH light brownish; under the SEM elliptic, ornamentation close, of complexly fused warts in various patterns, some small warts in interspaces; apiculus at an angle, with a depression in the broken end, base plage-like; Basidia 25-30 x 6-7 μm, 4-spored, clavate in ventricose, in KOH hyaline to pale yellowish; basidioles 13-25 x 3.0-5.5 μm, similar to basidia. Subhymenial hyphae compactly interwoven, of tubular cells, 2-4 μm wide, walls 0.5 μm, in KOH light reddish or vinaceous purple, more commonly hyaline, in Melzer's yellowish; tramal hyphae parallel, subparallel, to slightly interwoven, of tubular to inflated cells, 4-10.5 μm wide, walls 1 μm, in KOH hyaline or light vinaceous purple, often having purplish granules, in Melzer's yellowish. Surface hyphae of pileus interwoven, radially arranged, of tubular to inflated cells, 5-13 μm wide, walls 1 μm, hyaline to light reddish brown

or light vinaceous purple, in Melzer's yellowish to yellowish brown; tramal hyphae interwoven, radially arranged especially near the surface, cells tubular, irregular and inflated, 7.8-13 μm wide, walls 1 μm, in KOH hyaline to pale yellowish, often containing purplish-pigmented particles, in Melzer's yellowish. Cortical hyphae of pileus parallel to interwoven, tubular, inflated, in KOH hyaline to light brownish, 5-15.5 μm wide; basal hyphae of tubular cells, irregularly interwoven, branched, 3-5.2 μm wide, containing some pigment globules, in KOH hyaline, reddish or purplish. Oleiferous hyphae present in the pileus and stipe trama. Interhyphal pigment deposits small, in the pileus, lamellar trama and the stipe cortex; in KOH yellowish to golden yellow, brownish, red-brown, in H_2O pale yellow to orangeish or reddish brown.

Habit and Habitat: Single, scattered to gregarious, occasionally cespitose, in conifer and mixed woods, occasionally on rotted wood or in moss. Late August to November.

Material Examined: 13243, 25/9/78, Caribou River, Pictou Co.; 13245, 14/10/78, Monastery, Antigonish Co.; 13246, 11/8/79, Aylesford, Kings Co.; 13247, 25/8/79, Caribou, Pictou Co.; 13248, 26/8/79, Caribou, Pictou Co.; 13249 and 13250, 31/8/79, Aylesford, Kings Co.; 13251 and 13252, 1/9/79, Harmony, Kings Co.; 13253, 2/9/79, Lake George, Kings Co.; 13254 and 13255, 12/9/79, Aylesford, Kings Co.; 13256 and 13257, 13/9/79, Aylesford Lake Road, Kings Co.; 13258, 30/9/79, Lake George, Kings Co; 13259 and 13261, 16/9/79, Lake George, Kings Co.; 13260, 18/9/79, Aldershot, Kings Co.

Observations: C. semisanguineus is common in conifer and mixed woods and is the most easily recognized species of *Dermocybe* in Nova Scotia. Some variation occurs in the color of the stipe and lamellae. In fresh specimens, stipes are medium yellow to ochraceous, with a characteristic pinkish to orange-reddish coloring at the base, and in age the stipe base may be olivaceous to drab. Similar variation in the color of the stipe base was observed in *C. huronensis* var. *huronensis* and in variants of *C. incognitus*. The color of the lamellae is a striking deep red, but in collections 13258 and 13261, the immature and mature lamellae were dull orange to rusty orange. It is possible that this form of *C. semisanguineus* is the result of early frost. The spores of the collections examined are consistent and within the published size-range for the species (Ammirati 1972). The only exceptions are the above-mentioned collections with orange-brown lamellae, with spores that were slightly larger. Further collecting and critical examination of the material should be done to establish the validity of frost effects.

Cortinarius cinnamomeoluteus Orton

Trans. Brit. Mycol. Soc. 43: 217. 1960.

Figs 5, 12, 20

Basidiocarp: Pileus 2.3-3.4 cm broad, convex to obtuse-umbonate; margin incurved to decurved, edge entire, splitting radially in age; surface dry, appressed fibrillose to velvety, buff olivaceous, pale (Deep Colonial Buff), margin paler (Colonial Buff), golden olivaceous (Tawny-Olive) on the disc, with dark brownish (Prout's Brown) fibrils overall; context 0.5-0.9 cm thick, firm, dull light beige (Cream-Buff), watery olivaceous above the lamellae; odor and taste not distinctive; KOH on fresh pileus brownish to reddish brown, on dried material dark brown on pileus, red-brown on lamellae. Lamellae 0.3-0.5 cm broad, sinuate to emarginate, edges roughened, wavy, close, olivaceous drab, dark (Straw Yellow,

Honey Yellow to Olive Yellow) darkening when mature to (Aniline Yellow). Stope 3.5-5.5 x 0.5-0.8 cm, equal; surface dry, appressed fibrillose, apex dull, pale olivaceous buff (Colonial Buff), becoming duller olivaceous buff below (Deep Colonial Buff), streaked dull yellow, brownish golden (Aniline Yellow) becoming brownish tinted to olivaceous golden (Sayal Brown to Tawny-Olive) just above the base; base drab whitish buff (Maize Yellow); context firm, somewhat fibrous, stuffed becoming hollowed, dull light beige (Cream-Buff); cortina pale yellowish or light olivaceous-tinted, near (Straw Yellow).

Microscopic Features: Spores under the optical microscope 7-8 x 4-5 μm, in face view ovate to elliptic, verrucose to verruculose, in KOH hyaline or light greenish tinted; under the SEM, ovate, ornamentation distant, interspaces rough with small warts, principal warts large, 0.2 μm high, some fused into irregular ridges, smoother toward apiculus; apiculus a roughly broken cone, 0.5 μm wide, 0.4 μm long arising from a plage. Basidia 4-spored, 23-25 x 5-6 μm, clavate; in KOH hyaline or with brownish golden to olivaceous pigments, many with colorless refractive granules and droplets; basidioles 14-23 x 4.4-6.6 μm, clavate; in KOH hyaline or containing colorless refractive granules and droplets. Subhymenial hyphae compactly interwoven, of tubular to inflated cells 2.2-4.4 μm wide, walls 0.5 μm, in KOH hyaline to light brownish, in Melzer's yellowish; tramal hyphae parallel to subparallel, cells tubular, inflated, 6.5-18 μm wide, walls 0.5-1.1 μm, in KOH hyaline to light brownish, in Melzer's yellowish. Pileal surface hyphae interwoven, cells tubular to inflated, 5-10.5 (15.5) μm wide, walls 0.5-1.1 μm, in KOH hyaline to light golden brown, or brownish-tinted, containing pigmented particles, in Melzer's yellowish or orange-golden or light orange-brown; tramal hphae interwoven, of tubular to inflated cells, 5-18.2 μm wide, in KOH hyaline to light brownish, in Melzer's yellowish. Cortical hyphae of stipe parallel to subparallel, tubular somewhat inflated, 5-14.3 μm wide, in KOH hyaline to light brownish, in Melzer's pale yellowish to light brownish, having droplets or pigment granules scattered throughout; basal hyphae irregularly interwoven, branched, in KOH hyaline to pale yellowish. Interhyphal pigment deposits present in the stipe cortex, the basal mycelium, and the pileal and lamellar trama; in KOH yellow, golden olivaceous, brownish, in H_2O olivaceous, gray-brown to brownish, in Melzer's yellow, red, brownish, and olivaceous; in the basal mycelium and stipe cortex the pigments are crystalline or spiny.

Habit and Habitat: Single to scattered, in red pine woods (*Pinus resinosa* Ait.). October.

Material Examined: 13238*, 5/10/79, Aldershot, Kings Co.

Observations: C. cinnamomeoluteus is a distinctive taxon of subgenus *Dermocybe*. It is characterized by subtle olive-beige tones in the pileus and stipe, and has pale olivaceous yellow lamellae. On the basis of color, spore size and KOH reaction, *C. cinnamomeoluteus* belongs to the stirps Malicorius (Ammirati 1972). The pileus may at first be overlooked as a pale specimen of *C. semisanguineus* since they are of similar stature; however, they differ distinctly in the colors of the stipe and lamellae.

Cortinarius pseudotubarius sp. nov.

Figs 6, 13, 21

Pileus 1-4.5 cm latus, campanulatus vel plano-convexus, obtuse umbonatus; ad marginem versus et integer; siccus appresso-fibrillosus vel fibrillo-squamatus,

ochraceo-brunneus vel umbrinus; contextus 2-5 mm crassus, luteus, sapor pungens vel indistinctus et odor indistinctus. Lamellae 6-9 mm latae, emarginati vel adnexae, confertae demum subdistantes; pallide lutei demum olivaceo-brunnae. Stipes 3-9 (11) cm longus, 2-7 mm crassus, aequalis; ochraceous vel cinnamomeus; basi porphyreus; fibrillosus; contextus firmus excavascens. Sporae (7)8-9 x 5.5-6 μm, ellipticae, verruculosae.

Holotypus ACAD 13265, in sylva, prope lacum Aylesford, comitato Kings, Nova Scotia lectus; in herbario E.C. Smithii, Universitatis Acadiae (ACAD) conservatus.

Basidiocarp: Pileus 1-4.5 cm broad, conic-campanulate, convex to plano-convex, obtuse umbonate; margin incurved to decurved, edge entire, thin, splitting radially when mature; surface more or less dry, velvety, appressed fibrillose to fibrillose-scaly, dark yellowish brown (Yellow Ocher, Old Gold, to Snuff Brown) on the margin, drab grey-brown, dark to dark reddish brown (Sepia, Bister, Chestnut-Brown to Prout's Brown) on the disc, dark brown fibrillose streaks over the pileus; context 0.2-0.5 cm thick, firm, moist, drab whitish buff to very pale yellow (Maize Yellow to Straw Yellow) becoming drab watery; taste raphanoid to indistinctive, odor not distinctive; KOH watery brown to dark brown on pileus surface, on dried material dark reddish brown on pileus and lamellae. Lamellae 0.6-0.9 cm broad, emarginate, adnexed, to seceding, ventricose, close to subdistant, edges even to wavy, at first yellow (Light Cadmium to Deep Chrome) to deep yellow-orange to brownish golden (Primuline Yellow to Aniline Yellow) and becoming rusty with maturity of the spores. Stipe 3-9 (11) x 0.2-0.7 cm, equal, or broader at the base; apex satiny yellow-orange-tinted to light yellow (Empire Yellow to Mustard Yellow), ground color similar, becoming dull to brownish at the base, overlaid with scattered to contiguous red-brown to dark brown (Cinnamon, Snuff Brown to Dresden Brown) fibrils; base dull reddish rusty brown (Tawny, Rufous), fibrils and base becoming dark or sordid from handling and age; context firm, stuffed, hollowing from base to apex, becoming watery when mature, at first dull yellowish orange (Empire Yellow, Light Orange-Yellow) to drab ochraceous (Buff-Yellow) or reddish-tinted with age, base cortex olivaceous, drab watery, often reddish-tinted; cortina pale yellow.

Microscopic Features: Spores (7)8-9 x 5-6 μm, in adaxial view long-ovate or elliptic, verruculose, in KOH hyaline to light golden yellow or golden brownish, often having a guttala; under the SEM, long-ovate or elliptic, ornamentation very close, of small irregular warts, variable in size, fused in many places into complex patterns; apiculus not visible. Basidia 25-30 x 6-7 μm, 4-spored, clavate to broadly clavate, in KOH hyaline, yellow or brownish-pigmented, often containing colorless refractive particles and droplets; basidioles 15-26 x 6-7.2 μm, clavate, similar to the basidia. Subhymenial hyphae compactly interwoven, of tubular to inflated cells, 2.2-4.4 μm wide, in KOH hyaline, in Melzer's yellowish; tramal hyphae subparallel to interwoven, cells inflated, tubular, 5.5-13 μm wide, walls 0.5-1.1 μm, in KOH hyaline to light yellowish, in Melzer's yellowish. Surface hyphae of pileus interwoven, cells tubular, slightly inflated, 5-13 (18) μm wide, walls 0.5-1.1 μm, in KOH hyaline to light brownish, in Melzer's dull yellow to light brownish; tramal hyphae interwoven, cells tubular, inflated, 5-14 μm wide, walls 0.5-1.1 μm, in KOH hyaline to pale yellowish, having yellow-pigmented areas, in Melzer's hyaline to yellowish. Cortical hyphae of stipe parallel to subparallel, cells tubular to inflated, 2.5-14.5 μm wide, in KOH hyaline, pale yellowish, to light brownish, in Melzer's hyaline to yellowish, often having colorless or yellowish particles on the cell walls; basal hyphae irregularly interwoven, branched, cells

tubular, 2.5-4 μm wide, in KOH hyaline to light yellowish, occasionally having orange pigments. Universal veil hyphae tubular, branched 2.5-10.5 μm wide, thin-walled, in KOH hyaline to dull yellowish, often containing minute colorless granules. Oleiferous hyphae present in the pileus, lamellar trama, stipe cortex and basal mycelium. Interhyphal pigment deposits present in the pileus, lamellar trama and stipe cortex; in KOH yellow, golden, red-orange and brownish, soon disappearing, in H_2O yellow-golden, greenish yellow (olivaceous) brownish, and red-brownish, in Melzer's yellow, golden yellow and orange-red.

Habit and Habitat: Single, scattered to gregarious, in *Sphagnum* spp. and other mosses, under conifers and in mixed woods. September to October.

Material Examined: 13263, 13/9/79, Aylesford Lake Road, Kings Co.; 13264, 16/9/79, Aylesford Lake Road, Kings Co.; 13265* and 13266, 18/9/79, Division Road, Pictou, Pictou Co.; 13267, 5/10/79, Aldershot, Kings Co.

Observations: C. pseudotubarius belongs in the stirps Tubarius (Ammirati 1972), and differs from *C. tubarius* in the dark olivaceous colors of the latter, and from *C. tubarius* var. *luteofolius* in that the stipe of *pseudotubarius* is reddish at the base and bright yellowish overall.

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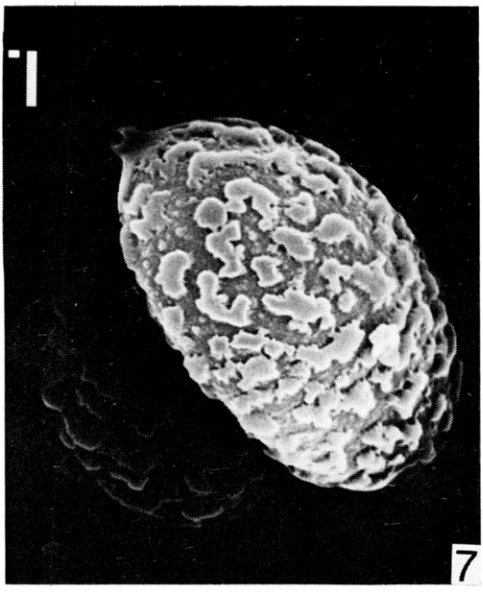
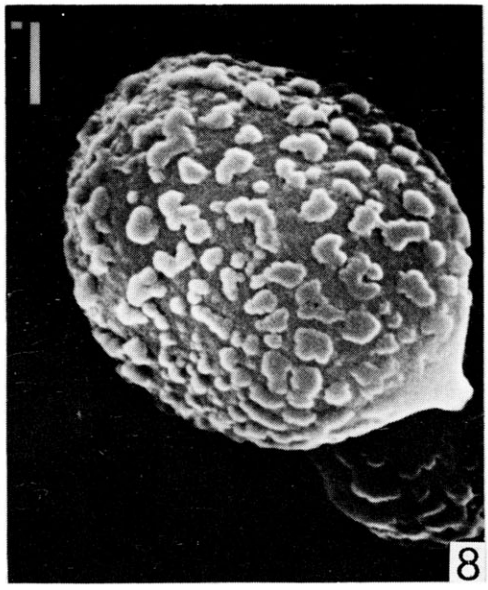
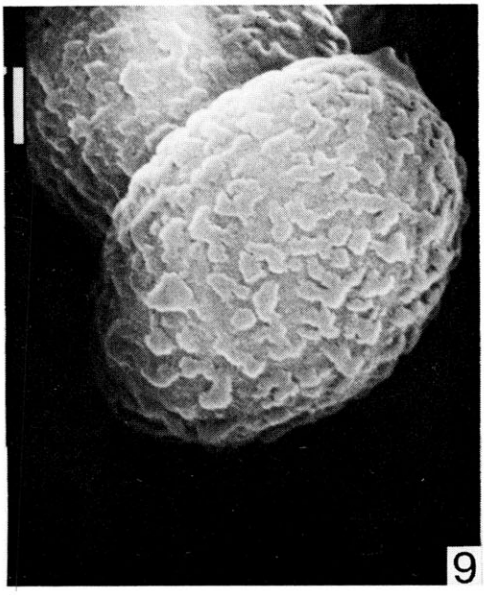
Fig 1. *Cortinarius huronensis* var. *huronensis*. Scale bar = 1 cm.
Fig 2. *Cortinarius malicorius*. Scale bar = 1 cm.

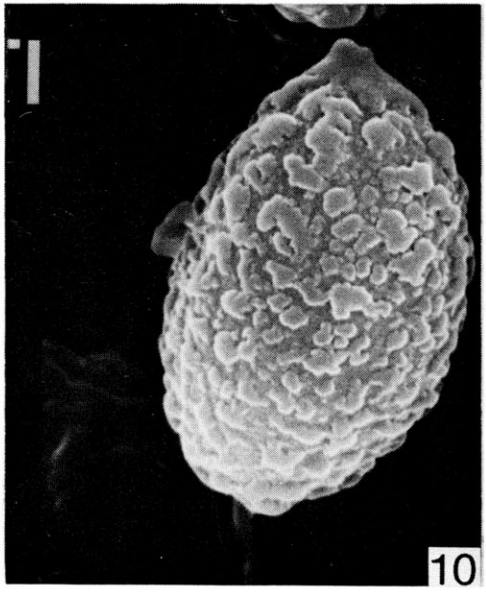
Fig 3. *Cortinarius rubeus*. Scale bar = 1 cm.
Fig 4. *Cortinarius semisanguineus*. Scale bar = 1 cm.

Fig 5. *Cortinarius cinnamomeoluteus*. Scale bar = 1 cm.
Fig 6. *Cortinarius pseudotubarius*. Scale bar = 1 cm.

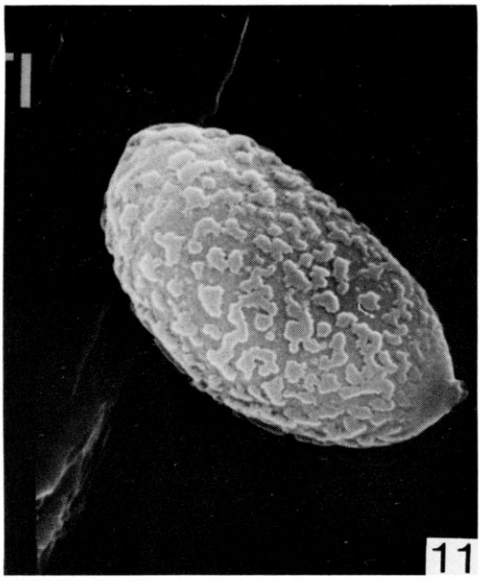


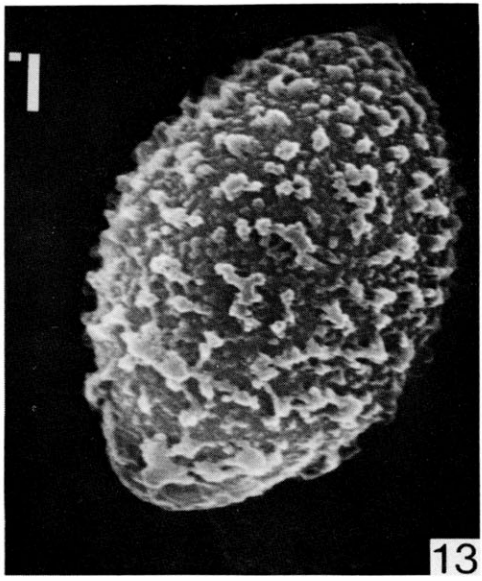




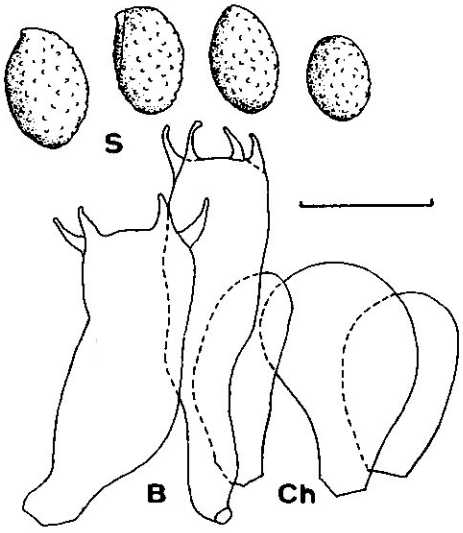


Figs 7-10. Scanning electron micrographs of *Cortinarius* spores. Scale bars = 1 μm. Fig 7. *C. huronensis* var. *huronensis*. Fig 8. *C. malicorius*. Fig 9. *C. rubeus*. Fig 10. *C. sanguineus*.





Figs 11-13. Scanning electron micrographs of *Cortinarius* spores. Scale bars = 1 μm. Fig 11. *C. semisanguineus*. Fig 12. *C. cinnamomeoluteus*. Fig 13. *C. pseudotubarius*.



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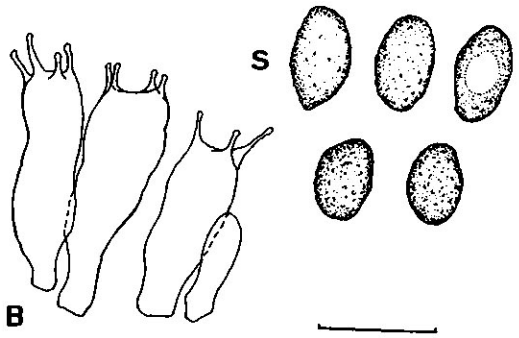

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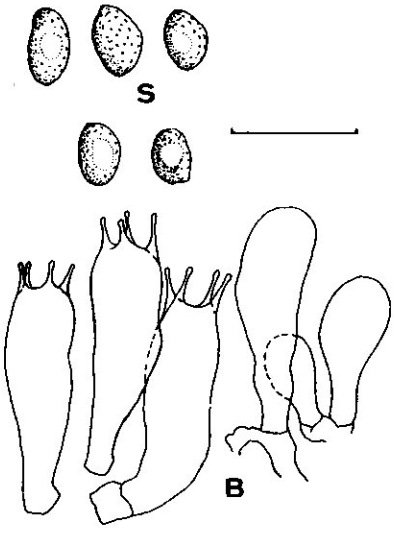

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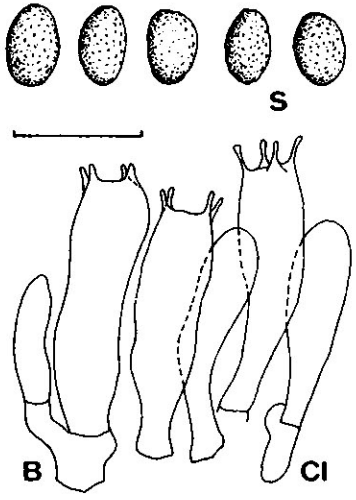

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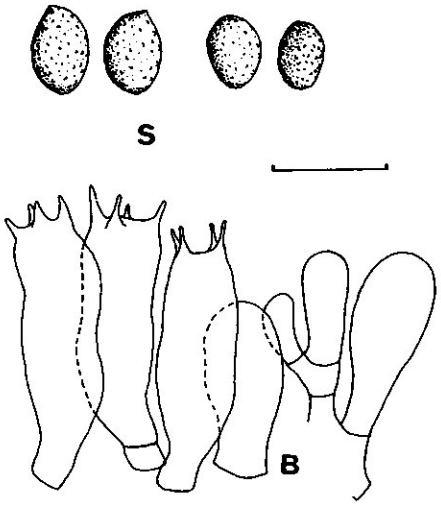
Figs 14-17. Basidia (B) and spores (S) of *Cortinarius*. Scale bars = 10 μm. Fig 14. *C. huronensis* var. *huronensis*. Ch. = cheilocystidia. Fig 15. *C. incognitus*. Fig 16. *C. malicorius*. Fig 17. *C. rubeus*. Cl = clamp.



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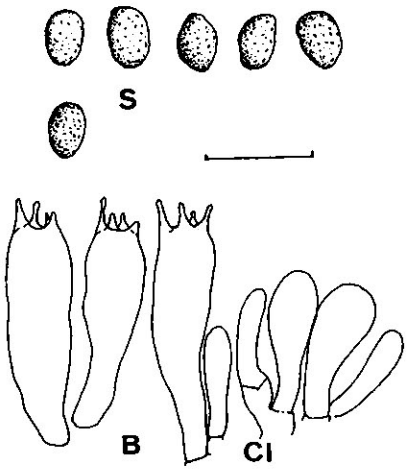

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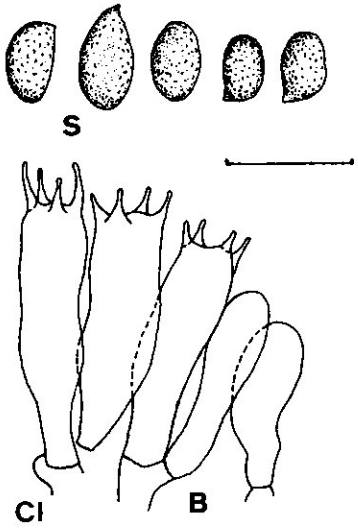

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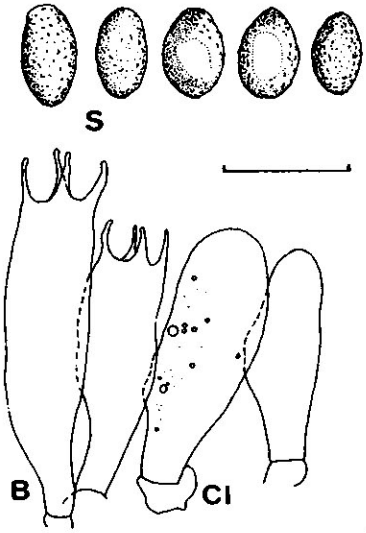

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Figs 18-21. Basidia (B) and spores (S) of *Cortinarius*. Cl = clamp. Scale bars = 10 μm. Fig 18. *C. sanguineus*. Fig 19. *C. semisanguineus*. Fig 20. *C. cinnamomeoluteus*. Fig 21. *C. pseudotubarius*.