

Nova Scotian Species of *Hygrophorus*

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NOVA SCOTIAN SPECIES OF *HYGROPHORUS**

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Fifty-three species and varieties of *Hygrophorus* occurring in Nova Scotia are described and illustrated. Techniques for their identification are discussed, and both technical and field keys are provided. Two species, *H. lignicola* and *H. macrosporus*, are described as new, and one species, *H. pustulatus*, is reported as a new record for the province. Nine species previously collected or reported from Nova Scotia are excluded on grounds of doubtful or incorrect identification. Complexes, or assemblages of intergrading minor variants, are recognized for *H. olivaceoalbus*, *H. puniceus*—*H. coccineus*, and *H. miniatus*—*H. cantharellus*.

Infrageneric classification is based on the recent comprehensive North American study of Hesler and Smith (1963) with two modifications: (1) a new section, *Lignicolohygrophorus*, is created to accommodate *H. lignicola*, a species peculiar in its lignicolous habitat and dimitic hyphae; (2) species with conic but nonviscid pilei are removed from Series *Conici* to a new series, *Marginati*, in Subsection *Hygrocybe*.

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Introduction

The genus *Hygrophorus* Fries in North America contains some 244 taxa as recognized by Hesler and Smith (1963). We have found 53 species and varieties in Nova Scotia, but it is certain that this paper does not contain all the entities here, as our intensive work on the genus goes back only to 1965.

Hygrophorus is a colorful genus with species that range from green to snowy white, gray, brown, brilliant yellow and scarlet. There are always various species to be found throughout the mushroom season. The first may be found in late June, followed by a regular procession of taxa until late autumn, when there is a flush of autumnal forms that lasts into the hard frosts of early winter.

Historically, the genus is based on the Friesian tribes *Limacium* and *Clitocybe* (in part) in *Systema Mycologicum* (Fries 1821), and later, Fries (1835) proposed the generic name *Hygrophorus*. This infrageneric classification was retained with minor orthographic changes in *Epicrisis Systematis Mycologici* (Fries 1838), wherein *Hygrophorus* included the three tribes, *Limacium*, *Hygrocybe* and *Camarophyllus*.

Kummer (1871) raised the *Epicrisis* tribes to generic rank, and this partitioning of the Friesian genus was widely accepted until quite recently. Subsequently to Kummer's work, further attempts have been made by various mycologists to segregate genera from *Hygrophorus* sensu Fries, but the discovery of additional taxa has supported the original concept of one large genus.

Most of the proposed changes occurred in the segregate genus *Hygrocybe* (Fr.) Kummer. Two early segregates were *Godfrinia* Maire, to accommodate *Hygrophorus conicus* (Maire 1902), and *Hydrophorus* (Batt.) Earle with *Hygrophorus coccineus* as the nomenclatural type (Earle 1909). Murrill (1916) validly published *Hydrocybe* (P. Karsten's misspelling of *Hygrocybe*) and retained *Hygrophorus* Fr. for only the *Limacium* group (sensu Kummer). Singer (1951) reestablished *Hygrocybe* (Fr.) Karst. for those species with parallel lamellar trama, and in 1958 separated *Humidicutis* for *Hygrophorus marginatus* and other brightly colored, clampless species (Singer, 1958). The next year, Herink (1959) created *Gliophorus* and *Neohygrocybe*, both of which Singer later recombined with *Hygrocybe* (Singer 1962).

Heim (1936) proposed *Bertrandia* for *Hygrocybe*-like agarics with latex and pseudocystidia. Singer (1951) included this genus in his survey of the Hygrophoraceae Roze, and Hesler and Smith (1963) acknowledged it as distinct from *Hygrophorus*.

Besides *Hygrocybe* and *Bertrandia*, Singer (1951) recognized 3 other genera of Hygrophoraceae: *Camarophyllus* (Fr.) Karst., for species with interwoven gill trama; *Hygrophorus* Fr. (following Murrill's example) for those with divergent lamellar trama; and *Neohygrophorus* Singer to accommodate *Hygrophorus angelesianus* Smith and Hesler, formerly in subgenus *Pseudohygrophorus* (Smith & Hesler 1942). Later, Singer (1955) also erected *Hygroaster* for species with ornamented spores.

Heim (1957) proposed *Hodophilus* for species with interwoven trama and greenish spore print, formerly *Aeruginospora* Höhnelt. Although Singer regarded the green spore color as an erroneous observation, he reinstated *Aeruginospora* for clampless species with interwoven trama and hymeniform cuticle, including *Hygrotrama* Singer (Singer 1962). Herink's (1959) division of *Hodophilus* Heim into *Camarophyllopsis* Herink and *Hodophilus* (Heim) Herink was not recognized by Hesler and Smith (1963).

Hesler and Smith (1963) reaffirmed their original position (Smith & Hesler 1939; 1942) by reducing all the genera except *Neohygrophorus* to sections or parts thereof within Subgenus *Hygrophorus*. *Neohygrophorus* resumed its status as Subgenus *Pseudohygrophorus*, and these two subgenera constituted the single genus *Hygrophorus* Fr. The foregoing and other changes within the genus are summarized diagrammatically in Figure 1.

It is interesting that the Friesian tribes *Limacium*, *Hygrocybe* and *Camarophyllum* correspond so closely to the present sections *Hygrophorus*, *Hygrocybe* and *Camarophylloopsis*, respectively (Hesler & Smith 1963), as Fries knew nothing of the microscopic features now used to separate these groups. Beyond the addition of new species and the removal of several borderline taxa, *Limacium* and *Camarophyllum* are essentially unchanged. The most significant shift occurred when the Friesian species *Agaricus camarophyllum*, from which the generic name *Camarophyllum* was derived, was found to be a *Limacium* because of its divergent lamellar trama. Thus, *Camarophyllum* became unavailable at any infrageneric level for *Hygrophori* with interwoven trama (Donk 1949, apud Hesler & Smith 1963), and Hesler and Smith (1963) adopted the sectional name *Camarophylloopsis* instead.

Somers (1882) provided the earliest record of *Hygrophorus* (*H. eburneus* Fr.) for Nova Scotia, in the first published check list of fungi of the province. A series of similar lists published between 1882-1890 furnished only 1 additional species, *H. speciosus* Peck (Somers 1890). MacKay (1908) published a more comprehensive list, incorporating Somers' records and adding *H. conicus* Fr., *H. miniatus* Fr., and *H. chlorophanus* Fr. A supplementary list (MacKay 1913) reported *H. coccineus* Shaeff., *H. flavodiscus* Frost, *H. fuliginosus* Frost, *H. pudorinus* Fr., and *H. puniceus* Fr., plus 2 species now regarded as questionable records (See *Doubtful and Excluded Species*, p. 12).

L. E. Wehmeyer, of the University of Michigan, collected in the Truro area between 1927-1935, and made brief excursions to Cape Breton Island, the Wolfville area, and Halifax County. In 1931 he was accompanied by A.H. Smith, then student assistant. Among the many collections that year were 15 taxa of *Hygrophorus*, and the new records for the province were *H. borealis* Pk., *H. ceraceus* Fr., *H. marginatus* Pk., *H. nitidus* B. & C., *H. peckii* Atk. [now *H. laetus* (Fr.) Fr.], *H. pratensis* Fr., *H. pratensis* var. *pallidus* Kauff. (now merged with the typical variety), *H. psittacinus* Fr. and *H. russula* (Fr.) Kauff. (Smith & Wehmeyer 1936).

K.A. Harrison, while a plant pathologist at the Canada Department of Agriculture Experimental Station, Kentville, N.S., made numerous collections of fleshy fungi, and Wehmeyer compiled these and other records of fungi for the Maritime provinces up to 1943 into 1 volume (Wehmeyer 1950). Harrison's duplicate collections from 1927-66 are now housed in the E.C. Smith Herbarium, Acadia University (ACAD), and include 35 species of *Hygrophorus* from Nova Scotia.

Bird and Grund (1970) supplied ten new records for the province, and described the new species, *H. murinus* Bird and Grund. Grund and Harrison (1974) described the new variety *H. conicus* (Fr.) Fr. var. *atrosanguineus* Grund and Harrison, and added 3 new records for the Maritime Provinces.

We have adopted the infrageneric classification proposed by Hesler and Smith (1963), with three modifications. (1) We omit sections, subsections, and series not found thus far in Nova Scotia. (2) We propose a new section, *Lignicolohygrophorus*, to accommodate a lignicolous species. (3) We create a new series, *Marginati*, which is segregated from Series *Conici* sensu Hesler and Smith (1963). In the latter system, Series *Conici* includes conic species with either viscid or dry pilei, and thus keys out under the 2 next higher taxa, Subsections *Hygrocybe* (dry) and *Punicei* (viscid). However, the similar conic series *Puri* is isolated in Subsection *Psittacini* because of stipe viscosity, although Hesler and Smith (1963, p. 216) acknowledge the close relationship of some of its species with the *H. conicus* group. It is not logical to combine Series *Conici* and *Puri*, regardless of viscosity of stipe or pileus, when the subsections have been delimited on that very basis. Nor does it seem reasonable to have 1 series bridging only 2 of the 3 subsections. Thus, we propose to remove conic species with nonviscid pilei and nonviscid stipes from Series *Conici* and assign them to a new series, *Marginati*, in Subsection *Hygrocybe*. As Series *Conici* thus now includes only species with viscid pilei (and dry stipes), we transfer it from Subsection *Hygrocybe* (Hesler & Smith, 1963) to Subsection *Punicei*.

Methods and Materials

Collection and Preservation

The specimens used in this investigation were carefully picked, wrapped in waxed paper, transported in baskets, and handled gently to minimize bruising. Notes were made of field habit and habitat, and, upon returning to the laboratory, spore prints and descriptions were prepared. Collections were assigned herbarium numbers and dried at 38-40°C. Later, they were relaxed in a steamer, lightly pressed, and redried for storage in 12.5 x 20-cm (5 x 8-in) envelopes under their given numbers in the E.C. Smith Herbarium, Acadia University, Wolfville, N.S. (ACAD).

Spore Prints

Spore prints were obtained by detaching the fresh pileus and placing it on pure white paper. When only one sporocarp was available, the stipe was placed through a hole in stiff, pure white paper and suspended thus over an open jar or beaker. Spore prints were made prior to storage of sporocarps in the refrigerator, as low temperatures inhibit discharge of spores.

Macrochemical Tests

Potassium hydroxide (KOH, 3% aqueous solution), ferrous sulphate (FeSO_4 , 10% aqueous solution), and Melzer's reagent [1.5 g. potassium iodide (KI) and 0.5 g iodine (I_2) in 20 ml water plus an equal volume of an aqueous solution (1:1 w:v) of chloral hydrate ($\text{CCl}_3\text{CH}(\text{OH})_2$)], were applied to fragments of the pileus, stipe, and lamellae. In *Hygrophorus*, the various tissues usually darken slightly or merely assume the color of the reagent; however, occasionally a significant color change occurs within 10 minutes. These reactions are discussed in the descriptions of the species.

Examination of Microscopic Structures

When possible, microscopic details were examined when sporocarps were fresh. Hyphae and basidia of dried specimens, when rehydrated in KOH solution, are brittle and frequently disintegrate in crush mounts. Moreover, hyphae occasionally fail to inflate fully when rehydrated and, in sections of pileal cuticle and lamellar trama, they sometimes do not resume their normal arrangement.

Unless otherwise stated, fresh material was mounted unstained in water, using standard 75 x 25-mm micro-slides and 22 x 22-mm cover glasses. Dried material was flooded with 100% ethanol and rehydrated in 3% KOH.

A. *Spores*. Measurements of spores were taken from spore deposits (prints) when available, to guarantee maturity (otherwise, a crush mount was made of a portion of lamella from a mature sporocarp). A deposit was applied to a film of Mayer's fixative on a micro-slide [Mayer's fixative: 50 ml egg white, 50 ml glycerine ($\text{C}_3\text{H}_5(\text{OH})_3$), and 1 g sodium benzoate ($\text{NaC}_7\text{H}_5\text{O}_2$); an aqueous solution of sodium benzoate (1:2 w:v) is added to the egg white]. At one end of the slide, a small drop of 3% KOH was placed over the spores, and at the other end a drop of Melzer's reagent to test for amyloidity.

B. *Hymenial Structures*. Crush mounts were used to examine basidia, cystidia, and spores in the absence of a spore print. A portion of lamella from a mature sporocarp was crushed beneath a cover glass, either in Melzer's reagent or in 3% KOH (or water) after staining with a 1:1 (v:v) mixture of 1% aqueous solutions of phloxine and Congo Red. Dried material was rehydrated and stained before crushing. With very few exceptions, as noted, camera lucida drawings for each taxon were prepared from a single crush mount.

C. *Lamellar Trama*. Lamellar trama was examined in free-hand transverse or

periclinal sections. Dried material was partially rehydrated in water and compressed for sectioning in elder pith. As *Hygrophorus* is usually very soft and fleshy, it was advantageous to dry the tissue to a leathery texture over an alcohol flame before sectioning; sections were mounted in 3% KOH.

The configuration of the lamellar trama is important at the level of section when keying species of *Hygrophorus*. There are 3 major types: interwoven, divergent and parallel (Figs 2-5). Parallel tramas may be subdivided into the *H. conicus* type, with broad, straight and sparingly septate hyphae (Fig 4); and the *H. coccineus* type, with inflated, subparallel and frequently septate hyphae (Fig 5). At times, the *H. coccineus* type approaches the interwoven type. Divergent tramas may have a thin, parallel mediostratum, but should not be confused with parallel trama in which the subhymenial hyphae diverge from a broad, parallel mediostratum. In sections prepared from dried material, divergent tramas may straighten (Hesler & Smith 1963), and interwoven trama may appear subparallel.

D. Pileal Cuticle. Pileal cuticle and context (trama) were examined in radial section. Unless the sporocarp had already been divided longitudinally, a narrow wedge wide enough to admit a razor blade was removed from the pileus. Sections were shaved from the exposed radial surface, passing the blade from cuticle to context to avoid tearing off gelatinous pellicles when present. Radial sections could also be taken directly from dry material, without prior rehydration, and mounted in 3% KOH. The depth of viscid cuticles, when present, was measured under low power (100x) without a cover glass. The weight of a cover glass tends to disrupt the arrangement of hyphae in gelatinous cuticles, and exaggerates the thickness of such layers.

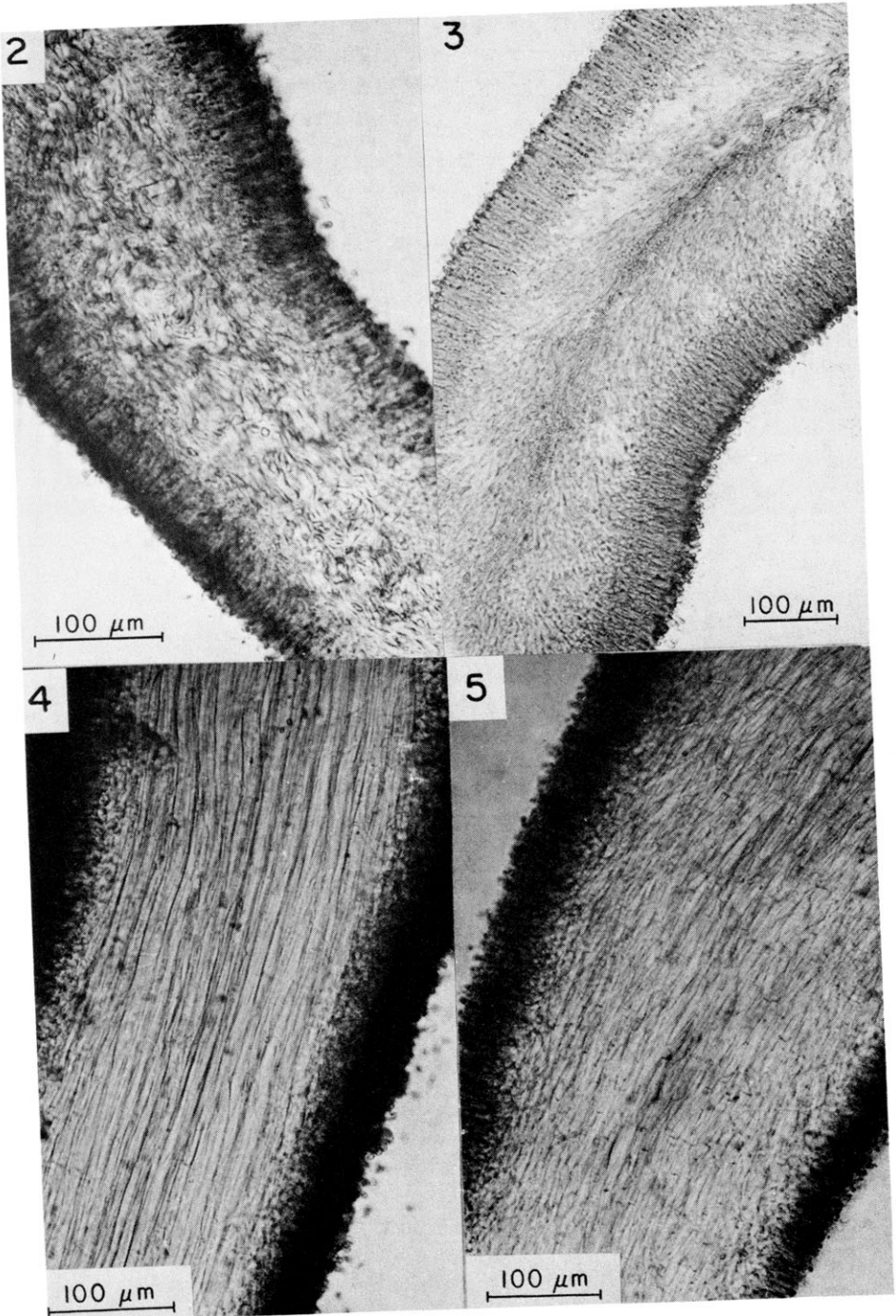
Viscosity of the pileus becomes important at the subsectional level of infrageneric classification. Even when not macroscopically apparent, pileal gluten can be revealed in radial sections of either fresh or dried material. However, the pellicle may be altered by drying; for example, an ixotrichodermium may revive as an ixocutis (Hesler & Smith 1963). Species of subsection *Hygrocybe* have less organized cuticles that sometimes do not revive at all, and should be sectioned when fresh.

E. Stipe Surface. Procedures for examining stipe surfaces were similar to those for the pileal cuticle. Stipe gluten, also important at the level of subsection, is either a viscid outer layer extending over the entire stipe, or a partial veil sheathing only the lower portion. Such gelatinous surfaces are usually less persistent than pileal gluten, and are often difficult to detect. Gelatinous veils may be absorbed into the fibrous context of the stipe, and are frequently absent in mature sporocarps. Then, radial sections of fresh material, taken from the base or near the superior annular zone, will sometimes reveal velar remnants.

Descriptions

Both the macroscopic and microscopic descriptions are taken from fresh

Figs 2-5. Types of lamellar trama in *Hygrophorus*. Fig 2. Interwoven trama, from *H. borealis* f. *borealis*; characteristic of Sections *Camarophyllopsis* and *Hygrotrama*; the preparation was made from dried material, and the hyphae have straightened slightly. Fig 3. Divergent trama, from *H. pudorinus* var. *pudorinus* f. *pudorinus*; characteristic of Section *Hygrophorus*. Fig 4. Parallel trama, *H. conicus* type, from *H. conicus* var. *conicus*, occurs primarily in the conic series of Section *Hygrocybe*. Fig 5. Parallel trama, *H. coccineus* type, from *H. miniatus* var. *miniatus*; present in Section *Lignicolohygrophorus* and most of Section *Hygrocybe*, where it intergrades with both the preceding type and the interwoven type.



specimens when available. For species represented only by earlier collections, and for which field notes were lacking, macroscopic data are compiled from various published descriptions or quoted from Hesler and Smith (1963), while the microscopic description is derived from our study of the dried specimens.

The *Reinhold Color Atlas* (Kornerup & Wanscher 1962) was used in most cases for identifying coloration of sporocarps. Color names followed by a code symbol in parentheses, consisting of 2 numbers and a letter, are taken from this source. Our descriptions also include the nearest color equivalent in the ISCC-NBS centroid color charts (Kelly & Judd 1955), as this publication is still in print and is becoming the standard color reference for agaricology. Colors not identified by an ISCC number are generalized terms and not taken from the ISCC dictionary. Color names in quotation marks in the quoted descriptions are from *Color Standards and Color Nomenclature* (Ridgway 1912).

Descriptive terminology apart from color names largely follows that of Snell and Dick (1957). The term "resinous," applied to the pileal surface, refers to a slight tackiness and not to a visual characteristic. "Brachybasidiole" is used as defined by Smith (1966).

Illustrations

In most cases, descriptions of species are accompanied by a photograph of carpophores, plus camera lucida drawings below of basidia (left) and spores (right). Other structures, when illustrated, are labelled accordingly. In keeping with current mycological conventions, photographs of carpophores are scaled thus: x 1.0, x .75; this figure is a multiple of a single linear dimension, and does not refer to the relative overall size, which is the square of this magnification factor.

The Genus Hygrophorus Fr.

Hygrophorus Fr., Gen. Hymen., p. 8. 1836.

- Syn: *Hygrocybe* (Fr.) Kummer, Fuhr in Pilzk., p. 111. 1871.
Camarophyllus (Fr.) Kummer, Fuhr in Pilzk., p. 117. 1871.
Limacium (Fr.) Kummer, Fuhr in Pilzk., p. 118. 1871.
Godfrinia Maire, Rech. Cyt. Tax. Basidiomycetes, p. 116. 1902.
Hydrophorus (Batt.) Earle, Bull. N.Y. Bot. Gard. 5: 431. 1909.
Hydrocybe (Karst.) Murrill, North Amer. Flora 9: 376. 1916.
Hygroaster Singer, Sydowia 9: 370. 1955.
Hodophilus Heim, Les Champ. d'Europe, p. 219. 1957.
Hygrotrama Singer, Sydowia 12: 221. 1958.
Humidicutis Singer, Sydowia 12: 225. 1958.

Type Species: *Hygrophorus eburneus* (Bull. ex Fr.) Fr.

Spores white in deposit, smooth or rarely nodulose, inamyloid or amyloid, basidia typically narrowly clavate, 5-6 times the spore length; lamellae thick, acute-edged, typically subdistant, presenting a clean waxy appearance, long-decurrent to almost free; pileus thin or fleshy, often hygrophanous and fragile; stipe central and confluent with pileus; partial veil present or absent; sporocarps mostly terrestrial rarely lignicolous, in forests, bogs, or grassy areas; frequently highly colored.

Synopsis of the Genus Hygrophorus in Nova Scotia

Genus HYGROPHORUS Fries

Subgenus HYGROPHORUS

Section CAMAROPHYLLOPSIS Hes. & Sm.

Subsection CAMAROPHYLLOPSIS

Series VIRGINEI (Bataille) Hes. & Sm.

1. *H. niveus* Fr.
2. *H. borealis* Pk. f. *borealis*
3. *H. virgineus* (Fr.) Fr.

Series VISCIDI (Sm. & Hes.) Hes. & Sm.

4. *H. rainierensis* Hes. & Sm.
5. *H. colemannianus* Blox. apud Berk.
6. *H. murinus* Bird & Grund

Series CAMAROPHYLLOPSIS

7. *H. pratensis* (Fr.) Fr. var. *pratensis*

Subsection MICROSPORI (Sm. & Hes.) Hes. & Sm.

Series MICROSPORI

8. *H. canescens* Sm. & Hes.

Section HYGROTRAMA (Sing.) Hes. & Sm.

9. *H. hymenocephalus* Sm. & Hes.

10. *H. subfuscescens* Sm. & Hes. var. *subfuscescens*

Section HYGROPHORUS

Subsection HYGROPHORUS

Series CHRYSODONTINI (Sing.) Hes. & Sm.

11. *H. chrysodon* (Fr.) Fr.

Series HYGROPHORUS

12. *H. eburneus* (Fr.) Fr.

Series AUREI (Bataille) Hes. & Sm.

13. *H. speciosus* Pk. var. *speciosus*
 14. *H. flavodiscus* Frost apud Pk.
 15. *H. gliocyclus* Fr.
 16. *H. hypothejus* (Fr.) Fr.

Series OLIVACEOUMBRINI (Fr.) Hes & Sm.

17. *H. olivaceoalbus* (Fr.) Fr. var. *olivaceoalbus*
 18. *H. fuliginus* Frost apud Pk.
 19. *H. tephroleucus* (Fr.) Fr. var. *tephroleucus*
 20. *H. pustulatus* (Fr.) Fr.

Subsection CAMAROPHYLLI (Fr.) Hes. & Sm.

Series PUDORINI (Bataille) Hes. & Sm.

21. *H. pudorinus* (Fr.) Fr. var. *pudorinus* f. *pudorinus*

Series RUBENTES (Fr.) Hes. & Sm.

22. *H. purpurascens* (Fr.) Fr.
 23. *H. capreolarius* (Kalchbr.) Sacc.
 24. *H. erubescens* (Fr.) Fr. var. *erubescens*
 25. *H. russula* (Fr.) Quél.

Series FULVENTES (Fr.) Hes. & Sm.

26. *H. tennesseensis* Sm. & Hes.
 27. *H. pacificus* Sm. & Hes.
 28. *H. monticola* Hes. & Sm.

Series CAMAROPHYLLI

29. *H. inocybiformis* Sm.
 30. *H. camarophyllus* (Fr.) Dumée, Grandjean, & Maire
 31. *H. agathosmus* Fr.
 32. *H. odoratus* Sm. & Hes.

Section LIGNICOLOHYGROPHORUS sec. nov.

33. *H. lignicola* sp. nov.

Section HYGROCYBE Fr.

Subsection PSITTACINI Bataille

Series PURI Hes. & Sm.

34. *H. ruber* Pk.

Series PSITTACINI

35. *H. psittacinus* (Fr.) Fr. var. *psittacinus*
 36. *H. laetus* (Fr.) Fr.
 37. *H. minutulus* Pk.
 38. *H. nitidus* B. & C.
 39. *H. ceraceus* (Fr.) Fr.
 40. *H. chlorophanus* (Fr.) Fr.

Series INOLENTES (Bataille) Hes. & Sm.

41. *H. unguinosus* (Fr.) Fr. var. *unguinosus*

Subsection PUNICEI Fayod

Series CONICI (Fayod) Hes. & Sm.

42. *H. conicus* (Fr.) Fr. var. *conicus*
 43. *H. conicus* (Fr.) Fr. var. *atrosanguineus* Grund & Harrison

Series PUNICEI

44. *H. flavescens* (Kauff.) Sm. & Hes.
 45. *H. puniceus* (Fr.) Fr.
 46. *H. marchii* Bres.

Subsection HYGROCYBE

Series MARGINATI ser. nov.

47. *H. marginatus* Pk. var. *marginatus*

48. *H. marginatus* var. *concolor* Sm.
 Series HYGROCYBE
 49. *H. cantharellus* (Schw.) Fr.
 50. *H. miniatus* (Fr.) Fr. var. *miniatus*
 Series COCCINEI (Fayod) Hes. & Sm.
 51. *H. nitiosus* Blytt
 52. *H. coccineus* (Fr.) Fr. sensu Ricken
 53. *H. macrosporus* sp. nov.

Complexes

In our collections, we encountered several specimens that appeared to be intermediate between established species or varieties. Further collection and examination yielded an intergrading series of specimens that keyed to either one taxon or the other, depending on the degree of expression of the key characteristics; however, they did not fully satisfy the description of either taxon. As the variants themselves were not uniform we chose to consider them as complexes rather than propose a new species or variety.

The *Hygrophorus olivaceoalbus* Complex.

The complex intergrades between *H. olivaceoalbus* var. *olivaceoalbus* and *H. olivaceoalbus* var. *gracilis* Maire. In this work and in the literature, the typical variety is restricted to specimens having spores about 9-12.5 μm long borne on 4-spored basidia. Hesler and Smith (1963 p. 294) describe var. *gracilis* as a constant, slender form with spores 10-14 μm long borne on 2-, 3-, 4-spored basidia in a single pileus. Its primary distinguishing feature is the dark brown granulation within the cuticular hyphae when treated with Melzer's reagent.

The following are examples of the intergradation:

ACAD 12118—stature stout, as in var. *olivaceoalbus*; cuticular hyphae with yellow-brown granules in Melzer's reagent; spores 11-15(16) μm long; basidia 2-, 3-, and 4-spored in one gill.

ACAD 12284—some sporocarps slender, others stout; cuticular hyphae yellowish-coagulated in Melzer's reagent but lacking granules; spores 10-14(16) μm ; basidia 2-, 3-, and 4-spored in one gill.

ACAD 12285—stature stout; cuticular hyphae lacking granules; spores 10-13.5(15) μm long; basidia 4-spored.

The first example is closest to var. *gracilis*; the last is closest to var. *olivaceoalbus*. All collections were macroscopically similar to the typical variety.

The *Hygrophorus puniceus*—*H. coccineus* Complex.

Several of our collections resembled *H. puniceus* in color, stature, lamellar attachment, and spore shape. However, they lacked a viscid pileus and subsequently keyed to the very similar *H. coccineus*. The essential difference between these 2 species is the presence of a gelatinous cuticle in *H. puniceus*, supported by arbitrary and variable characteristics such as larger size and adnexed gills. Spores of the 2 species do not differ significantly in size, although most mycologists agree that *H. puniceus* has slightly larger spores.

None of these collections showed a definite pellicle in sections of either fresh or dry material, even in young sporocarps. At most, there were a few subgelatinous hyphae near the surface, or spores and agglutinated amorphous matter adhering to a compact epicutis. The drying process may enhance the visible gelatinization of a pellicle or it may collapse the pellicle beyond revival. However, we found pileal gluten to be a usually persistent and reliable feature. Hesler and Smith (1963) claimed that the *H. puniceus* pellicle is well-organized and demonstrable in even the oldest

carpophores. Thus, as the sporocarps showed no sign of mechanical removal of the pellicle during the drying and pressing process, we concluded that it was absent from the beginning.

It is misleading to consider the specimens as a complex intermediate between *H. puniceus* and *H. coccineus*. Usually, they are closer to *H. puniceus*, and only the dry pileus connects them to *H. coccineus*. In size of spores and of basidia, and in number of spores per basidium, they display the variability common to *H. puniceus* but not reported in *H. coccineus*. The number of spores per basidium may be consistently 4, or may vary from 1 to 4 in a single mount, with different proportions of each type of basidium from one collection to another. Spore size equals or exceeds the range for *H. puniceus*, depending on the most prevalent type of basidium. The spores are not only ellipsoidal as in *H. coccineus*, but also oblong to subfusiform as in *H. puniceus*. Thus, despite the dry pileus, the microscopic similarity to *H. puniceus* precludes labelling these specimens as *H. coccineus*.

The European species *H. intermedius* Pass., as described by Bresadola (1928), Romagnesi (1962-63), and Poelt and Jahn (1963), corresponds rather closely with the aberrant specimens. As we have not seen an authentic specimen of *H. intermedius*, we hesitate to label our collections as that species.

The *Hygrophorus miniatus*—*H. cantharellus* Complex.

Most authors have recognized that *H. miniatus* and *H. cantharellus* are related, and Kauffman (1918) stated that they intergrade. Our collections include a few specimens combining the diagnostic features of the 2 species. Collection ACAD 12165, growing on a moss (not *Sphagnum*), has the slender stature and spore size of *H. cantharellus*, but a nondepressed pileus and adnate gills more typical of *H. miniatus* var. *miniatus*. Others, while not intermediate, reflect the variability of the 2 species. For example, ACAD 12124, discussed under *H. cantharellus*, is short like *H. miniatus*, while ACAD 12187, discussed under *H. miniatus* var. *miniatus*, is tall and slender like *H. cantharellus*. It is necessary to note the habitat of these 2 species to determine whether stature is a product of heredity or of environment.

Doubtful and Excluded Species

Nine previously recorded *Hygrophorus* species are excluded from this work. Some represent incorrect identification as determined from a study of all collections of the species in the E.C. Smith Herbarium. Others are European species mentioned only once in the records and unavailable for study, or, if available, then lacking data needed to confirm the identification.

1. *Hygrophorus aureus* Arrh. in Fr. This is a European species. The single collection available, ACAD 5263, is probably *H. speciosus* var. *speciosus*.

2. *H. circinans*. A single collection, ACAD 890, bears this name. We have been unable to locate the species in the available literature.

3. *H. distans* Berk. MacKay (1913) provided the first report of this European species. A.H. Smith corrected the identification of ACAD 291 from *H. distans* to *H. monticola*. The amygdaline odor mentioned in descriptions by Masee (1893) and Rea (1922) probably accounts for the misnomer. Singer (1962) listed *H. distans* as a synonym of *Hygrocybe fornicata* (Fr.) Sing. (= *Hygrophorus fornicatus* Fr. in Hesler and Smith, 1963), a species without a distinctive odor.

4. *H. limacinus* Fr. Wehmeyer (1950) considered MacKay's record (MacKay 1913) as doubtful. The species has not been reported since then in Nova Scotia.

5. *H. laurae* Morg. Six of the 7 collections (ACAD-1417, 2010, 2631, 5258, 5259, and 7097) have coarse red-brown squamules on the stipes, and are apparently some

variety of *H. pudorinus*. The other collection, ACAD-294, although confirmed by A.H. Smith, has spores too large for *H. laurae*.

6. *H. odorus*. This European species scarcely ever appears even in the available European literature. Collections ACAD-2644, 2645, and 2646 are apparently *H. monticola*.

7. *H. pallidus* Pk. Collections ACAD-3953 and 7187 have ellipsoidal spores 6-9.5 μm long and are therefore incorrectly identified.

8. *H. peckianus* Howe. Collections ACAD-293 (fide A.H. Smith), 1469, 1470, and 2634 all display a gelatinous cuticle and ellipsoidal spores 6-8(10) μm long, and are therefore incorrectly identified.

9. *H. sciophanus* Fr. This is a European species. Collection ACAD-314 could be the closely related North American counterpart, *H. perplexus* Sm. & Hes. owing to its adnate rather than decurrent gills. However, the ixotrichodermium characteristic of *H. perplexus* is missing from the specimen.

A Technical Key to the Nova Scotian Species of Hygrophorus

Key to Subgenera

1. Lamellar trama interwoven, reddish in KOH; spores amyloid Subgenus PSEUDOHYGROPHORUS, (not in Nova Scotia)
1. Not with the above combination of characters Subgenus HYGROPHORUS

Subgenus HYGROPHORUS

Key to Sections

1. Lamellar trama intricately to moderately interwoven 2.
1. Lamellar trama divergent, parallel, or slightly interwoven 3.
 2. Pileal cuticle not hymeniform; lamellar trama intricately interwoven Section CAMAROPHYLLOPSIS, p. 13.
 2. Pileal cuticle hymeniform; lamellar trama moderately interwoven Section HYGROTRAMA, p. 14.
3. Lamellar trama divergent Section HYGROPHORUS, p. 14.
3. Lamellar trama parallel to slightly interwoven 4.
 4. Sporocarp lignicolous and thick-walled hyphae present in lamellar and pileal tramas; flesh soft but slightly rubbery, not brittle Section LIGNICOLOHYGROPHORUS
(*H. lignicola* is the only known species, p. 85.)
 4. Sporocarp usually terrestrial; thick-walled hyphae absent; flesh waxy and fragile Section HYGROCYBE, p. 17.

Section CAMAROPHYLLOPSIS

Key to Subsections

1. Spores 6-8 μm or more long, ellipsoidal Subsection CAMAROPHYLLOPSIS, p. 23.
1. Spores usually shorter than 6.5 μm , globose or subglobose Subsection MICROSPORI, p. 14.

Subsection CAMAROPHYLLOPSIS

Key to Series

1. Pileus white, not discoloring appreciably Series VIRGINEI, p. 14
1. Pileus colored when young 2.
 2. Pileus viscid from a gelatinous cuticle Series VISCIDI, p. 14.

2. Pileus moist to dry, lacking a gelatinous cuticle
 Series CAMAROPHYLLOPSIS, p. 14.

Series VIRGINEI

Key to Species

1. Spores 6-8 x 4-5 μm ; pileal cuticle not gelatinous
 *H. pratensis* var. *pratensis*(Series *Camarophyllopsis*), p. 35.
1. Spores 7-9.5 μm or more long 2.
2. Pileus viscid to lubricous from a pellicle 15 μm or more thick
 *H. niveus*, p. 23.
2. Pileus moist to dry, resinous at most; subgelatinous cuticular hyphae,
 if present, form a layer less than 10 μm deep 3.
3. Spores 7-9.5 x 4-6 μm (basidia 4-spored); pileal cuticle a thin subgelatinous layer
 up to 10 μm deep *H. borealis* f. *borealis*, p. 27.
3. Spores 8-10.5 (12.5) x 5-7 μm ; pileal cuticle of nongelatinous hyphae
 *H. virgineus*, p. 28.

Series VISCIDI

Key to Species

1. Odor of fresh green corn *H. rainierensis*, p. 28.
1. Odor mild or not distinctive 2.
2. Pileus brown or reddish brown, fading to buff; lamellae pinkish
 *H. colemannianus*, p. 31.
2. Pileus gray, fading to cream; lamellae gray *H. murinus*, p. 32.

Series CAMAROPHYLLOPSIS

Key to Species

1. Spores 6-8(8.5) μm long; pileus rufous to pale orange, fading, not becoming
 scurfy or squamulose *H. pratensis* var. *pratensis*, p. 35.
1. Spores 7-11.5 (15.5) μm long; pileus red to medium orange, becoming scurfy to
 squamulose on disc *H. cantharellus* (Series *Hygrocybe*), p. 115.

Subsection MICROSPORI

Series MICROSPORI

1. Pileus with canescent fibrils overlying the glabrous, brownish gray surface
 *H. canescens*, p. 36.

Section HYGROTRAMA

Key to Species

1. Pileus pinkish cinnamon fading to pinkish buff; lamellae concolorous or
 becoming dull brown; stipe becoming blackish *H. hymenocephalus*, p. 39.
1. Pileus pale dingy yellow to yellowish gray
 *H. subfuscescens* var. *subfuscescens*, p. 39.

Section HYGROPHORUS

Key to Subsections

1. Stipe glutinous to viscid from a gelatinous outer veil, or, at least, with a narrow,
 gelatinous to moist and membranous superior ring where the veil
 terminates Subsection HYGROPHORUS, p. 15.
1. Stipe dry; veil, if present, fibrillose and not terminating in a thin, gelatinous or
 moist ring Subsection CAMAROPHYLLI, p. 16.

Subsection HYGROPHORUS

Key to Series

1. Sporocarp white with yellow flecks and floccules on the stipe apex and pileus margin Series CHRYSODONTINI
..... (*H. chrysodon* is the only known species, p. 40.)
1. Sporocarp not with the above combination of characters. 2.
 2. Sporocarp entirely white to whitish before maturity
..... Series HYGROPHORUS, p. 15.
 2. Sporocarp colored, at least on the pileus disc. 3.
3. Pileus disc yellow, orange, or red Series AUREI, p. 15.
3. Pileus disc umber, olive brown, gray-brown, or gray
..... Series OLIVACEOUMBRINI, p. 15.

Series HYGROPHORUS

Key to Species

1. Entire sporocarp persistently white; lamellae adnate to decurrent; spores 6.5-8.5(10) x 4-6 μm *H. eburneus*, p. 43.

Series AUREI

Key to Species

1. Pileus red, fading to orange and finally yellow-orange toward the margin; growing under larch *H. speciosus* var. *speciosus*, p. 44.
1. Pileus yellow overall, or the disc yellow and the margin cream to whitish, or dark olive brownish that changes in age through yellow and finally to red . . . 2.
 2. Pileus olive brown changing to red. *H. hypothejus*, p. 53.
 2. Pileus yellowish, a mixed yellow with pallid shades 3.
3. Spores 6-8.5 x 3.5-5 μm *H. flavodiscus* p. 49
3. Spores 8-10(12.5) x 4-5 μm *H. gliocyclus*, p. 50.

Series OLIVACEOUMBRINI

Key to Species

1. Stipe with a fibrillose inner veil of fuscous to brown fibrils that sometimes form ragged rings and patches; stipe gluten evanescent, terminated above by a narrow, gelatinous annulus or a thin, moist, brown ring 2.
1. Stipe not as above 3.
 2. Spores (8.5)9.5-12.5(14.5) μm long; basidia 4-spored
..... *H. olivaceoalbus* var. *olivaceoalbus*, p. 53.
 2. Spores 10-15(16) μm long; basidia 2-, 3-, and 4-spored; sporocarps usually not slender *H. olivaceoalbus* complex
3. Apical stipe ornamentation, if present, white and unchanging with age or injury; stipe persistently glutinous, white or slightly gray-streaked as gluten dries, pileus almost uniformly blackish brown when fresh. *H. fuliginus*, p. 54.
3. Apical stipe ornamentation soon becoming cinereous to fuscous; stipe soon dry; pileus color paler 4.
 4. Stipe 2-5(7) mm thick at apex, with fine, cinerescent fibrillose points to minute fuscous squamules at maturity
..... *H. tephroleucus* var. *tephroleucus*, p. 57.
 4. Stipe 5-10 mm thick, coarsely brown-squamulose at maturity.
..... *H. pustulatus*, p. 58.

Subsection CAMAROPHYLLI

Key to Series

1. Apical stipe ornamentation of white squamules, quickly yellow in KOH, and yellow-brown to red-brown with age or drying Series PUDORINI, p. 16.
1. Apical stipe ornamentation, if present, not becoming yellow-brown or red-brown with age or drying 2.
 2. Lamellae soon vinaceous-spotted near edges, or becoming vinaceous over all Series RUBENTES, p. 16.
 2. Lamellae not changing as above 3.
3. Pileus rusty brown, vinaceous brown, tan, or pale yellow-orange Series FULVENTES, p. 16.
3. Pileus gray, gray-brown, or blackish brown. Series CAMAROPHYLLI, p. 17.

Series PUDORINI

Key to Varieties and Forms

1. Pileus pale tan to salmon-buff; odor not distinctive; stipe base white to yellowish. *H. pudorinus* var. *pudorinus* f. *pudorinus*, p. 62.

Series RUBENTES

Key to Species

1. Stipe with a sparse, cottony to appressed-fibrillose annulus 2.
1. Stipe lacking an annulus of any sort 3.
 2. Pileus and stipe heavily streaked dark vinaceous; annulus the remains of a whitish partial veil, becoming purplish and disappearing at maturity. *H. purpurascens*, p. 65.
 2. Pileus streaked dark vinaceous on disc only; stipe sparsely streaked; annulus not the remains of a partial veil (check young sporocarps). *H. erubescens* var. *erubescens*, p. 69.
3. Pileus and stipe uniformly dusky vinaceous to vinaceous brown; lamellae paler, becoming sordid pinkish buff at maturity. *H. capreolarius*, p. 66.
3. Pileus and stipe colors not uniform, or else paler than above 4.
 4. Pileus streaked and spotted dark vinaceous brown on disc, paling to yellowish on margin; spores 6-9.5 x 4-6 μm *H. erubescens* var. *erubescens*, p. 69.
 4. Pileus yellowish at first, slowly becoming unevenly streaked and flushed with pink, sometimes pink overall, or light red-brown on disc; spores (4.5)5-7 x 3-4 μm *H. russula*, p. 70.

Series FULVENTES

Key to Species

1. Taste of pileal context bitter and odor of raw potatoes *H. tennesseensis*, p. 73.
1. Taste and odor not as above 2.
 2. Pileus disc rusty brown to tawny; lamellae adnate, or decurrent by a tooth at the most *H. pacificus*, p. 74.
 2. Pileus disc tan or vinaceous; lamellae decurrent. *H. monticola*, p. 74.

Series CAMAROPHYLLI

Key to Species

1. Pileus dry (check by sectioning) 2.
1. Pileus viscid 3.
 2. Spores 9.5-17 x 6-9 μm ; unexpanded pileus conic; stipe brown-streaked from a fibrillose veil *H. inocybiformis*, p. 77.
 2. Spores 7-11 x 4-6 (6.5) μm ; unexpanded pileus convex; stipe innately brownish, lacking a veil. *H. camarophyllus*, p. 78.
3. Stipe with ragged, fuscous or brown streaks and zones remaining from a fibrillose veil; pileus brownish. *H. olivaceoalbus* var. *olivaceoalbus*, p. 53, or the *H. olivaceoalbus* complex (Series *Olivaceoumbri*)
3. Stipe not as above 4.
 4. Odor distinctive; stipe white or becoming ashy to yellowish with age, but not fuscous-dotted 5.
 4. Odor not distinctive; mature stipe with fine to coarse brown squamules *H. tephroleucus* var. *tephroleucus*, p. 57. or *H. pustulatus*, p. 58. (Series *Olivaceoumbri*)
5. Spores 7-11 μm long; odor amygdaline; pileus persistently gray or brownish gray *H. agathosmus*, p. 81.
5. Spores 9.5-12.5(14) μm long; odor aromatic; pileus gray, becoming yellow-tinged with age *H. odoratus*, p. 82.

Section HYGROCYBE

Key to Subsections

1. Stipe and pileus both viscid (check fresh, moist specimens) Subsection PSITTACINI (below)
1. Stipe dry; pileus viscid or not. 2.
 2. Pileus viscid Subsection PUNICEI, p. 18.
 2. Pileus moist to dry Subsection HYGROCYBE, p. 18.

Subsection PSITTACINI

Key to Series

1. Pileus conic. Series PURI, p. 17.
1. Pileus convex to depressed 2.
 2. Pileus color in red, yellow, or green ranges Series PSITTACINI, p. 17.
 2. Pileus color gray to dull brown, drab Series INOLENTES, p. 18.

Series PURI

Key to Species

1. Pileus red, not blackening; spores 7.5-12.5 x 4-8 μm *H. ruber*, p. 89.

Series PSITTACINI

Key to Species

1. Sporophore bright olive green at first, soon fading to yellow but green persisting at stipe apex and gill edges; odor not distinctive *H. psittacinus* var. *psittacinus*, p. 90.
1. Sporophore not green, or green tints drab and confined to pileus and gill faces, and then odor mephitic 2.
 2. Pileus color a mixture of sordid olive, reddish, and yellow, fading to yellowish; stipe apex often pinkish livid; odor mephitic *H. laetus*, p. 93.

2. Pileus and stipe colors not as above 3.
3. Pileus red when young, slowly fading to yellow; disc not depressed
 *H. minutulus*, p. 94.
3. Pileus yellow-orange or yellow when young, depressed or not 4.
 4. Cheilocystidia filiform; odor mephitic *H. laetus*, p. 93.
 4. Cheilocystidia absent; odor not distinctive 5.
5. Pileus yellow, fading to white, convex-umbilicate to infundibuliform, persistently viscid *H. nitidus*, p. 97.
5. Pileus not fading to white, not umbilicate or infundibuliform. 6.
 6. Lamellae adnate to subdecurrent. *H. ceraceus*, p. 98.
 6. Lamellae adnexed to emarginate *H. chlorophanus*, p. 101.

Series INOLENTES

Key to Species

1. Pileus and stipe dark grayish brown to gray; odor not distinctive; clamp connections rare *H. unguinosus* var. *unguinosus*, p. 101.

Subsection PUNICEI

Key to Series

1. Pileus sharply to bluntly conic, expanding. Series CONICI, p. 18.
1. Pileus obtuse to convex or depressed. Series PUNICEI, p. 18.

Series CONICI

Key to Species

1. Sporocarp blackening with age or injury; pileus red 2.
1. Sporocarp not blackening; pileus orange, fading to yellow, obtusely conic at most. *H. flavescens* (Series *Punicei*), p. 106.
 2. Odor not distinctive; pileus medium red fading to streaky orange
 *H. conicus* var. *conicus*, p. 102.
 2. Odor strongly aromatic, pileus deep blood red, not fading
 *H. conicus* var. *atrosanguineus*, p. 105.

Series PUNICEI

Key to Species

1. Pileus orange when young, fading to yellow *H. flavescens*, p. 106.
1. Pileus red when fresh and moist. 2.
 2. Spores (8)8.5-12.5(13.5) μm long; pellicle well-developed, usually more than 100 μm deep; sporophores robust *H. puniceus*, p. 109.
 2. Spores (6.5)7-11(12) μm long; pellicle thin, less than 100 μm deep; sporophores slender, small *H. marchii*, p. 110.

Subsection HYGROCYBE

Key to Series

1. Pileus conic Series MARGINATI
1. Pileus convex to depressed 2.
 2. Pileus becoming fibrillose-scurfy to squamulose on the disc at maturity Series HYGROCYBE, p. 19.
 2. Pileus remaining glabrous to appressed fibrillose
 Series COCCINEI, p. 19.

Series MARGINATI

Key to Species

1. Lamellae bright orange, the color persisting at least on the edges after the pileus fades or is dried. *H. marginatus* var. *marginatus*, p. 111.
1. Lamellae yellow-orange, concolorous with the pileus or at least not brighter than it. *H. marginatus* var. *concolor*, p. 115.

Series HYGROCYBE

Key to Species

1. Pileus dull brown; context slowly bruising pinkish brown; odor nitrous. *H. nitiosus* (Series *Coccinei*), p. 120.
1. Pileus scarlet, fading to orange or yellow-orange 2.
 2. Lamellae long-decurrent *H. cantharellus*, p. 115.
 2. Lamellae adnate-subdecurrent to adnexed *H. miniatus* var. *miniatus*, p. 119.

Series COCCINEI

Key to Species

1. Pileus dull brown; context and lamellae slowly bruising pinkish to brown; odor nitrous *H. nitiosus*, p. 120.
1. Pileus red to yellow 2.
 2. Pileus red when moist and fresh, streaked with orange when faded 3.
 2. Pileus some shade of yellow or orange 4.
3. Spores 8-10.5(11) μm long; basidia 4-spored *H. coccineus*, p. 123.
3. Spores (7)10.5-14(15) μm long; basidia 1-, 2-, 3-, or 4-spored in varying proportions *H. puniceus* - *H. coccineus* complex
 4. Lamellae bright orange, the color persisting at least on the edges after the pileus fades; spores 7-11.5 μm long. *H. marginatus* var. *marginatus* (Series *Marginati*), p. 111.
 4. Lamellae yellow to light yellow-orange. 5.
5. Lamellae free; spores 12-16.5(18) μm long; basidia mostly 2-spored. *H. macrosporus*, p. 124.
5. Lamellae adnate to decurrent, spores 6-10 μm long, basidia mostly 4-spored 6.
 6. Clamp connections present; spores 3-5 μm broad *H. ceraceus* (Series *Psittacini*), p. 98.
 6. Clamp connections absent; spores 6-7 μm broad *H. marginatus* var. *concolor* (Series *Marginati*), p. 115.

Field Key to the Nova Scotian Species of *Hygrophorus*

We include a key based entirely on macroscopic features, as an alternative to the technical key when facilities for microscopy are not immediately available.

Collections to be identified with the field key should consist of fresh sporocarps in various stages of maturity. In *Hygrophorus*, sporocarps may change dramatically in color, shape, and surface characteristics from their first emergence to old age, and single specimens thus may not exhibit key features. As weather also influences color and viscosity to some degree, it is important to consider whether colors have been bleached by prolonged exposure to sunlight, or if gelatinization of cuticles has been hampered by drought, or whether gelatinous layers have been washed away by heavy rain. Distinctive odors, when present, are usually evanescent, and may not be detectable in old or dry specimens. Further, as some species have specific habitats or mycorrhizal affiliation, it is necessary to note associated vegetation at the time of collection.

A word of caution is appropriate here. The field key should not be regarded as an easy, foolproof substitute for the technical key. Like most large genera of Agaricales, *Hygrophorus* contains a number of closely similar species separable only by critical inspection of their microscopic as well as macroscopic anatomy. Exclusive reliance on the field key could cause new records for the province to be misidentified, as their distinguishing features may not occur in the key; such anomalies are more likely to be detected in the technical key. In any case, identifications made with the field key should be checked by microscopic examination.

1. Sporocarps lignicolous; pileus and stipe pallid yellowish, pruinose-tomentose. *H. lignicola*, p. 85.
1. Sporocarps terrestrial, or in moss or humus. 2.
 2. Odor aromatic, or of raw potatoes, freshly husked corn, almonds, or otherwise distinctive 3.
 2. Odor not distinctive (mild) or absent. 11.
3. Odor and taste of almonds (amygdaline); carpophores yellow-buff, robust. *H. monticola*, p. 74.
3. Not as above; if odor amygdaline, then taste unpleasant 4.
 4. Odor of raw potatoes or jasmine *H. tennesseensis*, p. 73.
 4. Odor otherwise 5.
5. Odor of green (freshly husked) corn *H. rainierensis*, p. 28.
5. Odor otherwise 6.
 6. Pileus bright red, blood red, reddish orange, orange, yellowish orange, or pinkish orange; stipe more or less concolorous. 7.
 6. Pileus pallid dingy yellowish, gray, russet, or brown; stipe paler. 8.
7. Pileus deep blood red and bruising black; lamellae yellow, also bruising black; odor aromatic *H. conicus* var. *atrosanguineus*, p. 105.
7. Pileus not colored as above; odor mephitic *H. laetus*, p. 93.
 8. Flesh slowly bruising pinkish to brown; odor nitrous, penetrating *H. nitiosis*, p. 120.
 8. Flesh not bruising; odor otherwise. 9.
9. Pileus tawny or rusty brown, at least on the disc *H. pacificus*, p. 74.
9. Pileus gray, lacking brown or yellow tints except at maturity 10.
 10. Odor amygdaline; stipe white, cinerescens; pileus persistently gray *H. agathosmus*, p. 81.
 10. Odor aromatic; stipe not cinerescens; pileus developing yellowish tints with age *H. odoratus*, p. 82.
11. Sporocarps entirely white or whitish, or white with yellow granules on pileal margin and/or stipe apex 12.
11. Sporocarps colored, at least on pileal disc 16.
 12. Sporocarp with yellow granules on pileal margin and/or stipe apex *H. chrysodon*, p. 40.
 12. Sporocarp not as above. 13.
13. Pileus viscid 14.
13. Pileus dry or moist, but not viscid 15.
 14. Pileus usually under 3 cm diameter, margin translucent-striate moist; stipe not viscid *H. niveus*, p. 23.
 14. Pileus usually over 3 cm diameter, not striate; stipe viscid when young *H. eburneus*, p. 43.
15. Pileus glabrous, persistently white, faintly striate when moist; stipe initially stuffed, soon hollow *H. borealis* f. *borealis*, p. 27.
15. Pileus pruinose or fibrillose in age, becoming pallid yellowish on disc, not striate (may be striatulate when wet); stipe solid, becoming stuffed at maturity *H. virgineus*, p. 28.

16. Pileus pinkish buff or pale tan; stipe stout, white with coarse apical squamules which turn yellow-brown to red-brown with age *H. pudorinus* var. *pudorinus* f. *pudorinus*, p. 62.
16. Not with the above combination of characters 17.
17. Pileus scarlet, reddish orange, orange, yellowish orange or yellow, at least on disc 18.
17. Pileus pallid, beige, dingy yellow-brown, brown, olive, gray, pinkish or dull vinaceous, or in combinations of these colors 40.
18. Pileus conic, red fading to orange tones; sporocarps slowly bruising gray, then black *H. conicus* var. *conicus*, p. 102.
18. Not with the above combination of characters 19.
19. Pileus viscid to glutinous 20.
19. Pileus moist or dry 33.
20. Stipe viscid except at apex, or with only a sparse gelatinous superior ring, whitish overall or streaked yellow, orange or olive-brown beneath a white or yellow apex 21.
20. Stipe not viscid, or viscid over *entire* length, not annulate, and strongly colored overall 25.
21. Pileus with reddish or dark orange colors 22.
21. Pileus with yellow colors 23.
22. Red color present only in old pilei, and disc tending to remain brown; under 2-needle pines *H. hypothejus*, p. 53.
22. Red color present in young pilei, persisting at least on the disc; under larch *H. speciosus* var. *speciosus*, p. 44.
23. Pileal disc persistently brown, margins yellowish *H. hypothejus*, p. 53.
23. Pileal disc yellow, margins yellow to whitish 24.
24. Lamellae yellowish in age; yellow tints on mature stipe caused by colored surface fibrils *H. gliocyclus*, p. 50.
24. Lamellae persistently whitish; yellow tints on stipe caused by gelatinous veil *H. flavodiscus*, p. 49.
25. Stipe viscid to glutinous 26.
25. Stipe not viscid (do not handle excessively, or some stipes may become slightly tacky) 31.
26. Pileus conic, in age plane with a small acute umbo, red fading to orange *H. ruber*, p. 89.
26. Pileus convex to plane 27.
27. Pileus and lamellae yellow-orange with green tints on edges *H. psittacinus* var. *psittacinus*, p. 90.
27. Pileus and lamellae lacking green tints 28.
28. Pileus and stipe initially red, fading to yellowish *H. minutulus*, p. 94.
28. Pileus and stipe not red in young sporocarps 29.
29. Lamellae adnexed to emarginate *H. chlorophanus*, p. 101.
29. Lamellae adnate to decurrent 30.
30. Margin incurved in young pilei; old pileus fading whitish; pileus and stipe persistently viscid *H. nitidus*, p. 97.
30. Margin not incurved; pileus not fading whitish; pileus and stipe subviscid, soon drying *H. ceraceus*, p. 98.
31. Pileus yellow to orange-yellow, lacking red tints *H. flavescens*, p. 106.
31. Pileus persistently red, with partial fading to orange or yellow-orange in age 32.
32. Stipe over 5 mm thick; pileus obtusely conic or with pronounced umbo *H. puniceus*, p. 109.
32. Stipe less than 5 mm thick; pileus convex to centrally depressed *H. marchii*, p. 110.

33. Pileal disc fibrillose-scurfy, usually depressed at maturity 34.
33. Pileal disc not as above 35.
34. Lamellae clearly decurrent *H. cantharellus*, p. 115.
34. Lamellae adnexed to adnate *H. miniatus* var. *miniatus*, p. 119.
35. Sporocarp uniformly yellow to yellow-orange. 36.
35. Sporocarp orange or with pronounced dark orange tints 38.
36. Lamellae free *H. macrosporus*, p. 124.
36. Lamellae adnate to uncinata. 37.
37. Pileus conic; stipe over 4 mm thick.
- *H. marginatus* var. *concolor*, p. 115.
37. Pileus not conic; stipe under 4 mm thick *H. ceraceus*, p. 98.
38. Lamellae persistently brilliant orange, at least on edges
- *H. marginatus* var. *marginatus*, p. 111.
38. Lamellae not so colored 39.
39. Lamellae decurrent at maturity; pileus tawny or rarely carrot red, fading to orange or tan. *H. pratensis* var. *pratensis*, p. 35.
39. Lamellae not decurrent; pileus and stipe red. *H. coccineus*, p. 123.
40. Pileus whitish; lamellae and stipe yellow *H. nitidus*, p. 120.
40. Not with the above combination of characters. 41.
41. Pileus green, at least on margin; stipe viscid over entire length
- *H. psittacinus* var. *psittacinus*, p. 90.
41. Pileus lacking green tints. 42.
42. Lamellae whitish with vinaceous spots and stains, or flushed with pink, or dull rose overall. 43.
42. Lamellae not colored as above 47.
43. Stipe with a cottony or appressed fibrillose annulus 44.
43. Stipe lacking an annulus 45.
44. Annulus resulting from a partial veil, cottony when young; pileus and stipe densely streaked vinaceous *H. purpurascens*, p. 65.
44. Annulus not velar in origin, merely aggregated colored fibrils. Pileus whitish with vinaceous streaks and stains on disc; stipe sparsely streaked vinaceous *H. erubescens* var. *erubescens*, p. 69.
45. Pileus and stipe uniformly dusky vinaceous or nearly so; lamellae paler, becoming sordid pinkish buff *H. capreolarius*, p. 66.
45. Pileus and stipe colors not uniform, or else paler than above 46.
46. Pileus whitish and streaked or stained dark vinaceous brown on disc.
- *H. erubescens* var. *erubescens*, p. 69.
46. Pileus becoming unevenly streaked and flushed with pink, or pink overall, or light red-brown on disc. *H. russula*, p. 70.
47. Pileus viscid (moisten dry pilei to check) 48.
47. Pileus not viscid 55.
48. Stipe viscid over entire length, slender, grayish to blackish; pileus concolorous with stipe. *H. unguinosus* var. *unguinus*, p. 101.
48. Stipe not viscid, or else viscid to glutinous except at apex 49.
49. Lamellae white or whitish 50.
49. Lamellae colored 53.
50. Stipe initially white, with squamulose ornamentation which becomes cinereous to fuscous 51.
50. Stipe not as above 52.
51. Pileus to 3 cm broad; stipe 2-5 mm thick at apex
- *H. tephroleucus* var. *tephroleucus*, p. 57.
51. Pileus over 3 cm broad; stipe 5-10 mm thick at apex *H. pustulatus*, p. 58.
52. Stipe with fuscous to medium brown streaks and patches except at the white apex, the colored portion initially glutinous but often soon drying *H. olivaceoalbus* var. *olivaceoalbus*, p. 53.

52. Stipe persistently white or whitish, the lower portion persistently glutinous. *H. fuliginus*, p. 54.
53. Lamellae gray, pileus gray to cream *H. murinus*, p. 32.
53. Lamellae colored otherwise. 54.
54. Lamellae pale yellowish green *H. hypothejus*, p. 53.
54. Lamellae buff to pinkish. *H. colemannianus*, p. 31.
55. Lamellae white or whitish 56.
55. Lamellae distinctly colored 57.
56. Young pileus conic; stipe white at apex, with fuscous streaks and patches below *H. inocybiformis*, p. 78.
56. Young pileus convex; stipe brownish overall, the color not in streaks or patches. *H. camarophyllus*, p. 78.
57. Lamellae gray to dull violet; pileus gray-brown to drab rose with an overlying thin layer of surface fibrils *H. canescens*, p. 36.
57. Not as above 58.
58. Lamellae yellowish to grayish yellow; stipe streaked brown, with white apex *H. inocybiformis*, p. 77.
58. Not as above 59.
59. Stipe persistently pale yellow, taste of flesh faintly subnauseous *H. subfuscescens* var. *subfuscescens*, p. 39.
59. Stipe drab yellow-brown, pinkish buff, or brown; taste none *H. hymenocephalus*, p. 39.

Descriptions of the Species

Subgenus HYGROPHORUS

Spores white, smooth or rarely nodulose, amyloid or not. Lamellar trama various, not reddish in KOH.

Section CAMAROPHYLLOPSIS Hes. & Sm. (not *Camarophyllopsis* Herink)

N. Am. Spec. of *Hygrophorus*, p. 48, 1963

Lamellar trama intricately interwoven; pileal cuticle not hymeniform; hymenial cystidia absent; spores smooth, inamyloid.

Type species: *H. pratensis* (Fr.) Fr.

Subsection CAMAROPHYLLOPSIS

Spores at least 6-8 μm long, ellipsoidal.

Series VIRGINEI (Bataille) Hes. & Sm.

N. Am. Spec. of *Hygrophorus*, p. 49, 1963

Pileus white.

Type species: *H. virgineus* (Fr.) Fr.

1. *Hygrophorus niveus* Fr.

Epicr. Myc., p. 327. 1838.

Camarophyllus niveus (Fr.) Wünsche, Die Pilze, p. 115. 1887.

Hydrocybe nivea (Scop.) Murr., N. Am. Flora 9: 377. 1916.

Figs 6, 7, 8.

Basidiocarp: Pileus 1-3(6) cm broad, obtuse to convex young, later broadly convex to

plane, often depressed or umbilicate, occasionally with small, low umbo, viscid to resinous, glabrous, margin usually conspicuously striate moist; white, becoming pale, yellowish white (2A2) (ISCC-92) in age; context thin (1-3 mm on disc), often hollow on disc in depressed pilei, white, fibrous; odor and taste not distinctive. Lamellae decurrent, concolorous with or slightly more yellowish than the pileus, broad to medium broad (2.5-7 mm), subdistant, sometimes intervenose or forked, thickish, edges even. Stipe 4-5.5 cm long, 3-12 mm thick at apex, concolorous with the pileus, white within, dry, glabrous to satiny, equal or tapering downward, at times subcompressed, stuffed, becoming hollow.

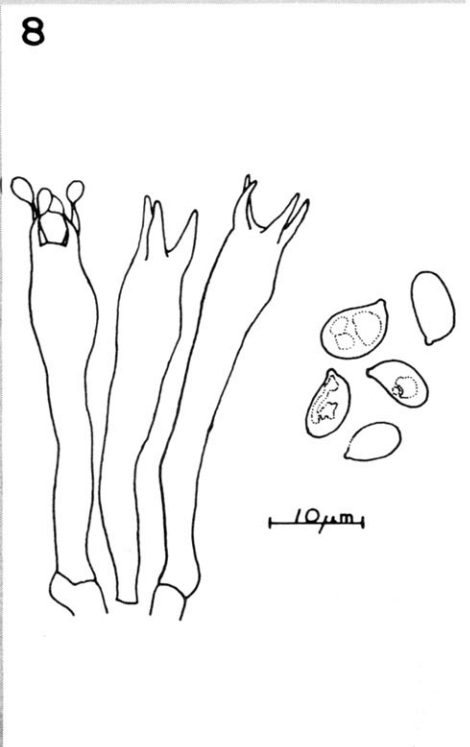
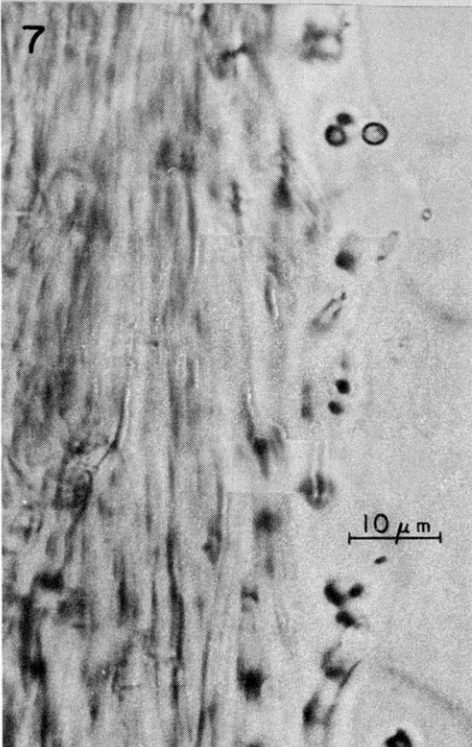
Microscopic Structures: Spores 7-9.5(10.5) x 3.5-5 μm , obovate to ellipsoidal, occasionally ovate, smooth, inamyloid. Basidia 32-47 x 6-9.5 μm , long-clavate, slender or rather stout, mostly 4-spored, occasionally 3-spored in the same gill, the sterigmata up to 6 μm long. Pleurocystidia and cheilocystidia none. Gill trama of interwoven hyphae 2-14 μm broad. Cuticle a narrow ixocutis 16-40 μm deep, the hyphae more or less repent and radial, occasionally erect, gelatinized, 2.5-3(5) μm broad. Pileal trama of radial, interwoven hyphae; hypodermium none. Clamp connections present in the cuticle, gill trama, and pileal trama.

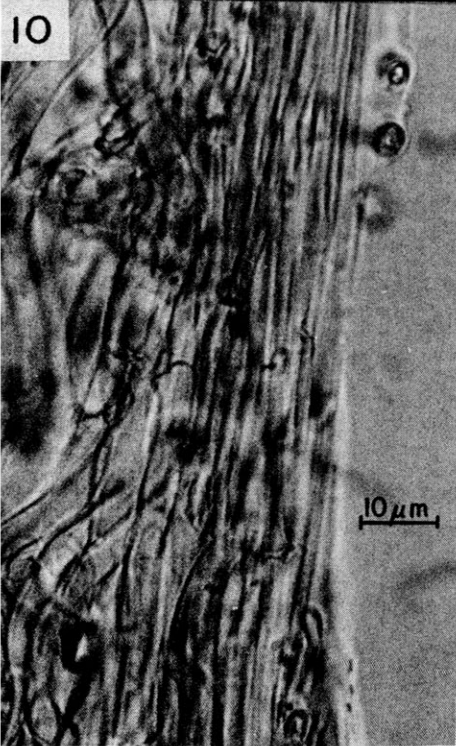
Habit and Habitat: Scattered to gregarious, in grassy clearings or in deciduous woods.

Material Studied: ACAD 12113, Hell's Gate, Kings Co., 21 Oct. 1967; ACAD 12266, Moose River, Pictou Co., 14 Oct. 1968.

Remarks: Typically, *H. niveus* is small, depressed to umbilicate, viscid, and coarsely striate when moist. However, ACAD 12266 is large (pileus up to 6 cm broad), convex and scarcely umbonate, resinous, and non-striate, more like *H. borealis* f. *borealis*. The depth of the pellicle places it in *H. niveus*, with the more typical specimens of ACAD 12113. (See the discussion of *H. borealis* f. *borealis* for further comparison of the 2 species).

Collection ACAD 12206 (Washabuck, Victoria Co., 25 Sept. 1968) answers the description of *H. niveus*, but appears to lack clamp connections, even at the bases of the basidia. As the significance of clamps is poorly understood (Smith, 1966), environmental influence on clamp development should be investigated before such anomalies are classed as distinct varieties.





2. *Hygrophorus borealis* Pk. f. *borealis*

N.Y. State Mus. Ann. Rep. 26:64. 1874.

Camarophyllus borealis (Pk.) Murr., N. Am. Flora 9: 385. 1916*Omphalina tepeitensis* Murr., N. Am. Flora 9: 348. 1916.

Figs 9, 10, 11.

Basidiocarp: Pileus 0.5-3 cm broad, at first convex-depressed or disc at least flattened, expanding broadly convex to plane, moist to slightly resinous, margin faintly striate moist; milk white (1A2) (ISCC-104) or whiter, becoming pale, yellowish white (2A2) (ISCC-92) in age; context thin on disc (1-1.5 mm), membranous over gills, whitish, fragile; odor and taste not distinctive. Lamellae decurrent, occasionally adnexed and uncinatate, whitish to pale yellow (2A3) (ISCC-104), subdistant, moderately broad (2-2.5 mm), thickish, at times intervenose, edges even. Stipe 2-5.5 cm long, 2-5 mm thick at apex, concolorous with the pileus, white within, dry, glabrous, with a dull pearly lustre, equal or slightly tapered downward, terete, stuffed, soon becoming hollow.

Microscopic Structures: Spores 7-9.5 x 4-6 μm , mostly ellipsoidal, some approaching pyriform or obovate, smooth, inamyloid, Basidia 29-38 x 6.5-11.5 μm , narrowly clavate, rather short, 4-spored, the sterigmata slender, up to 6 μm long. Pleurocystidia and cheilocystidia absent. Gill trama of interwoven hyphae 3.5-14 μm broad. Cuticle a thin layer, 6.5-9.5 μm deep (about 3-5 hyphae), of repent, radial, subgelatinous hyphae 1.7-3 μm broad. Pileal trama of interwoven, radially oriented hyphae 3.5-11.5 μm broad, similar to gill tramal hyphae, gradually transitional to the cuticular hyphae; hypodermium absent. Clamp connections present in the cuticle, lamellar trama, and pileal trama.

Habit and Habitat: Scattered to gregarious in moss and leaf mould under beech and *Osmunda* species.

Material Studied: ACAD 12194, Perry Road, Yarmouth Co., 22 Sept, 1968.

Remarks: This beautiful white fungus is apt to be confused with *H. virgineus* or *H. niveus*. The pileus of *H. virgineus* is moist to dry, and the slightly broader cuticular hyphae are never gelatinous. Moreover, the spores of *H. virgineus* are slightly larger, regularly ranging up to 12 μm long, although Hesler and Smith (1963) mentioned collections of *H. borealis* having 2-spored basidia with spores of this length.

Hygrophorus borealis is very close to *H. niveus* and Singer (1951) has suggested that they may be a single species. The critical difference used by Hesler and Smith (1963), and applied here, is the degree of gelatinization in the cuticle. *H. borealis* has a few, narrow, subgelatinous hyphae on its pileal surface. *H. niveus* possesses a pellicle at least 15 μm thick. Should these features prove variable, *H. borealis* would be synonymous with *H. niveus*.

Figs 9-11. *H. borealis* f. *borealis*. Fig 9. ACAD 12194, X 1.0. Fig 10. pileal cuticle of ACAD 12194 in radial section, showing little or no gelatinization. Fig 11. ACAD 12113, basidia and spores.

3. *Hygrophorus virgineus* (Fr.) Fr.

Epicr. Myc., p. 327. 1838.

Agaricus virgineus Fr., Syst. Myc. 1: 100. 1821.

Camarophyllus virgineus (Fr.) Kummer, Führ. in Pilzk., p. 117. 1871.

Figs 12, 13.

Basidiocarp: Pileus 2-6 cm broad, convex when young, becoming plane to slightly depressed, moist to dry, margin sometimes striatulate when rainsoaked; surface subglabrous centrally, slightly pruinose on margins; white or pallid with yellowish disc; context white, soft, unchanging; odor absent to sometimes pleasant, taste not distinctive. Lamellae decurrent, subdistant to distant, pallid or concolorous with pileus. Stipe 3-8 cm long, 3-8 mm thick, white, tapering, glabrous to slightly pruinose; context solid becoming stuffed, pallid.

Microscopic Structures: Spores 8-10 (12.5) x 5-7 μm , short-elliptical, rarely obovate, smooth, inamyloid. Basidia 35-50 x 7.5-10 μm , narrowly clavate, often enlarged at apex, 4-spored, very rarely 1- or 2-spored, the sterigmata stout, up to 6 μm long. Pleurocystidia and cheilocystidia none. Gill trama of interwoven hyphae 3-16 μm broad. Cuticle of repent, nongelatinous hyphae 1.5-4 μm broad, little differentiated from context. Pileal trama of interwoven, radially disposed hyphae 4-17.5 μm broad; hypodermium none. Clamp connections present in the hyphae of the cuticle, gill trama, and pileal trama.

Habit and Habitat: "Gregarious on soil, at times among moss, in deciduous and coniferous, and mixed woods . . ." (Hesler & Smith 1963).

Material Studied: ACAD 7190, Lake Kejimikujik, Annapolis Co., 22 Sept. 1962.

Remarks: *Hygrophorus virgineus* is easily distinguished from *H. niveus* by its non-viscid pileus and larger spores. Separation from *H. borealis* f. *borealis* is more difficult and depends on the combination of a nongelatinous epicutis and slightly larger spores in *H. virgineus*.

Series VISCIDI (Sm. & Hes.) Hes. & Sm.

N. Am. Spec. of *Hygrophorus*, p. 61. 1963

Pileus other than white, viscid; spores usually longer than 6.5 μm ; lamellar trama interwoven.

Type species: *H. subviolaceus* Pk.

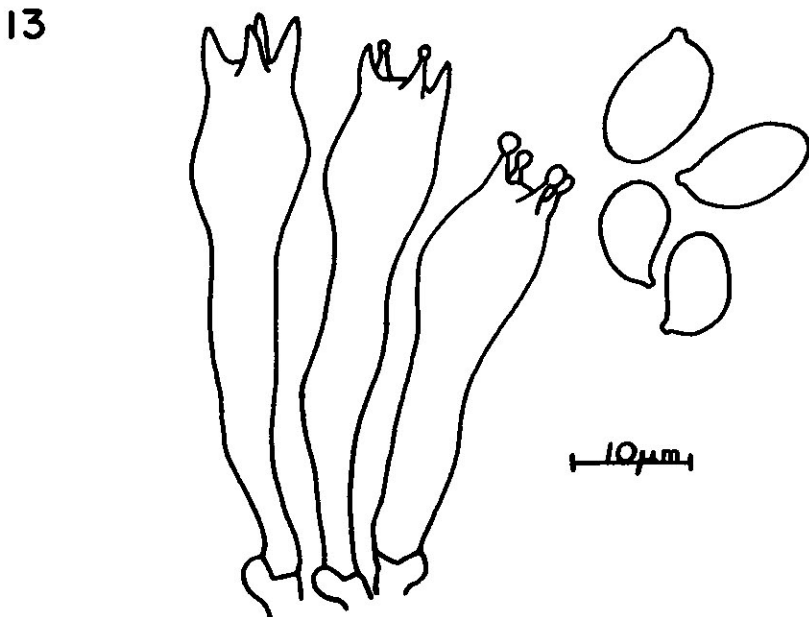
4. *Hygrophorus rainierensis* Hes. & Sm.

N. Am. Spec. of *Hygrophorus*, p. 64. 1963.

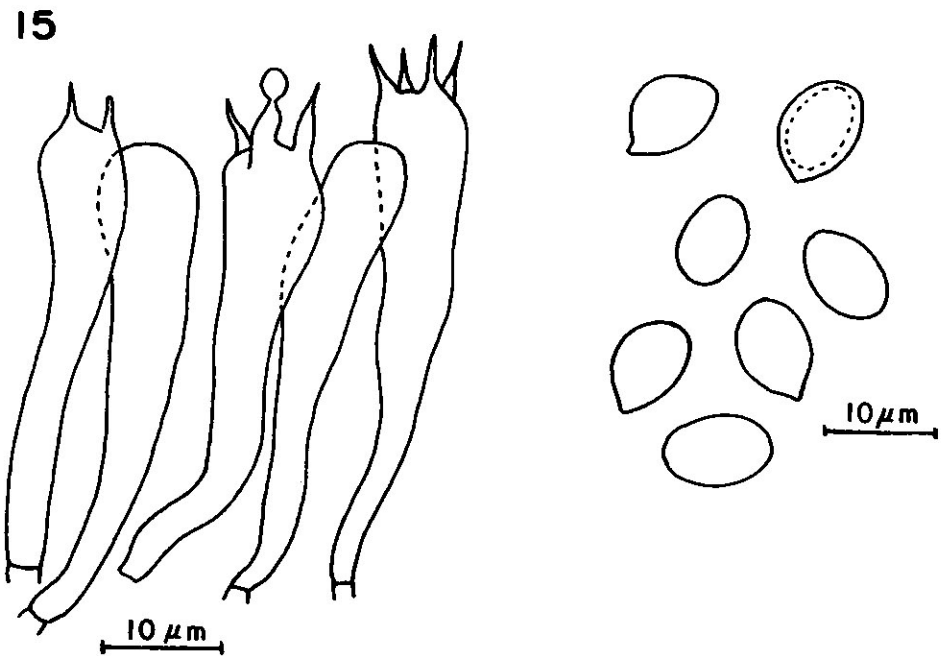
Figs 14, 15.

Basidiocarp: Pileus 2.5-5 cm broad, convex becoming plane and often depressed in age, occasionally subumbonate when plane, viscid, glabrous, hygrophanous; margin striatulate, irregular, wavy; gray to olive gray (1E2) (ISCC 113) on disc, becoming medium gray (1E1) (ISCC 265) on margin; context pale gray (1B1) (ISCC 264), thick at disc, unchanging; odor strongly of freshly husked green corn, taste farinaceous and unpleasant to nearly mild. Lamellae deeply decurrent, edges eroded, platinum (1D1) (ISCC 265). Stipe 3-6 cm long, 5-9 mm thick, equal, often curved, dry, glabrous, pallid or whitish, lighter at base, unchanging; context solid, becoming stuffed.

Microscopic Structures: Spores (4.5)6-8(9) x 4-5.5 μm , subglobose to broadly ellipsoid, inamyloid. Basidia 38-48 x 5-8 μm , long-clavate, mostly 4-spored. Pleurocystidia and cheilocystidia absent. Lamellar trama interwoven. Cuticle an ixotrichodermium,



Figs 12, 13. *H. virgineus*. Fig 12. Smith 64497, X 1.5. Fig 13. ACAD 7190, basidia and spores.



Figs 14, 15. *H. rainierensis*. Fig 14. Courtesy of K.A. Harrison, X 1.25. Fig 15. ACAD 11978, basidia and spores.

becoming appressed at maturity, 45-80 (120) μm thick, of irregular hyphae (1.5)2-3.5 μm broad; pileal trama radial. Clamp connections present but rare, small.

Habit and Habitat: Gregarious in coniferous forest.

Material Studied: ACAD 11978, West Gaspereau, Kings Co., 12 Oct. 1977.

Remarks: This species is easily identified by its gray, viscid pileus, decurrent lamellae, and odor of freshly husked green corn. *H. murinus* is similar, but lacks an odor and has much larger spores than *H. rainierensis*. Two other closely related species, *H. nordmanensis* and *H. subviolaceus*, do not occur in Nova Scotia. *H. fuliginus* may superficially resemble *H. rainierensis*, but is extremely glutinous on both stipe and pileus, has a divergent lamellar trama, and also lacks a distinctive odor.

5. *Hygrophorus colemannianus* Blox. apud Berk.

Outl. Brit. Fungol., p. 200. 1860.

Camarophyllus colemannianus (Blox. apud. Berk.) Ricken, Vademecum für Pilzfreunde, p. 197. 1920.

Figs 16, 17.

Basidiocarp: "Pileus 1-4.5 cm broad, obtuse to turbinate, sometimes broadly convex to nearly plane in age or with the margin recurved slightly, sometimes with a low obtuse umbo, the margin decurved, color evenly 'walnut brown' to 'cinnamon brown', hygrophanous, fading to 'fawn color' or 'avellaneous' and finally 'cinnamon buff' to 'vinaceous buff' (dull, deep rusty brown fading to avellaneous or buff), glabrous, viscid and shining, with a thin separable pellicle, the margin translucent striate when moist. Context concolorous with the surface, no color change when bruised, thick under the disc, thin toward the margin, fragile; odor and taste mild.

Lamellae arcuate and soon distinctly decurrent, 'avellaneous' to 'vinaceous buff' fading to 'tilleul buff' (whitish) at times, close to subdistant (20-26 reach the stipe), narrow to moderately broad, many forking near their outer extremities, usually one tier of lamellulae, edges entire.

Stipe 3-6(8) cm long, 4-7 mm thick, white, equal or narrowed toward the base, solid or with a narrow tubule, glabrous, not viscid, apex merely silky and not pruinose." (Hesler & Smith, 1963).

Microscopic Structures: Spores 6.5-8(9.5) \times 4.5-6(7) μm , short-elliptical to obovate, smooth, inamyloid. Basidia 40-53(62) \times 7-8.5(10.5) μm , clavate, slender, 4-spored, the sterigmata up to 7 μm long. Pleurocystidia and cheilocystidia absent. Gill trama of interwoven hyphae 2-10 μm broad, the mediostrate reviving brownish in KOH where it joins the pileus. Cuticle an ixocutis 43-69 μm deep, the hyphae gelatinous, radial, usually repent but occasionally erect, colorless, 1-3 μm broad. Pileal trama of radial, slightly interwoven hyphae 2.3-11.5 μm broad, reviving brownish in KOH. Clamp connections present in the cuticle, gill trama, and pileal trama.

Habit and Habitat: "Gregarious on humus in oak and beech woods . . ." (Hesler & Smith 1963).

Material Studied: ACAD 288, Agriculture Experimental Station, Kentville, Kings Co., 10 Sept. 1933.

Remarks: *Hygrophorus colemannianus* is distinguished by its brown, viscid pileus, its white stipe, and its whitish to pinkish gills. The hypodermium of radial, parallel, brown hyphae, described by Hesler and Smith (1963), appears to constitute the entire pileal trama in the material examined here.

6. *Hygrophorus murinus* Bird & Grund.

Can. J. Bot. 48: 408-409. 1970.

Figs 18, 19.

Basidiocarp: Pileus 2-6 cm broad, convex, becoming plano-convex, often subumbonate, finally plane to shallowly depressed with uplifted margin, slightly viscid to resinous, glabrous to appressed fibrillose, nougat (5D3) (ISCC-60) or dust (5D2) (ISCC-63), often zonate, bleaching with age to pale cream, sometimes with dark blond (5D4) (ISCC-77) zones or tints on umbo; context 1.5-5.5 mm on disc, thick when young, thinner with age, cinereous under pellicle, whitish elsewhere; odor and taste mild, not distinctive. Lamellae decurrent, birch gray (5C2) (ISCC-63) to dust (5D2) (ISCC-63), bleached and yellowed by age and frost, narrow (2-6.5 mm broad) subdissectant, often intervenose, thin to thickish, edges even. Stipe 3-5 cm long, 4-12 mm thick at apex, white, tinted cream, sometimes yellowish at base, especially when handled, appressed fibrillose, equal or tapering downward, terete.

Microscopic Structures: Spores 7-9.5(10.5) x (4.5)5-6 μm , short-elliptical, smooth, inamyloid. Basidia 43-56(68) x 7-9.5 μm , narrowly clavate, 4-spored, the sterigmata stout and prominent, up to 6.5 μm long. Pleurocystidia and cheilocystidia absent. Gill trama interwoven, the hyphae 3-10.5(15.5) μm broad. Cuticle a thin ixotrichodermium, 24-84 μm deep, the hyphae 1-3 μm broad, generally erect, often becoming repent after drying and then forming an ixocutis. Pileal trama of radial, interwoven hyphae 3-25(31) μm broad. Clamp connections conspicuous, present in the cuticle, gill trama, and pileal trama.

Habit and Habitat: Gregarious to subcespitate in hemlock-white birch woods.

Material Studied: ACAD 12120 (type), Gaspereau Valley, Kings Co., 3 Nov. 1967; ACAD 12258, Waternish, Guysborough Co., 14 Oct. 1968.

Remarks: *Hygrophorus murinus* is one of several related gray-gilled species of Subsection *Camarophylloopsis*. In the most recent North American monograph (Hesler & Smith 1963), this fungus keys to *H. nordmanensis* Hes. & Sm., which differs in having a green-corn odor and lacking clamp connections, although the authors cautioned against stressing the importance of the latter feature. The tendency of the lower stipe to stain yellow places *H. murinus* close to the European species *H. lacmus* Fr.; however, the Nova Scotian material lacks the pileal striations and reddish tints of *H. lacmus*. Moreover, *H. lacmus* has subglobose spores, usually about 6 μm and never more than 7.5 μm long (Lange 1940; Wakefield & Dennis 1950). Bresadola's (1928) description of *H. lacmus* applies to the above Nova Scotian collections, but differs so widely from other concepts of *H. lacmus* that Bresadola appears to be in error. *H. murinus* also closely resembles *H. subviolaceus* Pk., which has a bitter or subnauseous to acrid taste and a pileal context more-or-less concolorous with the pileal surface (Hesler & Smith 1963).