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ECTOMYCORRHIZAE OF MAINE

3. A LISTING OF *HYGROPHORUS* WITH THE ASSOCIATED HOSTS

(with additional information on edibility)



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INTRODUCTION

Hygrophorus Fr. of the family Hygrophoraceae are gilled mushrooms that produce a light colored spore deposit. They grow abundantly on the soil of both coniferous and deciduous forests in Maine during the summer and fall seasons. Hygrophori are one of the more common woodland mushrooms. Most species are ectomycorrhizal and many are edible. Only a few are suspected of being poisonous. Therefore, it is important to know the *Hygrophorus* species and their woody plant associates.

The genus *Hygrophorus* is somewhat difficult to describe; yet, with a little field experience a mushroom collector can soon recognize members of this genus which includes about 200 species. *Hygrophorus* species can be recognized on the basis of field characteristics alone. The colorful mushroom caps have a lustrous waxy or even moist to slimy appearance. The stipes are often fleshy with decurrent lamellae. The lamellae are relatively thick, widely spaced and veins may be found between them. The lamellae have a waxy texture when rubbed between the fingers. These waxy lamellae are used as the principal characteristic for identifying the genus *Hygrophorus* by most specialists, although in our opinion it is not as easy as most mycologists suggest to recognize this waxiness.

Some mycologists split this genus into several genera. For convenience we decided to follow the traditional classification and placed all species into one genus, *Hygrophorus*.

Hygrophori occur most frequently in forests, along edges of forests under shrubs or in *Sphagnum* bogs (1). They can be found less commonly in pastures or grassy areas beside woodlots. Certain ones are found only in association with specific seed plants. For example, *Hygrophorus speciosus* is found almost exclusively under larch. A number of species, *H. fuliginus*, *H. olivaceoalbus* and *H. monticola*, are found most often under white spruce. *Hygrophorus sordidus* and *H. russula* are found in deciduous woods, especially associated with red oak. When specific association occurs, the relationship is taken as evidence for ectomycorrhizal association.

In Maine, *H. turundus* is found only in *Sphagnum* bogs containing black spruce and larch in late summer and early fall; but, whether *H. turundus* is a saprophyte/parasite on *Sphagnum* or ectomycorrhizal with black spruce is not clear. Here *H. turundus* is listed only as an associate of *Picea mariana*, black spruce. To confirm this association, black spruce seedlings are grown aseptically in sterilized soil and a pure culture of *H. turundus* grown from tissue or spores is added to see whether mycorrhizae then form. This is a difficult and very time-consuming task.

Some of the forest-inhabiting *Hygrophorus* species are very generalized, occurring under both hardwoods and conifers. These species are more difficult to classify as mycorrhizal and may form rather non-specific associations or they may be merely saprophytes. *Hygrophorus nitratus*, *H.*

psittacinus, *H. unquinosus*, *H. perplexus* and *H. deceptivus*, are examples of ambiguous ectomycorrhizal fungi. These fungi are listed under the Maine possible host and not under the many possible associated hosts mentioned in the literature.

Hygrophorus spadiceus and *H. conicus* var. *conicus* are often found on soil following a forest fire and these two species have been frequently collected in blueberry fields that have been pruned the previous year by burning. *Hygrophorus spadiceus* and *H. conicus* var. *conicus* are suspected mycorrhizal associates of the lowbush blueberry, a common shrub in the succession of burned areas in the Northeastern United States.

It is likely that some members of *Hygrophorus* are saprophytes and not ectomycorrhizal at all. For example, *H. cantharellus* is found growing on decaying wood (5), deciduous leaves and plant debris in low wet areas. In such instances the species is listed as an associate with the predominant higher plant in the collecting area.

Often there is no information available on the edibility of certain *Hygrophorus* species. When information is available, most *Hygrophori* are reported to be edible; and only a few are suspected or cited as possibly poisonous. *H. conicus* var. *conicus* is one that is considered poisonous.

The first report on the ectomycorrhizae of Maine was a listing of Boletaceae with the associated hosts (3). A second listing, with the addition of information on edibility, was published on ectomycorrhize of the genus *Lactarius* with their associated hosts (4). The present report follows the format of the 1981 publication on ectomycorrhizal *Lactari*. Mycorrhizal associations and edibility are compared with those of Bird and Grund (1), Hesler and Smith (2), Lincoff (5), Pomerleau (6), Smith (7) and Smith *et al.* (8).

The format followed in reporting hosts and their associated fungal species is:

Host (Scientific Name: Common Name.)

Fungus (Scientific Name; collector and collection number identifying specimens in the University of Maine Herbarium at Orono.)

Figure number. Figure numbers refer to the color plates. For convenience, the listing is divided into coniferous hosts and deciduous hosts. The trees and the fungi are listed in alphabetical order according to scientific name. A comment on edibility is given at the end of each species discussed.

MYCORRHIZAL HOSTS

CONIFEROUS HOSTS:

Abies balsamea (L.) Mill.: Balsam Fir

Hygrophorus pudorinus (Fr.) Fr. var. *pudorinus*; Homola 6415 (Fig. 9). We found *H. pudorinus* in woods where spruce and fir woods

predominate. Hemlock was also very common.

Hygrophorus pudorinus is reported to be edible according to Lincoff (5) and Smith *et al.* (8).

Larix laricina (DuRoi) K. Koch: Tamarack; Eastern Larch

Hygrophorus speciosus Pk. var. *speciosus*.

Homola 4101 (Fig. 14). We found *H. speciosus* under tamarack. Lincoff (5) cites it as edible.

Picea glauca (Moench) Voss: White Spruce; Cat Spruce

Hygrophorus agathosmus Fr.; Homola 5072 (Fig. 10). We found

H. agathosmus in spruce and fir woods.

Lincoff (5) cites it as edible.

Hygrophorus camarophyllus (Fr.) Dumel, Frandjean, et Marie; Homola 4096 and 7756 (Fig. 11). We found *H. camarophyllus* under white spruce.

Smith *et al.* (8) and Lincoff (5) consider *H. camarophyllus* to be edible.

Hygrophorus fuligininus Frost apud Pk.; Homola 5861 (Fig. 13). For more information see *H. fuligininus* under *Pinus strobus*.

Hygrophorus monticola Hes. & Sm.; Homola 5471 (Fig. 8). Hesler and Smith (1) report *H. monticola* in a larch, spruce and fir woods from the western United States. In the East we find it in spruce and fir woods.

Smith *et al.* (8) reported *H. monticola* as edible but not highly rated. Because of its odor like bitter almonds, we caution anyone attempting to eat *H. monticola* because the bitter almond odor is associated with cyanide.

Hygrophorus olivaceoalbus (Fr.) Fr. var. *olivaceoalbus* Homola 5874 (Fig. 12). Hesler and Smith (2) reported *H. olivaceoalbus* under

spruce and redwood. We find it in a predominantly spruce forest.

Hemlock and an occasional white pine were often in the area also. Lincoff (5) reported *H. olivaceoalbus* as edible, but recommends caution. Pomerleau (6) cites it as edible and rates it very good.

Hygrophorus purpurascens (Fr.) Fr.; Homola 6141 (Fig. 6). We found

H. purpurascens commonly under spruce in Maine.

Smith *et al.* reported *H. purpurascens* as edible but sometimes bitter.

Hygrophorus tephroleucus. No collection number cited (Fig. 44). We found *H. tephroleucus* in spruce, fir and hemlock forests.

We found no reports on its edibility.

Picea mariana (Mill.) BSP.: Black Spruce

Hygrophorus turundus (Fr.) Fr. var. *turundus*; Homola 7763 (Fig. 38).

We found *Hygrophorus turundus* in *Sphagnum* bogs near black spruce.

We found no reports on the edibility of *H. turundus*.

Pinus resinosa Ait.: Red Pine

Hygrophorus hypothejus (Fr.) Fr.; Homola 6165 (Fig. 23). We found *H. hypothejus* on the edge of a red pine plantation.

Lincoff (5) reports *H. hypothejus* as edible.

Pinus strobus L.: Eastern White Pine; Pumpkin Pine; Soft Pine

Hygrophorus flavodiscus Frost apud Pk.; Homola 3462 (Fig. 15).

In Maine, *H. flavodiscus* was found in a forest under or near white pine.

Lincoff (5) lists *H. flavodiscus* as edible.

Hygrophorus fuligineus Frost apud Pk.; Homola 5861 (Fig. 13). We found *H. fuligineus* in a coniferous forest near scattered white pine.

In Pennsylvania, two mushroom hunters were mixing unintentionally *H. fuligineus* and *Gomphidius glutinosus* (Schaeff. ex. Fr.) Fr. for the table. They indicated that they had collected this mushroom for years and found it to be excellent.

Thuja occidentalis L.: Northern White Cedar; Eastern Arbor-Vitae

Hygrophorus marginatus Pk. var. *marginatus*; Homola 4946 (Fig. 28).

Hygrophorus marginatus var. *marginatus* was found in moss under white cedar. Lincoff (5) lists it as edible.

Hygrophorus nitidus B. & C.; Homola 5652 (Fig. 20). We found *H. nitidus* in a cedar swamp in which *Sphagnum* was a very common moss.

The edibility is unknown.

Hygrophorus nitratus Fr.; Homola 7437 (Fig. 25). Hesler & Smith (2) report *H. nitratus* on soil in deciduous or coniferous woods.

We have found it also under cedar and in beech-maple woods.

We found no report on the edibility of *H. nitratus*.

Hygrophorus perplexus Sm. & Hes.; Homola 5695 (Fig. 21). Hesler and Smith (2) reported *H. perplexus* under aspen and beech on thin sandy soil. We found *H. perplexus* in moss along a cedar swamp. The cedar swamp is next to a predominantly beech woods.

No report on its edibility was found.

Hygrophorus reai Maine; Homola 6866 (Fig. 37). We found *H. reai* in moss in a cedar swamp.

Hygrophorus reai is bitter and likely unpalatable.

Hygrophorus subviolaceus Pk.; Homola 7314 (Fig. 43). We found *H. subviolaceus* in cedar swamps.

We found no reports on the edibility of *H. subviolaceus*.

Tsuga canadensis (L.) Carr. Eastern Hemlock

Hygrophorus auratocephalus (Ellis) Murr.; Homola A3130 (Fig. 26).

We found *H. auratocephalus* on the edge of a deciduous woods in a swamp surrounded with hemlock.

The edibility is unknown.

Hygrophorus borealis Pk.; Homola A6018 (Fig. 1). We found *H. borealis* in conifer woods, especially with hemlock.

Pomerleau (6) reports *H. borealis* as edible.

Hygrophorus canescens Sm. & Hes.; Homola 5006 (Fig. 42). We found *H. canescens* under hemlock. It is not a common species.

Edibility is unknown.

Hygrophorus chrysodon (Fr.) Fr.; Homola 5866 (Fig. 16). We found *H. chrysodon* under conifers in very low wet areas. Hemlock and cedar were the dominant tree species.

Pomerleau (6) lists it as edible.

Hygrophorus conicus var. *atrosanguineus* Grund & Harrison; Homola 6567 (Fig. 34). Bird & Grund (1) report it to be found under hemlock. We found var. *atrosanguineus* in a hemlock forest near a stream. *H. conicus* var. *atrosanguineus* may be identical to *H. conicoides* Orton.

Lincoff (5) list var. *conicus* as possibly poisonous. There is no report on the edibility of var. *atrosanguineus*.

Hygrophorus eburneus (Fr.) Fr.; Homola 4077 (Fig. 3). According to Hesler and Smith (1), *H. eburneus* has a wide geographic range and is found in a variety of habitats. It has been found in grassy areas, thickets, predominantly beech hardwoods, and conifer forests. In Maine, we found it commonly in predominantly hemlock forests.

Lincoff (5) lists *H. eburneus* as edible.

Hygrophorus laetus (Fr.) Fr.; Homola 5575 (Fig. 18). We found *H. laetus* in wet mossy areas in cedar swamps where hemlock also was present.

The edibility is unknown.

Hygrophorus marginatus var. *concolor* Sing.; Homola A5582 (Fig. 27).

We found *H. marginatus* var. *concolor* among hemlocks on the edge of a beech-maple woods.

The edibility is unknown.

Hygrophorus pudorinus (Fr.) Fr. var. *pudorinus*; Homola 6415 (Fig. 9). For more information see *H. pudorinus* var. *pudorinus* under *Abies balsamea*.

DECIDUOUS HOSTS:

Betula papyrifera Marsh.: White Birch; Paper Birch; Canoe Birch

Hygrophorus purpureofolius Bigelow; Homola 7476 (Fig. 39). *Hygrophorus purpureofolius* was found in Connecticut in *Sphagnum* with birch and maple. We suspect that it could occur in Maine and, for that reason, we include it here.

Its edibility is unknown.

Fagus grandifolia Erhh.: American Beech

Hygrophorus cantharellus (Schw.) Fr.; Homola 7844 (Fig. 30). We found *Hygrophorus cantharellus* in wet muddy aspen areas among deciduous debris. Alder was common.

Lincoff (5) lists *H. cantharellus* as edible.

Hygrophorus chrysapsis Metrod; Homola 6025 (Fig. 4). Hesler and Smith (1) reported *H. chrysapsis* to be found under hardwoods, especially beech.

We found no reports on the edibility of *H. chrysapsis*.

Hygrophorus coccineus (Fr.) Fr. sensu Ricken; Homola 5750 (Fig. 32).

We find *H. coccineus* in deciduous woods. Beech was the predominant tree.

Lincoff (5) reported *H. coccineus* as edible.

Hygrophorus flavescens (Kauff.) Sm. & Hes.; Homola 3681 (Fig. 19).

We found *H. flavescens* along disturbed open paths in beech-maple woods.

Lincoff (5) reported *H. flavescens* as edible.

Hygrophorus parvulus Pk.; Homola 6042 (Fig. 40). Hesler and Smith

(1) report it to be found under *Rhododendron*. We found *H. parvulus* in a predominantly beech woods.

We found no reports on the edibility of *H. parvulus*.

Hygrophorus psittacinus (Fr.) Fr. var. *psittacinus*; Homola 5379 (Fig.

17). Hesler and Smith (1) reported it in coniferous and deciduous woods, in pastures and along roadsides. We found it in wet areas in beech-maple woods.

Lincoff (5) reported it as edible.

Hygrophorus russula (Fr.) Quél.; Homola 3309 (Fig. 7). Hesler and

Smith (1) reported *H. russula* in oak and mixed oak-pine woods.

We have found *H. russula* in beech-maple woods.

Lincoff (5) reported *H. russula* as edible.

Hygrophorus unquinosus (Fr.) Fr. var. *unquinosus*; Homola 5574 (Fig.

22). *H. unquinosus* was found on the edge of predominantly beech woods, along a cedar and hemlock swamp.

We found no reports on its edibility.

Hygrophorus virgineus (Fr.) Fr.; Homola 7158 and 7643 (Fig. 2).

We found *H. virgineus* in deciduous woods, mainly beech-maple

with occasional birch and oak.

The edibility is unknown.

Populus grandidentata Michx.: Big-tooth Aspen

Hygrophorus acutoconicus (Clements) Sm.; Homola 8107 (Fig. 36).

We found *H. acutoconicus* along a wet area on the edge of a wet deciduous wood. Birch and aspen were dominant trees.

The edibility is unknown. Since *H. acutoconicus* resembles *H. conicus* and *H. conicus* reported as poisonous (5), we do not recommend *H. acutoconicus* for the table.

Quercus rubra L.: Northern Red Oak

Hygrophorus cuspidatus Pk.; Homola 5981 (Fig. 35). *Hygrophorus cuspidatus* (Homola 5981) was found in Pennsylvania in a predominantly oak woods. Hesler and Smith (1) reported it from New Hampshire and Canada. We suspect that it could occur here and for that reason, we include it.

Its edibility is unknown.

Hygrophorus deceptivus Sm. & Hes., Homola 7470 (Fig. 29). *H. deceptivus* was found in open muddy areas in a mixed deciduous woods. Oak was present.

Its edibility is unknown.

Hygrophorus pratensis Fr.; Homola 5195 (Fig. 41). In Maine we found *H. pratensis* in *Sphagnum* in a mixed conifer and deciduous woods. In Pennsylvania, *H. pratensis* was found in a wet area in a predominantly oak woods.

Hygrophorus pratensis is listed as edible and choice by both Lincoff (5) and Pomerleau (6).

Hygrophorus sordidus Pk.; Homola 5780 (Fig. 5). Hesler and Smith reported *H. sordidus* to be in open oak and hickory woods. We found *H. sordidus* in open deciduous woods, also. Beech was the dominant species with scattered oak.

Smith *et al.* (8) listed *H. sordidus* as edible.

Hygrophorus subovinus Hes. & Sm.; Homola 7864 (Fig. 24). *Hygrophorus subovinus* was collected in a deciduous woods in Pennsylvania. Oak was one of the dominant trees. *H. subovinus* has not been reported from Maine.

Its edibility is unknown.

Vaccinium angustifolium Ait.: Lowbush Blueberry.

Hygrophorus conicus (Fr.) Fr. var. *conicus*; Homola 7046 (Fig. 33). Pomerleau (6) reports *H. conicus* to be found under both broad-leaf and conifer trees. We found it also in various habitats. *H. conicus* var. *conicus* was found in a burned area adjacent to Baxter State Park and in blueberry fields that had been pruned the previous year by burning. Lowbush blueberry was a common shrub

in both burned areas.

Hygrophorus conicus was listed as possibly poisonous by Lincoff (5).

Hygrophorus spadiceus (Fr.) Fr. var. *spadiceus*; Homola 7095 (Fig. 31).

H. spadiceus was collected with *H. conicus* in freshly burned areas of blueberry fields and in natural burns at Baxter State Park.

We found no reports on the edibility of *H. spadiceus*.

SUMMARY

Hygrophori have been collected and identified with their possible ectomycorrhizal associates in Maine. Most of the ectomycorrhizal relationships reported from Maine were confirmed by the work of others. The information on edibility is from authors' popular mushroom guides. Colored photos of forty-four Hygrophori are included here.

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Fig. 2 *Hygrophorus virgineus* (Homola 7158)



Fig. 1 *Hygrophorus borealis* (Homola A6018)



Fig. 4 *Hygrophorus chrysopsis* (Homola 6025)



Fig. 3 *Hygrophorus eburneus* (Homola 4077)



Fig. 6 *Hygrophorus purpurascens* (Homola 6141)



Fig. 8 *Hygrophorus monticola* (Homola 5471)



Fig. 5 *Hygrophorus soroticus* (Homola 5780)



Fig. 7 *Hygrophorus russula* (Homola 3309)



Fig. 10 *Hygrophorus agathosmus* (Homola 5072)

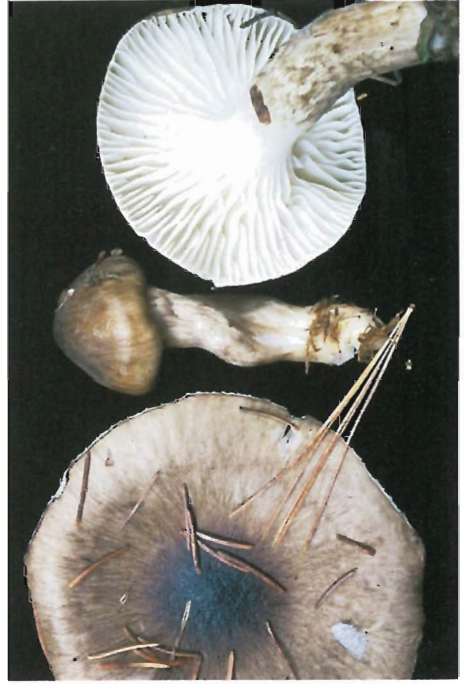


Fig. 12 *Hygrophorus olivaceoalbus* var. *olivaceoalbus* (Homola 5874)



Fig. 9 *Hygrophorus pudorinus* var. *pudorinus* (Homola 6415)



Fig. 11 *Hygrophorus camarophyllus* (Homola 4096)



Fig. 13 *Hygrophorus fuliginus* (Homola 5861)



Fig. 14 *Hygrophorus speciosus* var. *speciosus* (Homola 4101)



Fig. 15 *Hygrophorus flavodiscus* (Homola 3462)



Fig. 16 *Hygrophorus chrysodon* (Homola 5866)



Fig. 17 *Hygrophorus psittacinus* var. *psittacinus* (Homola 5379)



Fig. 18 *Hygrophorus laetus* (Homola 5575)



Fig. 19 *Hygrophorus flavescens* (Homola 3681)



Fig. 20 *Hygrophorus nitidus* (Homola 5652)

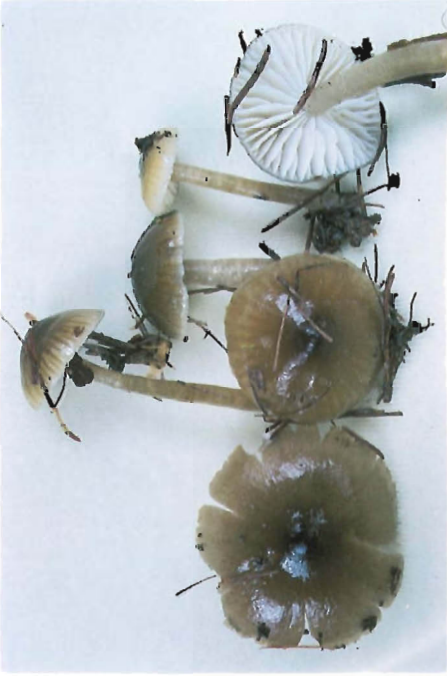


Fig. 22 *Hygrophorus unquinosus* var. *unquinosus* (Homola 5574)



Fig. 24 *Hygrophorus subovinus* (Homola 7864)



Fig. 21 *Hygrophorus perplexus* (Homola 5695)



Fig. 23 *Hygrophorus hypothejus* (Homola 6165)



Fig. 25 *Hygrophorus nitratus* (Homola 7437)



Fig. 26 *Hygrophorus auratocephalus* (Homola A3130)



Fig. 27 *Hygrophorus marginatus* var. *concolor* (Homola A5582)



Fig. 28 *Hygrophorus marginatus* var. *marginatus* (Homola 4946)



Fig. 29 *Hygrophorus deceptivus* (Homola 7470)



Fig. 30 *Hygrophorus cantharellus* (Homola 7844)



Fig. 31 *Hygrophorus spadiceus* var. *spadiceus* (Homola 7095)



Fig. 32 *Hygrophorus coccineus* (Homola 5750)



Fig. 33 *Hygrophorus conicus* var. *conicus* (Homola 7046)



Fig. 34 *Hygrophorus conicus* var. *atrosanguineus* (Homola 6567)



Fig. 35 *Hygrophorus cuspidatus* (Homola 5981)



Fig. 36 *Hygrophorus acutoconicus* (Homola 8107)



Fig. 37 *Hygrophorus reai* (Homola 6866)



Fig. 38 *Hygrophorus turundus* var. *turundus* (Homola 7763)



Fig. 39 *Hygrophorus purpureofolius* (Homola 7576)



Fig. 40 *Hygrophorus parvulus* (Homola 6042)



Fig. 41 *Hygrophorus pratensis* (Homola 5195)



Fig. 42 *Hygrophorus canescens* (Homola 5006)



Fig. 43 *Hygrophorus subviolaceus* (Homola 7314)



Fig. 44 *Hygrophorus tephroleucus* (No collection number cited)