

A Contribution to *Tricholoma*

Howard E. BIGELOW

Department of Botany, University of Massachusetts, Amherst, Massachusetts
01003, USA

Abstract. The species described in North America of stirps *Flavovirens* of *Tricholoma* subgenus *Tricholoma* are discussed. Complete descriptions are given for *Tricholoma flavovirens* var. *albipes* (PECK) comb. nov., *T. aestuans* (FRIES) GILLET, *T. sejunctum* (FRIES) QUÉLET, and *T. fumosoluteum* (PECK) SACCARDO. Additional data are contributed about the type collections of *Melanoleuca yatesii* MURRILL, *Tricholoma intermedium* PECK, and *Tricholoma subluteum* PECK.

In the classification of SINGER (1975), most species of *Tricholoma* which have yellow pilei are placed in subgenus *Tricholoma*, section *Tricholoma*, stirps *Flavovirens*. The taxa of this group can be divided further into those having yellow lamellae and those having white lamellae. Since there is a well-known and widely distributed species of each type, it is convenient to regard them as the *Tricholoma flavovirens* complex and the *Tricholoma sejunctum* complex, respectively. The North American representatives of stirps *Flavovirens* are the subject of this contribution.

The colors noted in parentheses in the following descriptions are from RIDGWAY (1912). All the collections cited, except for the type collections of PECK (NYS) und MURRILL (NY), are deposited in the University of Massachusetts herbarium (MASS).

The *Tricholoma flavovirens* complex

Tricholoma flavovirens (FRIES) LUNDELL, in LUNDELL & NANN-FELDT, Fungi exsiccati Suecici, fasc. 23, n. 1102. 1942. var. *flavovirens*

Syn.: *Tricholoma equestre* (FRIES) QUÉLET, Champ. Jura et Vosges, p. 76. 1872.

The typical variety is widespread in North America and occurs most frequently under pine. A complete field description would be superfluous here as most books on fleshy fungi include the species. In general it is characterized by a viscid, pale yellow to sulphur yellow pileus which becomes reddish to brownish on the disc. The lamellae are sulphur yellow as is the stipe. An odor is lacking and the taste varies from mild to slightly farinaceous or unpleasant. The microscopic characters of the pileus and lamellae are the same as in the following var. *albipes*.

Material examined: U. S. A.: Arizona: BIGELOW 17217; California: BIGELOW 17031; Idaho: BIGELOW 1847; Maine: BIGELOW 16723; Massachusetts: BIGELOW 8754; Michigan: BIGELOW 1355; Washington: BIGELOW 2347.

Tricholoma flavovirens var. *albipes* (PECK) BIGELOW, comb. nov.

Tricholoma equestre var. *albipes* PECK, Bull. New York State Mus. 157: 53 (Latin description: p. 115). 1912.

Pileus 3—11.5 cm broad, broadly convex or conic at first with margin slightly incurved and inrolled, not striate, becoming plane, at times with low broad umbo, margin broadly undulate at times, surface viscid when moist, glabrous or with appressed small scales on and near disc, generally bright yellow (“martius yellow”, “picric yellow”, “pinard yellow”), disc tinged dull “tawny” in age; context thin, firm, brittle, white. Odor and taste farinaceous.

Lamellae sinuate, close, broad (up to 11 mm), narrowed toward pileus margin, yellow (concolorous with pileus or slightly paler, “primrose yellow”), edges even, slightly undulate.

Stipe 4—9 cm long, apex 7—18 mm thick, equal or base enlarged (up to 2.7 cm thick), cortex thick, stuffed in center and white, apex with a thin pruinose coating, innately fibrillose below, white or whitish.

Spores 6.5—7.5(—8.5) × 4—4.5(—5) μ m, elliptic, smooth, inamyloid, deposit white. Basidia 25—28 × 5—7.5 μ m, 4-spored. Cystidia absent. Pileus: epicutis gelatinous in KOH, hyphae cylindric, 2—2.5 μ m diam, smooth and thin walled, hypocutis vinaceous in KOH, of cylindric hyphae, 2—4 μ m diam, often with coarse encrustations (> 2 μ m high), walls also somewhat thickened at times; context hyphae of cylindric or somewhat inflated hyphae, 2.5—12 μ m diam, walls smooth, thin or thickened. Hymenophoral trama of parallel hyphae, mostly somewhat inflated, 2.5—11(—17) μ m diam. Clamp connections present.

Gregarious to cespitose. On soil and humus under pine or spruce or in mixed woods of pine-birch-aspen. September into November.

Material examined: U. S. A.: Maine: BIGELOW 16761; Massachusetts: BIGELOW 10030, 17751; Vermont: BIGELOW 14176, 14177, 14178, 14179, 14180. Canada: Quebec: BIGELOW 4807.

Variety *albipes* is distinct from var. *flavovirens* by the white stipe and farinaceous odor.

The distribution of variety *albipes* throughout North America is not known, but certainly fruitings are not uncommon in the northeast.

Tricholoma aestuans (FRIES) GILLET, Hymen. France, p. 102. 1874.

Agaricus aestuans FRIES, Syst. Mycol. 1: 47. 1921.

Pileus 1.5—6.5 cm broad, obtuse or hemispheric to convex at first with margin incurved and inrolled, expanding to broadly convex

or nearly plane, margin undulate or irregular at times in age, not striate, disc shallowly depressed in age, surface dull on disc, shiny at margin, generally glabrous-appearing to the eye but fibrillose under a lens, dry when collected, yellow (nearest „baryta yellow” or „straw yellow” but duller and dingier), disc brownish in age; context white, thin, firm. Odor and taste not distinctive.

Lamellae nearly free in immature basidiocarps, sinuate when expanded, close, broad (> 8 mm), yellow (nearest „primrose yellow”), edges eroded and undulate.

Stipe 1.5–5 cm long, 8–15 mm thick, equal or base clavate, solid (white within), surface fibrillose, faintly yellow like pileus, dingy near the base in age.

Spores $5.5-7(-7.5) \times 4.5-5.5$ μm , broadly elliptic, smooth, inamyloid. Basidia $24-31 \times 6-8.5$ μm , mostly 4-spored, rarely 2-spored. Cheilocystidia present, clavate pedicellate, smooth, thin walled, hyaline, $10-15$ μm diam. Pileus: epicutis subgelatinous in KOH, yellowish or in places reddish in KOH, hyphae cylindric, $2.5-4.5$ μm diam, pigment encrusted or in thickened walls; context hyaline in KOH, hyphae cylindric or slightly inflated, $4.5-14.5$ μm diam. Hymenophoral trama of parallel hyphae, hyphae cylindric or somewhat inflated, $3-11.5$ μm diam. Clamp connections absent.

Gregarious. On leaves and moss under hardwoods. September.

Material examined: U. S. A.: Massachusetts: BIGELOW 9303. Finland: BIGELOW 16360.

On present information *T. aestuans* would appear to be rare in North America, but it is quite conceivable that this species has been confused with *T. flavovirens* in view of the similarity of field characters. The cheilocystidia of *T. aestuans* provide the most definitive means for separation.

My description conforms well to that of ORTON (1969), except that a bitter taste was not noted for the Massachusetts specimens. Such a taste is diagnostic for *T. aestuans*, but I am reluctant to consider that my collection represents a different taxon on this basis alone.

Melanoleuca yatesii MURRILL (North Amer. Flora 10: 29. 1914.), described from California, seems to be a synonym of *T. flavovirens* var. *flavovirens*. The microscopic features of the type collection (H. S. YATES 8, Berkeley, California, January 24, 1913, under Monterey cypress and eucalyptus trees. NYS) are: Spores $5-6.5(-7) \times 3-4(-4.5)$ μm , elliptic, smooth, inamyloid. Basidia $22-45 \times 6-8$ μm , 4-spored. Cystidia are absent. Pileus: cutis gelatinous in KOH, hyphae $0.5-3$ μm diam, hyaline, hypocutis vinaceous in KOH, hyphae $2.5-5$ μm diam, walls often thickened and sometimes encrusted; context faintly yellowish in KOH, hyphae cylindric or

broadly cylindric, rarely inflated, (3—)10—15 μm diam, walls often thickened (1—1.5 μm thick), smooth. Hymenophoral trama of parallel hyphae, cylindric adjacent to subhymenium, 2.5—5 μm diam, cylindric to slightly inflated in mediostratum, 3—10 μm diam. Clamp connections absent.

The field characters of *M. yatesii* are also those of *T. flavovirens* var. *flavovirens* although the odor and taste are not recorded.

Tricholoma davisiae PECK, Bull. Torrey Bot. Club 27: 611. 1900.

A description of this species was presented by BIGELOW (in BIGELOW & BARR, 1962), based upon collections made in Massachusetts and a study of the type (NYS). It has a yellow pileus and lamellae like *T. flavovirens* and *T. aestuans*, but the lamellae and white stipe bruise reddish. Both pleurocystidia and cheilocystidia are present in *T. davisiae*, and the surface of the pileus is dry.

Melanoleuca citrinifolia MURRILL, Mycologia 30: 365. 1938.

Murrill wrote of this species, "very pretty and distinct, not suggesting to me any of our northern species." MURILL certainly knew *T. flavovirens*, so the "pale rosy-isabelline" pileus, in conjunction with the lemon-yellow lamellae and stipe, provided a different aspect to him. The bitter taste of *M. citrinifolia* suggests *T. aestuans*, but this has cheilocystidia. HESLER (1958) did not find cystidia in his study of the type. The spores were 5—6 \times 3.5—4.5 μm , ovoid, smooth, inamyloid. The pileus epicutis consistend of interwoven, narrow hyphae, 2.5—4.5 μm diam, which were not gelatinized.

The combination of colors, bitter taste, and microscopic characters indicate that *Tricholoma citrinifolium* (MURR.) MURILL is a distinct species. As far as known, the type collection from Gainesville, Florida, 5 Feb. 1929 (F 9860) is the only collection.

The *Tricholoma sejunctum* complex

Tricholoma sejunctum (FRIES) QUÉLET, Champ. Jura et Vosges, p. 76. 1872.

Agaricus sejunctus FRIES, Syst. Mycol. 1: 47. 1821.

Tricholoma subsejunctum PECK, Bull. New York State Mus. 157: 53. 1912. Plate 124.

Melanoleuca subsejunctum (PECK) MURRILL, North Amer. Flora 10: 24. 1914.

Pileus (1.2—)1.8—5.7 cm broad, obtuse conic to convex when young with the margin incurved and narrowly inrolled, not striate, finally expanding to broadly convex or nearly plane, dry, strongly virgate with blackish or blackish-brown fibrils, ground color yellow ("empire yellow"), often evident only at margin, incurved edge whitish in young pilei, splitting radially in age; context thin, firm but rather brittle, white. Odor and taste farinaceous.

Lamellae sinuate, often with a slight decurrent tooth, close, broad (up to 1 cm), white or tinged faintly yellowish in age, edges undulate, brittle in age

Stipe 3—7 cm long, apex 8—13 mm thick, equal or somewhat ventricose or enlarged at either end, stuffed (whitish within), cortex thick, apex fibrillose, innately fibrillose below, white or with yellow bluish.

Spores 6—7(—7.5) × 4—5.5 μ m, subglobose to broadly elliptic, smooth, inamyloid, white in deposit. Basidia 33—37 × 7.5—8 μ m, 4-spored. Cheilocystidia absent or rare, clavate pedicellate, 28—43 × 10—11 μ m, smooth, walls slightly thickened, hyaline. Pileus: cutis gelatinous and hyaline in KOH, hyphae cylindric, 1.5—4 μ m diam, some finely encrusted, hypocutis brownish in KOH, walls thickened (up to 1.5 μ m); context cylindric to inflated, 3—18 μ m diam, cells often short, walls mostly thin. Hymenophoral trama of parallel hyphae, cylindric to inflated, (2.5—)5—11(—20) μ m, hyaline, walls thin. Clamp connections absent.

Scattered, on soil and needles, under pine, spruce or hemlock. Collected twice on humus under oak and maple. Late August through October.

Material examined: U. S. A.: Maine: BIGELOW 11485; Massachusetts: BIGELOW 8932, 9305, 9371, 15281, 16070, 16071, 16093, 17773; New Hampshire: BIGELOW 15839; New York: C. H. PECK, Mohawk Hill, Lewis Co., September (type of *Tricholoma subsejunctum*, NYS); Vermont: BIGELOW 13758, 13934, 14205, 14320.

The virgate, heavy blackish fibrils of the pileus provide the most distinctive character of *T. sejunctum* in distinguishing it from other species of the stirps. Weathered specimens could be confused with other species having white lamellae though, and comparisons with these species follow.

Cheilocystidia are reported in the preceding description of *T. sejunctum*, but these should not be overemphasized and considered to be a diagnostic character. At most, only one or two were found on an occasional lamella in sections.

It is not clear why PECK decided that *T. subsejunctum* differed from *T. sejunctum*. The descriptions, illustrations, and microscopic characters are certainly identical. Perhaps Peck thought there was a difference in taste for in 1891, he described his collections of *T. sejunctum* as only "scarcely bitter" The taste of *T. subsejunctum* was farinaceous. Both tastes are acceptable for *T. sejunctum* according to MOSER (1967).

The following species described in North America appear to be linked in a close series to *T. sejunctum*. One might speculate upon the variations possible in one or two species of this group and derive all



Fig. 1. *Tricholoma fumosoluteum* (PECK) SACCARDO. X 2/3

the "species" without an inordinate amount of imagination. Certainly a population of *T. sejunctum* consisting of basidiocarps of different expansion and exposures to light will exhibit considerable variation in the development of blackish fibrils and yellow blush on the stipe. The tones of yellow on the pileus are likewise affected, as is the degree of gelatinization detectable in the epicutis. At present, there is no experimental proof via cultures, and insufficient field data to support any conclusions, but a species like *T. subluteum* may be only an extreme variation of *T. sejunctum*.

Tricholoma fumosoluteum (PECK) SACCARDO, Syll. Fung. 5: 122. 1887. Fig. 1

Agaricus fumosoluteus PECK, Rep. New York State Mus. 27: 92. 1875.

Melanoleuca fumosolutea (PECK) MURILL, North Amer. Fl. 10: 13. 1914.

Pileus 2—7.5 cm broad, conic to campanulate at first with margin slightly incurved at first, disc at times with abrupt umbo, margin undulate and elevated in age, sometimes incised, surface moist but not viscid, soon dry, glabrous, or at times slightly radiate-fibrillose on disc with grayish fibrils, dull, mostly yellow (nearest "Empire yellow" but with a smoky tint), sometimes more orangish in age (nearest "light cadmium"); context thin, white or yellow near cuticle, firm. Odor and taste strongly farinaceous.

Lamellae adnexed to sinuate, close, broad (up to 11 mm), arched, narrowed at ends, brittle in age, white but sometimes tinged yellow under pileus margin, edges even and rather undulate, broken and incised in age.

Stipe 3—10 cm long, apex 9—13 mm thick, base enlarged at times (11—27 mm), rarely to subclavate, solid (whitish within), straight or curved near base, surface fibrillose, whitish at base, concolorous with pileus from medial portion upward.

Spores 5.5—6(—7) × 5—5.5(—6) μm , globose or subglobose, smooth, not amyloid, white in deposit. Basidia 23—39 × 4.5—7.5 μm , 4-spored. Cheilocystidia present, 18—40 × 7.5—13 μm , hyaline, smooth, clavate-bulbous or subfusoid. Pileus cutis hyaline and \pm gelatinous-appearing in KOH under phase contrast, hyphae cylindric, 2.5—4.5 μm diam, hypocutis yellowish in KOH, hyphae cylindric to somewhat inflated, 5.5—7.5 μm diam, pigment encrusted or walls sinuous-thickened; context hyaline, hyphae cylindric to inflated, (4—)7.5—15 μm , walls often thickened. Hymenophoral trama of subparallel to parallel hyphae, hyaline, cylindric to inflated, 2.5—11.5 μm diam, broadest in mediostratum, walls often thickened. Clamp connections absent.

Solitary to gregarious. Usually under hardwoods, rarely conifers. Late July into October.

Material examined: U. S. A.: Maine: BIGELOW 11474; Massachusetts: BIGELOW 7439, 8732, 8743, 9001, 9648, 14428, 14844, 15840, 16286, 17274; New Hampshire: BIGELOW 15890; New York: C. H. PECK, Forestburgh, September, 1874 (type of *Agaricus fumosoluteus*, NYS); Vermont: BIGELOW 13332, 13348, 13362, 13463, 13539, 13763.

Tricholoma fumosoluteum does not have the virgate pileus of *T. sejunctum*, and usually *T. fumosoluteum* grows under hardwoods instead of conifers. Cheilocystidia are present on most lamellae of *T. fumosoluteum*, and these provide a usable microscopic character for separating the two species.

Tricholoma intermedium PECK, Rep. New York State Mus. 41: 60. 1888

Melanoleuca intermedium (PECK) MURRILL, North Amer. Fl. 10: 22. 1914.

On the basis of the greenish-yellow pileus, white lamellae and stipe, PECK (1891) suggested that this species seemed intermediate between *T. equestre* (i. e. *T. flavovirens*) and *T. sejunctum*. He stated that *T. intermedium* differed from the latter by the glabrous pileus and crowded lamellae. Curiously, he did not compare *T. intermedium* to *T. fumosoluteum* which he had described several years before.

According to my examination of the type collection (C. H. PECK, Catskill Mts., New York, September, NYS), the microscopic characters are:

Spores $5-6 \times 3.5-4$ μm , elliptic, smooth, inamyloid. Basidia $25-35 \times 4.5-6$ μm , 4-spored. Cystidia not differentiated. Pileus: epicutis gelatinous in KOH, hyphae cylindric, $1.5-2.5$ μm diam, hypocutis of cylindric hyphae, $2.5-4$ μm diam, walls with encrusted pigment or thickened, vinaceous in KOH; context hyaline in KOH, hyphae cylindric or slightly inflated, $5-13$ μm diam, walls thickened at times. Hymenophoral trama of parallel hyphae, cylindric or slightly inflated, broadest in the mediostratum, $2.5-8$ μm diam, walls thickened at times. Clamp connections absent.

Tricholoma subluteum PECK, Rep. New York State Mus. 75: 21. 1904. Plate 0.

Melanoleuca sublutea (PECK) MURILL, North Amer. Fl. 10: 13. 1914.

This species is characterized by a yellow pileus and stipe and white lamellae. PECK did not comment on an odor or taste, and he noted the surface as only "obscurely fibrillose" *Tricholoma subluteum* was found under conifers.

My study of the type collection (C. H. PECK: Lake Pleasant, New York, August, NYS) revealed the following:

Spores $4.5-6 \times 4-5.5 \mu\text{m}$, subglobose or globose, smooth, inamyloid. Basidia $27-35 \times 6-8.5 \mu\text{m}$, 4-spored or sometimes 2-spored. Cystidia not differentiated. Pileus: epicutis gelatinous in KOH, hyaline, hypocutis yellow in KOH, hyphae cylindric, $1.5-3 \mu\text{m}$ diam, pigment apparently intracellular; context hyaline, hyphae mostly cylindric, $4-8 \mu\text{m}$ diam. Hymenophoral trama of subparallel hyphae, cylindric, $2.5-5 \mu\text{m}$ diam. Clamp connections absent.

Melanoleuca angustifolia MURILL, North Amer. Fl. 10: 22. 1914

Murill found this *Tricholoma* during August in woods near the New York Botanical Garden. The viscid pileus was "brownish-yellow with a lilac tint at the center, fading out to a broad, white marginal zone" The lamellae are described as "white", the stipe "milk white", the odor "pleasant" and the flavor "nutty" SINGER (1945) studied the type (NY) and found the spores to be $5-7 \times 3-4 \mu\text{m}$, elliptic, smooth, inamyloid. The basidia are $21-28 \times 6 \mu\text{m}$, 4-spored. The epicutis of the pileus consisted of interwoven hyphae, $3-7 \mu\text{m}$ broad, and clamp connections were absent. SINGER suggested that the species was near *T. equestre* (i. e. *T. flavovirens*).

Tricholoma cheilolaminum OVREBO & TYLUTKI, Mycologia 67: 76. 1975.

The pink color at the base of the stipe, the light buff to pinkish lamellae, and broad cheilocystidia ($12-22.5 \mu\text{m}$) separate this species from *T. sejunctum*, *T. fumosoluteum*, and others of this complex. In addition, the pileus of *T. cheilolaminum* has a dark brown disc (noted as "Cacao Brown", "Saccardo's Umber", "Mummy Brown", "Raw Umber" by the authors). Presumably, the cutis did not gelatinize in KOH like most taxa of the stirps. *Tricholoma cheilolaminum* is known from coniferous woods in Oregon and Idaho.

Tricholoma leucophyllum OVREBO & TYLUTKI, Mycologia 67: 78. 1975.

There would seem to be a strong resemblance in the field between this *Tricholoma* and *T. fumosoluteum*. In general, both have a viscid, yellow pileus, white lamellae and stipe, as well as a farinaceous odor and taste. *Tricholoma leucophyllum* has elliptic spores ($5.3-6.8 \times 3.8-4.5 \mu\text{m}$) though, and no cheilocystidia. It was found under coniferes in northern Idaho.

Perhaps even more closely related to *T. leucophyllum* is *T. intermedium* PECK, which was discussed previously. If it can be assumed that *T. intermedium* had no odor and taste from Peck's lack of comment on these features, there is a clear distinction. Final decision on the relationship must await the discovery of more material of *T. intermedium* and a more complete description.

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