

WEST INDIAN SPECIES OF *AQUASCYPHA* AND *VELUTICEPS*,
WITH NOTES ON EXTRALIMITAL SPECIESA. L. WELDEN¹*Tulane University, New Orleans*

Each of the two genera considered in this report consist of a few species. Both are reported to have species occurring in Asia and in the Americas (although I have studied only the American collections of *Aquascypha*) in both temperate and tropical regions. *Veluticeps* (Cke.) Pat. contains seven taxa presently recognized as valid species. *Aquascypha* Reid was established as monotypic, but I am adding *Stereum vibrans* Berk. & Curt.

Aquascypha Reid, Beih. Nova Hedw. 18:51. 1965.

Basidiocarps stipitate and infundibuliform or sessile and umbonate to effuso-reflexed, brown, coriaceous, lignicolous, darkening permanently in KOH; abhymenial surface tomentose, velutinate to spiny with simple or branched spines; hymenial surface smooth, concolorous, or whitish. Pileus showing three zones in section; cuticle with tomentum, an interwoven context, and a hymenium; generative hyphae thin-walled, hyaline, with clamp-connections; skeletal hyphae thick-walled, yellow-brown; binding hyphae thick-walled, hyaline or pigmented; hymenium with cylindrical-clavate, four-sterigmata basidia; spores thin-walled, hyaline, non-amyloid.

Aquascypha hydrophora (Berk.) Reid. l.c., p. 52. For a comprehensive description of this species see Reid. He calls the hyaline to brown, thick-walled, clavate, sterile hymenial cells "pseudoparaphyses." I prefer to follow Singer and Gamundi (1963) and refer to them as "cystidioles." During their maturation the cystidioles develop pigmentation and often accumulate granular matter on their apices. The mass of cystidioles gives a velvety macroscopic appearance to the hymenium rather than a setulose one as I reported previously (1954). The thick-walled, dark brown skeletal hyphae most frequently terminate adjacent to and above the hymenium, but on occasion some may project into and rarely beyond the hymenium.

In addition to the specimens cited by Reid and by me, several more collections from British Guiana and Venezuela made by Dr. Maguire and his coworkers are on deposit at NY.²

Aquascypha vibrans (Berk. & Curt.) Welden, comb. nov.; *Stereum vibrans* Berk. & Curt., Jour. Linn. Soc. Bot. 10: 332. 1868. Fig. 1, A-C. Basidiocarp on dead wood, coriaceous-felty, sessile, attached by an attenuated base, effuso-reflexed, or umbonate; abhymenially surface concentrically zoned, velvety-hirsute, near

Leather Brown (14 A 10),³ faded in older parts; hymenial surface smooth, concolorous or Moonmist (12 A 2), priunose; margin tomentose, undulate to lobed. Tomental hyphae 5-7 μ in diam with light to dark golden brown thickened walls; cuticle almost black, composed of hyphae 3-7 μ in diam and similar to tomental hyphae; context tightly interwoven; generative hyphae 2-4 μ in diam; skeletal hyphae 3-7 μ in diam, often turning into subhymenium and hymenium; binding hyphae 2-3 μ in diam; basidia 29-33 \times 4-5 μ and each sterigma ca. 4-5 μ long; spores 5-6 \times 2-3 μ (av. of ten = 5.6 \times 2.6 μ).

Specimens examined: Cuba: Plantae Cubensis Wrightiani 404 (COTYPE in FH); Jamaica: F. S. Earle 299, 303, (NY); Trinidad: Herb. Geo. Masee (NY) as *Hymenochaete vibrans*; Guatemala: TENN 18423; Colombia: NO 6554. Reported from India by Banerjee (Jour. Indian Bot. Soc. 14: 13-48. 1935) and from Japan by Sasaki (Bull. Tokyo Univ. Forests 47: 145-153. 1954).

Our present collections show *A. vibrans* as sharply distinct from *A. hydrophora* in habit, in distribution, and in morphology. There are neither pilear spines nor cystidioles in *A. vibrans*.

Veluticeps (Cke.) Pat., Bull. Soc. Myc. France 10: 77. 1894.

Basidiocarps umbonate, effuso-reflexed, pezizoid, complicate-dimidiolate, coriaceous, soft-corky, lignicolous, solitary to crowded, darkening permanently in alkali (KOH); abhymenial surface tomentose, velvety, rusty brown to black; hymenial surface usually lighter colored, bearing many protruding hyphal fascicles; margin ochraceous or darker, acute or obtuse. Pileus showing at least two zones in section; a context and a hymenium, and sometimes a \pm defined cuticular region; generative hyphae with thin or thickened hyaline to golden brown walls and clamp-connections; skeletal hyphae thick-walled and usually deeply pigmented; fascicular hyphae predominately skeletal; basidia long cylindrical-clavate with four thick arcuate sterigmata; spores smooth, hyaline, thin-walled, nonamyloid, obovate to fusiform.

Fomes angularis Lloyd, Myc. Writ. 4: 239. 1915.⁴ Basidiocarp on dead wood, umbonate, umbonate-ungulate, effuso-reflexed, soft corky to woody, rigid, stratosed,

³ Maer and Paul. Dictionary of Color. 2d. ed. McGraw-Hill, 1950.

⁴ On hand in NO is a specimen of this species whose label bears the transfer to *Veluticeps* by Aoshima & Furrikawa kindly given to me by Prof. R. P. Korf of Cornell University. It has been determined by Aoshima. I concur in this transfer but cannot find in the usual indices where such a transfer occurred. A letter to Dr. Aoshima, several months outstanding, has not been answered at this writing.

¹ Investigations supported by the National Science Foundation.

² Herbarium abbreviations according to *Index Herbariorum*, 5th ed.

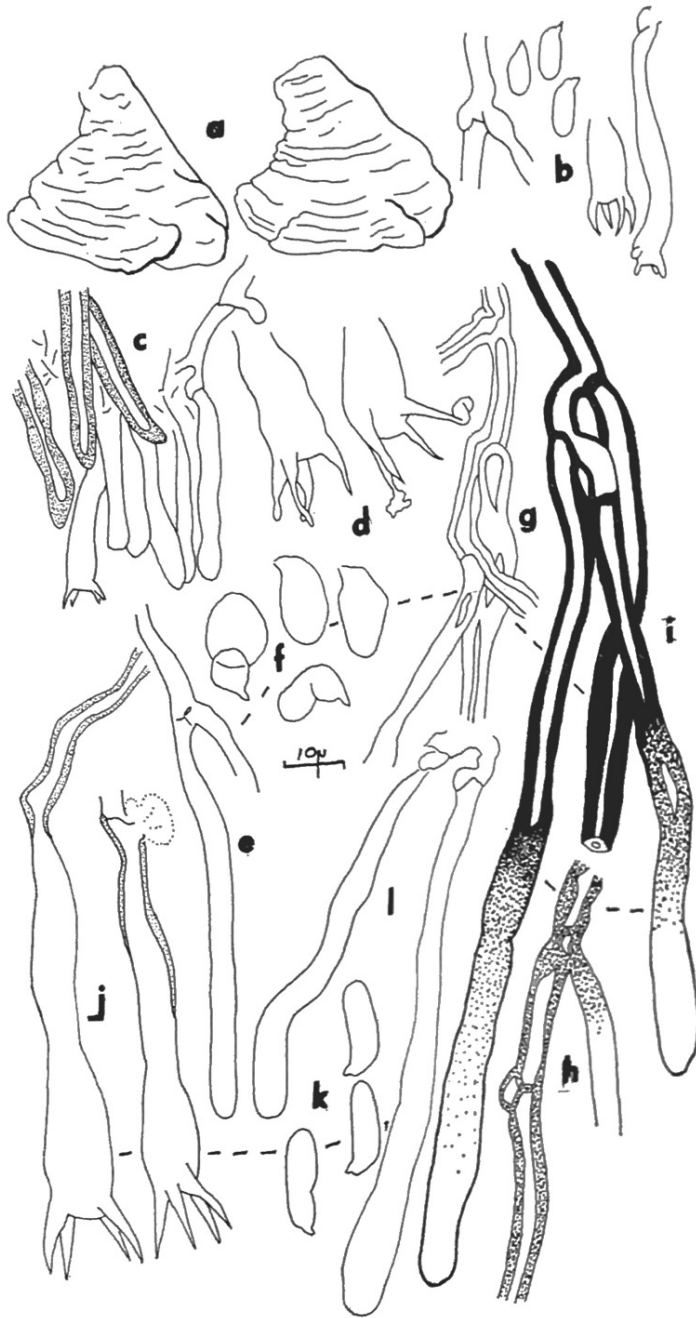


Fig. 1. a-c. *Aquascypha vibrans* (Berk. and Curt.) Welden. a. Habit sketch (Herb. Geo. Masee, T'ad, in NY). b. Generative hypha, spores, and basidia (F. S. Earle 299, in NY and FH). c. Hymenial detail showing a basidium, basidioles, and subtending skeletal hyphae (NO 6554). d-i. *Veluticeps berkeleyi* Cke. d. Basidia. e. Basidiole. f. Spores. g. Origin of skeletal hyphae. h. Thick-walled generative hyphae. i. Origin of skeletal hyphae which help compose the fascicles (all C. Wright ex Cuba in FH). j-k. *Veluticeps fusca* Burt. j. Basidia. k. Spores. l. Basidioles (TYPE).

dark brown; abhymenial surface tomentose or glabrous because of agglutinated hyphae, rusty brown to black; hymenial surface ochraceous to brown, darker tints caused by fascicles, may be broken into polygonal masses; hyphal fascicles dense, short, conspicuously fimbriate; margin narrow, obtuse, sterile, ochraceous to black. Tomental hyphae 4 (-6) μ in diam, very thick-walled, brown to brown-black or rarely hyaline, clamped or not; context narrow, ill-defined; generative hyphae 2-4 μ in diam; skeletal hyphae 4-6 μ in diam, often pseudoseptate at tips; hymenium stratose, enclosing embedded crystalline masses; basidia (60-) 72-78 \times 5-7 μ ; sterigmata ca. 6 μ long; spores 10-15 \times 3-4 μ ,

hyaline, thin-walled when young, older ones with oily brown contents and pigmented wall.

Specimens examined: Japan: Lloyd Herb. 16108 (TYPE in BPI); NO 6706.

Veluticeps berkeleyi Cke., Grevillea 8: 148. 1880. Fig. 1, D-I. Basidiocarp on dead wood, soft to hard coriaceous, effuso-reflexed, dimidiate; abhymenial surface sulcate-zonate, felty, glabrous with age, dark reddish brown to black; hymenial surface pale brown; margin thick, acute, sterile. Tomental hyphae 4-6 μ in diam, brown to brown-black, very thick-walled, clamped or not; cuticle of similar longitudinally parallel hyphae; context similar to cuticle but not as deeply pigmented; generative hyphae 3-5 μ in diam, often encrusted in older parts; skeletal hyphae 4-6 μ in diam, often encrusted; hymenium stratose with basidia at least 65 \times 8-10 μ , only a few seen; spores 9-12 \times 5-6 μ , some become geniculate after discharge.

Specimens examined: Cuba: leg. C. Wright in FH & NY labelled in Cooke's hand (?), "*Veluticeps* gen. nov. MCC" and probable TYPE.

Veluticeps fusca Burt, Ann. Missouri Bot. Gard. 13: 329. 1926. Fig. 1, J-L. Basidiocarp on dead coniferous wood, resupinate, effuso-reflexed, conchate, often crisped, cup- or saucer-shaped when young, later confluent; abhymenial surface velvety-tomentose, near auburn to almost black with age; hymenial surface near hazel, glittering like mica because of long narrow crystals on its surface; margin ochraceous, darkening with age, thin, obtuse, or tumid. Tomentum hyphae arising from a very dark cuticle which is composed of \pm longitudinally parallel hyphae; context \pm interwoven; generative hyphae 3-4 μ in diam; skeletal hyphae 4-5 μ in diam; basidia 72-76 \times 8 μ ; spores 12-13 \times 3.5-4 μ , some \pm geniculate.

Specimens examined: Arizona MO 20084 (TYPE in BPI).

Veluticeps pini Pat. Bull. Myc. Soc. France 23: 72. 1907. Basidiocarp on dead coniferous wood, erumpent, umbonate, may be elongated into stipe-like base, cup-like or complicate, laterally confluent with a rusty red basal mycelium; abhymenial surface brownish black, concentrically sulcate, matted tomentose, covered with scattered crystals; hymenial surface brownish yellow, covered with scattered, needle-like, inconspicuous crystals; margin obtuse, rusty red or brown. Tomentum hyphae arising from a dark cuticle which is composed of \pm longitudinally parallel hyphae; context similar to cuticle; generative hyphae 3-4 μ in diam; skeletal hyphae 4-5 μ in diam; some hyphae with scattered granular matter on their walls; basidia 72-74 \times 6 μ , with swollen subapical portion 8 μ in diam; spores 14 \times 4.5 μ .

Specimens examined: Indo-China, Tonkin, Eberhardt 93 in Patouillard Herb. (TYPE in FH).

Veluticeps setosa G. H. Cunningham, Bull. N.Z. Dept. Sci., Industr. Res. 145: 301. 1963. Basidiocarp on rotten wood, resupinate, effused, thick, coriaceous, near

auburn or darker; abhymenial surface only a very narrow shelf; hymenial surface broken into irregular polygonal masses, \pm ochraceous; hyphal fascicles with fimbriate tips; margin \pm ochraceous, sterile. Cuticle poorly developed, darker than rusty red context; generative hyphae $2-3\mu$ in diam; skeletal hyphae $3-4\mu$ in diam; fascicular hyphae septate toward apices, often expanded apically into clavate apex, up to 9μ in diam; hymenium stratose, filled with collapsed basidia and with basidioles; basidia not observed; basidioles ca. $78 \times 7\mu$, tapering rapidly from clavate apex to narrow base; spores hyaline to brown, pigments in wall and in cytoplasm, $19-20 \times 7-8\mu$.

Specimens examined: Australia: Queensland (ISO-TYPE in PDD 17463).

Veluticeps tabacina (Cke.) Burt, Ann. Missouri Bot. Gard. 6: 261. 1919. Basidiocarp on dead wood, attached by a vertex, pezizoid, occurring singly or in loosely compact cluster, sessile; abhymenial surface tomentose drying deep rust brown to black; hymenial surface concolorous; margin acute, projecting beyond the hymenial surface as a spinulose tufts of hyphae which fold over and \pm completely cover the hymenial surface when dry. Tomentum hyphae dark, arising from a black cuticle; context of hyphae \pm perpendicular to the substrate; amorphous brown granules scattered over hyphal walls generative hyphae $3-4\mu$ in diam, those of the subhymenium and hymenium gelatinously modified, i.e., their thickened hyaline walls do not stain with Phloxine; skeletal hyphae $4-5\mu$ in diam, greenish brown in KOH, with scattered dark green material within the hyphal walls, infrequently pseudoseptate; basidia ca. $130 \times 12\mu$; sterigmata $9-10\mu$ long; spores $25-30 \times 7-9\mu$ (av. of 10 = $26.8 \times 8.4\mu$).

Specimens examined: Australia: N.S. Wales (TYPE in NY).

SPECIES INCERTAE

Veluticeps philippiniensis Bres., Hedw. 61: 302. 1915. Basidiocarp on dead wood, effuso-reflexed, sessile, dimidiate, tough but not brittle or hard; abhymenial surface tomentose, brownish black, concentrically zonate; hymenial surface slightly lighter in color; hyphal fascicles sometimes anastomosing laterally forming thin, short sheets that give a semi-reticulate appearance to the hymenium. Basidiocarp soft, rusty red in section, no cuticle; generative hyphae yellow to dark brown, thin to very thick-walled; skeletal hyphae $3-4\mu$ in diam, deeply pigmented, walls very thick; basidia and spores not observed.

Specimens examined: Flora of Philippines, Herb. Bureau of Sci., leg. H. M. Curran, Prov. of Cagayan, Luzon, March 1909, Forestry Bureau 16811, labelled COTYPE in a hand unknown to me; Flora of the Philippines, Butuan subprov., Mindanao, leg. C. M. Weber 1279, Mar-Jul 1911, (both in NY).

The hymenial surface of these specimens resemble nothing so much as an immature poroid fungus. Bresadola reports (in Sacc., Syll. Fung. 23: 530. 1925)

"*Habitu videtur prorsus Fomes pectinatus* Kl." *Fomes Angularis* gives the same appearance after it has been wet and then allowed to dry.

Two species in *Veluticeps* can be easily distinguished. The spores of *V. setosa* and *V. tabacina* are notably larger than those of the other five species. The spores of *V. setosa* are smaller than those of *V. tabacina*, and even if their other characteristics did not differ, it is possible to recognize them on this basis alone. Fortunately, they also differ in growth habit, hyphal organization and structure, and in their reaction to KOH, as a cursory reading of their descriptions will show. *Veluticeps tabacina*, in fact, is to some extent anomalous in the genus—it bears some similarity to *Stereum radiatum* Peck. Its gelatinously modified hyphae are unknown for the other species. The remaining five species are perplexing and their status as valid taxa is uncertain. Two of these five can be disentangled with some facility. The hyphal fascicles of *Fomes angularis* and *V. philippiniensis* are conspicuously fimbriate at their tips, a characteristic not possessed by the other three taxa. I suspect the two are synonymous, but I treat *V. philippiniensis* as *Species Incertae* since the only two specimens known to me are sterile. The remaining three species, *V. berkeleyi*, *V. fusca*, and *V. pini*, can be separated at present only on the basis of habit and distribution (notoriously variable features), and by their small and probably insignificant differences in spore size. *Veluticeps fusca* and *V. pini* share two features: both occur on coniferous wood, and both produce needle shaped crystals over their hymenial surfaces which are similar in shape and color to those found on *Stereum abietinum* (Pers. ex Fr.) Fr. and *Stereum rugisporum* (Ell. & Everh.) Burt.

There is a serious need for more specimens of *Veluticeps* spp. Practically all of the known specimens were available for this study (several are known only from type collections). I did not find any specimens in my West Indian collections, although *Veluticeps* carpophores are of conspicuous size. It must be that they occur only rarely or only seasonally.

While the paucity of collections makes it very difficult to draw conclusions about the validity of its taxa, the intergeneric relationships of *Veluticeps* seem clear. The protruding fascicular hyphae are certainly homologous to those which occur singly in those species of *Stereum* often segregated into *Columnocystis* Pouz., i.e., *Stereum abietinum*, *Stereum ambiguum* Peck. Further and compelling evidence for the close kinship of these species can be seen in basidial size and shape, and in their corresponding spore shape. Hyphal construction and orientation in the two groups are similar, as is their reaction to KOH. There is also some evidence which can be interpreted, rightly so I believe, to show a close relationship between *Stereum crassum* Lev. non. Fr., *Stereum papyrinum* Mont. and the other taxa sometimes grouped into *Lopharia Kalchbr.* and MacO. emend. Boidin (see Boidin, 1959, for a discussion of these species). It is through these species that kinship of *Veluticeps* and *Aquascypha* may be demonstrated in the future. This is not to say that the degree of affinity will

be either as clear or as close as between *Veluticeps* and *Stereum abietinum* et al, but certain features indicate that such might be the case. All of these taxa show thickened, sterile, and, soon or late, pigmented hyphae arising within the various tissues of their basidiocarps. These hyphae terminate at various levels and usually penetrate the hymenium, although this may be very rare in *Aquascypha*. These hyphae may [as shown for *Stereum schomburgki* Berk. (= *Stereum fulvum* Lev.) by Talbot, 1951] ultimately replace the basidia. The hymenium in *Aquascypha* is replaced by such hyphae that metamorphose from basidioles. The replacement is more regularized, being limited almost exclusively to the hymenial cells, and the replacing cystidioles do not lengthen extraordinarily. In all these species the cystidioles, pseudosetae, metuloids, pseudocystidia (several names are used) are in turn embedded or partly embedded in the thickening hymenium. Later, by further growth and differentiation, these hyphae become prominent again. There is, then, this alternation of hyme-

nium formation, development of sterile structures, enclosure by the thickening hymenium, etc. Such a growth pattern, taken with the morphological features indicate that an intensive study of *Aquascypha*, *S. abietinum* et al, *S. fulvum*, et al, and *Veluticeps* may reveal a closely related group of fungi.

I wish to express my thanks to Drs. C. R. Benjamin, Joan Dingley, L. R. Hesler, I. M. Lamb, and C. T. Rogerson for the loan of material under their care.

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NEWS OF TENNESSEE SCIENCE

The 18th Annual Fisk Institute will be held at Fisk University, Nashville, Tennessee 14-25 August 1967, under the direction of Nelson Fuson, Ernest A. Jones and James R. Lawson. The institute includes two infrared spectroscopy sessions, one ultra-violet-visible spectroscopy session and one gas chromatography session. The Basic IR Session and the Basic GC Session will run concurrently during the first week. The Interpretation of IR Spectra Session and the Basic UV-Visible Spectroscopy Session will run concurrently during the second week. Participants may elect to attend either one or both weeks, and any combination of sessions they prefer. The most recent commercial infrared, ultra-violet-visible spectrophotometers and gas chromatographs and accessories will be exhibited at all four sessions. These instrument exhibits will be available for use by the Institute participants during the afternoon laboratory programs under the guidance of the Institute Faculty and instrument company engineers.

Each of the four 1967 Fisk Institute sessions is limited to 50 persons. The tuition fee for each session is \$150.00, the registration fee for the Institute, \$10.00. Partial tuition fellowships are available for academic personnel.

For further information write the Director, Fisk Institute, Box 8, Fisk University, Nashville, Tennessee 37203.

The Roan Mountain Citizens Club has announced the program for the Fifth Roan Mountain Naturalists Rally on September 8 and 9, 1967. The program will start at 4:00 p.m. September 8 with registration at Cloudland Elementary School, and will continue through September 9 with field trips. For additional details, write Fred Behrend, 607 Range Street, Elizabethton, Tennessee.