Appendix A6: Draft Keys to Species of *Amanita* Occurring in the Northeastern U.S.A. and Eastern Canada

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Rodham E. Tulloss, P. O. Box 57, Roosevelt, New Jersey 08555-0057, USA

Section *AMANITA*

1. Universal veil material powdery to pulverulent/floccose and often left in part as a "smear" on upper surface of bulb.

2. Pileus margin long striate or tuberculate-striate; pileus white to very pale gray to tan to gray-brown; fruiting body rather small and delicate.

3. Pileus white to very pale gray; spores: [Not yet measured.]. ..... *Amanita sp. N23*.

3. Pileus gray to gray brown to tan.

4. Pileus gray to gray brown; bulb subabrupt or longitudinally compressed; spores (6.0-) 6.5 - 8.8 (-10.5) × (5.2-) 5.5 - 7.0 (-9.0) µm, with **Q** = 1.15 - 1.27 (-1.31)..... *Amanita farinosa*.

4. Pileus tan; bulb subglobose; spores [Not yet measured.]..... *Amanita sp. O3*.

2. Pileus margin striate, but neither long striate nor tuberculate-striate; pileus a shade of yellow or tan or salmon; fruiting body not small and delicate.

5. Pileus a shade of yellow or tan, universal veil a pale dingy tan; most spores subglobose to broadly ellipsoid; spores (5.9-) 7.3 - 10.2 (-14.2) × (4.8-) 6.2 - 8.8 (-14.2) µm, with **Q** = (1.08-) 1.10 - 1.25 (-1.36)..... *Amanita crenulata*.

5. Pileus a shade of salmon; universal veil yellow; most spores ellipsoid to elongate; spores (8.7-) 9.4 - 14.5 (-18.0) × (4.9-) 5.2 - 8.8 (-10.8) µm, with **Q** = 1.52 - 1.92..... *Amanita wellsii*.

1. Universal veil material pulverulent or not, left as rings or warts on lower stipe or as a limb or roll of tissue at the top of the bulb or ocreate or cothurnate, not left as a "smear" on upper surface of bulb.

6. Universal veil material on pileus pinkish to red-brown or darker, with a layer of darker pyramidal warts sometimes found sitting on a lower pulverulent layer; spores (8.2-) 8.8 - 11.0 × 6.0 - 8.0 (-8.8) µm, with **Q** = 1.39..... *Amanita roseitincta* =*Amanita komarekensis*.

6. Universal veil material white, cream, tan, red, orange, or yellow.

7. Universal veil material bright yellow in fresh material.

8. Exannulate from the "button" stage onward; pileus red; pileus margin long striate; spores (8.4-) 9.1 - 11.5 (-12.6) × (5.6-) 6.3 - 7.9 (-8.0) µm, with **Q** = 1.38 - 1.55. ..... *Amanita parcivolvata*.

8. Annulus present.

9. Pileus yellow-orange; pileus marginal striae not long; spores 7.0 - 10.2 × 7.0 - 10.2 µm, with **Q** = 1.01 (or slightly greater). .....
Amanita frostiana var. *frostiana*.

9. Pileus deep red at first, but rapidly fading to dull brownish orange in sunlight; universal veil always yellow at first (last places to change: under edge of partial veil, on top of bulb); spores (7.5-) 9.1 - 12.5 (-19.0) × (5.5-) 6.6 - 8.6 (-11.5) µm, with **Q** = (1.29-) 1.31 - 1.54 (-1.95).
Amanita muscaria var. *flavivolvata*.

7. Universal veil material not bright yellow in fresh material.

10. Pileus orange to red or a combination of these colors over the disc with yellow toward the margin.

11. Pileus deep red at first, either remaining deep red or fading to a dull brownish orange; in first case usually with white universal veil warts; in second, always with universal veil yellow at first.

12. Pileus deep red, not rapidly fading to dull brownish orange in sunlight; universal veil material white to yellowish; spores (7.4-) 8.5 - 11.5 (-14.0) × (5.6-) 6.5 - 8.5 (-9.8) µm; **Q** = 1.26 - 1.41 (-1.44). .....
Amanita muscaria var. *muscaria*.
[Not confirmed for North America south of Alaska in my experience.]

12. Pileus deep red at first, but rapidly fading to dull brownish orange in sunlight; universal veil always yellow at first (last places to change: under edge of partial veil, on top of bulb); spores (7.5-) 9.1 - 12.5 (-19.0) × (5.5-) 6.6 - 8.6 (-11.5) µm, with **Q** = (1.29-) 1.31 - 1.54 (-1.95).
Amanita muscaria var. *flavivolvata*.

11. Pileus yellow, with disk yellow to orange to red-orange.

13. Universal veil material cream to tan; universal veil on stipe in broken rings; spores (7.0-) 8.7 - 12.2 (-14.8) × (5.9-) 6.5 - 8.2 (-9.5) µm, with **Q** = 1.30 - 1.49. .....
Amanita muscaria var. *formosa sensu* D. T. Jenkins.

13. Universal veil warts white; universal veil on bulb as a boot; at present known only from Nova Scotia; spores 8.4 - 21.0 × 8.2 - 15.0 µm, with **Q** = 1.20. .....
Amanita macrospora.

10. Pileus not red or orange in any part.

14. Pileus entirely white to silvery white; stipe bruising yellowish; universal veil material as a series of broken rings on lower stipe; spores 7.9 - 14.1 × 6.3 - 9.4 µm, with **Q** = 1.41. .....
Amanita muscaria var. *alba*.

14. Pileus usually not pure white, never silvery white; stipe bruising yellowish or not; universal veil material not in a series of ring or broken rings on stipe base.

15. Pileus whitish with colored disk (yellow to tan to brown, may be very pale).

16. Most basidia 2-spored; marginal striae rather short; spores 7.5 - 9.0 µm long, subglobose to broadly ellipsoid. .....
Amanita sp. R. Shaffer 5457 (MICH).

16. Most basidia 4-spored.

17. Stipe exannulate; pileus white, with disc yellow or yellowish; volva strongly ocreate; spores (7.3-) 7.7 - 9.4 (-11.5) × 6.6 - 8.4 (-9.4) µm, with **Q** = 1.10 - 1.16. .....
Amanita albocreata.

17. Stipe annulate; also differing in other characters.

18. Universal veil on bulb in small, appressed limb; pileus disc yellow to citron-stramineus; fruiting body small and fragile; annulus may be lost.

19. Spores (7.0-) 7.7 - 9.1 (-9.4) × (5.6-) 6.3 - 7.7 (-8.4) µm, with **Q** = 1.14 - 1.20 (-1.27).
Amanita sp. 34.

19. Spores *ca.* 8 - 10 µm in diameter, globose. .....
Amanita stranella.
[Also, see *Amanita sp. 32*, below.]

18. Universal veil cothurnate or ocreate or as a thickened (often rolled) limb; fruiting bodies of diverse sizes.

20. Disk brownish to tannish (may be rather pale to nearly white); margin long striate; fruiting body not large; spores (6.6-) 7.0 - 11.2 (-15.0) × (5.2-) 5.6 - 8.4 (-8.7) µm, with **Q** = 1.22 - 1.39. .....
Amanita pantherina var. *multisquamosa*
=*Amanita cothurnata*.

20. Otherwise.

21. Fruiting body pallid, slender, small; pileus often viscid/glutinous; spores (7.3-) 7.9 - 10.2 × (5.8-) 6.3 - 7.9 (-8.4) µm; **Q** = 1.28. .....
(?)*Amanita frostiana* var. *pallidipes*.

21. Medium-sized to large fruiting body; pileus disc rather strongly colored yellowish, never glutinous; volva strongly ocreate; spores 7.9 - 13.2 × 6.3 - 7.9 µm, with **Q** = 1.43. .....
Amanita velatipes
≡*Amanita pantherina var. velatipes*.

15. Pileus entirely colored (except possibly at margin).

22. Pileus usually a bright yellow, with or without brownish tints.

23. Medium to large fruiting body; universal veil in broken rings on stipe base; spores 8.7 - 12.9 × 6.3 - 7.9 µm, with **Q** = 1.36. .....
Amanita muscaria var. *formosa sensu* D. T. Jenkins.

23. Small to medium-sized fruiting body; universal veil limbate or cothurnate.

24. Pileus deep yellow with brownish tints at least at first; universal veil submembranous; volva limbate; spores (7.5-) 8.0 - 10.2 (-11.5) × (7.0-) 7.2 - 9.8 (-10.2) µm, with **Q** = 1.10. .....
Amanita sp. N25.

24. Fruiting body small; universal veil on stipe base cothurnate; spores [Not yet measured.] .....
Amanita sp. W2.

22. Usually less intensely colored (pale yellow, citron, sordid pale yellow) or not entirely yellow.

25. Pileus sordid pale yellow to stronger yellow, disk sometimes browning; stipe soon becoming exannulate; universal veil ocreate to limbate on starkly white bulb; spores (6.3-) 7.3 - 9.8 (-12.6) × (5.6-) 6.6 - 9.1 (-11.9) µm, with **Q** = 1.05 - 1.12. .....
Amanita sp. 32.
[Also, see *Amanita stranella*, above.]

25. Pileus yellow with or without darkened disc; stipe exannulate or with partial veil at least at first; universal veil on stipe base limbate or ocreate; spores having **Q** > 1.30.

26. Pileus pale yellow; stipe annulate; subhymenium ramose to slightly inflated ramose [Salem County, NJ specimen had cellular subhymenial base much broader than

subhymenium, with w_{st}-near = 110 - 115 µm and w_{st}-far = 120 - 125 µm and w_{cs} = 80 - 85 µm]; spores: 8.7 - 11.0 × 5.5 - 8.5 µm, with **Q** = 1.39. ..... *Amanita russuloides*.

26. Pileus uniformly colored or not; stipe with ephemeral annulus or exannulate from the outset; subhymenium dominated by inflated cells or with structure not yet known; spores with **Q** in the range 1.42 - 1.60.

27. Pileus yellowish with darker disc; lamella trama collapsed in material at hand; spores: (8.8-) 9.5 - 11.5 (- 13.2) × (6.0-) 6.5 - 7.8 (-8.0) µm, with **Q** = 1.48 - 1.53. ..... *Amanita sp. N19*.

27. Subhymenium dominated by inflated elements.

28. Entire pileus very pale yellowish cream, with margin tuberculate striate (up to 0.35R); partial veil ephemeral, sometimes found in shreds on pileus margin; w_{st}-near = 10 - 20 µm; w_{st}-far = 25 - 30 µm; spores: (8.4-) 8.7 - 11.2 (-12.2) × (5.9-) 6.2 - 7.3 (-7.7) µm, with **Q** = 1.42 - 1.60. ..... *Amanita sp. S1* =*Amanita sp. 37*.

28. Pileus pale citron yellow, with margin short striate; w_{st}-near = 25 - 35 µm (approximate); w_{st}-far = 30 - 45 µm (approximate); w_{cs} unmeasurable in existing material; spores: (8.4-) 9.1 - 10.5 (-11.2) × (5.6-) 5.9 - 6.6 (-7.3) µm, with **Q** = 1.55 - 1.56. ..... *Amanita sp. N8*.

Section *VAGINATAE*
[Color-Oriented Key]

1. Pileus white or cream or pale tan or pale gray. [For gray or pale brownish gray, see the other half of this couplet, below.]

2. Annulate.

3. More than 30% (often more than 50%) of basidia 2-spored.

4. White pileus; gills pinkish; spores (9.2-) 10.2 - 13.9 (-17.0) × (6.6-) 7.0 - 9.0 (-12.8) µm, with **Q** = 1.42 - 1.57. ..... *Amanita ristichii*.

4. Pileus gray, with disc sometimes darker; spores (9.5-) 10.5 - 16.2 (-20.0) × (6.0-) 7.5 - 10.5 (-12.5) µm, with **Q** = (1.30-) 1.31 - 1.64. ..... *Amanita pachysperma*.

3. More than 70% of basidia 4-spored.

5. Annulus present at first, then disappearing; universal veil submembranous to subpulverulent; pileus pallid, then pale umbrinous gray and virgate; spores (8.0-) 8.7 - 11.5 (-12.9) × (6.3-) 6.6 - 8.0 (-8.5) µm, with **Q** = 1.33 - 1.39. ..... *Amanita sp. N4*.

5. Annulus persistent; universal veil membranous; pileus without gray tint.

6. Spores with **Q** ≥ 1.20.

7. Spores with **Q** < 1.40.

8. Pileus whitish, with universal veil forming large white calyptra over most of surface; spores 12.5 - 13.0 × 9.0 - 10.0 µm, with **Q** = 1.31. ..... *Amanita calyptrata* var. *albescens*.

8. Pileus white, without universal remnants; spores 10.8 - 13.0 (-14.5) × (8.0-) 8.2 - 10.2 (-10.5) µm, with **Q** = 1.30. .....
Amanita sp. QUE1.

7. Pileus cream, sometimes nearly white at margin, with disc pale tan; spores (9.0-) 10.0 - 12.5 (-13.6) × (6.5-) 6.8 - 8.5 (-9.2) µm, with **Q** = 1.43 - 1.53. .....
Amanita murrilliana.

6. Spores with **Q** < 1.20.

9. Pileus cream; stipe bearing yellow fibrils and squamules; spores 9.4 - 11.2 (-11.5) × (7.7-) 8.7 - 10.1 (-10.5) µm, with **Q** = 1.12. .....
Amanita sp. W. Litten L-715.

9. Pileus getting an umbrinous tint to disc in age, with marginal striae approx. 0.4R; stipe lacking yellow decoration; spores approx. “9 µm” in diameter. .....
Amanita sp. ONT1.

2. Exannulate.

10. Universal veil saccate, although sometimes fragile; universal veil usually absent from pileus.

11. Pileus pale gray to pearly gray, may be darker over disc; universal veil graying with maturity; spores (8.2-) 9.0 - 11.8 (-12.2) × (7.5-) 8.2 - 11.0 (-11.8) µm, with **Q** = 1.07. .....
Amanita sp. N28.

11. Pileus without gray tints; universal veil remaining white at maturity.

13. Pileus pure white; spores 9.5 - 12.0 × 9.5 - 11.5 µm, with **Q** = 1.10. .....
Amanita vaginata var. *alba sensu* eastern U.S. authors

13. Pileus not pure white or, if entirely white, then having differently shaped spores.

14. Pileus pale cream, becoming olive-cream with brown disc in age; spores (8.5-) 9.5 - 11.8 × (8.2-) 8.5 - 10.2 (-10.5) µm, with **Q** = 1.10. .....
Amanita sp. N35.

14. Pileus not getting olivaceous or brown tints in age.

15. Pileus white to slightly cream; volva large and saccate; at present reported only from northern Québec; spores 9.1 - 12.5 × 7.5 - 9.6 µm, with **Q** approx. 1.25. .....
Amanita arctica sensu Hutchison *et al.*

15. Pileus cream or very pale pinkish- or orangish-white, becoming sordid yellowish cream in age; spores 9.2 - 11.0 × (8.2-) 8.5 - 9.5 µm, with **Q** = 1.12. .....
Amanita sp. N26.

15. Pileus white, with pale yellow tint over disc; spores [Not yet measured.]. .....
Amanita sp. W4.

10. Universal veil breaking up into warts on pileus and around stipe base.

16. Pileus cream or white becoming cream with age; universal veil graying with age; occurring in woods without *Populus*.

17. Pileus white at first, often under 50 mm wide; subhymenium with numerous small inflated cells; spores (8.4-) 9.1 - 10.5 (-11.5) × (7.7-) 8.4 - 9.4 (-10.5) µm, with **Q** = 1.08. .....
Amanita sp. S3.

17. Pileus cream, 80 mm wide; subhymenium dominated by frequently branching, short-segmented, filamentous, undifferentiated hyphae; spores (9.5-) 9.8 - 11.5 (-13.5) × (8.8-) 9.0 - 11.0 (-12.2) µm, with **Q** = 1.07. .....
Amanita sp. N42.

16. Pileus soon off-white to pale tan, then becoming tan or pale gray; occurring in deciduous woods or in pure stands of *Populus*.

18. Pileus off-white to pale tan at first, becoming more tan with age; universal veil on pileus white and unchanging at first, becoming yellowish brown on edges in age; only known to occur with *Populus*; spores (7.0-) 9.2 - 12.5 (-21) × (6.0-) 8.2 - 11.2 (-15.8) µm, with **Q** = (1.06-) 1.08 - 1.15 (-1.19). .....
Amanita populiphila.

18. Pileus white with pale tan tint in disc, eventually becoming pale gray; universal veil on pileus white, becoming ochraceous and then brown on high points; known from deciduous woods containing *Quercus*; spores (9.5-) 9.8 - 11.5 (-13.0) × (9.0-) 9.2 - 11.0 (-11.5) µm, with **Q** = 1.06. .....
Amanita sp. W13.

1. Pileus neither white nor cream nor pale tan nor pale gray.

19. Pileus scarlet, orange, orange-brown, orange-yellow, yellow-brown, or yellow, often with intense pigmentation.

20. Pileus intensely scarlet at first, umbonate, developing yellow margin; stipe annulate; spores (7.0-) 7.8 - 9.8 (-12.1) × (5.2-) 5.8 - 7.5 (-8.7) µm, with **Q** = 1.25 - 1.37 (-1.40). .....
Amanita jacksonii
≡*Amanita umbonata Pomerleau non (Sumstine) Sartory & Maire*
=*Amanita caesarea sensu eastern U.S. authors.*

20. Pileus not intensely scarlet at first.

21. Stipe annulate; pileus with yellow, orange, and brown tones, more yellow toward margin.

22. Stipe cream to yellow, often white near base, and often with more strongly yellow, fibrillose scales; pileus often developing brown umbo; volval sac not very large, attached more broadly than just at stipe base, up to 55 mm high; paracresol spot test strong positive throughout much of context; spores (7.5-) 8.4 - 11.9 (-15.0) × (5.2-) 5.9 - 7.5 (-9.8) µm, with **Q** = 1.39 - 1.61 (-1.69). .....
Amanita sp. 16
=*Amanita sp. N12*.

22. Stipe pallid with yellow to yellow-orange, fibrillose decoration; pileus usually not developing brown umbo; universal veil as copious volval sac, attached only at stipe base, up to 110 mm high; paracresol spot test positive in volva and scattered spots of context; spores (7.0-) 7.7 - 10.5 (-15.0) × (5.6-) 6.0 - 8.0 (-10.2) µm, with **Q** = (1.22-) 1.24 - 1.38. .....
Amanita arkansana.

21. Stipe exannulate; also differing in other character(s).

23. Orangish, chevron-patterned decoration on stipe; pileus yellow-orange; spores (7.4-) 8.3 - 12.5 (-20) × (6.8-) 7.2 - 11.5 (-14.5) µm, with **Q** = 1.07 - 1.15. [See, also, *Amanita crocea sensu* eastern U.S. and Mexican authors.] .....
Amanita sp. MN1
=*Amanita crocea sensu western and central U.S. authors.*

23. Lacking patterned stipe; pileus orange-brown or fulvous (sometimes somewhat pale at first, but then with intensity of pigmentation increasing with age); spores (8.0-) 9.2 - 12.0 (-14.0) × (6.8-) 8.8 - 11.2 (-12.5) µm, with **Q** = 1.06 - 1.09 (-1.10). .....
Amanita fulva sensu eastern U.S. authors
=*Amanita sp. N15*.

19. Pileus neither red nor orange nor orange-brown nor orange-yellow or, if one of these colors, then weakly pigmented.

24. Pileus yellow, yellow with brown disk, pale brownish orange, or pale orange, lacking olivaceous tints, not maculate.

25. Pileus yellow-brown; stipe often decorated with orangish white pulverulence; universal veil submembranous to subpulverulent, always with an orange tint, even though it may become slightly grayish on pileus; spores (8.5-) 9.0 - 12.2 (-15.5) × (8.0-) 8.5 - 11.0 (-12.5) µm, with **Q** = 1.08 - 1.09.....
Amanita sp. 49.

25. Universal veil membranous, white or whitish.

26. Spores with **Q** < 1.15.

27. Pileus often pale, somewhat brownish orange; spores (8.2-) 9.0 - 11.0 (-12.0) × (7.2-) 8.0 - 9.5 (-11.2) µm, with **Q** = 1.10 - 1.14. [See, also, *Amanita fulva sensu* eastern U.S. authors and *Amanita crocea sensu* western and central U.S. authors, above.].....
Amanita sp. W10
=Amanita crocea sensu eastern U.S. and Mexican authors.

27. Pileus yellowish to pale orange at first, developing brown tints upon full expansion; spores (7.5-) 8.7 - 10.5 (-11.0) × (7.2-) 8.0 - 9.5 (-9.8) µm, with **Q** = 1.07 - 1.09.....
Amanita sp. N3.

26. Spores with **Q** ≥ 1.15.

28. Medium-sized to large mushroom; pileus pale yellow; universal veil copious, coherent; spores 11.9 - 14.7 (-15.7) × (9.5-) 10.5 - 11.9 (-14.0) µm, with **Q** = 1.18. .....
Amanita sp. 24.

28. Small mushroom; pileus bronze-yellow; universal veil saccate, but breaking up, graying, sometimes leaving patches on pileus disk; spores 9.4 - 11.9 (-13.3) × (7.7-) 8.4 - 9.4 (-11.2) µm, with **Q** = 1.20. .....
Amanita sp. 31.

24. Pileus bronze, brown, red-brown, chestnut brown, fuligineous, olive or with olivaceous tint, gray to brownish gray to grayish brown, or maculate.

29. Small mushroom with irregular, unpigmented regions on pileus; spores (8.0-) 8.7 - 14.7 (-17.1) × (7.0-) 7.3 - 13.3 (-16.8) µm, with **Q** = 1.02 - 1.08. .....
Amanita sp. N9.

29. Pileus not maculate.

30. Universal veil friable, originally orangish yellow (look on very base of stipe) becoming red-brown to brown, eventually somewhat grayish brown in age; pileus red-brown, becoming somewhat umbrinous with age; spores (8.2-) 9.2 - 12.0 (-13.5) × (7.5-) 8.8 - 11.0 (-12.5) µm, with **Q** = 1.06 - 1.11.....
Amanita sp. N29.

30. Universal veil not originally orangish yellow.

31. Universal veil becoming gray or black rather quickly (even during "button" stage of expansion), submembranous to subpulverulent (friable), often breaking up on pileus and/or around stipe base.

32. Annulus present at first; pileus pale umbrinous gray, virgate; spores (8.0-) 8.7 - 11.5 (-12.9) × (6.3-) 6.6 - 8.0 (-8.5) µm, with **Q** = 1.33 - 1.39. .....
Amanita sp. N4.

32. Exannulate.

33. Pileus bronze or yellow-brown or pale brown or red-brown.

34. Pink bruising in context of stipe; spores 8.4 - 12.6 (-15.0) × (7.7-) 8.4 - 11.9 (-14.7) µm, with **Q** = 1.04. .....
Amanita sp. N6.

34. Stipe context not discoloring when bruised or cut.

35. Pileus pale tan or pale brown to brown with slight umbrinous tint. [See, also, second half of couplet 33 if pileus is umbrinous brown.]

36. Pileus pale tan; universal veil on pileus often as a large volval patch, graying with age, submembranous; spores (8.8-) 9.5 - 12.5 (-15.0) × (8.5-) 9.2 - 11.2 (-14.0) µm, with **Q** = 1.06. .....
Amanita sp. 45.

36. Pileus pale brown to brown with slight umbrinous tint; universal veil on pileus as irregular warts and patches, becoming dark gray; spores (*sp. N34*) 9.8 - 11.8 × (9.2-) 9.5 - 11.2 (-11.5) µm, with **Q** = 1.04; spores (*sp. V3*) (7.7-) 9.0 - 12.0 (-14.2) × (7.0-) 8.8 - 11.8 (-13.5) µm, with **Q** = 1.04 - 1.07.....
Amanita sp. N34
?=*Amanita sp. V3*.

35. Pileus red-brown.

37. Pileus lacking volval material; universal veil at stipe base in gray patches; stipe developing red-brown fibrils after handling; spores (8.8-) 9.0 - 11.0 (-12.0) × (8.2-) 8.8 - 10.5 (-11.5) µm, with **Q** = 1.05. .....
Amanita sp. N24.

37. Universal veil on pileus as confluent warts, white at first, becoming gray (especially on high points), eventually black; universal veil at stipe base in patches, graying more slowly than on pileus; stipe decorated with red-brown fibrils in chevron pattern; spores (8.5-) 9.8 - 10.8 × (6.8-) 9.0 - 10.0 (-10.2) µm, with **Q** = 1.10. .....
Amanita sp. N32.

33. Pileus differently colored—brown or deep brown or fuligineous or umbrinous brown or grayish yellow or grayish brown or Chinese yellow or curry colored or olive brown or gray or brownish gray.

38. Pileus curry to Chinese yellow to olive brown to grayish yellow to grayish brown.

39. Universal veil often as a rather weakly structured, white sac rather quickly turning gray.

40. Spores (8.0-) 9.1 - 12.1 (-15.4) × (7.0-) 8.4 - 11.5 (-15.4) µm, with **Q** = 1.04 - 1.09 (-1.10). .....
Amanita sinicoflava.

40. At present only reported from northern Québec; spores 9.8 - 15.6 × 8.8 - 13.6 µm, with **Q** approx. 1.15. .....
Amanita groenlandica sensu Hutchison *et al*.

39. Universal veil mostly as dark gray to black pileus warts; spores (7.7-) 8.4 - 13.3 (-13.6) × (7.3-) 8.0 - 13.3 µm, with **Q** = 1.03 - 1.04. .....
Amanita sp. 42.

38. Pileus brown or brown deep brown or fuligineous or umbrinous or some shade of gray or brownish gray.

41. Pileus pale gray to pearly gray to brownish gray; universal veil submembranous, usually absent from pileus.

42. Pileus pale gray to pearly gray, may be darker over disc; spores (8.2-) 9.0 - 11.8 (-12.2) × (7.5-) 8.2 - 11.0 (-11.8) µm, with **Q** = 1.07. .....
Amanita sp. N28.

42. Pileus brownish gray with brown disc; spores (9.1-) 9.5 - 10.8 (-11.0) × (8.0-) 8.5 - 10.0 (-10.5) µm, with **Q** = 1.11. .....
Amanita sp. S6.

41. Pileus a shade of brown without any shade of gray in any part; universal veil on pileus in warts or as a calyptra or (occasionally) absent.

43. Pileus umbrinous. Universal veil gray-brown becoming darker with age; spores [None present on single specimen.]. .....
Amanita sp. N16.

43. Pileus not umbrinous, brown to deep brown to fuligineous.

44. Pileus dark chocolate brown; universal veil on pileus absent or as a sordid calyptra; spores 8.7 - 10.8 (-11.9) × (7.3-) 8.7 - 9.1 (-10.8) µm, with **Q** = 1.12. .....
Amanita sp. W3.

44. Universal veil on pileus as warts.

45. Spores (7.0-) 8.4 - 9.8 (-10.5) × 7.0 - 9.1 (-10.5) µm, with **Q** = 1.05. .....
Amanita sp. 26.

45. Pileus dark brown; universal veil friable, pallid at first, then grayish to dark gray (but lighter than pileipellis); spores (9.0-) 10.2 - 13.1 (-14.4) × (8.0-) 9.5 - 12.0 (-13.0) µm, with **Q** = 1.08 - 1.09. .....
Amanita sp. 48.

31. Universal veil firm and membranous, usually not graying, never becoming black.

46. Pileus never zonate. [See, also, under the second half of this couplet if the pileus is pale grayish brown to pale brownish gray.]

47. Annulate.

48. Small fruiting body; pileus brown to grayish brown over disk and pallid at margin; pileus margin long striate; stipe having scant annulus; with basidia dominantly 2-spored; spores (9.1-) 11.5 - 15.0 (-20.5) × (6.5-) 8.5 - 11.2 (-15.5) µm, with **Q** = (1.16-) 1.21 - 1.42 (-1.55). .....
Amanita virginiana.

48. Fruiting body medium-sized to large; basidia dominantly 4-spored.

49. Pileus very dark colored; spores (9-) 11 - 14 (-15) × 6.5 - 8.5 µm, with **Q** approx. 1.67. .....
Amanita eliae sensu Walt Sturgeon.

49. Pileus pallid or with pallid margin.

50. Pileus with date brown disk and pallid margin, campanulate to umbonate; spores [Not yet measured.]. .....
Amanita spreta sensu McIlvaine.

50. Pileus cream to grayish to gray-brown to brown or brownish over disc and paler near margin. [These two entries possibly identical.]

51. Pileus broadly campanulate to convex (and then lacking an umbo), cream to grayish to gray-brown to brown, densely virgate; spores (7.7-) 9.4 - 13.1 (-15.5) × (5.2-) 5.9 - 7.7 (-9.0) µm, with **Q** = 1.60 - 1.76. .....
Amanita spreta var. *spreta*.

51. Pileus umbonate, brownish over disc, paler toward margin, weakly virgate; spores (8.4-) 8.7 - 11.9 (-14.0) × 5.6 - 7.3 (-8.4) µm, with **Q** = 1.59 - 1.64. .....
Amanita sp. V2.

47. Exannulate.

52. Pileus slightly brownish gray, sometimes darker over disc; base of stipe sometimes becoming brick red when damaged by larvae; universal veil becoming ochraceous or rusty in part or whole, sometimes partially left on pileus, when at base then with long

inner limb in flaring, unitangent volva; spores: (8.7-) 9.6 - 12.5 (-14.5) × (8.2-) 9.0 - 11.5 (-14.0) µm, with **Q** = 1.07 - 1.11.....
Amanita sp. 28.

52. Base of stipe not becoming brick red; universal veil otherwise.
53. Fruiting body large to very large.
54. Pileus olivaceous and/or with yellow tones (including yellowish brown).
55. Pileus olive to olive-umbraceous to sordid olivaceous yellow; stipe with dark fibrils; basidia with clamps; spores: (8.5-) 10.0 - 11.8 (-12.2) × (7.8-) 9.0 - 11.0 (-11.2) µm, with **Q** = 1.09.....
Amanita violettae
≡*Amanita vaginata var. crassivolvata.*

55. Pileus with strong yellow-brown component; stipe lacking dark fibrils; basidia lacking clamps.
56. Pileus yellowish-brown with an umbrinous tint to brown; stipe whitish; subhymenial base including plentiful relatively large inflated cells with walls up to 1.0 µm thick; spores: (9.0-) 9.2 - 11.8 (-15.5) × (6.5-) 6.8 - 9.2 (-11.8) µm, with **Q** = 1.26 [size may be skewed too low because sole specimen known was senescent when dried].....
Amanita sp. S7.

56. Pileus olivaceous yellow-brown with brown umbo; stipe gray with delicate fibrils in chevron pattern; subhymenial base lacking large, thick-walled cells; spores (11.1-) 11.5 - 14.0 × (10.5-) 10.8 - 12.5 µm, with **Q** = 1.11.....
Amanita sp. W14.

54. Pileus brownish gray or umber or reddish brown becoming dark umbrinous brown, virgate.
57. Pileus lacking reddish tones.
58. Pileus brownish gray; spores 10.8 - 14.0 (-17.2) × (6.0-) 8.5 - 11.0 µm, with **Q** = 1.36.....
Amanita sp. N22.

58. Pileus umber; spores 9.0 - 10.8 × 8.5 - 9.8 (-10.5) µm, with **Q** = 1.07.....
Amanita sp. 46.

57. Pileus reddish brown at first, becoming dark umbrinous brown; spores 10.5 - 12.2 (-12.9) × (8.4-) 9.8 - 11.9 µm, with **Q** = 1.06. .....
Amanita sp. W8.

53. Fruiting body not “very large.”
59. Pileus gray to brownish gray, often drying steel gray; some gills forking and anastomosing; spores [*Amanita sp. 17*] (6.6-) 8.4 - 12.2 (-16.8) × (5.2-) 6.6 - 8.4 (-11.9) µm, with **Q** = (1.21-) 1.27 - 1.44; spores [*Amanita sp. N36*] (9.8-) 10.5 - 12.8 (-14.2) × (7.2-) 7.5 - 9.2 (-9.5) µm, with **Q** = 1.36; spores [*Amanita sp. W7*] (9.4-) 10.0 - 12.2 (-13.8) × (6.5-) 7.0 - 8.8 (-9.2) µm, with **Q** = 1.43 - 1.44.....
Amanita sp. 17
?=Amanita sp. N36
?=Amanita sp. W7.

59. Spores having **Q** < 1.20.
60. Pileus gray to brownish gray.
61. Gills very pale gray at first, taking on grayish pink or lavender tones; spores (10.1-) 10.5 - 12.2 (-15.4) × 9.4 - 11.5 (-13.3) µm, with **Q** = 1.10.....
Amanita sp. W9.

62. Gills never having grayish pink or lavender tones.

63. Universal veil intergrown with undifferentiated tissue at base of stipe; spores (7.8-) 9.2 - 12.5 (-15.8) × (7.2-) 8.7 - 12.0 (-14.2) µm, with **Q** = 1.04 - 1.07.....
Amanita vaginata var. *vaginata sensu* eastern U.S. authors.

63. Universal veil easily removed from base of stipe; spores [*Amanita sp. N33*] (9.8-) 10.2 - 12.0 (-12.8) × (8.8-) 9.0 - 10.2 (-10.5) µm, with **Q** = 1.14.; spores [*Amanita sp. V1*] (8.4-) 9.8 - 12.2 (-17.5) × (7.0-) 8.4 - 11.9 (-12.9) µm, with **Q** = 1.13 - 1.14.....
Amanita sp. N33
?=*Amanita sp. V1*.
[See also *Amanita sp. N30*.]

60. Pileus differently colored.

64. Only known from dried material; spores 9.4 - 11.2 × 8.7 - 9.4 (-10.1) µm, with **Q** = 1.12.....
Amanita sp. N13.

64. Spores with **Q** < 1.10; universal veil (and sometimes other parts of fruiting body) liable to rusty stains.

65. Pileus dark fulvous over disc only, becoming tan toward margin.

66. Pileus warm brown over disc, fox color or chamois (somewhat orangish brown) to tan away from umbo, with marginal striations 0.1R; subhymenium 2 cell layers thick; spores 9.8 - 11.6 (-11.9) × (8.4-) 8.8 - 10.5 (-11.6) µm, with **Q** = 1.10.....
Amanita sp. N45.

66. Pileus dark fulvous over disc, else tan without fulvous tint, with marginal striations 0.4R; subhymenium 1-2 (-3) cell layers thick; spores (12.5-) 12.6 - 14.0 (-15.5) × (11.8-) 11.9 - 13.5 (-14.5) µm, with **Q** = 1.06.....
Amanita sp. N46.
[Could this be an immature collection of *Amanita sp. N45*?]

65. Pileus more uniformly colored—brown to chestnut brown to umbrinous.

67. Pileus brown; volval sac flaring and with rusty stains; spores [*Amanita sp. 44*] (8.4-) 9.1 - 11.2 (-14.3) × (8.4-) 9.1 - 10.8 (-13.3) µm, with **Q** = 1.04; spores [*Amanita sp. N37*] 9.8 - 11.2 × (8.8-) 9.2 - 10.8 µm, with **Q** = 1.06.....
Amanita sp. 44
?=*Amanita sp. N37*.

67. Pileus chestnut brown (becoming more umbrinous with age), volval sac white, with ochraceous stains, large; spores (9.8-) 10.0 - 11.5 × 9.0 - 10.5 (-10.8) µm, with **Q** = 1.08. .....
Amanita sp. N27.

46. Pileus often zonate (usually by a line of darker pigmentation touching the inner ends of the striae).

68. Pileus gray or grayish.

69. Pileus pale grayish brown to pale brownish gray; spores (7.2-) 8.5 - 11.2 (-12.2) × (6.0-) 7.5 - 10.0 (-11.2) µm, with **Q** = 1.13 - 1.14.....
Amanita sp. N30.
[See also *Amanita sp. N33*.]

69. Pileus gray; spores [Not yet measured.]. .....
Amanita sp. N14.

68. Pileus with some other coloration.

70. Pileus olivaceous cream to olive; spores 8.0 - 10.1 × 7.7 - 9.8 µm, with **Q** = 1.03 - 1.04.
Amanita sp. 21.

70. Pileus with some other coloration.
71. Pileus red-brown; spores (8.4-) 9.1 - 9.8 (-11.9) × 7.7 - 9.1 (-9.8) µm, with **Q** = 1.13. *Amanita sp. 22*.

71. Pileus umber to umbrinous brown or sepia or ochraceous umber.
72. Pileus umber or sepia or ochraceous umber, at times with olive tint; spores (8.4-) 8.7 - 11.5 (-11.9) × (7.7-) 8.4 - 11.2 µm, with **Q** = 1.05 - 1.06. ..... *Amanita sp. 35*.

72. Pileus umbrinous brown to pale umbrinous brown, at times densely virgate; spores (10.0-) 10.2 - 13.2 (-13.8) × (9.2-) 9.5 - 12.5 (-13.2) µm, with **Q** = 1.05 - 1.06. *Amanita sp. N40*.

Section *VAGINATAE*
[Volva/Pileipellis/Subhymenium/Color-Oriented Key]

Primary Key.

1. Universal veil friable pulverulent or weakly structured and breaking up into warts or patches, often discoloring rather strongly during and after expansion of basidiocarp.

2. Universal veil friable/pulverulent, as warts or plaques on pileus; on stipe base, often as ring of material above strangulate pallid region or absent, *not* as weakly structured, saccate volva and *not* as collapsed, graying limb; partial veil absent. ..... ***Subkey A***.

2. Universal veil weakly structured and, therefore, breaking up into warts or patches on the pileus, but also commonly found collapsed against stipe base; partial veil very rarely present..... ***Subkey B***.

1. Universal veil membranous, thin to very thick, exterior almost always white (occasionally with superficial staining—often brown, rusty, or ochraceous, sometimes fuligineous or black) and almost always smooth (rarely areolate or bearing densely packed warts), occasionally leaving one or a few membranous patches on pileus (a constant and diagnostic feature in some species, a rare occurrence in others).

4. Stipe annulate—at least at first. [If (rather than membranous or submembranous annulus) floccose sheath present over several cm of stipe below apex, see *Amanita arctica*, page 146, and *Amanita islandica*, page 147, in Appendix 8.]. ..... ***Subkey C***.

4. Stipe always exannulate from beginning of basidiocarp expansion.

5. Fruiting body often large; universal veil at stipe base as saccate volva, proportionately large and fleshy when fresh; basidia commonly bearing clamps. ..... ***Subkey D***.

5. Mushroom not having the combination of a large fruiting body with a proportionately large, fleshy volval sac and common basidial clamps.

6. Suprapellis comprising gelatinous matrix including narrow, loosely curving, filamentous, undifferentiated hyphae often less than 4.0 µm wide; subpellis comprising closely packed, subradially oriented hyphae; distribution tropical. Not present in region of study. ..... ***Subkey E***.

6. Pileipellis lacking such a suprapellis; distribution not restricted to the tropics. Pileipellis entirely comprising densely packed hyphae or composed of subpellis of densely packed hyphae and gelatinized suprapellis derived from breakdown of walls of similar hyphae.

7. Subhymenium ramose (with or without small inflated elements) in mature regions of lamellae, with plentiful uninflated hyphal segments in subhymenial tree..... ***Subkey F***.

7. Subhymenium pseudoparenchymatous or at least with many basidia arising from inflated cells in mature regions of lamellae; or with many basidia arising from partially inflated or uninflated hyphal segments, but then having basidia commonly arising from inflated cells and also having many rather large globose to subglobose to ovoid to ellipsoid cells in subhymenial base; basidial clamps absent (or, in one case, uncommon)..... ***Subkey G***.

Subkey A—Universal veil friable/pulverulent usually darkening with age.

1. Pileus white to cream to pale tan to pale gray.

2. Pileus cream or white becoming cream with age; occurring in woods without *Populus*.

3. Pileus white at first, often under 50 mm wide; subhymenium with numerous small inflated cells; spores (8.4-) 9.1 - 10.5 (-11.5) × (7.7-) 8.4 - 9.4 (-10.5) µm, with **Q** = 1.08. ..... *Amanita sp. S3*.

3. Pileus cream, 80 mm wide; subhymenium dominated by frequently branching, short-segmented, filamentous, undifferentiated hyphae; spores (9.5-) 9.8 - 11.5 (-13.5) × (8.8-) 9.0 - 11.0 (-12.2) µm, with **Q** = 1.07. ..... *Amanita sp. N42*.

2. Pileus soon off-white to pale tan, then becoming tan or pale gray; occurring in deciduous woods or in pure stands of *Populus*.

4. Pileus off-white to pale tan at first, becoming more tan with age; universal veil on pileus white and unchanging at first, becoming yellowish brown on edges in age; only known to occur with *Populus*; spores (7.0-) 9.2 - 12.5 (-21) × (6.0-) 8.2 - 11.2 (-15.8) µm, with **Q** = (1.06-) 1.08 - 1.15 (-1.19). ..... *Amanita populiphila*.

4. Pileus white with pale tan tint in disc, eventually becoming pale gray; universal veil on pileus white, becoming ochraceous and then brown on high points; known from deciduous woods containing *Quercus*; spores (9.5-) 9.8 - 11.5 (-13.0) × (9.0-) 9.2 - 11.0 (-11.5) µm, with **Q** = 1.06. ..... *Amanita sp. W13*.

1. Pileus neither white nor cream nor pale tan nor pale gray.

5. Pileus yellow-brown; stipe often decorated with orangish white pulverulence; universal veil submembranous to subpulverulent, always with an orange tint, even though it may become slightly grayish on pileus; spores (8.5-) 9.0 - 12.2 (-15.5) × (8.0-) 8.5 - 11.0 (-12.5) µm, with **Q** = 1.08 - 1.09. ..... *Amanita sp. 49*.

5. Pileus bronze, brown, red-brown, chestnut brown, fuligineous, olive or with olivaceous tint, gray to brownish gray to grayish brown.

6. Universal veil originally orangish yellow (look on very base of stipe) becoming red-brown to brown, eventually somewhat grayish brown in age; pileus red-brown, becoming somewhat umbrinous with age; spores (8.2-) 9.2 - 12.0 (-13.5) × (7.5-) 8.8 - 11.0 (-12.5) µm, with **Q** = 1.06 - 1.11. *Amanita sp. N29*.

6. Universal veil not originally orangish yellow.

7. Pileus bronze or yellow-brown or pale brown to brown with slight umbrinous tint or red-brown.

8. Pink bruising in context of stipe; spores 8.4 - 12.6 (-15.0) × (7.7-) 8.4 - 11.9 (-14.7) µm, with **Q** = 1.04. .....
Amanita sp. N6.

8. Stipe context not discoloring when bruised or cut.

9. Pileus pale brown to brown with slight umbrinous tint; universal veil on pileus as irregular warts and patches, becoming dark gray; spores [*Amanita sp. N34*] 9.8 - 11.8 × (9.2-) 9.5 - 11.2 (-11.5) µm, with **Q** = 1.04; spores [*Amanita sp. V3*] (7.7-) 9.0 - 12.0 (-14.2) × (7.0-) 8.8 - 11.8 (-13.5) µm, with **Q** = 1.04 - 1.07. .....
Amanita sp. N34
?=*Amanita sp. V3*.

9. Pileus red-brown.

10. Pileus lacking universal veil material; universal veil at stipe base in gray patches; stipe developing red-brown fibrils after handling; spores (8.8-) 9.0 - 11.0 (-12.0) × (8.2-) 8.8 - 10.5 (-11.5) µm, with **Q** = 1.05. .....
Amanita sp. N24.

10. Universal veil on pileus as confluent warts, white at first, becoming gray (especially on high points), eventually black; universal veil at stipe base in patches, graying more slowly than on pileus; stipe decorated with red-brown fibrils in chevron pattern; spores (8.5-) 9.8 - 10.8 × (6.8-) 9.0 - 10.0 (-10.2) µm, with **Q** = 1.10. .....
Amanita sp. N32.

7. Pileus differently colored—brown or deep brown or fuligineous or umbrinous brown or grayish yellow or grayish brown or Chinese yellow or curry colored or olive brown or gray or brownish gray.

11. Pileus olivaceous over disc, with disc surrounded by yellow band and margin white early in development, later more uniformly olivaceous; universal veil mostly as dark gray to black pileus warts; spores (7.7-) 8.4 - 13.3 (-13.6) × (7.3-) 8.0 - 13.3 µm, with **Q** = 1.03 - 1.04. .....
Amanita sp. 42.

11. Pileus or brown deep brown or fuligineous or umbrinous or some shade of gray or brownish gray.

12. Pileus some shade of gray or brownish gray. [No entries at this time.]

12. Pileus a shade of brown without any shade of gray in any part.

13. Pileus umbrinous. Universal veil gray-brown becoming darker with age; spores [None present on single specimen.]. .....
Amanita sp. N16.

13. Pileus not umbrinous, brown to deep brown to fuligineous.

14. Pileus brown; spores (7.0-) 8.4 - 9.8 (-10.5) × 7.0 - 9.1 (-10.5) µm, with **Q** = 1.05. .....
Amanita sp. 26.

14. Pileus brown to fuligineous; universal veil friable, pallid at first, then grayish to dark gray (but lighter than pileipellis); spores (9.0-) 10.2 - 13.1 (-14.4) × (8.0-) 9.5 - 12.0 (-13.0) µm, with **Q** = 1.08 - 1.09. .....
Amanita sp. 48.

Subkey B—Universal veil not friable or pulverulent, but weakly structured and often darkening with age.

1. Pileus pale umbrinous gray; partial veil present, at least at first, eventually graying and collapsing; spores (8.0-) 8.7 - 11.5 (-12.9) × (6.3-) 6.6 - 8.0 (-8.5) µm, with **Q** = 1.33 - 1.39. ..... *Amanita sp. N4*.

1. Stipe exannulate from outset of development; spores with **Q** < 1.25.

2. Pileus pale gray to pearly gray, may be darker over disc; spores (8.2-) 9.0 - 11.8 (-12.2) × (7.5-) 8.2 - 11.0 (-11.8) µm, with **Q** = 1.07..... *Amanita sp. N28*.

2. Neither pale gray nor pearly gray.

3. Small mushroom; pileus bronze-yellow; universal veil saccate, but breaking up, graying, sometimes leaving patches on pileus disk; spores 9.4 - 11.9 (-13.3) × (7.7-) 8.4 - 9.4 (-11.2) µm, with **Q** = 1.20. ..... *Amanita sp. 31*.

3. Pileus not bronze-yellow—pale tan or curry to Chinese yellow to olive brown to grayish yellow to grayish brown or brownish gray or deep chocolate brown; spores with **Q** < 1.18.

4. Pileus pale tan; universal veil on pileus often as a large volval patch, graying with age, submembranous; spores (8.8-) 9.5 - 12.5 (-15.0) × (8.5-) 9.2 - 11.2 (-14.0) µm, with **Q** = 1.06. ..... *Amanita sp. 45*.

4. Pileus not pale tan—curry to Chinese yellow to olive brown to grayish yellow to grayish brown or brownish gray or deep chocolate brown.

5. Pileus curry to Chinese yellow to olive brown to grayish yellow to grayish brown.

6. At present, not reported north of Maine and southern Québec; spores (8.0-) 9.1 - 12.1 (-15.4) × (7.0-) 8.4 - 11.5 (-15.4) µm, with **Q** = 1.04 - 1.09 (-1.10). ..... *Amanita sinicoflava*.

6. At present, only reported from northern Québec; spores 9.8 - 15.6 × 8.8 - 13.6 µm, with **Q** approx. 1.15. ..... *Amanita groenlandica sensu* Hutchison *et al*.

5. Pileus brownish gray with brown disc or uniformly dark chocolate brown.

7. Pileus brownish gray with brown disc, virgate for most of radius; universal veil absent from pileus; spores (9.1-) 9.5 - 10.8 (-11.0) × (8.0-) 8.5 - 10.0 (-10.5) µm, with **Q** = 1.11. ..... *Amanita sp. S6*.

7. Pileus dark chocolate brown; universal veil on pileus absent or as a sordid calyptra; spores 8.7 - 10.8 (-11.9) × (7.3-) 8.7 - 9.1 (-10.8) µm, with **Q** = 1.12. ..... *Amanita sp. W3*.

Subkey C—Universal veil membranous, stipe annulate (at least at first).

1. More than 30% (often more than 50%) of basidia 2-spored.

2. Pileus white to pale avellaneous.

3. White pileus; gills pinkish; spores (9.2-) 10.2 - 13.9 (-17.0) × (6.6-) 7.0 - 9.0 (-12.8) µm, with **Q** = 1.42 - 1.57. ..... *Amanita ristichii*.

3. Uniformly avellaneous or whitish with slightly pigmented umbo; spores (9.0-) 10.5 - 13.8 (-15.5) × (6.2-) 7.8 - 10.0 (-11.8) µm, with **Q** = 1.33 - 1.37.....
Amanita subvirginiana.

2. Pileus with gray or brown tones, with margin long striate.

4. Pileus gray, with disc sometimes darker; spores (9.5-) 10.5 - 16.2 (-20.0) × (6.0-) 7.5 - 10.5 (-12.5) µm, with **Q** = (1.30-) 1.31 - 1.64. .....
Amanita pachysperma.

4. Pileus brown to grayish brown over disk and pallid at margin; spores (9.1-) 11.5 - 15.0 (-20.5) × (6.5-) 8.5 - 11.2 (-15.5) µm, with **Q** = (1.16-) 1.21 - 1.42 (-1.55). .....
Amanita virginiana.

1. More than 70% of basidia 4-spored.

5. Pileus white to whitish or cream or cream with pale tan disc or whitish to pale pinkish buff with disc pale straw color to pinkish buff or white with disc becoming faintly umbrinous in age. [See also, *Amanita spreta* listed with more intensely pigmented taxa below.]

6. Spores with **Q** ≥ 1.20.

7. Spores with **Q** < 1.40.

8. Pileus whitish, with universal veil forming large white calyptra over most of surface; spores 12.5 - 13.0 × 9.0 - 10.0 µm, with **Q** = 1.31.....
Amanita calyptrata var. *albescens*.

8. Pileus white, without universal remnants; spores 10.8 - 13.0 (-14.5) × (8.0-) 8.2 - 10.2 (-10.5) µm, with **Q** = 1.30.....
Amanita sp. QUE1.

7. Spores with **Q** ≥ 1.40. [See also *Amanita spreta*, listed with more intensely pigmented taxa below.]

9. Pileus hemispheric at first, then convex with flattened or depressed disc, pallid tan with smoky pink tint and paler toward margin; habit rather squat; spores 8.5 - 11.5 × 5.2 - 7.4, with **Q** approx. 1.6.....
Amanita recutita sensu Coker p. p.

9. Pileus umbonate; habit similar to that of *Amanita jacksonii*, etc. Pileus cream, sometimes white at margin, with disc pale tan; spores (9.0-) 10.0 - 12.5 (-13.6) × (6.5-) 6.8 - 8.5 (-9.2) µm, with **Q** = 1.43 - 1.53. .....
Amanita murrilliana.

6. Spores with **Q** < 1.20.

11. Pileus cream; stipe bearing yellow fibrils and squamules; spores 9.4 - 11.2 (-11.5) × (7.7-) 8.7 - 10.1 (-10.5) µm, with **Q** = 1.12. .....
*Amanita sp. W. Litten L-71*5.

11. Pileus getting an umbrinous tint to disc in age, with marginal striae approx. 0.4R; stipe lacking yellow decoration; spores approx. “9 µm” in diameter. .....
Amanita sp. ONT1.

5. Pileus differently colored—with brown or gray tones or scarlet, orange, orange-brown, orange-yellow, yellow-brown, yellow, or a combination of these colors, often with intense pigmentation.

12. Pileus scarlet, orange, orange-brown, orange-yellow, yellow-brown, yellow, or a combination of these colors, often with intense pigmentation.

13. Pileus entirely intensely scarlet at first, umbonate, becoming oranger or fading or developing yellow margin with age; spores (7.0-) 7.8 - 9.8 (-12.1) × (5.2-) 5.8 - 7.5 (-8.7) µm, with **Q** = 1.25 - 1.37 (-1.40). .....
Amanita jacksonii
≡*Amanita umbonata* Pomerleau *non* (Sumstine) Sartory & Maire
=*Amanita caesarea sensu* eastern U.S. authors.

13. Pileus not entirely intensely scarlet at first.

14. Pileus yellow with intensely scarlet disc; spores (8.4-) 8.7 - 10.1 (-13.6) × 5.2 - 7.0 µm, with **Q** = 1.66 - 1.72. .....
Amanita sp. F11.

14. Pileus lacking scarlet regions throughout development and aging.

15. Stipe cream to yellow, often white near base, and often with more strongly yellow, fibrillose scales; pileus often developing brown umbo; volval sac not very large, attached more broadly than just at stipe base, up to 55 mm high; paracresol spot test strong positive throughout much of context; spores (7.5-) 8.4 - 11.9 (-15.0) × (5.2-) 5.9 - 7.5 (-9.8) µm, with **Q** = 1.39 - 1.61 (-1.69). .....
Amanita sp. 16
=*Amanita sp. N12*.

15. Stipe pallid with yellow to yellow-orange, fibrillose decoration; pileus usually not developing brown umbo; universal veil as copious volval sac, attached on at stipe base, up to 110 mm high; paracresol spot test positive in volva and scattered spots of context; spores (7.0-) 7.7 - 10.5 (-15.0) × (5.6-) 6.0 - 8.0 (-10.2) µm, with **Q** = (1.22-) 1.24 - 1.38.....
Amanita arkansana.

11. Pileus differently colored—with brown or gray tones or pallid tan with smoky pink tint and paler toward margin.

16. Pileus very dark colored; spores (9-) 11 - 14 (-15) × 6.5 - 8.5 µm, with **Q** approx. 1.67.....
Amanita eliae sensu Walt Sturgeon.

16. Pileus pallid or with pallid margin.

17. Pileus with date brown disk and pallid margin, campanulate to umbonate; spores [Not yet measured.]. .....
Amanita spreta sensu McIlvaine.

17. Pileus cream to grayish to gray-brown to brown or brownish over disc and paler near margin or pallid tan with smoky pink tint and paler toward margin.

18. Pileus broadly campanulate to convex (and then lacking an umbo), cream to grayish to gray-brown to brown, markedly and densely virgate; spores 10.2 - 13.3 × 5.5 - 7.0 µm, with **Q** = 1.86. .....
Amanita spreta var. *spreta*.

18. Pileus umbonate, brownish over disc, paler toward margin, weakly virgate; spores (8.4-) 8.7 - 11.9 (-14.0) × 5.6 - 7.3 (-8.4) µm, with **Q** = 1.59 - 1.64. .....
Amanita sp. V2.

Subkey D—Fruiting body often large; universal veil as large, thick, saccate volva; stipe exannulate from earliest development; basidia bearing clamps.

1. Pileus with olivaceous tints in part or whole or developing such tints with age.

2. Pileus olive to olive-umbraceous to sordid olivaceous yellow; stipe with dark fibrils; basidia with clamps; spores: (8.5-) 10.0 - 11.8 (-12.2) × (7.8-) 9.0 - 11.0 (-11.2) µm, with **Q** = 1.09. ..... *Amanita violettae* ≡*Amanita vaginata var. crassivolvata.*

2. ***??***.

1. Pileus lacking olivaceous tints at all stages of development and aging. [No entries at this time.]

Subkey E—Stipe exannulate; universal veil membranous; suprapellis comprising gelatinous matrix including narrow, loosely curving, filamentous, undifferentiated hyphae often less than 4.0 µm wide; subpellis comprising closely packed, subradially oriented hyphae; distribution tropical.

Not present in region of study.

Subkey F—Stipe exannulate; universal veil membranous; pileipellis not having a suprapellis comprising a gelatinous matrix; basidia with or without clamps; subhymenium ramose (with or without small inflated elements) in mature regions of lamellae, with plentiful uninflated hyphal segments and few if any inflated cells in subhymenial base.

1. Pileus olivaceous yellow-brown with brown umbo; stipe gray with delicate fibrils in chevron pattern; spores (11.1-) 11.5 - 14.0 × (10.5-) 10.8 - 12.5 µm, with **Q** = 1.11. ..... *Amanita sp. W14.*

1. ***??***

Subkey G—Stipe exannulate; universal veil membranous; pileipellis not having a suprapellis comprising a gelatinous matrix; basidial clamps absent (or, in one case, uncommon); subhymenium pseudoparenchymatous or at least with many basidia arising from inflated cells in mature regions of lamellae; or with many basidia arising from partially inflated or uninflated hyphal segments, but then having basidia commonly arising from inflated cells and also having many rather large globose to subglobose to ovoid to ellipsoid cells in subhymenial base.

1. Subhymenium pseudoparenchymatous or with many basidia arising from inflated cells.

2. Subhymenium strictly pseudoparenchymatous.

3. Pileus warm brown over disc, fox color or chamois (somewhat orangish brown) to tan away from umbo, with marginal striations 0.1R; subhymenium 2 cell layers thick; spores 9.8 - 11.6 (-11.9) × (8.4-) 8.8 - 10.5 (-11.6) µm, with **Q** = 1.10. ..... *Amanita sp. N45.*

See also *Amanita sp. N46* immediately below.

3. Pileus dark fulvous over disc, else tan without fulvous tint, with marginal striations 0.4R; subhymenium 1-2 (-3) cell layers thick; spores (12.5-) 12.6 - 14.0 (-15.5) × (11.8-) 11.9 - 13.5 (-14.5) µm, with **Q** = 1.06. ..... *Amanita sp. N46.*

See also *Amanita sp. N45* immediately above.

2. Subhymenium not strictly pseudoparenchymatous.

4. Pileus pallid orange, orange, yellow-orange, yellow, fulvous or predominated by one or more of these colors.

5. Stipe lacking orange, yellow, orange-brown, or brown fibrils or fibrous squamules.

6. Pileus fulvous (if somewhat pale at first, then with intensity of pigmentation increasing with age); spores (8.0-) 9.2 - 12.0 (-14.0) × (6.8-) 8.8 - 11.2 (-12.5) µm, with **Q** = 1.06 - 1.09 (-1.10). .....
Amanita fulva sensu eastern U.S. authors
=*Amanita sp. N15*.

6. Pileus pale, somewhat brownish orange; spores (8.2-) 9.0 - 11.0 (-12.0) × (7.2-) 8.0 - 9.5 (-11.2) µm, with **Q** = 1.10 - 1.14. [See also *Amanita crocea sensu* western and central U.S. authors, below.]. .....
Amanita sp. W10
=*Amanita crocea sensu eastern U.S. and Mexican authors.*

5. Stipe having orange, yellow, orange-brown, or brown fibrils or fibrous squamules.

7. Pileus orangish; stipe decorated with orange-brown fibrils below and pallid fibrils in apical region; spores (7.5-) 8.5 - 12.0 (-12.8) × 7.2 - 10.5 µm, with **Q** = 1.12. .....
Amanita sp. MN1
=*Amanita crocea sensu western and central U.S. authors.*

7. ***??***

3. Pileus brown to yellowish brown with umbrinous tint or bearing shades of gray or brown.

8. Spores having **Q** ≥ 1.21.

9. Pileus gray to brownish gray.

10. Pileus gray to brownish gray, often drying steel gray; some gills forking and anastomosing; spores [*Amanita sp. 17*] (6.6-) 8.4 - 12.2 (-16.8) × (5.2-) 6.6 - 8.4 (-11.9) µm, with **Q** = (1.21-) 1.27 - 1.44; spores [*Amanita sp. N36*] (9.8-) 10.5 - 12.8 (-14.2) × (7.2-) 7.5 - 9.2 (-9.5) µm, with **Q** = 1.36; spores [*Amanita sp. W7*] (9.4-) 10.0 - 12.2 (-13.8) × (6.5-) 7.0 - 8.8 (-9.2) µm, with **Q** = 1.43 - 1.44. .....
Amanita sp. 17
?=Amanita sp. N36
?=Amanita sp. W7.

10. Pileus brownish gray; spores 10.8 - 14.0 (-17.2) × (6.0-) 8.5 - 11.0 µm, with **Q** = 1.36. .....
Amanita sp. N22.

9. Pileus yellowish-brown with an umbrinous tint to brown; stipe whitish; subhymenial base including plentiful relatively large inflated cells with walls up to 1.0 µm thick; spores: (9.0-) 9.2 - 11.8 (-15.5) × (6.5-) 6.8 - 9.2 (-11.8) µm, with **Q** = 1.26 [size may be skewed too low because sole specimen known was senescent when dried]. .....
Amanita sp. S7.

8. Spores having **Q** < 1.20.

11. Pileus umbrinous brown to pale umbrinous brown, at times densely virgate, often zonate; spores (10.0-) 10.2 - 13.2 (-13.8) × (9.2-) 9.5 - 12.5 (-13.2) µm, with **Q** = 1.05 - 1.06. .....
Amanita sp. N40.

11. ***??***

1. Subhymenium neither pseudoparenchymatous nor having many basidia arising from inflated cells, but having rather common, rather large inflated cells in subhymenial base. [No entries at this time.]

Holding Area.

1. Pileus white or cream or pale tan or pale gray. [For gray or pale brownish gray, see the other half of this couplet, below.]

2. Pileus pure white; spores 9.5 - 12.0 × 9.5 - 11.5 µm, with **Q** = 1.10. .....
Amanita vaginata var. *alba sensu auct. amer.*

2. Pileus not pure white or, if entirely white, then having differently shaped spores.

3. Pileus pale cream, becoming olive-cream with brown disc in age; spores (8.5-) 9.5 - 11.8 × (8.2-) 8.5 - 10.2 (-10.5) µm, with **Q** = 1.10. .....
Amanita sp. N35.
[**??**Compare *Amanita violettae*.]

3. Pileus not getting olivaceous or brown tints in age.

4. Pileus white to slightly cream; volva large and saccate; at present reported only from northern Québec; spores 9.1 - 12.5 × 7.5 - 9.6 µm, with **Q** approx. 1.25. .....
Amanita arctica sensu Hutchison *et al.*

4. Pileus cream or very pale pinkish- or orangish-white, becoming sordid yellowish cream in age; spores 9.2 - 11.0 × (8.2-) 8.5 - 9.5 µm, with **Q** = 1.12. .....
Amanita sp. N26.

4. Pileus white, with pale yellow tint over disc; spores [Not yet measured.].....
Amanita sp. W4.

1. Pileus another color.

5. Pileus yellow, yellow with brown disc, pale brownish orange, or pale orange, lacking olivaceous tints, not maculate.

6. Pileus yellowish to pale orange at first, developing brown tints upon full expansion; spores (7.5-) 8.7 - 10.5 (-11.0) × (7.2-) 8.0 - 9.5 (-9.8) µm, with **Q** = 1.07 - 1.09. .....
Amanita sp. N3.

6. Medium-sized to large mushroom; pileus pale yellow; universal veil copious, coherent; spores 11.9 - 14.7 (-15.7) × (9.5-) 10.5 - 11.9 (-14.0) µm, with **Q** = 1.18. .....
Amanita sp. 24.

5. Pileus bronze, brown, red-brown, chestnut-brown, fuligineous, olive or with olivaceous tint, gray to brownish gray to grayish brown, or maculate.

7. Small mushroom with irregular, unpigmented regions on pileus; spores (8.0-) 8.7 - 14.7 (-17.1) × (7.0-) 7.3 - 13.3 (-16.8) µm, with **Q** = 1.02 - 1.08. .....
Amanita sp. N9.

7. Pileus not maculate.

8. Pileus never zonate. [See, also, under the second half of this couplet if the pileus is pale grayish brown to pale brownish gray.]

9. Pileus slightly brownish gray, sometimes darker over disc; base of stipe becoming brick red when damaged by larvae; universal veil becoming ochraceous or rusty in part or whole, often partially left on pileus, when at base then with large inner limb in widely flaring volva; spores: (8.7-) 9.5 - 12.5 (-14.5) × (8.2-) 9.0 - 11.6 (-14.0) µm, with **Q** = 1.07 - 1.10. .....
Amanita sp. 28.

9. Base of stipe not becoming brick red; universal veil otherwise.

10. Fruiting body large to very large.

11. Pileus umber; spores 9.0 - 10.8 × 8.5 - 9.8 (-10.5) µm, with **Q** = 1.07. .....
Amanita sp. 46.

11. Pileus reddish brown at first, becoming dark umbrinous brown; spores 10.5 - 12.2 (-12.9) × (8.4-) 9.8 - 11.9 µm, with **Q** = 1.06. .....
Amanita sp. W8.

10. Fruiting body not "very large."

12. Pileus gray to brownish gray.

13. Gills very pale gray at first, taking on grayish pink or lavender tones; spores (10.1-) 10.5 - 12.2 (-15.4) × 9.4 - 11.5 (-13.3) µm, with **Q** = 1.10. .....
Amanita sp. W9.

13. Gills never having grayish pink or lavender tones.

14. Spores (7.8-) 9.2 - 12.5 (-15.8) × (7.2-) 8.7 - 12.0 (-14.2) µm, with **Q** = 1.04 - 1.07.....
Amanita vaginata var. *vaginata sensu* eastern U.S. authors.

14. Universal veil easily removed from base of stipe; spores [*Amanita sp. N33*] (9.8-) 10.2 - 12.0 (-12.8) × (8.8-) 9.0 - 10.2 (-10.5) µm, with **Q** = 1.14; spores [*Amanita sp. V1*] (8.4-) 9.8 - 12.2 (-17.5) × (7.0-) 8.4 - 11.9 (-12.9) µm, with **Q** = 1.13 - 1.14. .....
Amanita sp. N33
?=*Amanita sp. V1*.
[See also *Amanita sp. N30*.]

12. Pileus differently colored.

15. Only known from dried material; spores 9.4 - 11.2 × 8.7 - 9.4 (-10.1) µm, with **Q** = 1.12. .....
Amanita sp. N13.

15. Spores with **Q** < 1.10.

16. Pileus brown; volval sac flaring and with rusty stains; spores [*Amanita sp. 44*] (8.4-) 9.1 - 11.2 (-14.3) × (8.4-) 9.1 - 10.8 (-13.3) µm, with **Q** = 1.04; spores [*Amanita sp. N37*-clamps**??**] 9.8 - 11.2 × (8.8-) 9.2 - 10.8 µm, with **Q** = 1.06.....
Amanita sp. 44
?=*Amanita sp. N37*.

16. Pileus chestnut brown (becoming more umbrinous with age), volval sac white, with ochraceous stains, large; spores (9.8-) 10.0 - 11.5 × 9.0 - 10.5 (-10.8) µm, with **Q** = 1.08.....
Amanita sp. N27.

8. Pileus often zonate (usually by a line of darker pigmentation touching the inner ends of the marginal striations).

17. Pileus gray or grayish.

18. Pileus pale grayish brown to pale brownish gray; spores (7.2-) 8.5 - 11.2 (-12.2) × (6.0-) 7.5 - 10.0 (-11.2) µm, with **Q** = 1.13 - 1.14. .....
Amanita sp. N30.
[See also *Amanita sp. N33*.]

18. Pileus gray; spores [Not yet measured.]. .....
Amanita sp. N14.

17. Pileus with some other coloration.

19. Pileus olivaceous cream to olive; spores 8.0 - 10.1 × 7.7 - 9.8 µm, with **Q** = 1.03 - 1.04....
Amanita sp. 21.

19. Pileus with some other coloration.

20. Pileus red-brown; spores (8.4-) 9.1 - 9.8 (-11.9) × 7.7 - 9.1 (-9.8) µm, with **Q** = 1.13. .....
Amanita sp. 22.

20. Pileus umber or sepia or ochraceous umber, at times with olive tint; spores (8.4-) 8.7 - 11.5 (-11.9) × (7.7-) 8.4 - 11.2 µm, with **Q** = 1.05 - 1.06. .....
Amanita sp. 35.

Section *AMIDELLA*

1. Subhymenium containing plentiful, clearly visible hyphae running parallel to central stratum of trama. Distribution: Provinces of Québec and Ontario, Canada to Wisconsin, U.S.A. to Florida and Texas, U.S.A; spores (7.1-) 9.7 - 15.0 (-26.6) × (3.4-) 4.2 - 6.8 (-9.2) µm, with **Q** = (1.73-) 1.86 - 2.93 (-3.08). .....
Amanita peckiana.

1. Subhymenium lacking such hyphae.

2. **Q** > $2.30^{\pm}$; volval sac never large and flaring.

3. With 90% of spores having width 4.0 - 6.2 µm. Distribution: Michigan, U.S.A. to Province of Québec, Canada to North Carolina, U.S.A. .....
Amanita sp. N39.

3. With 90% of spores having width 3.5 - 4.8 µm. Distribution: Florida and Georgia to Texas, U.S.A. .....
Amanita sp. F3.

2. **Q** < $2.30^{\pm}$; volval sac may be large and flaring or tubular or bag-like at first.

4. Universal veil as an ovoid to subglobose volval sac the bulk of which is provided by thickened limbs enclosing the fully elongating stipe, rarely leaving a patch on the pileus.

5. Basidiocarp small; trama divergent in a smooth slow curve; cells still not aligned perpendicularly to hymenial surface when 1-2 cells away from base of basidia; more than 90% of spores 4.5 - 6.0 µm wide. Distribution: northern coast of the Gulf of Mexico to Province of Ontario, Canada to Maine, U.S.A. .....
Amanita sp. 41.

5. Basidiocarp medium to large; subhymenium cellular and comprising a layer 4 - 6 inflated cells thick; more than 90% of spores 5.2 - 7.2 µm wide. Distribution: Iowa, U.S.A. to Nova Scotia, Canada to Louisiana and Texas, U.S.A. .....
Amanita volvata.

4. Universal veil as a cylindrical to short cylindrical to tubular to large and flaring volval sac which may be thickened at the base, but has upper portion of the limb as a somewhat thickened or thin, often distinctly layered, membrane; occasionally leaving membranous patch or patches on pileus.

6. Volva large and tubular and/or flaring; subhymenium of inflated cells and uninflated short hyphal segments with inflated cells up to 2 - 3 layers deep and not in chains perpendicular to central stratum; spores (7.0-) 8.8 - 12.0 (-14.1) × (4.3-) 4.8 - 6.5 (-8.2) µm. Distribution: Minnesota to Illinois to Maine to Florida, U.S.A. .....
Amanita sp. 50 (=*Amanita whetstoneae* Tulloss *nom. prov.*).

6. Volva tubular or "bag-like" or collapsing against stipe; spores (7.0-) 8.8 - 12.5 (-24.0) × (4.0-) 5.0 - 6.2 (-7.2) µm; universal veil on pileus usually only rather scant fibrous-fibrillose remains of inner surface layer; subhymenium consisting of chains of small inflated, partially inflated,

or uninflated elements arising perpendicular to central stratum. Distribution: West Virginia and Virginia to Maine, U.S.A.....
Amanitopsis volvata var. *elongata*.

Section *LEPIDELLA*

1. *Café au lait* colored gills.

2. Base of stipe and upper bulb staining blue-green; upper bulb and pileus lacking rings of small pyramidal warts; spores (8.8-) 9.8 - 13.6 (-15.0) × (5.5-) 6.0 - 9.1 (-10.1) µm, with **Q** = 1.49 - 1.76.
Amanita pelioma.

2. Fruiting body lacking blue-green stains; small pyramidal warts plentiful on pileus and upper part of bulb; spores (8.2-) 8.4 - 10.8 × (5.6-) 5.9 - 7.3 (-8.0) µm, with **Q** = 1.36 - 1.51. .....
Amanita microlepis.

1. Gills usually white or whitish, pallid.

3. Yellowing at least in part when cut or bruised.

4. Very deeply rooting; crushed context (and sometimes annular flocculence) bruising yellow to tannish yellow; spores (7.0-) 8.4 - 11.5 (-14.7) × (4.5-) 4.9 - 6.5 (-7.8) µm, with **Q** = (1.66-) 1.74 - 1.97.....
Amanita sp. 9.

4. Totally yellowing.

5. Small mushroom; with thick gills bearing mature spores; spores (6.6-) 8.7 - 11.5 (-14.0) × (4.2-) 4.5 - 6.0 (-6.3) µm, with **Q** = 1.89 - 1.99.....
Amanita crassifolia.

5. Medium to large mushroom, often associated with white (unchanging) specimens of *Amanita subsolitaria*; often with no normal, mature spores on lamellae. .....
Amanita subsolitaria terat.

3. Basidiocarp not becoming yellow when cut or bruised.

6. Universal veil limbate.

7. Anise odor; raspberry sherbert-colored staining in context; spores (8.7-) 10.0 - 14.6 (-18.9) × (5.0-) 6.0 - 8.0 (-12.6) µm, with **Q** = (1.60-) 1.65 - 1.78. .....
Amanita mutabilis.

7. Lacking an anise odor; lacking red or pink staining in context.

8. Pileipellis containing numerous vascular hyphae; spores (7.3-) 8.0 - 12.2 × 4.5 - 7.0 µm, with **Q** = 1.82 - 1.87.....
Amanita limbatula.

8. Pileipellis lacking vascular hyphae; spores (10.5-) 11.2 - 12.9 (-13.3) × 4.9 - 5.6 (-5.9) µm, with **Q** = 2.30. .....
Amanita parva.

6. Universal veil not limbate.

9. Universal veil not white.

10. Salmon, orangish, yellowish, cream or pinkish universal veil.

11. Salmon or pinkish universal veil; concolorous felted patch of universal veil often left at base of stem (top of bulb); spores (8.0-) 9.0 - 11.5 (-13.8) × 5.5 - 7.2 (-9.9) µm, with **Q** = 1.57 - 1.68.....
Amanita daucipes.

11. Pale orangish white universal veil not leaving felted patch at base of stem (top of bulb); spores (5.0-) 6.5 - 10.0 (-11.0) × (4.0-) 4.5 - 5.8 (-6.5) µm, with **Q** = 1.56 - 1.68.....
Amanita sp. 6.

10. Brownish or grayish universal veil.

12. Brown to grayish brown universal veil.

13. Warts on pileus subpyramidal; warts on bulb in concentric circles extending even below broadest part of bulb; partial veil rather thick and floccose-felted, evanescent or, if present at maturity, becoming slimy and yellowish; spores (8.0-) 8.5 - 10.5 (-13.0) × (5.9-) 6.0 - 7.7 (-8.5) µm, with **Q** = 1.41.....
Amanita atkinsoniana.

13. Warts on pileus in confluent arcs or in patches; warts on stipe and bulb not often evident; partial veil fragmentary or evanescent; spores (8.5-) 9.5 - 12.5 (-16.1) × 5.2 - 6.6 (-7.5) µm, with **Q** = 1.75 - 1.84.....
Amanita hesleri.

12. Brownish gray to gray universal veil, rarely reddish brown in age.

14. Large mushroom; universal veil on pileus as irregular warts; odor of biscuit dough; spores (8.0-) 8.7 - 12.0 (-14.1) × (4.9-) 5.2 - 7.0 (-8.0) µm, with **Q** = 1.63 - 1.78. .....
Amanita cinereopannosa.

14. Differing in one or more characters.

15. Universal veil in felted rags on gray pileus; bulb smooth, ovoid; spores (8.0-) 8.4 - 11.9 (-12.6) × 5.6 - 7.3 (-7.7) µm, with **Q** = 1.39 - 1.86. .....
Amanita sp. 38.

15. Universal veil as irregular to conic to pyramidal warts on pileus.

16. Universal veil as irregular, lumpy warts on pileus, gray to brownish gray; bulb rather slender and rooting, with universal veil as white warts; spores (9.2-) 9.5 - 11.8 (-12.8) × (5.8-) 6.0 - 6.5 (-6.8) µm, with **Q** = 1.72. .....
Amanita sp. N38.

16. Universal veil in dense, conical or pyramidal warts on pileus; bulb often deeply rooting with upper part scaly or with dark gray warts.

17. Spores (7.0-) 7.6 - 11.0 (-13.0) × (5.0-) 5.5 - 7.0 (-7.7) µm, with **Q** = 1.36 - 1.65 (-1.84).....
Amanita onusta.

17. Spores (9.8-) 10.5 - 12.3 (-12.6) × 4.9 - 5.6 (-6.3) µm, with **Q** = 2.16.....
Amanita sp. 11.

9. With universal veil white or pallid, at least at first.

18. Pileus grayish-brown at least over disc (even in button) with white or near white margin. [Note: A pair of very similar taxa—if indeed they can be separated.]

19. With pale salmon or pale orangish yellow fibrils on stipe (especially after handling); odor not distinctive or faintly fungoid or faintly of cedar wood or burnt sugar (but then not unpleasant as in *Amanita sp. 5*); spores (6.5-) 7.2 - 10.5 (-11.2) × (4.5-) 4.8 - 5.8 (-6.3), with **Q** = 1.60 - 1.69.....
Amanita canescens.

19. Stipe lacking such fibrils, more or less browning from handling although flocculence on stipe under annulus may become golden yellow when crushed; odor of chlorine bleach or "CaCl"; spores (6.5-) 7.5 - 9.8 (-11.9) × (4.0-) 4.2 - 5.6 (-6.3) µm, with **Q** = 1.65 - 1.74. .....
Amanita sp. 39.

18. Pileus completely white, except possibly in age.

20. Bulb abrupt and turnip-like with pseudorhizzae; spores (6.8-) 7.2 - 9.1 (-10.2) × (5.6-) 6.0 - 7.5 (-9.2) µm, with **Q** = 1.17 - 1.25. .....
Amanita abrupta.

20. Otherwise.

21. Stipe base above radicating bulb encircled by terraces or nearly complete rings of universal veil tissue; spores (8.5-) 11.8 - 15.5 (-17.0) × (4.0-) 4.2 - 5.5 (-6.0) µm, with **Q** =2.61 - 2.98. .....
Amanita sp. 4.

21. Otherwise.

22. Large to very large mushroom; pileus having many small, pyramidal warts; many rings of tiny warts around base of clavate stipe; spores (7.0-) 8.7 - 13.0 (-17.5) × (5.2-) 5.9 - 7.8 (-9.5) µm, with **Q** = (1.35-) 1.50 - 1.81. .....
Amanita polypyramis
=Amanita alexandri.

22. Otherwise.

23. Partial veil membranous, thick-margined, often having fibrils connecting underside to stipe; sometimes having duplex partial veil joined at edge or even having two separate skirtlike partial veils.

24. Odorless at least up to period of sporulation, sometimes with odor in age.

25. Large scales on bulb; pileus with white, pyramidal warts; spores (9.2-) 10.8 - 13.2 (-15.0) × (5.5-) 6.5 - 8.7 (-9.5) µm, with **Q** = 1.44 - 1.56 (-1.74). .....
Amanita cokeri.

25. Bulb without scales; pileus with pale cream/orangish warts; spores (5.0-) 6.5 - 10.0 (-11.0) × (4.0-) 4.5 - 5.8 (-6.5) µm, with **Q** = 1.56 - 1.68. .....
Amanita sp. 6.

24. With strong odor of burnt sugar, cedar wood, or old cedar cigar box, old ham or chlorine in period of sporulation prior to start of senescence.

26. Odor “strong”; spores 9.1 - 10.5 × (5.6-) 6.3 - 7.0 µm, with **Q** = 1.58. .....
Amanita sp. 30.

26. Odor of burnt sugar, cedar wood, or old cedar cigar box; 90% of specimens with **Q** in the range 1.64 - 2.02.

27. Odor of burnt sugar and cedar wood, or old cedar cigar box; spores: (8.0-) 10.1 - 14.0 (-19.0) × (5.2-) 5.9 - 7.5 (-10.9) µm, with **Q** = (1.59-) 1.64 - 2.02 (-2.11). .....
Amanita sp. 5.

27. Odor of burnt sugar; spores: (7.7-) 9.1 - 13.3 (-14.2) × (5.2-) 5.6 - 6.3 (-6.6) µm, with **Q** = 1.70 - 2.15. .....
Amanita sp. 40.

23. Partial veil absent or collapsing in nonmembranous (but possibly submembranous or felted) fragments.

28. Large mushroom; very massive, deeply rooting bulb.

29. With overhanging, sterile pileus margin; spores 7.0 - 10.2 × 5.5 - 6.2 µm, with **Q** = 1.51. .....
Amanita marginata.

29. Lacking overhanging, sterile pileus margin.

30. Warts on pileus radially fibrillose (lens); often with massive and irregular bulb; spores (7.0-) 8.0 - 11.9 (-14.0) × (4.6-) 5.2 - 7.7 (-8.5) µm, with **Q** = 1.48 - 1.64 (-1.81). .....
Amanita ravenelii.

30. Warts on pileus not radially fibrillose; if bulb massive, then top shaped or deeply radicating (subfusiform or carrot-shaped) and sometimes doglegged.

31. Recurved scales at top of rooting bulb; spores (7.0-) 8.0 - 9.1 (-9.8) × (4.9-) 5.2 - 6.6 µm, with **Q** = 1.47. ..... *Amanita sp. N7*.

31. Smooth bulb.

32. Very slender habit; extremely deeply rooting (nearly impossible to collect entire bulb); spores (7.0-) 8.4 - 11.5 (-14.7) × (4.5-) 4.9 - 6.5 (-7.8) µm, with **Q** = (1.66-) 1.74 - 1.97. ..... *Amanita sp. 9*.

32. Not so deeply rooting, although bulb is massive; with **Q** < 1.62.

33. Massive, dog-legged bulb; spores (8.0-) 8.5 - 10.5 (-12.5) × (5.0-) 5.6 - 6.8 (-7.8) µm, with **Q** = 1.46 - 1.56. ..... *Amanita rhopalopus* f. *rhopalopus*.

33. Massive, top-shaped or turnip-shaped bulb; spores (7.3-) 8.2 - 11.5 (-14.5) × (5.0-) 5.6 - 7.8 (-9.0) µm, with **Q** = 1.42 - 1.58. ..... *Amanita rhopalopus* f. *turbinata*.

28. Otherwise.

34. Carrot- or turnip-shaped bulb; usually with a few forking lamellae; spores (8.0-) 8.7 - 15.4 (-21.0) × (3.5-) 3.8 - 6.0 (-6.3) µm, with **Q** = 2.21 - 2.81. ..... *Amanita subsolitaria* =*Amanita solitariiformis*.

34. Otherwise.

35. Small mushroom with rooting stipe; spores (9.0-) 10.0 - 13.5 (-14.0) × (4.2-) 4.8 - 5.8 (-6.5) µm, with **Q** = 2.25. ..... *Amanita sp. N18*.

35. Medium-sized to large mushroom; very flocculent universal veil.

36. Dog-legged bulb slightly radicating; no clamps at base of basidia; spores (7.2-) 9.8 - 14.0 (-21) × (3.9-) 4.9 - 6.3 (-7.7) µm, with **Q** = (1.85-) 1.94 - 2.48 (-2.51). ..... *Amanita longipes*.

36. Clavate stipe; rather obvious and plentiful clamps at base of basidia; spores (7.5-) 8.0 - 11.0 (-12.2) × (4.5-) 4.7 - 6.5 (-7.5) µm, with **Q** = 1.52 - 1.81. ..... *Amanita chlorinosma*.

Section PHALLOIDEAE

1. Pileus white or off-white.

2. Stipe often largely below surface of soil; spores cylindric to bacilliform, (7.8-) 11.5 - 15.8 (-25) × (3.2-) 3.8 - 5.0 (-6.2) µm, with **Q** = (2.44-) 2.55 - 3.55 (-3.60). ..... *Amanita cylindrispora*.

2. Otherwise.

3. Universal veil saccate to limbate.

4. Basidia dominantly bisterigmate; small to medium-sized mushroom; pileus margin not striate; spores (5.2-) 7.2 - 9.9 (-11.0) × (4.8-) 6.5 - 8.6 (-10.0) µm, with **Q** = (1.05-) 1.06 - 1.18 (-1.20). *Amanita bisporigera* =*Amanita phalloides* var. *striatula*.

4. Basidia dominantly 4-sterigmate.

5. KOH solution producing yellow reaction on pileus; spores with **Q** < 1.20.

6. Medium to large mushroom; spores (7.0-) 7.5 - 10.0 (-13.2) × (6.0-) 7.0 - 9.5 (-11.5) µm, with **Q** = 1.06 - 1.11 (-1.13). .....
Amanita virosa sensu auct. amer.

6. Small mushroom; spores (4.9-) 8.0 - 10.1 (-11.2) × (4.2-) 7.0 - 8.7 (-9.4) µm, with **Q** = (1.09-) 1.16 - 1.17. .....
Amanita sp. 33.

5. KOH solution usually not producing a yellow reaction on pileus; spores with average **Q** ≥ 1.20.

7. Spores *per* Marchand (1971) "(8.75-) 10.0 - 10.5 (-11.2) × (7.0-) 7.5 - 8.25 (-9.4) µm," with **Q** approx. 1.2 - 1.3. .....
Amanita verna.
[Not confirmed from region of study.]

7. Spores with average **Q** > 1.30.

8. Spores: (6.8-) 8.3 - 11.4 (-16.3) × (4.8-) 5.7 - 8.0 (-11.0) µm, with **Q** = (1.32-) 1.35 - 1.57 (-1.65). .....
Amanita magnivelaris
=Amanita eburnea
=Amanita elliptosperma.

8. Spores: (7.3-) 8.4 - 11.2 (-13.5) × (4.9-) 5.5 - 6.8 (-8.5) µm, with **Q** = 1.50 - 1.60 (-1.69). ...
Amanita sp. S4.

3. Bulb marginate without saccate or limbate universal veil.

9. Globose to subglobose, marginate bulb; powdery universal veil on pileus; spores "7.0 - 10.0 µm" in diameter. .....
Amanita floccocephala, but check if pale example of *Amanita citrina sensu auct. amer.*

9. Abrupt to subabrupt, usually cleft bulb; context browning.

10. Very pale yellow to very pale citrine, faintly virgate pileus, with umber-gray virgation developing with age; spores 7.8 - 9.4 × 7.8 - 8.6 µm, with **Q** = 1.07. .....
Amanita brunnescens var. *pallida.*

10. Fruiting body entirely white except for some yellow or tan coloration on pileus over disc; pileus with no sign of innate, colored, radial fibrils—even in age; spores (7.0-) 7.2 - 8.5 (-8.8) × 6.8 - 8.2 (-8.5) µm, with **Q** = 1.06. .....
Amanita aestivalis.

1. Pileus pigmented.

11. Spores with **Q** ≥ 1.5; universal veil saccate or limbate with relatively long, upstanding free limb.

12. Pileus sometimes yellowish cream at first, eventually grayish brown to umbrinous; spores (10.0-) 10.5 - 12.8 (-14.8) × (4.2-) 5.0 - 6.5 (-7.2) µm, with **Q** = 2.0 - 2.28. .....
Amanita longitibiale.

12. Pileus "midnight blue" (!!) at first, becoming grayer with maturation; spores (8.5-) 9.1 - 11.0 (-2.5) × 5.0 - 6.2 (-6.8) µm, with **Q** = 1.78. .....
Amanita sp. S7.

11. Spores with **Q** < 1.4; universal veil saccate to limbate occasionally, often leaving scattered remains on stipe above abrupt bulb.

13. Having a gray annulus. [Also, see *Amanita citrina* of which old specimens may have a sordid annulus.]

14. Pileus purplish-brown; spores (7.5-) 8.0 - 9.8 (-11.2) × (7.0-) 7.5 - 9.2 (-11.0) µm, with **Q** = 1.05 - 1.07. .....
Amanita porphyria.

14. Pileus grayish olive to umbraceous; spores [Not yet measured.]. .....
Amanita sp. N17.

13. Having a white or yellowish annulus.

15. Pileus citrine yellow or paler yellow.

16. Entire mushroom with an odor of Pepto-Bismol (oil of wintergreen); spores (6.3-) 7.0 - 9.1 (-9.8) × (5.6-) 8.0 - 9.1 µm, with **Q** = 1.07. .....
Amanita sp. 25.

16. Bulb with an odor of freshly dug potatoes.

17. Universal veil whitish, browning; spores (6.0-) 7.0 - 9.5 (-11.0) × (5.8-) 6.8 - 9.0 (-10.2) µm, with **Q** = 1.05 - 1.06. .....
Amanita citrina sensu auct. amer.
=A*manita brunnescens* var. *straminea*.

17. Universal veil with lavender tint and/or pileus with lavender streaks; spores 5.5 - 7.0 × 5.5 - 7.0 µm, with **Q** = 1.04. .....
Amanita citrina f. *lavendula*.

15. Pileus some other color.

18. Pallid with no brown tint; spores 7.8 - 9.4 × 7.8 - 8.6 µm, with **Q** = 1.07. .....
Amanita brunnescens var. *pallida*.

18. Pileus brownish, olive brown or greenish.

19. Pileus olive brown or greenish.

20. Pileus greenish or olivaceous, sometimes with yellow tint, virgate; universal veil limbate to saccate and very white; odor becoming nauseatingly sweetish; spores (7.5-) 8.0 - 10.1 (-12.5) × (5.5-) 6.1 - 8.0 (-9.0) µm, with **Q** = 1.20 - 1.33 (-1.40). .....
Amanita phalloides var. *phalloides*.

20. Pileus with olive brown disk; universal veil limbate; bulb with odor of new potatoes; spores 6.6 - 9.0 × 6.1 - 9.2 µm, with **Q** = 1.04. .....
Amanita solaniolens.

19. Pileus brown without olivaceous tints.

21. Very small mushroom with disk often lacking pigmentation; spores (6.6-) 7.2 - 9.0 (-10.8) × (5.9-) 6.6 - 8.5 (-10.1) µm, with **Q** = 1.06 - 1.11. .....
Amanita sp. O2.

21. Otherwise.

22. Warts of universal veil on pileus and in soil yellow at first, fading to tan or off-white; spores 7.0 - 8.8 (-10.5) × (5.5-) 6.5 - 8.0 (-9.5) µm, with **Q** = 1.06 - 1.16. .....
Amanita sp. N20.

22. Universal veil never yellow.

23. Pileus virgate, umber; whitish to pallid patches of universal veil; spores (7.0-) 7.5 - 8.8 (-9.2) × (6.5-) 7.0 - 8.0 (-8.5) µm, with **Q** = 1.08. .....
Amanita brunnescens var. *brunnescens*.

23. Pileus gray-brown to extremely dark brown.

24. Gray-brown pileus, with gray-brown floccose patches of universal veil; spores 7.8 - 9.4 × 7.2 - 9.5 µm, with **Q** = 1.05. .....
Amanita lignophila.

24. Extremely dark brown, virgate pileus; spores "8.8 × 7.7" µm, with **Q** approx. 1.15.
Amanita crassivolvata.

Section VALIDAE

1. Fruiting body, excepting universal veil, entirely white (at least prior to bruising or aging).

2. Strongly staining red-brown when cut or bruised, universal veil remnants sometimes yellow (e.g., under partial veil); spores (6.5-) 7.0 - 9.8 (-10.5) × (4.5-) 5.0 - 7.0 (-8.5) µm, with **Q** = 1.34 - 1.49 (-1.50).....
Amanita rubescens var. *alba*.

2. Context not staining red-brown; universal veil never yellow; differing in other characters.

3. Stipe surface and other parts of mushroom bruising salmon when handled; spores (5.9-) 6.6 - 9.1 (-10.5) × (4.2-) 4.5 - 5.9 (-6.3) µm, with **Q** = 1.45 - 1.62.....
Amanita salmonescens.

3. Lacking bruising reaction.

4. Large, mushroom with irregularly facetted, somewhat rooting bulb; spores 6.3 - 7.5 × 4.2 - 5.0 µm, with **Q** = 1.50. .....
?*Amanita spissa* var. *alba* Coker *non* Rick.

4. Slender mushroom with smooth ovoid bulb.

5. Spores: 6.5 - 7.5 (-7.8) × 5.2 - 6.2 (-7.0) µm, with **Q** = 1.21. .....
Amanita sp. N31.

5. Spores with **Q** > 1.35.

6. Spores: 7.0 - 8.7 (-9.4) × 5.2 - 6.3 (-6.6) µm, with **Q** = 1.40.....
Amanita sp. N5.

6. Spores: 7.1 - 9.4 × 5.5 - 6.3 (-6.6) µm, with **Q** = 1.43. .....
Amanita sp. 20.

1. Entire fruiting body not white.

7. Universal veil material yellow at first, with color persisting beyond "button" stage.

8. Pileus a shade of yellow or orange at first.

9. Pileus yellow, sometimes with wine stains in age; stipe context wine in base in age; spores (7.4-) 7.6 - 10.5 (-12.6) × (4.9-) 5.4 - 7.0 (-8.4) µm, with **Q** = (1.34-) 1.37 - 1.61.....
Amanita flavorubens
=*Amanita flavorubescens*.

9. Pileus yellow to orange to orange-red, stipe context not staining; 95% of spores having length ≤ 9.4 µm.

10. Pileus yellow-orange; stipe yellowish; spores (6.5-) 6.8 - 8.5 (-9.5) × (4.8-) 5.0 - 6.5 (-7.5) µm, with **Q** = (1.21-) 1.34 - 1.49.....
Amanita flavoconia var. *flavoconia*.

10. Pileus yellow or orange-red; spores with differing value of **Q**.

11. Pileus yellow; stipe white; spores (7.5-) 7.8 - 9.4 (-10.0) × (4.5-) 5.5 - 6.2 µm, with **Q** = 1.51 - 1.54.....
Amanita elongata.

11. Pileus orange-red; stipe white to ivory to pale yellow; spores (5.0-) 5.5 - 9.0 (-10.5) × (3.8-) 4.5 - 6.5 (-8.2) µm, with **Q** = 1.24 - 1.36. .....
Amanita sp. MD1.

8. Pileus pale tan to brown or yellow-brown.

12. Pileus with brown pigmentation in "innate fibrils." [Occasionally, the pileus of *Amanita franchetii* may be faintly virgate; hence, see, also, the other half of this couplet.]

13. Spores: 7.7 - 12.2 × (4.5-) 4.9 - 7.7 µm, with **Q** = 1.65. .....
Amanita sp. 23.

13. Like *Amanita flavoconia* but with an olive-brown to brown pigmentation; spores 7.0 - 9.1 (-9.4) × (4.9-) 5.2 - 6.3 µm, with **Q** = 1.42 - 1.47. .....
Amanita sp. 10.

12. Pileus continuously colored golden-brown or yellow-brown or tan or uneven medium brown with some yellowish regions.

14. Pileipellis pale tan; context without yellow color under pileipellis; spores 7.3 - 9.1 (-9.8) × (4.9-) 5.2 - 6.3 µm, with **Q** = 1.47. .....
Amanita sp. 43.

14. Context under pileipellis either permanently yellow or staining yellow in button specimen.

15. Scraping pileipellis in button produces yellow staining of context; reaction not occurring in fully expanded fruiting body; spores (Kühner & Romagnesi, 1974): 7.5 - 11.0 × 5.2 - 9.5 µm, with **Q** approx. 1.25. .....
Amanita franchetii (brownish capped form).
[Not confirmed for the region of study.]

15. Scraping pileipellis in button or adult reveals permanent yellow coloration.

16. Spores: (5.9-) 6.6 - 8.4 (-9.4) × 4.2 - 5.2 (-5.6) µm, with **Q** = 1.51 - 1.58. .....
Amanita sp. 36.

16. Spores: (7.5-) 8.2 - 9.2 (-11.0) × (5.8-) 6.0 - 6.8 (-7.2) µm, with **Q** = 1.40. .....
Amanita sp. ONT2.

7. Universal veil on pileus may be yellow or yellowish (especially near pileus margin) in early stages of expansion (*e.g.*, see *Amanita rubescens* var. *rubescens sensu auct. amer.*, below); but, if so, the yellow color does not persist.

17. Pileus yellow or orange or orangish red. [Variants of taxa listed as having yellow universal veil material, above.]

17. Pileus differently colored.

18. Entire fruiting body liable to red-brown staining/bruising as it matures; spores (7.0-) 7.3 - 9.5 (-9.8) × (5.6-) 5.9 - 7.0 (-7.3) µm, with **Q** = 1.23 - 1.38. .....
Amanita rubescens var. *rubescens sensu auct. amer.*

18. Entire fruiting body not liable to red-brown staining.

19. Spores: (7.0-) 7.5 - 10.5 (-13.5) × (5.3–) 5.8 – 7.5 (–8.5) µm, with **Q** = 1.34 - 1.36. .....
Amanita excelsa
≡*Amanita ampla*
=*Amanita spissa*.
[Not confirmed from the region of study and probably not present.]

19. 95% of spores with length ≤ 9.8 µm.

20. Pileus nearly dark brown to nearly black at first, underside of partial veil *Pale Ochraceous Buff* to orangish tan to pinkish; spores (6.0-) 7.2 - 9.8 (-11.5) × (4.2-) 5.5 - 7.0 (-8.2) µm, with **Q** = (1.28-) 1.30 - 1.42 (-1.44). ..... *Amanita morrisii*.

20. Pileus differently pigmented; partial veil white; spores with **Q** × 1.40.

21. Pigmentation continuous (although possibly darkest over disk).

22. Margin of pileus somewhat lobed; odorless; rather large, coarse warts on pileus; spores (7.0-) 7.3 - 9.8 (-11.5) × (4.5-) 4.9 - 6.2 (-6.5) µm, with **Q** = 1.54 - 1.56. ..... *Amanita sp. 19* [?= *Amanita spissa sensu* Coker].

22. Margin not lobed; odor of apples; fine subgranular warts on pileus; spores (8.0-) 8.4 - 9.8 (-11.5) × 5.6 - 7.7 (-8.4) µm, with **Q** = 1.37 - 1.42. ..... *Amanita sp. 15*.

21. Pileus virgate (pigmentation distributed in innate radial fibrils).

23. Odorless; pileus silky gray; spores 7.3 - 9.8 (-11.2) × 5.2 - 7.0 µm, with **Q** = 1.40 - 1.52. *Amanita sp. N11*.

23. Having a distinctive odor; pileus pigmentation a shade of brown.

24. Odor of anise; spores (7.7-) 8.0 - 9.4 (-10.5) × 5.2 - 6.3 (-7.3) µm, with **Q** = 1.46. ..... *Amanita sp. N10*.

24. Odor of apples or similar fruit-like odor or (occasionally) somewhat like tar or creosote; spores [*Amanita sp. 18*] (7.0-) 7.5 - 9.8 (-10.5) × (4.5-) 4.9 - 6.8 (-7.5) µm, with **Q** = 1.42 - 1.56; spores [*Amanita sp. 29*] 7.0 - 9.8 (-11.9) × (4.2-) 4.9 - 7.3 (-8.4) µm, with **Q** = 1.44 - 1.51. ..... *Amanita sp. 18* *?=Amanita sp. 29* [?=*Amanita submaculata*].