Studies on the Genus *Peniophora* Cke. and its Allied Genera in Japan

By

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Contents

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I Introduction

The genus *Peniophora* of Corticiaceae was established by COOKE[48] in 1879. It was segregated from the genus *Corticium* based on the presence of sterile structures in the hymenium which were designated as "Metuloids" by COOKE and later called cystidia. After the establishment of the genus *Peniophora* by COOKE, many species were reported under this genus.

When established, the genus *Peniophora* CKE. designation of type species was not made. *Peniophora quercina* (FR.) CKE., the first species in the original description of COOKE was the same species as *Thelephora quercina* PERS., the type species of the genus *Corticium* S. F. GRAY (1821). Fifteenth species in the original description of COOKE, *Peniophora velutina* (DC. ex FR.) CKE. was the same species as *Thelephora velutina* DC. ex FR., which is the type species of the genus *Corticium* FR. (1835). Therefore the genus *Peniophora* CKE. was subjected to the several different interpretations.

In 1912, BOURDOT and GALZIN[29] divided the species of the genus *Peniophora* CKE. into seven groups based on the macroscopic and microscopic characteristics. Hereafter their systematic consideration of dividing into genera within the genus *Peniophora* CKE. has been accepted by several workers.

KARSTEN[97][98] established the genera *Diplonema* KARST., *Gloeocystidium* KARST., *Peniophorella* KARST. and *Amphinema* KARST. HOEHNEL and LITSCHAUER[87] established the genus *Gloeopeniophora* HOEHN. & LITSCH. RICK[144] established the genus *Gloeopeniophorella* RICK. They limited themselves to recombination of some of the species of the genus *Peniophora* CKE. to these genera. DONK[62] established the genus *Tubulicrinis* DONK. ERIKSSON[69] established the genera *Hyphodontia* ERIKSS., *Fibricium* ERIKSS. and *Membranicium* ERIKSS. DONK[62][63][66] emended the genera *Gloeocystidiellum* DONK, *Phlebia* FR., *Hyphoderma* WALLR., *Peniophora* CKE. and *Phanerochaete* KARST. They made attempts to systematize the species of the genus *Peniophora* CKE. under these genera. Nowadays the study of the genus *Peniophora* is directed to the examination of the generic value of the "grouping" of BOURDOT & GALZIN[28][29] together with the classification of the species.

In 1901, HENNINGS[84] described *Peniophora discoidea* P. HENN. based on a collection by SHIRAI at Nikko. This is the first record of the genus *Peniophora* in Japan. In 1904, MATSUMURA[117] listed two species of *Peniophora*, *P. discoidea* and *P. quercina* in his "Index Plantarum Japonicarum", without description. YASUDA[170]~[178] reported six species of the genus *Peniophora* (Kawatake Zoku) with description in Japanese. T. ITO[91] reported fourteen species and one variety, including eight species already reported by HENNINGS and YASUDA. S. ITO[90] treated eleven species and one variety of *Peniophora* and two species of *Gloeocystidium* which were already reported in Japan, in his "Mycological Flora of Japan (1955)".

The author examined more than five hundred specimens of resupinate Corticiaceae of fungi collected from Hokkaido south to Honshu, Shikoku, Kyushu and Amami Oshima Is., and in this report describes the macroscopic and microscopic characteristics in fruit body morphology, chemical reactions of the fruit body, cultural characteristics, and the type of decay of wood. Taxonomical discussions on the genera and species as well as their keys are presented.

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II Historical review on the concept of the genus *Peniophora* CKE.

1. COOKE's concept of the genus *Peniophora* CKE.

The concept of the genus *Peniophora* Cke. (1879) was as follows : Cooke[48] established the genus *Peniophora* Cke. based on the presence of "the projecting bodies or metuloids" called cystidia arising in the hymenium of the genus *Corticium*, but he did not designate the type species. He recorded fourteen species which were newly reclassified from the genus *Corticium*, one species newly reclassified from the genus *Stereum* and one new species. The difference between the genus *Peniophora* and *Corticium* was that the former possesses cystidia in the hymenium. *Thelephora quercina* Pers., the first described species in the original description of the genus *Peniophora* Cke. has been selected as a lectotype by Donk[63].

Studies of the genus *Peniophora* before Cooke :

Eighty-three years earlier than Cooke's establishment of the genus *Peniophora* Cke., several workers studied numerous species of *Peniophora* Cke. though they treated them under genera other than *Peniophora* Cke., namely, the genera *Corticium* Pers. ex Fr., *Thelephora* Fr. and *Stereum* Pers. ex Fr.

In 1796, Persoon[133] established the genus *Corticium* based on effuse and resupinate characteristics and described[134)~136] a number of known and new species in France, and he placed them in the genera *Corticium* and *Thelephora* which were established by Fries. In 1821, Fries[72] established the genus *Thelephora* based on stipitate and pileate fruit bodies and pileous hymenium, and his[72)~77] described species were mostly treated under the genus *Thelephora*. Schweinitz[153] reported the genus *Thelephora* on the German species. Berkeley[5)~8] described many species of the genera *Corticium*, *Thelephora* and *Stereum* in England and North America, seventeen species of which were treated later under the genus *Peniophora* by Cooke[51)~54] and Massee[114)~116].

Studies of the genus *Peniophora* after Cooke were as follows :

After the establishment of the genus *Peniophora* by Cooke, many species were reported under this genus or later established genera into which many workers after Cooke divided the genus *Peniophora* Cke.

Between 1882~1896, Karsten[96)~101] established the genera *Diplonema* Karst., *Gloeocystidium* Karst., *Peniophorella* Karst. and *Amphinema* Karst. He treated the several species under these genera. And he also reported many species under the genus *Corticium* without the genus *Peniophora* Cke.

Diplonema Karst., Bidr. Kaenn. Finl. Nat. Folk 48 : 310, 1889. Type species : *Diplonema sordescens* Karst. This genus is characterized as follows : Resupinate fruit bodies, yellowish rhizomorphus, clamped cystidia and hyaline, nonamyloid spores are present. The genus

Amphinema KARST. is a synonym.

Gloeocystidium KARST., Bidr. Kaenn. Finl. Nat. Folk 48 : 429, 1889. Type species : *Gloeocystidium exsudans* KARST. The genus belongs to Hydnaceae and includes the species without cystidia.

Peniophorella KARST., Bidr. Kaenn. Finl. Nat. Folk 48 : 427, 1889. Type species : *Peniophorella pubera* (?FR.) KARST. According to DONK[63] identity of type species was uncertain, and moreover it seemed to be a "nomen dubium", therefore adoption of this genus is in question.

Amphinema KARST., Bidr. Kaenn. Finl. Nat. Folk 51 : 228, 1892. Type species : *Diplonema sordescens* KARST. KARSTEN[100] changed the generic name *Diplonema* KARST. to *Amphinema* KARST., and according to the International Rules *Amphinema* KARST. is a synonym of *Diplonema* KARST.

PATOUILLARD[127][128] reported species which were later put under the genus *Peniophora* by MASSEE[114], ROGERS & JACKSON[148] and JACKSON[98], but first they were treated under the genera *Corticium* and *Hypochnus* for the species in France. PECK[129]~[132] described under the genus *Corticium* on the several new North American species which were later put into the genus *Peniophora* by HEOHNEL & LITSCHAUER[86] and BURT[40][41]. MASSEE[114] described in "A Monograph of the Thelephoraceae" twenty-nine new species and seventeen new combinations in the genus *Peniophora*. In his newly combined species, several well-known species of the genus *Peniophora* were included: these are *P. gigantea*, *P. laevigata*, *P. similis*, *P. tenuis*, and *P. violaceo-livida* etc. SACCARDO[149]~[152] listed fifty-two species of the genus *Peniophora*, including eight new combinations. BRESADOLA[33]~[39] described many *Peniophora* species under the genera *Peniophora*, *Corticium*, *Kneiffia* and *Gonatobotrys*, nine species of which were recombined afterwards to the genus *Peniophora* and its allied genera (*Membranicium* ERIKSS. and *Hyphoderma* DONK) later by HOEHNEL & LITSCHAUER[86][88], BOURDOT & GALZIN[29][30], ERIKSSON[69] and DONK[63]. HOEHNEL & LITSCHAUER[86]~[89] reported eighty-three species of the genus *Peniophora*, including forty-five species newly combined from the genus *Corticium*, and they established the genus *Gloeopeniophora* HOEHN. & LITSCH.

Gloeopeniophora HOEHN. & LITSCH., K. Akad. Wiss. Wien, Math. - Nat. Kl. Sitzungsb. 116:815, 1907. Type species : *Peniophora incarnata* (PERS. ex FR.) CKE. This genus is characterized as follows : Resupinate fruit bodies, cystidia, gloeocystidia and hyaline, nonamyloid spores are present. *P. incarnata*, the type species of this genus was included in the genus *Peniophora* CKE. em. DONK by DONK[63] for the reason of having tinted spores.

BOURDOT & GALZIN[29][30] divided the genus *Peniophora* into seven groups and described one hundred and eight species including twenty-eight new species from France. In "The Thelephoraceae of North America", BURT[41][42] reported one hundred and twenty-three species, including sixty-seven new species, of the genus *Peniophora*. Several species treated as members of the genus *Corticium* by BURT were recombined afterwards to the species of the genus *Peniophora* later by some workers[148]. LITSCHAUER[112][113] described six new species of the genus *Peniophora* in Sweden and Austria. RICK[144] established the new genus *Gloeopeniophorella* RICK.

Gloeopeniophorella RICK, Brotéria, Sér. Ci. not. 3 : 47, 173, 1934. Type species : *Gloeopeniophorella rubro-flava* RICK. The genus includes species having resupinate fruit bodies, cystidia, hyaline spores and smaller gloeocystidia than *Gloeopeniophora incarnata*. PILÁT[137] reported fifteen species of Siberian *Peniophora*. ROGERS & JACKSON[148] examined the relationships of the genus *Peniophora* and its allied genera of all over the world. JACKSON[92][93] and JACKSON & DEARDEN[94][95] reported twenty-eight species of the genus *Peniophora* including fourteen new species and two newly combined species from North America. ERIKSSON[67][69] made an attempt to divide *Peniophora* sect. Coloratae, group VII of BOURD. & GALZ., into six groups. He established three new genera *Hyphodontia* ERIKSS., *Fibricium* ERIKSS. and *Membranicium* ERIKSS.

Talbot[157)159)] reported eighteen species including two new species of the South African *Peniophora*. Weresub[166)~168)] added detailed information to the concept of section Tubuliferae of the genus *Peniophora* Cke., Group II-Tubuliferae of Bourd. & Galz., and described forty-seven species belonging to the section. Cunningham[56)57)] proposed thirty-eight species including seventeen new species and one newly combined species of the genus *Peniophora* from Australia and New Zealand. Donk[61)~66)] proposed the following genera : *Gloeocystidiellum* Donk em. Donk, *Tubulicrinis* Donk, *Phlebia* Fr. em. Donk, *Hyphoderma* Wallr. em. Donk, *Peniophora* Cke. em. Donk and *Phanerochaete* Karst. em. Donk. Boidin[21)22)24)~26)] described cultural characters and reaction of mycelium to several reagents in thirty-eight species of the genus *Peniophora*. Christiansen[45)46)] reported Danish species according to the Eriksson's and Donk's systems. Slysh[156)] classified ninety-one species of the genus *Peniophora* into eight sections by the microscopic features using materials collected in northern North America. Parmasto[125)] reported nine species of the genus *Peniophora* and he[126)] recombined three species under the genus *Phanerochaete* Karst. em. Donk from Kamchatka Peninsula.

2. Bourdot and Galzin's concept of the genus *Peniophora* Cke.

They[29)30)] divided the genus *Peniophora* Cke. into seven groups and described one hundred and eight species including twenty-eight new species.

Group I : Gloeocystidiales—the species with gloeocystidia belong to this group, consisting of eight species including three new species.

Group II : Tubuliferae—the species with cystidia having capillary lumen belong to this group, having thirty-three species including eighteen new species.

Group III : Hyphales—the species with cystidia having capitate apex and septate stem belong to this group, having thirteen species including one new species.

Group IV : Radicatae—the species with mycelial strands belong to this group, having seven species including two new species.

Group V : Membranaceae—the species with thick and membranous fruit bodies belong to this group, having fifteen species including one new species.

Group VI : Ceracae—the waxy species belong to this group, having twelve species including one new species.

Group VII : Coloratae—the spore masses of the species of this group are pale red. This group has twenty species including two new species.

Hereafter their systematic consideration of dividing sections within the genus *Peniophora* Cke. has been accepted by many workers.

3. Eriksson's concept of the genus *Peniophora* Cke. and its allied genera

In 1950, Eriksson[67)] made an attempt to divide *Peniophora* sect. Coloratae, Group VII of Bourd. & Galz. into six groups.

1) *P. incarnata*-group : with ellipsoid spores, lacks dendrophyses (five species).
2) *P. lilacea*-group : with ellipsoid spores and gloeocystidia, lacks dendrophyses (one species).
3) *P. cinerea*-group : with cylindrical spores, lacks dendrophyses (ten species, including one new species).
4) *P. lycii*-group : with cystidia and hyaline dendrophyses (two species).
5) *P. versiformis*-group : with cystidia and brown-walled dendrophyses (one species).

6) *P. polygonia*-group : with cylindrical spores and gloeocystidia, lacks dendrophyses (one species).

In 1958, ERIKSSON[69] established three new genera : *Hyphodontia* ERIKSS. on the basis of Group III-Hyphales of BOURD. & GALZ., *Fibricium* ERIKSS. on the basis of dimitic basal hyphae, and *Membranicium* ERIKSS. on the basis of Group V-Membranaceae of BOURD. & GALZ.

1) *Hyphodontia* ERIKSS., Symb. Bot. Ups. 16(1) : 101, 1958. Type species : *Gonatobotrys pallidula* BRES.

ERIKSSON's concept of this genus contains those of *Odontia* and *Corticium*.

2) *Fibricium* ERIKSS., Symb. Bot. Ups. 16(1) : 112, 1958. Type species : *Corticium greschikii* BRES.

The main feature of this genus is the nature of the hyphae which is dimitic.

3) *Membranicium* ERIKSS., Symb. Bot. Ups. 16(1) : 115, 1958. Type species : *Peniophora cremea* BRES.

The scope of this interemistic genus comprises *Peniophora* sect. Membranaceae of BOURD. & GALZ., in which basal hyphae are thick-walled, without clamps and with branches.

ERIKSSON recognized DONK's concept of the genus *Peniophora* and he accepted the following genera, *Peniophora* CKE. em. DONK, *Gloeocystidiellum* DONK em. DONK, *Tubulicrinis* DONK, *Phlebia* FR. em. DONK, *Hyphoderma* WALLR. em. DONK. His treatment of the species extends to the fungi belonging not only to Corticiaceae but also to Hydnaceae.

4. DONK's concept of the genus *Peniophora* CKE. and its allied genera

DONK[61)~66)] recognized the following six genera : *Gloeocystidiellum* DONK em. DONK, *Tubulicrinis* DONK, *Phlebia* FR. em. DONK, *Hyphoderma* WALLR. em. DONK, *Peniophora* CKE. em. DONK, and *Phanerochaete* KARST. em. DONK.

Gloeocystidiellum DONK em. DONK, Fungus 26 : 8, 1956. Type species : *Corticium porosum* BERK. & CURT. The species of this genus have gloeocystidia and amyloid spores. He reported nine newly combined species.

Tubulicrinis DONK, Fungus 26 : 13, 1956. Type species : *Peniophora glebulosa* (BRES.) SACC. & P. SYD. The distinguishing trait of this genus is that their cystidial walls are soluble in ten per cent potassium hydroxide solution. Before DONK established the genus, ROGERS and JACKSON[148)] already pointed out "nomen confusum" of the type species of this genus. WERESUB[168)] said that DONK's action in designating, as the type species of his new genus *Tubulicrinis*, "*P. glebulosa* (BRES.) SACC. & P. SYD.", followed by ERIKSSON's and CHRISTIANSEN's acceptance of the name, necessitated this restatement about what it was to us. Thus, the idea of the species *Peniophora glebulosa* (BRES.) SACC. & P. SYD. is uncertain at the present time. FOR this reason WERESUB[168)] selected *Peniophora gracillima* ELL. & EVERH. ex ROGERS & JACKS. as the lectotype species of the genus.

Phlebia FR. em. DONK, Fungus 27 : 9, 1957. Type species : *Phlebia radiata* FR. The genus belongs to Meruliaceae. The species of this genus have gelatinous fruit bodies which shrink into a varnish-like film upon drying. DONK treated *Peniophora gigantea* (FR. ex FR.) MASS. in this genus.

Hyphoderma WALLR. em. DONK, Fungus 27 : 13, 1957. Type species : *Hyphoderma spiculosum* WALLR. = *Peniophora setigera* (FR.) HOEHN. & LITSCH. According to MILLER[121)], *P. setigera* is the synonym of *Odontia setigera* (FR.) MILL., therefore this genus is now obsolete.

Peniophora Cke. em. Donk, Fungus 27 : 15, 1957. Type species : *Corticium quercinum* (Pers. ex Fr.) Fr. The genus emended by Donk is about equal to *Peniophora* sect. Coloratae in Bourd. & Galz. The color of spore mass is pale red, and he included three species in this genus.

Phanerochaete Karst. em. Donk, Persoonia 2 (2) : 223, 1962. Type species : *Peniophora coccineofulva* (Schw.) Burt. From the original description, it includes species of *Peniophora*-(complex) traditionally accepted, excluding fifteen species of *Peniophora* in the sense of Donk.

Donk emended the genus *Peniophora* Cke., and proposed that species of the genus *Peniophora* were limited to those assumed to be pale red in spore mass. And many other species were treated in the genera established by himself and others. Species not included in the above genera were put under the genus *Phanerochaete.*

5. Japanese *Peniophora* species hitherto known

In Japan, fourteen species and one variety of the genus *Peniophora* Cke. have been reported by Hennings[84)85)], Yasuda[170)~173)] and T. Ito[91)], during the past sixty years and they are as follows :

Peniophora gigantea (Fr.) Mass.
P. glebulosa (Bres.) Sacc. & P. Syd.
P. ravenelii Cke.
P. mutata (Peck) Hoehn. & Litsch.
P. similis (Berk. & Curt.) Mass.
P. incarnata (Pers. ex Fr.) Karst.
P. affinis Burt
P. nuda (Fr.) Bres.
P. cremea (Bres.) Sacc. & Syd.
P. versicolor (Bres.) Sacc. & Syd.
P. filamentosa (Berk. & Curt.) Burt
P. cinerea (Fr.) Cke.
P. quercina (Pers. ex Fr.) Cke.
P. discoidea P. Henn.
P. quercina (Pers. ex Fr.) Cke. var. *komabensis* (P. Henn.) Hoehn. & Litsch.

In 1901, Hennings[84)] described *Peniophora discoidea* P. Henn. based on the specimens on *Quercus* sp. collected by Shirai at Nikko. Shirai's collection is missing in Japan. And also in 1902, Hennings[85)] described *Peniophora quercina* (Fr.) Cke. and *Corticium komabensis* P. Henn. based for the former, on the specimens on *Castanea* sp. collected by Kannatsuno and for the latter, on the specimens on *Quercus* sp. collected by Suzuki at Komaba, Tokyo. These collections are missing in Japan. Matsumura[117)] noted the names *Peniophora discoidea* P. Henn., *P. quercina* Cke. and *Corticium komabensis* P. Henn. without description. Yasuda[170)~173)] described six species of the genus *Peniophora,* namely, *Peniophora incarnata* Pers., *P. quercina* (Pers.) Cke., *P. versicolor* Bres., *P. allescheri* Bres. [=*P. mutata* (Peck) Hoehn. & Litsch.], *P. gigantea* (Fr.) Cke. and *P. glebulosa* (Fr.) Bres., and gave them Japanese names. T. Ito[91)] reported fourteen species and one variety, including eight species already reported by Hennings and Yasuda, examining the specimens in the Yasuda herbarium. The following seven species were newly found in Japan by T. Ito : *Peniophora ravenelii* Cke., *P. similis* (Berk. & Curt.) Mass., *P. laevis* (Fr.) Burt [=*P.*

affinis Burt], *P. nuda* (Fr.) Bres., *P. cremea* (Bres.) Sacc., *P. filamentosa* (Berk. & Curt.) Burt and *P. cinerea* (Pers.) Cke. S. Ito[90] enumerated in his "Mycological Flora of Japan" two genera and fourteen species already recorded by Hennings, Yasuda and T. Ito. He transferred *Peniophora incarnata* and *P. mutata* to the genus *Gloeocystidium* Karst. as "ad interim". The genus *Gloeocystidium* Karst. belongs to Hydnaceae, therefore this treatment was essentially needless. Hayashi[82], Hayashi and Aoshima[80][81] reported twelve species of the Japanese *Peniophora* species.

III Description of Japanese genera and species

1. Materials and methods

Materials : The descriptions were based on specimens collected from various parts of Japan by the author and the collaborators, and Yasuda's specimens identified by E. A. Burt and C. G. Lloyd kept in the National Science Museum, and specimens determined by H. S. Jackson, V. Litschauer, L. O. Overholts and R. F. Cain, kept in the Herbarium of Forest Mycology, Government Forest Experiment Station were also examined.

Methods : Macroscopic characters of specimens were studied with a stereoscopic microscope at ×16 and ×40. Judging spore color mostly depended on spore print. The spore print was obtained by wrapping a fruit body in cellophane from the specimen in good fruiting condition. Spore colors were mostly white or creamy white and in some species were pale red.

Thickness of fruit body is variable among the species, 50 to 2,000 μ. Hymenial surface is pruinose, farinose or pilose by projecting cystidia, and in several species is sometimes cracked.

The colors of species examined were white, cream, yellow and brown, and changeable under natural conditions of temperature, humidity and light etc. Color reaction of fruit body was tested by using five per cent potassium hydroxide solution. The original color of fruit bodies of many species turns to various colors, e. g. yellow, purple, wine-red, reddish, blue, brownish, tawny, dusky, black or bleached.

The sterile marginal zones of fruit bodies of many species have different colors against fruit bodies, and become thin and fibrillose.

Without critical study of the microscopic characters correct identification can not be made for the species of the genus *Peniophora* and its allied genera based only on the macroscopic ones. For microscopic study a longitudinal hand section of the fertile fruit body was made.

Sections were mounted with three per cent lactic acid, and microscopic characters of spores, hyphae and original colors in section were observed. Lactic acid does not change granular matter which incrusts the cystidia and hyphae, and fungus pigment which is included in hyphal cell. They are dissolved and bleached in potassium hydroxide solution.

Texture depends on the arrangement of hyphae composing the fruit body. To make clear the nature of the texture, a macroscopic examination should be taken in connection with the study of a longitudinal section. The following types of texture were generally recognized : Floccose—the hymenium does not form a continuous palisade layer. It is interrupted and is often at different levels. Macroscopically the fruit body appears to be a cottony mass of hyphae. Membranous—the hyphae do not distinctly differentiate in the hymenium, subhymenium and subiculum. Macroscopically the fruit body looks downy. Pelliculose—the hymenial

layer is compact and sharply differentiated from the loosely arranged or gelatinized subhymenium and subiculum. Macroscopically the fruit body looks like a thin crust. Waxy—the section appears very compact and often gelatinized. The fruit body is rigid.

The color of texture depends on the hyphae. The color of hyphae is distinguishable only under the microscope of low power. The hyphae of many species are colorless and they look hyaline also in section, though several species have distinctly yellowish or brownish color in their sections.

Sections were mounted with five per cent potassium hydroxide solution and mixed with a saturated aqueous solution of phloxine. This mount was useful for detailed study of particular structures. The author utilized this mount to analyze hyphal system, shape, size, wall, lumen, septum, clamp connection, base, apex and protrusion of cystidia, and shape and size of basidia. Ten per cent potassium hydroxide solution was added to the same mount to test the persistence of the cystidial walls.

Sections were also mounted in Melzer's solution to determine if an amyloid reaction occurred. The reaction was indicated by a more or less blue color in the spores and hyphae. The examination of spores attaching to the sterigmata is necessary to distinguish from spores of other species. In this study shape and size of mature spores were measured.

Gloeocystidia of waxy specimens were indistinguishable in ordinary mounting media, but were distinguishable in the sulfuric benzaldehyde reagent. In this mount the gloeocystidia turned to violaceous black.

The formulae of Melzer's reagent and sulfuric benzaldehyde are :

a) Melzer's reagent (in Boidin, 1958)

Potassium iodide	1.5 g
Iodine	0.5 g
Water	20.0 g
Chloral hydrate	22.0 g

b) Sulfuric benzaldehyde (in Maire, 1910)

Water	1.5 cc
Pure sulfuric acid	5.0 cc
Benzaldehyde	4.5 cc

2. General references and abbreviations

Scientific names of the trees have reference to Honda's "Nomina Plantarum Japonicarum" (1957).

In describing the appearance of fruit bodies, the color has been denoted according to the "Color Standard for fundamental researches of forestry experiment" (Tokyo Regional Forestry Office, 1943).

In this paper the following abbreviations are used :

1) Herbarium name :

F : Government Forest Experiment Station, Meguro, Tokyo, Japan.
TNS : National Science Museum, Ueno Park, Tokyo, Japan.
TRT : University of Toronto, Department of Botany, Toronto, Ontario, Canada.
DAOM : Mycological Herbarium, Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Ontario, Canada.

2) Collector's name :
K. A. : Kiyowo Aoshima
Y. H. : Yasuo Hayashi
H. F. : Hisahiko Furukawa
T. K. : Tadashi Kobayashi

3) Figures :
cc : clamp connections.
mc : multiple clamp connections.
icy : incrusted cystidia.
g : granular matter on the surface of mycelia.
gm : coarse granular matter on the surface of mycelia.
gc : granular contents.
ch : chlamydospores.

4) Plates : sign ↑ : indicates color change treated with 5% KOH solution.

3. Important morphological characteristics of the genus *Peniophora* Cke. and its allied genera with a key of genera

1) Important morphological characteristics of the fruit body

Basidiospores : The spores of the species of *Peniophora* Cke. and its allied genera are smooth and hyaline under the microscope even when they show pale red in mass macroscopically. The shape, size and amyloidity are a specific character for each species. Therefore these are the valuable elements for identification. They are mostly ellipsoid or oval, rarely globose.

The presence of amyloid spores is characteristic to the genus *Gloeocystidiellum* Donk em. Donk. Donk[63] adopted the genus *Peniophora* Cke. em. Donk to the species limited to those appearing to be pale red in spore mass.

Basidia : Usually clavate and bear 4 sterigmata.

The presence of urn-shaped basidia is characteristic to the genus *Fibricium* Erikss.

Gloeocystidia : Several species of the genus *Peniophora* Cke. and its allied genera have thin-walled, non-septate, unincrusted, and clavate to flexuous gloeocystidia. They usually originate from subhymenium and are embedded in the textures. They contain granular or oil materials and appear slightly colored. They are easily observed by using sulfuric benzaldehyde reagent, in which the gloeocystidia appear violaceous black. The presence, shape and size of gloeocystidia are the diagnostic characteristics in several species and genera.

The presence of gloeocystidia is the characteristic feature in genera *Gloeocystidiellum* Donk em. Donk and *Gloeopeniophora* Hoehn. & Litsch.

Cystidia : Their presence is of generic significance, separating *Peniophora* Cke. and its allied genera from the genus *Corticium*. These are usually present in the hymenium, rarely near the substratum, and have no contents. Shape and size are variable among the species, but within one species they remain fairly constant. Cystidia have wide or capillary lumen and either thin- or thick-walled, incrusted with granular matter or unincrusted, septate or non-septate, with or without clamp connections and capitate apex, rooted or not rooted at the base. Their walls persist or dissolve in ten per cent potassium hydroxide solution.

The cystidia of the species of the genus *Tubulicrinis* Donk are rooted at the base and they

have capillary lumen which dissolve in ten per cent potassium hydroxide solution. They are the characteristics of the genus *Tubulicrinis* Donk. The presence of clamped cystidia is characteristic to the genus *Amphinema* Karst. The presence of hyphoid and capitate cystidia is characteristic to the genus *Hyphodontia* Erikss.

Hyphae : Many species of *Peniophora* Cke. and its allied genera are composed of monomitic hyphal system. Only a few species are composed of dimitic hyphal system. Hyphae of many species are unincrusted. Incrusted granular matter in hyphae of several species quickly dissolve in five per cent potassium hydroxide solution. The hyphae are septate and branched, and in many species have clamp connections at every septum or at some septa. Several species have bridging hyphae.

The species of the genus *Fibricium* Erikss. have dimitic subiculum hyphae. The species of the genus *Membranicium* Erikss. have no clamp connections in subiculum hyphae and in the genus *Amphinema* Karst. clamp connections exist at every septum of hyphae.

Texture : The fruit body consists of horizontally arranged subiculum near the substratum and longitudinally arranged subhymenial layer on the subiculum. Sometimes subhymenial layer is absent and hymenium is formed directly on the subiculum. In *Peniophora* Cke. and its allied genera, hymenial surface is even. The hymenium consist of continuous palisade layer with regular thickness, granting that the hymenial surface become waved. Hymenium is not interrupted even at the top of the waves, and forms ordinal basidia. From this point the species of the genus *Peniophora* and its allied genera which have continuous hymenium are strictly distinguished from species of Hydnaceae.

Several species of the genus *Peniophora* Cke. and its allied genera have distinct colors in their sections, and sometimes two or three distinct layers may be recognized in section.

The species of the genus *Hyphodontia* Erikss. have no subhymenial layer and hymenium is formed directly on the subiculum. The species of the genus *Membranicium* Erikss. are composed of membranous texture.

Sterile marginal zones : In several species of the genus *Peniophora* Cke. and its allied genera, the sterile marginal zones curl away from the substratum or form the mycelial strands. The presence or absence of the mycelial strand is the diagnostic characteristic in both genus and species.

All the species of the genus *Amphinema* Karst. have yellowish mycelial strands.

2) Interpretation of Corticiaceae and Corticieae

Corticiaceae : Fruit bodies resupinate or subpileate, effused, rarely with loose margin; arachnoid, peilicular, membranaceous, waxy, rarely, subgelatinous; hymenial surface corticioid, grandinioid, odontoid, merulioid, hydnoid, poroid; cystidia, cystidioles, gloeocystidia, acanthophyses, dendrophyses present or lacking; basidia short oblong, clavate, suburniform to urniform; sterigmata 2~4, 4~8; spores hyaline, smooth, rarely warted or echinulate, nonamyloid or amyloid.

Family Corticiaceae belongs to order Aphyllophorales, and occurs on living trees and dead woods. Japanese name of family Corticiaceae is Kooyakutake Ka. Family Corticiaceae includes ten subfamilies, Corticieae, Hypochneae, Asterostromeae, Vararieae, Aleurodiscineae, Stereae, Cladoderreae, Cyphelleae, Sparasseae and Gloeostereae.

Corticieae : Fruit bodies annual, resupinate, effused; hymenial surface smooth or pilose;

floccose, membranous, pelliculose, waxy; hyphae thin- to thick-walled; cystidia present or absent; spores hyaline. Japanese name of subfamily Corticieae is Kooyakutake Aka.

The most distinctive characters of subfamily Corticieae are the resupinate fruit body, even hymenial surface and hyaline spores. In Corticieae two big genera *Corticium* Pers. ex Fr. and *Peniophora* Cke. are included. The genus *Corticium* Pers. ex Fr. is represented in having no cystidia, and *Peniophora* Cke. and its allied genera in having cystidia.

3) Taxonomic discussion of the genus *Peniophora* Cke. and its allied genera in Corticiaceae

In 1879, Cooke established the genus *Peniophora*. It was segregated from the genus *Corticium* based on the presence of cystidia in the hymenium. After the establishment of the genus *Peniophora* by Cooke, many species which were reported under the genera *Corticium*, *Thelephora* and *Stereum* since Persoon (1796), were combined in this genus, and many new species were reported under the genus *Peniophora* Cke. from all parts of the world by several workers.

The genus *Peniophora* by Cooke was based only on the presence of cystidia, and characteristics of cystidia, hyphal system and texture of fruit bodies, presence of gloeocystidia and amyloid spores were disregarded. Therefore, several species which were treated under the genus *Peniophora* Cke. were recombined to newly established genera, *Diplonema* Karst., *Gloeocystidium* Karst., *Peniophorella* Karst., *Amphinema* Karst., *Gloeopeniophora* Hoehn. & Litsch., *Gloeopeniophorella* Rick, *Hyphodontia* Erikss., *Fibricium* Erikss., *Membranicium* Erikss., *Gloeocystidiellum* Donk em. Donk, *Tubulicrinis* Donk, *Phlebia* Fr. em. Donk, *Hyphoderma* Wallr. em. Donk, *Peniophora* Cke. em. Donk and *Phanerochaete* Karst. em. Donk.

Recent study in the genus *Peniophora* is following two general courses. The one recognizes the heterogeneity of the genus, but retains the old generic concept, and restricts the study to species or groups of species. The other representated by Eriksson and Donk, is attempting to create a more natural classification, partly by more strictly defined generic concepts, and it seems necessary for a better understanding and rearrangement of the species involved.

The author proposed a modern system of interpretation of the genus *Peniophora* Cke. and newly established genera divided from the genus *Peniophora* Cke.

The author accepted *Thelephora quercina* Pers. ex Fr. which was selected by Donk[68], as the type species of the genus *Peniophora* Cke. From the characteristics of the type species, the species of the genus *Peniophora* Cke. were limited to those lacking gloeocystidia and nonamyloid spores, and hyphae having clamps. The author rejected the genus *Peniophora* Cke. em. Donk which was established by Donk[68] based on pale red in spore mass, because of Donk's illfounded concept.

Diplonema Karst. changed the generic name to *Amphinema* Karst. by Karsten[100]. The genus *Amphinema* Karst. was established by Karsten[100] based on the presence of yellowish mycelial strands, yellowish hyphae, clamped cystidia and nonamyloid spores. The concept was recognized as the specific characteristics of the genus in *Peniophora*-complex of Corticiaceae, therefore the author accepted the genus *Amphinema* Karst. The genus *Amphinema* Karst. was supported by Eriksson[69] and Christiansen[46].

Gloeocystidium Karst. belongs to Hydnaceae, so the author can not adopt this genus. And also the author has some doubts as to the substance of *Peniophorella pubera* (?Fr.) Karst., the type species of the genus *Peniophorella* Karst., so this genus cannot be adopted.

The genus *Gloeopeniophora* Hoehn. & Litsch. was established by Hoehnel and Litschauer[87] based on the presence of gloeocystidia. The presence of gloeocystidia was a very important characteristic in resupinate and cystidiate Corticiaceae.

The genus *Gloeopeniophorella* Rick was established by J. Rick[144] based on a weak concept, that is, smaller gloeocystidia than *Gloeopeniophora incarnata* (Pers. ex Fr.) Hoehn. & Litsch., the type species of the genus *Gloeopeniophora* Hoehn. & Litsch., therefore the author can not adopt it.

The genus *Hyphodontia* Erikss. was established by Eriksson[69] based on the presence of hyphoid and capitate cystidia. The texture of odontoid parts on the hymenial surface of the species of the genus *Hyphodontia* Erikss. was arrangement of Corticiaceae, that is, hymenium were not interrupted, and had horizontally arranged subiculum and longitudinally arranged subhymenium. The author accepted the genus *Hyphodontia* Erikss. as the genus with intermediate concept between Corticiaceae and Hydnaceae. The genus *Hyphodontia* Erikss. was supported by Christiansen[46].

The genus *Fibricium* Erikss. was established by Eriksson[69] based on the presence of dimitic subiculum hyphae in addition to urn-shaped basidia. They were specific characteristics in *Peniophora*-complex.

The genus *Membranicium* Erikss. was established by Eriksson[69] based on the presence of membranous texture and subiculum hyphae without clamps. The author treated in the genus those species which were membranous texture, subiculum hyphae without clamps, absence of gloeocystidia and nonamyloid spores in *Peniophora*-complex. According to Donk[66], *Membranicium* Erikss. was a synonym of his genus *Phanerochaete* Karst. em. Donk. The genus *Phanerochaete* Karst. em. Donk was composed of miscellaneous concept. The genus *Membranicium* Erikss. was supported by Christiansen[46].

The genus *Gloeocystidiellum* Donk em. Donk was established by Donk[62] based on the presence of gloeocystidia and amyloid spores. They were specific characteristics in resupinate Corticiaceae, so this genus deserves adoption. The author proposed that the genus *Peniophora* Cke. was limited to absent gloeocystidia, and the genus *Gloeopeniophora* Hoehn. & Litsch. having only gloeocystidia and also the genus *Gloeocystidiellum* Donk em. Donk having gloeocystidia and amyloid spores. The genus *Gloeocystidiellum* Donk em. Donk was supported by Eriksson[69] and Christiansen[46].

The concept of the genus *Tubulicrinis* Donk ex Weresub[168] was based on solubility of cystidia in ten per cent potassium hydroxide solution. Excepting the genus *Tubulicrinis* Donk ex Weresub, the characteristic could not be recognized in Corticiaceae. Rogers & Jackson[148] pointed out "nomen confusum" in that *Peniophora glebulosa* (Bres.) Sacc. & P. Syd. consists of a mixture of two species, and they accepted *Peniophora gracillima* Ell. & Everh. ex Rogers & Jacks. (The herbarium name of Ellis and Everhalt). Donk[62] proposed *Peniophora glebulosa* (Bres.) Sacc. & P. Syd. as the type species of his new genus *Tubulicrinis* Donk. Weresub[168] proposed the concept of the genus *Tubulicrinis* Donk, and the name of type species of Donk's new genus *Tubulicrinis* Donk to be *Peniophora gracillima* Ell. & Everh. ex Rogers & Jacks. The author accepted the concept of Weresub.

The genus *Phlebia* Fr. em. Donk belongs to Hydnaceae, and is based on gelatinous fruit bodies. The author could not treat the species of *Peniophora*-complex under this genus. The genus *Phlebia* Fr. em. Donk was supported by Christiansen[46].

The concepts of the genus *Hyphoderma* WALLR. em. DONK were derived from the genera *Corticium* FR., *Gloeocystidium* KARST. sense HOEHN. & LITSCH., *Peniophora* CKE., *Odontia* FR. and *Radulum* FR. The genus *Hyphoderma* WALLR. em. DONK included the species which were without cystidia.

The concept of the genus *Phanerochaete* KARST. em. DONK included the lack of cystidia group, merulioid or toothed hymenial surface group, therefore the author could not adopt it. The genus *Phanerochaete* KARST. em. DONK was supported by PARMASTO[126].

The author treated in the above eight genera those species of *Peniophora*-complex belonging to Corticieae in Corticiaceae. The heterogeneity of the genus *Peniophora* was removed, and the species of *Peniophora*-complex were treated from the standpoint of the natural classification, in consequence of adding an interpretation on modern taxonomy.

4) Key to the Japanese genera in Corticiaceae

1. Spores amyloid 2
1. Spores nonamyloid 3
2. Gloeocystidia present ..... *Gloeocystidiellum* DONK em. DONK
3. Gloeocystidia present ..... *Gloeopeniophora* HOEHN. & LITSCH.
3. Gloeocystidia absent 4
4. Hyphae with clamps, spores ellipsoid ..... *Peniophora* CKE.
4. Cystidia dissolve in 10% KOH ..... *Tubulicrinis* DONK ex WERESUB
4. Cystidia hyphoid, capitate, hyphae with clamps ..... *Hyphodontia* ERIKSS.
4. Cystidia clamped, forming yellowish mycelial strands ..... *Amphinema* KARST.
4. Subiculum hyphae dimitic, basidia somewhat urn-shaped ..... *Fibricium* ERIKSS.
4. Fruit bodies membranous, hyphae without clamps, spores ellipsoid ... *Membranicium* ERIKSS.

4. Description of Japanese genera and species

1) *Gloeocystidiellum* DONK em. DONK

Fungus 26 : 8, 1956; Taxon 6 : 70, 1957; ERIKSS., Symb. Bot. Ups. 16(1) : 77, 1958; CHRISTIANSEN, Dansk Bot. Ark. 19(2) : 114, 1960—*Gloeocystidiellum* DONK, Meded. Nederl. mycol. Ver. 18–20 : 156, 1931

Fruit bodies resupinate, annual, waxy to membranous; hymenial surface even to hill-like; subiculum thin; cystidia thick- to rather thick-walled; gloeocystidia elongate, immersed; spores smooth or warted to spiny, amyloid.

Habitat & type of rot : Growing on wood associated with a white rot.

Place : Corticiaceae.

Genotype : *Corticium porosum* BERK. & CURT.

Japanese name : Shibu-kawatake Zoku (nom. nov.)

The most important characteristics of the genus *Gloeocystidiellum* DONK em. DONK are the presence of gloeocystidia and amyloid spores.

Nine species of *Gloeocystidiellum* DONK em. DONK were reported by DONK[68].

In Japan, two species are recorded here. One is a new combination, *Gloeocystidiellum laevigatum* (FR.) HAYASHI, and another a new species, *Gloeocystidiellum subsimilis* HAYASHI.

KEY TO THE SPECIES

1. In section brownish, cystidia brownish, hyphae thin-walled, fruit bodies bleached in KOH ..... No. 1. *G. laevigatum*

1. In section pale yellow, cystidia hyaline, hyphae gelatinized, fruit bodies turning dusky in KOH ……No. 2. *G. subsimilis*

No. 1 ***Gloeocystidiellum laevigatum* (Fr.) Hayashi, comb. nov.**

Thelephora laevigata Fr., Elench. Fung. 1 : 224, 1828—*Corticium laevigatum* Fr., Epicr. Myc. p. 565, 1836～1838; Hym. Eur. p. 656, 1874; Sacc., Syll. Fung. 6 : 628, 1888—*Peniophora laevigata* (Fr.) Mass., Jour. Linn. Soc. 25 : 149, 1890; Karst., Finska Vet.-Soc. Bidrag. Natur. och Folk 48 : 426, 1889; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 408, 1912; Burt, Ann. Mo. Bot. Gard. 12 : 338, 1926; Bourd. & Galz., Hymén. de Fr. p. 326, 1928; Kitajima, Forest Pathology p. 442, 1942; Christiansen, Dansk Bot. Ark. 19(2) : 247, 1960; Slysh, Syracuse Univ. Tech. Pub. 83, 18, 1960

Macroscopic characteristics : Fruit bodies resupinate, longitudinally effused, not easily separable from the substratum, Buff-Pink to Vinaceous Tawny, bleached in KOH, membranous, 100～250μ thick; hymenial surface even, pilose, deeply cracking and showing the brownish subiculum in the fissures; sterile marginal zones whitish, thinning out, fibrillose, without mycelial strands (Plate 2 : A).

Microscopic characteristics : Hyphae of subiculum loosely interwoven, brownish, thin-walled, septate, without clamps, branched, not incrusted, 4.0～6.5μ in diameter (Fig. 2 : F); subhymenial layer 30～70μ thick, hyphae becoming somewhat compact toward the hymenium, brownish, thin-walled, septate, without clamps, branched repeatedly with wide

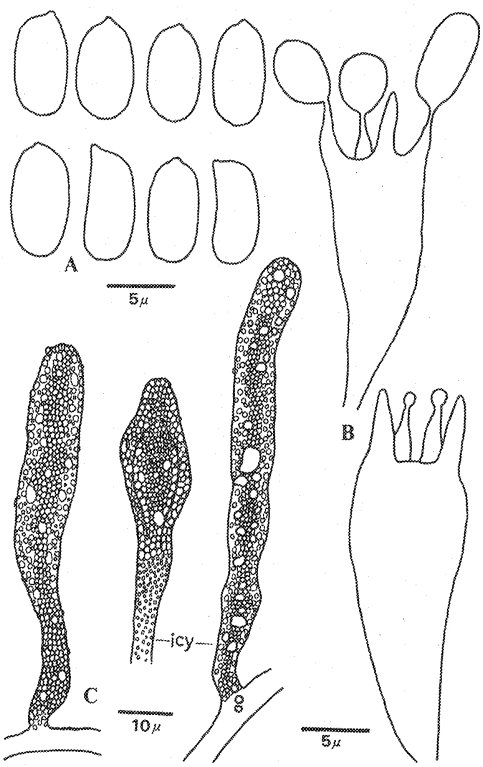


Fig. 1 Microscopic elements of *Gloeocystidiellum laevigatum* (Fr.) Hayashi, comb. nov. (10335-F)
A : Basidiospores B : Basidia C : Cystidia

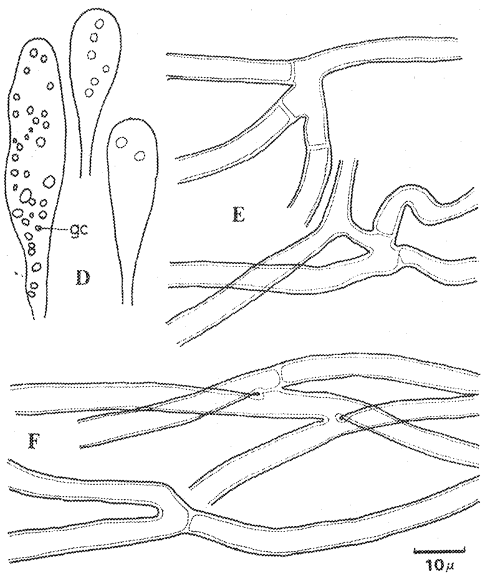


Fig. 2 Microscopic elements of *Gloeocystidiellum laevigatum* (Fr.) Hayashi, comb. nov. (10335-F)
D : Gloeocystidia E : Subhymenial hyphae
F : Subiculum hyphae

angles, not incrusted, 4～5μ in diameter (Fig. 2 : E); hymenium loosely arranged, 50～80μ thick; cystidia abundant, brownish, fusiform to cylindrical, 50～87×6.5～12.5μ, not rooted at the base, with obtuse apex, thick-walled, heavily incrusted with granular matter, non-septate, without clamps, immersed or projecting 10～25μ, cystidial walls do not dissolve in 10% KOH (Fig. 1 : C); gloeocystidia numerous, immersed, slightly colored, 30～40×5～9μ (Fig. 2 : D); basidia subclavate, 25～30×5.5～7.5μ, with 4 sterigmata of 6～8μ long (Fig. 1 : B); spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, amyloid, 7.0～8.5×3.5～4.0 (8.0×3.5)μ (Fig. 1 : A).

Japanese name : Shibu-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Honshu)

Specimen examined : Asakawa, Tokyo, on bark of decaying trunk of *Chamaecyparis obtusa*, July 14, 1964, T. K. (10335-F)

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 30°C very rapid, with mat having a diameter of 90 mm after five days (Table 2); silky at first, fragile, adherent, then felty, slightly raised at the middle; mat white at first, after pale orange; the agar under the mat stained brownish; culture has an apple odor; the oxidase reaction negative on gallic acid medium and positive on tannic acid medium, with mycelial growth profuse on gallic acid medium and showing a trace of growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : Hyphae hyaline, thin-walled, septate, clamps not seen, branched with wide angles, 3.0～

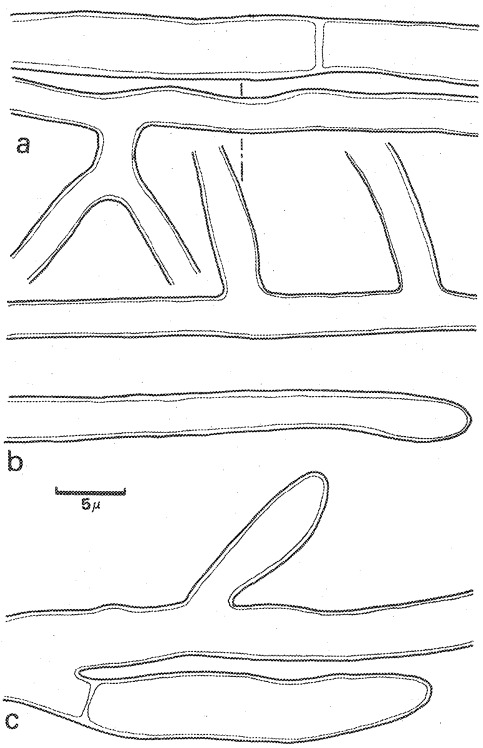


Fig. 3 Mycelium from cultures of *Gloeocystidiellum laevigatum* (Fr.) Hayashi, comb. nov. (A1 37a)
a : Aerial hyphae b : Hypha from advancing zone c : Submerged hyphae

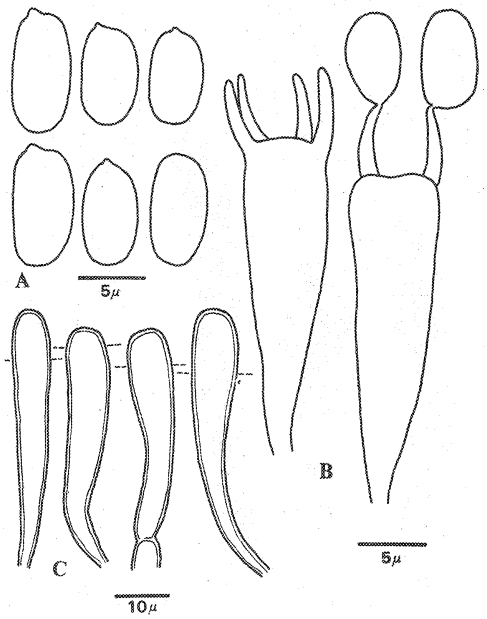


Fig. 4 Microscopic elements of *Gloeocystidiellum subsimilis* Hayashi, sp. nov. (11164-F)
A : Basidiospores B : Basidia C : Cystidia

5.0μ in diameter (Fig. 3 : a). Advancing zone : hyphae hyaline, thin-walled, gradually become more than thin-walled toward the top, 4.0μ in diameter (Fig. 3 : b). Submerged mycelium : hyphae hyaline, thin-walled, septate, branched, 4.0~5.0μ in diameter (Fig. 3 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 20°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 3 days.

The present species is readily recognized by its deep brown cystidia which are unique among the species in Corticiaceae.

No. 2 ***Gloeocystidiellum subsimilis*** **HAYASHI, sp. nov.**

Fructificatio longitudinale effusa, maydi-flava, tenuis, pruinosa, rimosa, fusca in KOH ; subiculum compactum agglutinum ; cystidia abundatia, clavata, 40~45×6.5~9.0μ ; gloeocystidia abundantia, fusiformia, 25~50×6~15μ ; basidia subclavata, 20~25×6.5~7.5μ, sterigmata 2~4 in numero, arcuatae, 5~6μ longae ; basidiosporae late ellipsoideae, laevigatae, hyaliae, amyloidae, 7~9×3.5~4.5μ.

Macroscopic characteristics : Fruit bodies resupinate, at first in small patches, then confluent and longitudinally effused, not easily separable from the substratum, Cream-Buff to Light Buff, turning dusky in KOH, waxy, 60~125μ thick ; hymenial surface even, rigid in appearance, pruinose, minutely cracking ; sterile marginal zones more or less whitish, thinning out, determinate, fibrillose, without mycelial strands (Plate 2 : B).

Microscopic characteristics : Subiculum 20~75μ thick, composed of pale yellow and gelatinized hyphae, mingled with few thin-walled hyphae, thin-walled hyphae septate, branched, not incrusted and not clamped, 3~6μ in diameter (Fig. 5 : E), subhymenial layer absent ; hymenium even, compactly arranged, pale yellow, 30~40μ thick ; cystidia abundant, clavate, 40~45×6.5~9.0μ, not rooted at the base, with obtuse apex, mostly thin- and smooth-walled, not incrusted, non-septate, without clamps, protruding 5~13μ, walls do not dissolve in 10% KOH (Fig. 4 : C) ; gloeocystidia abundant in hymenium and subhymenium, fusiform, immersed, 25~50×6~15μ (Fig. 5 : D) ; basidia subclavate, 20~25×6.5~7.5μ, with 2~4 sterigmata of 5~6μ long (Fig. 4 : B) ; spores broadly ellipsoid, apiculate, smooth, hyaline, amyloid, 7.0~9.0×3.5~4.5μ (Fig. 4 : A).

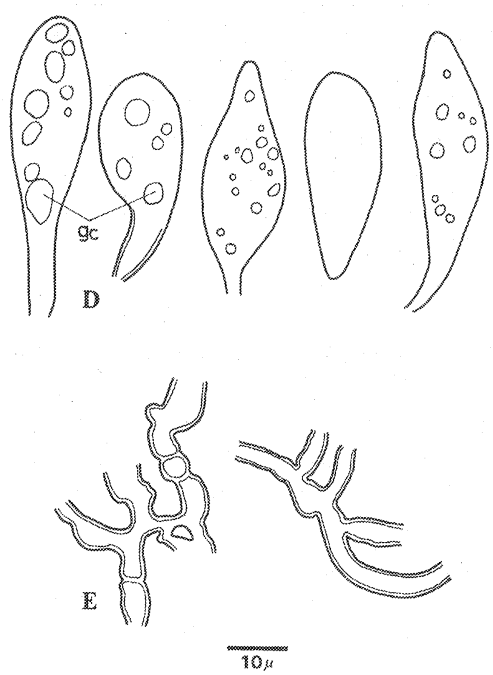


Fig. 5 Microscopic elements of *Gloeocystidiellum subsimilis* HAYASHI, sp. nov. (11164-F)
D : Gloeocystidia E : Subiculum hyphae

Japanese name : Niseki-kawatake (nom. nov.)

Distribution : Japan (Honshu)

Specimen examined : Chichibu, Saitama pref., on bark of decaying branch of *Prunus* sp., Nov. 11, 1969, K. A. • Y. H. & T. K. (11164-F)

Habitat & type of rot : Found only once on decayed wood of *Prunus* sp. associated

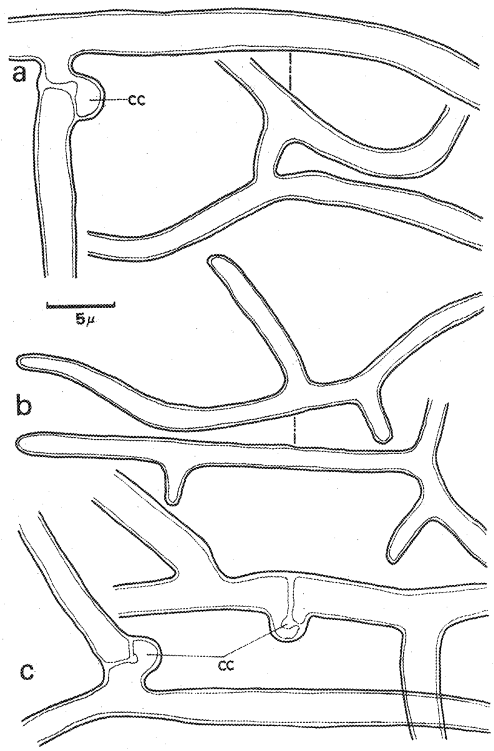


Fig. 6　Mycelium from cultures of *Gloeocystidiellum subsimilis* Hayashi, sp. nov. (Al 102a)
a : Aerial hyphae　b : Hyphae from advancing zone　c : Submerged hyphae

with a white rot.

Cultural characteristics : Growth characters—Growth on malt extract agar at 25°C very slow, with mat having a diameter of 7 mm after five days (Table 2), 65 mm after 21 days; silky at first, then tough, adherent, slightly raised at the center, spreading as a thin, felty mat which remains entirely white; the underside of the mat pale yellow at the center; culture odorless, or with a faint apple odor; the oxidase reaction positive on gallic acid and tannic acid media showing a trace of growth on both media (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, with clamps, branched with wide angles, 2.5～3.0μ in diameter (Fig. 6 : a). Advancing zone : hyphae hyaline, branched with wide angles, 1.5～2.0μ in diameter (Fig. 6 : b). Submerged mycelium : hyphae as in aerial hyphae (Fig. 6 : c).

Temperature relations—The optimum growth temperature was 25°C, the minimum 10°C, and the maximum 30°C (Table 2). Cultures were killed at 40°C for 5 days.

The diagnostic characteristics of this species are the presence of agglutinated subiculum and smooth and large spores.

The present new species resembles macroscopically No. 12, *Peniophora similis* (Berk. & Curt.) Mass., *Peniophora subsulphurea* (Karst.) Hoehn. & Litsch. and *Peniophora subincarnata* (Peck) Litsch., but microscopically is quite different[9)~26)55)~57)].

2) ***Gloeopeniophora* Hoehn. & Litsch.**

K. Akad. Wiss. Wien, Math. -Nat. Kl. Sitzungsb. 116 : 815, 1907; Donk, Taxon 6 : 70, 1957.

Fruit bodies resupinate, annual, variously colored, membranous to waxy, mycelial strands absent; hyphae compactly arranged, hyaline to brown in appearance, thin-walled, with clamps; cystidia cylindrical to fusiform, immersed or projecting, non-septate, without clamps, walls do not dissolve in 10% KOH; gloeocystidia present; basidia clavate; spores cylindrical to ellipsoid, smooth, hyaline, non-amyloid.

Habitat & type of rot : Growing on wood associated with a white rot.

Place : Corticiaceae

Genotype : *Thelephora incarnata* Pers.

Japanese name : Shiracha-kawatake Zoku (nom. nov.)

Gloeopeniophora Hoehn. & Litsch. is separated from *Peniophora* Cke. in having gloeocystidia.

KEY TO THE SPECIES

1. Fruit bodies waxy 2
1. Fruit bodies membranous 3
2. Fruit bodies bleached in KOH ..... No. 3 *G. violaceo-livida*
2. Fruit bodies do not change color in KOH ..... No. 4 *G. incarnata*
3. Fruit bodies turning red in KOH ..... No. 5 *G. mutata*
3. Fruit bodies do not change color in KOH ..... No. 6 *G. aurantiaca*

No. 3 ***Gloeopeniophora violaceo-livida* (Sommerf.) Hayashi, comb. nov.**

Thelephora violaceo-livida Sommerf., Lapp. p. 283, 1826; Fr., Elench. Fung. 1 : 222, 1828—*Corticium violaceo-lividum* (Sommerf.) Fr. Epic. Myc. p. 564, 1836–1838; Hym. Eur. p. 655, 1874; Quél., Flore Myc. p. 6, 1888—*Peniophora violaceo-livida* (Sommerf.) Bres., in Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 405, 1912; Rea, Brit. Basid. p. 695, 1922; Burt, Ann. Mo. Bot. Gard. 12 : 347, 1926; Bourd. & Galz., Hymén. de Fr. p. 324, 1928—*Peniophora violaceo-livida* (Sommerf.) Mass., Jour. Linn. Soc. 25 : 152, 1890; Erikss., Symb. Bot. Ups. 10(5) : 34, 1950; Christiansen, Dansk Bot. Ark., 19(2) : 191, 1960; Slysh, Syracuse Univ. Tech. Pub. 83, 30, 1960; Hayashi & Aoshima, Trans. Mycol. Soc. Japan 7(2・3) : 158, 1966.

Macroscopic characteristics : Fruit bodies resupinate, forming small patches, then confluent and longitudinally effused, not easily separable from the substratum, Tilleul-Buff to Pale Drab-Gray, bleached in KOH, waxy, very thin, 50~100μ thick; hymenial surface even, rigid in appearance, pruinose, rarely cracked; sterile marginal zones whitish, thinning out, fibrillose, without mycelial strands.

Microscopic characteristics : Subiculum 13~28μ thick, hyphae longitudinally and compactly arranged next to the substratum, which are brownish, thin-walled, septate, branched, not incrusted, clamps not seen, 4μ in diameter; subhymenium 12~28μ thick, hyphae yellowish, compact and coherent, indistinct; hymenium 13~30μ thick, compactly arranged; cystidia abundant, slightly brownish, subfusiform, mostly immersed, rarely protruding 10~13μ, 18~45×6.5~10.0μ, not rooted at the base, with obtuse apex, thick- and flexuous-walled, heavily incrusted with granular matter which does not dissolve in 5% KOH, non-septate, without clamps, walls do not dissolve in 10% KOH; gloeocystidia rare, clavate, immersed in the hymenium, 30~40×5~12μ; basidia clavate, 23~28×6.5~7.5μ, with 2~4 sterigmata of 3.0~3.5μ long; spores cylindrical, slightly curved, prominently apiculate, smooth, hyaline, non-amyloid, 7.5~12.5×2.5~4.5 (9.0×3.8)μ.

Japanese name : Usucha-kawatake (Y. Hayashi & K. Aoshima)

Distribution : North America, Europe and Asia : Japan.

Specimens examined : Hinoemata, Fukushima pref., on bark of fallen branches of *Fagus crenata*, Oct. 10, 1963, T. K. (10185-F); Wada, Nagano pref., on bark of decaying branch of *Malus toringo*, Sept. 18, 1962, Y. H. & H. F. (10434-F); do., on bark of fallen twigs of *Prunus verecunda*, Aug. 1, 1965, K. A.・Y. H. & H. F. (10995-F); Kuroki, Kagoshima pref., on bark of fallen branches of *Chamaecyparis obtusa*, Nov. 14, 1967, T. K. (11199-F); Kirizumi, Gumma pref., on bark of decaying branch of *Castanea crenata*, Oct. 2, 1968, Y. H. & H. F. (11200-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 25°C rapid, with mat having a diameter of 60 mm after five days (Table 2), 90 mm after seven days; silky at first, adherent,

usually with the surface growth loose, spreading as a thin layer; upper surface entirely white, the underside pale yellow; culture having a sour odor; the oxidase reaction weakly positive on gallic acid medium and strongly positive on tannic acid medium, with mycelial growth profuse on both media (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, with clamps, branched with wide angles, 3.5～4.0μ in diameter (Fig. 7 : a). Advancing zone : hyphae hyaline, narrow, thin-walled, with clamps, branched, with granular contents, 2.0～2.5μ in diameter (Fig. 7 : b). Submerged mycelium : hyphae hyaline, thin-walled, septate, branched, 3.5～4.0μ in diameter (Fig. 7 : c).

Temperature relations—The optimum growth temperature was 25°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 7 days.

This species is easily recognized in having purplish brown to dark brown fruit bodies, and microscopically in having small and clavate gloeocystidia.

No. 7, *Peniophora quercina* (Pers. ex Fr.) Cke. and No. 8, *Peniophora cinerea* (Fr.) Cke. are somewhat similar in having waxy fruit bodies but they have no gloeocystidia.

No. 4 ***Gloeopeniophora incarnata*** **(Pers. ex Fr.) Hoehn. & Litsch.**

K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 116, 816, 1907—*Thelephora incarnata* Pers., Syn. Meth. Fung. p. 573, 1801; Myc. Eur. 1 : 130, 1822—*Thelephora incarnata* Pers. ex Fr., Syst.

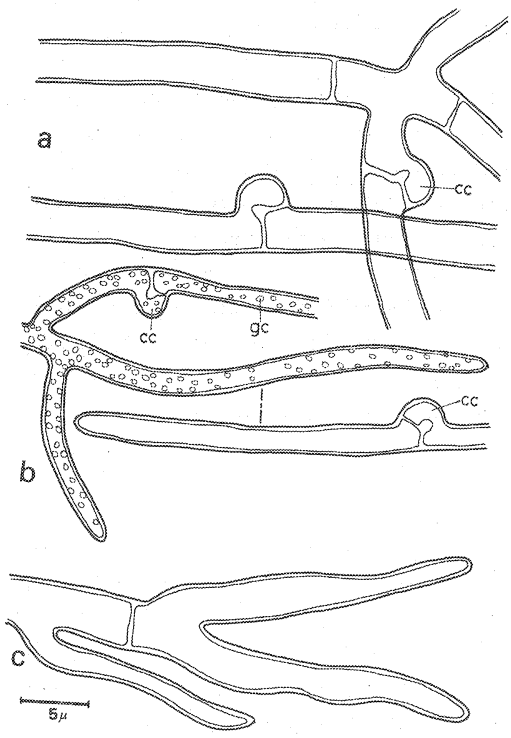


Fig. 7 Mycelium from cultures of *Gloeopeniophora violaceo-livida* (Sommerf.) Hayashi, comb. nov. (Al 65a)
a : Aerial hyphae　b : Hyphae from advancing zone　c : Submerged hyphae

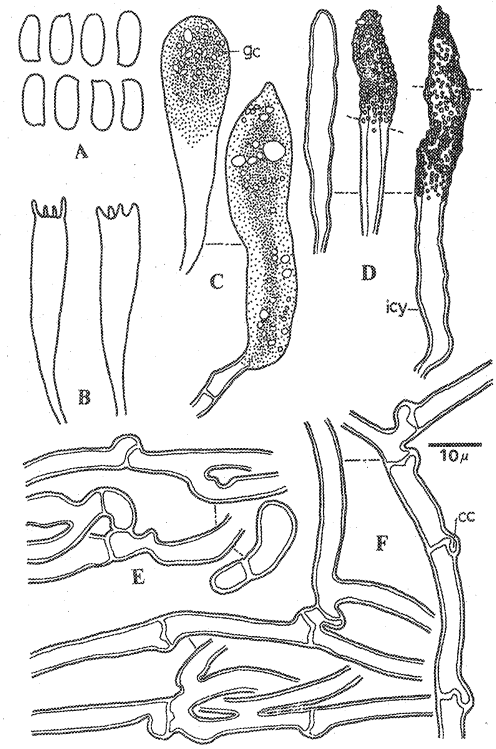


Fig. 8 Microscopic elements of *Gloeopeniophora incarnata* (Pers. ex Fr.) Hoehn. & Litsch. (10199–F)　A : Basidiospores　B : Basidia
C : Gloeocystidia　D : Cystidia　E : Subhymenial hyphae　F : Subiculum hyphae

Myc. 1 : 444, 1821—*Corticium incarnatum* (Pers. ex Fr.) Fr., Epicr. Myc. p. 564, 1836~1838; Hym. Eur. p. 654, 1874; Berk., Brit. Fung. p. 275, 1860; Peck, N. Y. State Mus. Rept. 24 : 80, 1872; Berk. & Curt., Grevillea 2 : 4, 1873; Sacc., Syll. Fung. 6 : 625, 1888—*Peniophora incarnata* (Pers. ex Fr.) Karst., Hedwigia 28 : 27, 1889; Finska Vet.-Soc. Bidrag Natur och Folk 48 : 424, 1889; Mass., Jour. Linn. Soc. 25 : 147, 1890; Sacc., Syll. Fung. 9 : 241, 1891; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 404, 1912; Yasuda, Bot. Mag. Tokyo 32 : 264, 1918; Rea, Brit. Basid. p. 694, 1922; Burt, Ann. Mo. Bot. Gard. 12 : 307, 1926; Shirai & Hara, List Japanese Fungi p. 245, 1927; Bourd. & Galz., Hymén. de Fr. p. 321, 1928; T. Ito, Bot. Mag. Tokyo 43 : 518, 1929; Pilát, Bull. Soc. Myc. Fr. 51 : 419, 1935; Hemmi & Akai, Wood Rotting Fungi p. 229, 1945; Erikss., Symb. Bot. Ups. 10(5) : 11, 1950; Cunn., Trans. Royal Soc. New Zealand 83(2) : 264, 1955; Talbot, Bothalia 7 : 148, 1958; Erikss., Symb. Bot. Ups. 16(1) : 118, 1958; Slysh, Syracuse Univ. Tech. Pub. 83, 32, 1960; Christiansen, Dansk Bot. Ark. 19(2) : 189, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 116, 1963—*Gloeocystidium incarnatum* (Pers.) S. Ito, Myc. Fl. Japan 2(4) : 119, 1955.

Macroscopic characteristics : Fruit bodies resupinate, even, at first in small patches, then coalescing and becoming longitudinally effused, Light Ochraceous-Buff to Ochraceous-Orange, do not change color in KOH, waxy, 50~150μ thick; hymenial surface rigid in appearance, pruinose, cracking and showing the white subiculum in the fissures; sterile marginal zones wide, whitish, thinning out, radiately fibrillose, without mycelial strands (Plate 2 : C).

Microscopic characteristics : Subiculum composed of longitudinally and loosely arranged hyphae, which are hyaline, thin-walled, with clamps at every septum, branched, not incrusted, 2.5~4.0μ in diameter, mingled with bridging hyphae (Fig. 8 : F); subhymenial layer 20~25μ thick, composed of vertically and loosely arranged hyphae, which are hyaline, thin-walled, septate, with clamps, branched, not incrusted, 2.5~4.0μ in diameter (Fig. 8 : E); hymenium compactly arranged, hyaline, 25~35μ thick; cystidia frequent, hyaline, cylindrical, immersed or projecting 15~20μ, 25~45×2.5~5.0μ, not rooted at the base, tapering toward the apex, thin-walled, with wider lumen, heavily incrusted with granular matter, which does not dissolve in 5% KOH, non-septate, without clamps, which walls do not dissolve in 10% KOH (Fig. 8 : D); gloeocystidia abundant, clavate to fusiform, immersed, 20~60×7.5~12.5μ (Fig. 8 : C); basidia narrowly clavate, 25~38×5.0~6.5μ (Fig. 8 : B); spores cylindrical, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 6.5~9.0×3.5~4.0μ (Fig. 8 : A).

Japanese name : Niku-kawatake (A. Yasuda)

Distribution : Europe, North America, South Africa, New Zealand and Asia : Japan

Specimens examined : Nippara, Tokyo, on bark of decaying branch of broad leaved tree, Nov. 9, 1963, Y. H. (10199-F); 202738-TNS (Det. by C. G. Lloyd); Holland R. Marsh, Ont., Canada, on *Ribes floridum*, Apr. 27, 1935, H. S. Jackson (10767-TRT), (TNS), (Det. by H. S. Jackson)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic characteristics of this well-known species are the thin, waxy and light orange fruit bodies having various forms of gloeocystidia present throughout the texture.

In Japan, Yasuda sent Burt two specimens (Yasuda Herb. No. 119 & 123; Mo. Bot. Gard. Herb. No. 59470 & 59474) collected in Awaji Is. for identification which were identified as this species by Burt[41]. In 1918, Yasuda[170] reported *Peniophora incarnata* Pers., Niku-Kawatake, thereafter Shirai & Hara[155] gave Kuwa-Kawatake as Japanese name for this species.

No. 5 ***Gloeopeniophora mutata* (PECK) HAYASHI, comb. nov.**

Corticium mutatum PECK, N. Y. State Mus. Rept. 43 : 67, 1890; SACC., Syll. Fung. 9 : 230, 1891; BRES., Ann. Myc. 1 : 94, 1903—*Peniophora mutata* (PECK) HOEHN. & LITSCH., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 115, 1580, 1906; BRES., Ann. Mycol. 6 : 44, 1908; BURT, Ann. Mo. Bot. Gard. 12 : 299, 1926; ROGERS & JACKS., Farlowia 1(2) : 313, 1943; WERESUB, Can. Jour. Bot. 30 : 770, 1952; SLYSH, Syracuse Univ. Tech. Pub. 83, 27, 1960—*Peniophora mutata* (PECK) BRES., in BOURD. & GALZ., Bull. Soc. Myc. Fr. 28 : 399, 1912; SACC., Fl. Ital. Crypt. Hymén. p. 1186, 1916; BOURD. & GALZ., Hymén. de Fr. p. 310, 1928; T. ITO, Bot. Mag. Tokyo 43 : 517, 1929; PILÁT, Bull. Soc. Myc. Fr. 51 : 420, 1935—*Gloeocystidium mutatum* (PECK) S. ITO, Mycol. Fl. Japan 2(4) : 120, 1955—*Hyphoderma mutatum* (PECK) DONK, Fungus 27 : 15, 1957; ERIKSS., Symb. Bot. Ups. 16(1) : 96, 1958; CHRISTIANSEN, Dansk Bot. Ark. 19(2) : 204, 1960—*Corticium allescheri* BRES., Fungi Trid. 2 : 62, 1898 teste ROGERS & JACKS., Farlowia 1(2) : 313, 1943—*Peniophora allescheri* (BRES.) SACC. & SYD., Syll. Fung. 16 : 194, 1902; YASUDA, Bot. Mag. Tokyo 34 : 266, 1920; BURT, Ann. Mo. Bot. Gard. 12 : 301, 1926; SHIRAI & HARA, List Japan. Fung. p. 245, 1927—*Gloeopeniophora allescheri* (BRES.) HOEHN. & LITSCH., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 117, 1082, 1908.

Macroscopic characteristics : Fruit bodies resupinate, longitudinally and broadly effused, not easily separable from the substratum, Cartridge Buff to Seashell Pink, turning reddish in KOH, membranous, 400~600μ thick; hymenial surface rigid in appearance, pilose, rarely cracked; sterile marginal zones whitish, thinning out, fibrillose, mycelial strands absent (Plate 2 : D).

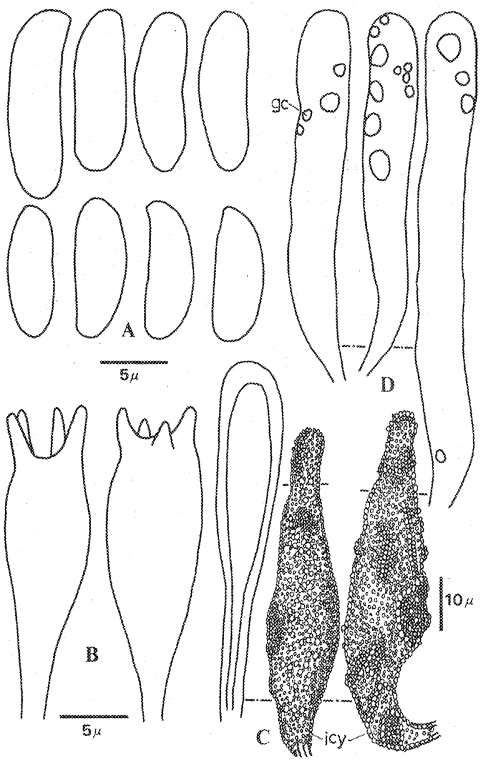


Fig. 9 Microscopic elements of *Gloeopeniophora mutata* (PECK) HAYASHI, comb. nov. (11253-F)
A : Basidiospores B : Basidia C : Cystidia
D : Gloeocystidia

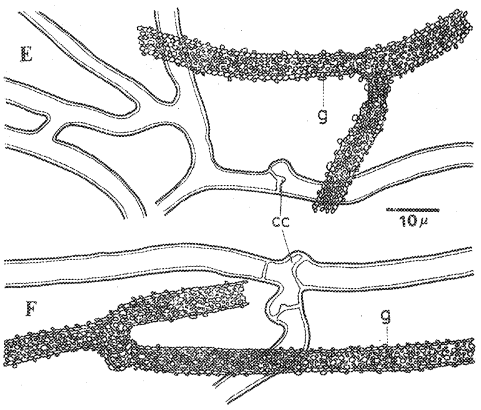


Fig. 10 Microscopic elements of *Gloeopeniophora mutata* (PECK) HAYASHI, comb. nov. (11253-F)
E : Subhymenial hyphae F : Subiculum hyphae

Microscopic characteristics : Subiculum 170~200μ thick, composed of longitudinally and loosely arranged hyphae, which are hyaline, thin-walled, septate, with clamps (at some septa), branched, incrusted with granular matter which does not dissolve in 5% KOH, 4.0~5.0μ in diameter (Fig. 10 : F); hyphae of subhymenium compactly arranged and somewhat coherent, similar to subiculum hyphae, 3.5~5.0 (3.5)μ in diameter (Fig. 10 : E); hymenium compactly arranged, hyaline, 30~45μ thick; cystidia abundant, hyaline, subcylindrical to fusiform, immersed or projecting 10~20μ, 40~65×10.0~12.5μ, not rooted at the base, with obtuse apex, thick- and smooth-walled, with wider lumen, incrusted with granules which do not dissolve in 5% KOH, non-septate, without clamps, cystidial walls do not dissolve in 10% KOH (Fig. 9 : C); gloeocystidia rare, cylindrical, 60~100×10.0~11.5μ (Fig. 9 : D); basidia subclavate, 20~25×6~10μ, with 4 sterigmata of 2~4μ long (Fig. 9 : B); spores copious, curved cylindrical, smooth, hyaline, non-amyloid, 9.5~13.0×3.5~4.5 (10.5×3.5)μ (Fig. 9 : A).

Japanese name : Shiracha kawatake (A. Yasuda)

Distribution : Europe, North America and Asia : Japan (Hokkaido and Honshu)

Specimens examined : Numanohara-Sounkyo, Hokkaido, on bark of fallen branches of *Sorbus alnifolia*, Sept. 11, 1969, Y. H. & H. F. (11253-F); Kiyosumi, Chiba pref., on bark of fallen branches of broad leaved tree, Sept. 1961, K. A. • Y. H. & H. F. (11255-F); Matagama Point, L. Temagami, T. F. R., Ont., Canada, on *Populus*, Aug. 16, 1937, H. S. Jackson (12695-TRT), (TNS), (Det. by H. S. Jackson)

Habitat & type of rot : Associated with a white rot of dead broad leaved trees.

The diagnostic characteristics of this species are the presence of gloeocystidia, hyaline and non-amyloid spores and the different arrangements of hyphae in subiculum and in subhymenium.

In Japan, this species was reported by Yasuda[171] for the first time as *Peniophora allescheri* (Bres.) Sacc. & Syd.—Shiracha-kawatake.

According to Rogers and Jackson[148] *Peniophora allescheri* (Bres.) Sacc. & Syd. is the synonym of *Peniophora mutata* (Peck) Hoehn. & Litsch., and this treatment has been accepted by many authorities.

No. 6 ***Gloeopeniophora aurantiaca* (Bres.) Hoehn. & Litsch.**

K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 117 : 1094, 1908—*Corticium aurantiacum* Bres., Fungi Trid. 2 : 37, 1892; Sacc., Syll. Fung. 11 : 126, 1895—*Peniophora aurantiaca* (Bres.) Hoehn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 115 : 1583, 1906; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 402, 1912; Burt, Ann. Mo. Bot. Gard. 12 : 310, 1926; Bourd. & Galz., Hymén. de Fr. p. 320, 1928; Pilát, Bull. Soc. Myc. Fr. 51 : 420, 1935; Rogers & Jacks., Farlowia 1(2) : 270, 1943; Eriks., Symb. Bot. Ups. 10(5) : 14, 1950; Christiansen, Dansk Bot. Ark. 19(2) : 189, 1960; Slysh, Syracuse Univ. Tech. Pub. 83, 25, 1960; Parmasto, Inves. Natural Hist. Soviet Far East. p. 243, 1963

Macroscopic characteristics : Fruit bodies resupinate, at first forming small patches at lenticels, then confluent, when mature broadly effused, not easily separable from the substratum, Light Buff to Pale Yellow-Orange, do not change color in KOH, membranous, 80~190μ thick; hymenial surface even, downy in appearance, pilose, rarely cracking; sterile marginal zones whitish, thinning out, fibrillose, mycelial strands absent (Plate 2 : E).

Microscopic characteristics : Subiculum longitudinally and compactly arranged next to the substratum, composed of hyaline, thin-walled hyphae, thin-walled hyphae septate, branched,

with clamps at some septa and not incrusted, mostly 4.0μ in diameter (Fig. 12 : F); subhymenium 10～33μ thick, hyphae ascending from the subiculum and becoming loosely arranged, similar to subiculum hyphae, 2.5～4.0μ in diameter (Fig. 12 : E); hymenium somewhat loosely arranged, hyaline, 50～75μ thick; cystidia abundant, hyaline, subcylindrical, 50～70×7.5～12.5μ, not rooted at the base, tapering and forming an obtuse apex, thick- and rough-walled, with not distinctly broadened lumen, incrusted around near the tip, non-septate, without clamps, immersed or protruding 18～25μ, cystidial walls do not dissolve in 10% KOH (Fig. 11 : C); gloeocystidia abundant, cylindrical or flexuous, no color change in MELZER's reagent, immersed, 37～70×6.5～10.0μ (Fig. 11 : D); basidia large, cylindrical or subclavate, 45～65×10.0～13.5μ, with 2～4 sterigmata of 10～12μ long (Fig. 11 : B); spores copious, broadly ellipsoid, apiculate, smooth, hyaline, non-amyloid, 11.5～17.5×9.0～11.5 (15×10)μ, (Fig. 11 : A).

Japanese name : Ezo-kawatake (nom. nov.)

Distribution : Europe, North America, Asia : Kamchatka Peninsula and Japan (Hokkaido)

Specimens examined : Otoineppu, Hokkaido, on *Alnus crispa* subsp. *maximowiczii*, Sept. 7, 1969, K. A. • Y. H. & H. F. (11254-F); Umiat, Arctic Alaska, U. S. A., on *Alnus crispa*, Aug. 13, 1965, Y. KOBAYASI (Y. KOBAYASI-Alaska No. 155)

Habitat & type of rot : Associated with a white rot of *Alnus*.

This species is easily recognized by its developing on bark of *Alnus* in the arctic and the subarctic zones. Microscopically cylindrical or flexuous gloeocystidia, thick-walled cystidia, long basidia and large ellipsoid spores scattered throughout the hymenium are very diagnostic.

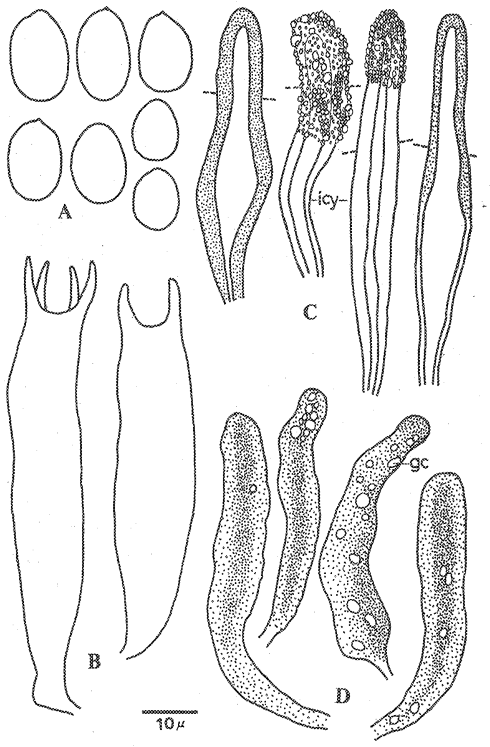


Fig. 11 Microscopic elements of *Gloeopeniophora aurantiaca* (BRES.) HOEHN. & LITSCH. (11254-F)
A : Basidiospores　B : Basidia　C : Cystidia
D : Gloeocystidia

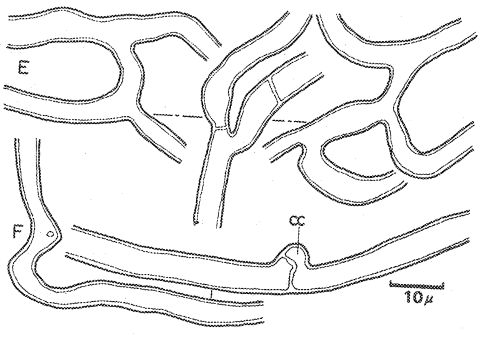


Fig. 12 Microscopic elements of *Gloeopeniophora aurantiaca* (BRES.) HOEHN. & LITSCH. (11254-F)
E : Subhymenial hyphae
F : Subiculum hyphae

3) ***Peniophora* Cke.**

Grevillea 8 : 20, 1879; Sacc., Syll. Fung. 6 : 640, 1888; Karst., Finska Vet.-Soc. Bidrag. Natur och Folk 48 : 421, 1889; Mass., Jour. Linn. Soc. 25 : 140, 1890; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 372, 1912; Burt, Ann. Mo. Bot. Gard. 12 : 215, 1926; Bourd. & Galz., Hymén. de Fr. p. 267, 1828; Slysh, Syracuse Univ. Tech. Pub. 83, 16, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 105, 1963

Fruit bodies resupinate, annual, thin, variously colored, firm, membranous to waxy; hymenial surface pruinose to pilose; sterile marginal zones fibrillose; mycelial strands present or absent; hyphae compactly arranged, hyaline to brown, with clamps, thin-walled; cystidia cylindrical to fusiform, incrusted or not incrusted, immersed or projecting, non-septate, without clamps, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate; basidiospores cylindrical or ellipsoid, smooth, hyaline, non-amyloid.

Habitat & type of rot : Growing on wood associated with a white rot of broad leaved trees.

Place : Corticiaceae

Genotype : *Thelephora quercina* Pers. ex Fr.

Japanese name : Kawatake-Zoku (A. Yasuda)

Donk[63] emended this genus selecting *Thelephora quercina* Pers. ex Fr. as the lectotype. His concept of the genus is that confined to those species as having spores pale red in mass.

Color change of fruit body by potassium hydroxide solution is closely correlated with the color in section; the species which do not change color in potassium hydroxide solution are colorless in section.

KEY TO THE SPECIES

1. Fruit bodies waxy 2
1. Fruit bodies membranous 3
2. Fruit bodies turning black in KOH, spores 9~10μ long ..... No. 7 *P. quercina*
2. Fruit bodies turning black in KOH, spores 7~8μ long ..... No. 8 *P. cinerea*
2. Fruit bodies bleached in KOH ..... No. 9 *P. gigantea*
2. Fruit bodies turning vinaceous in KOH ..... No. 10 *P. roumeguerii*
2. Fruit bodies turning tawny in KOH ..... No. 11 *P. farlowii*
2. Fruit bodies do not change color in KOH, cystidia incrusted ..... No. 12 *P. similis*
2. Fruit bodies do not change color in KOH, cystidia not incrusted ..... No. 13 *P. phlebioides*
3. Fruit bodies bleached in KOH, pale yellow in section ..... No. 14 *P. affinis*
3. Fruit bodies bleached in KOH, brownish yellow in section ..... No. 15 *P. velutina*
3. Fruit bodies turning wine-red in KOH ..... No. 16 *P. ludoviciana*
3. Fruit bodies do not change color in KOH, mycelial strands present ..... No. 17 *P. burtii*
3. Fruit bodies do not change color in KOH, mycelial strands absent ..... No. 18 *P. pilosa*

No. 7 ***Peniophora quercina* (Pers. ex Fr.) Cke.**

Grevillea 8 : 20, 1879; Sacc., Syll. Fung. 6 : 641, 1888; Mass., Jour. Linn. Soc. 25 : 141, 1890; Brit. Fung. Fl. 1 : 109, 1892; P. Henn., Bot. Jahrb. 32 : 38, 1902; Matsumura, Index Plant. Jap. 1 : 158, 1904; Shirai & Miyake, List Jap. Fungi p. 62, 1905; Mass., Brit. Fung. p. 418, 1911; Yasuda, Bot. Mag. Tokyo 32 : 357, 1918; Rea, Brit. Basid. p. 696, 1922; Bres., Icon. Myc. 22 : 1071, 1932; Erikss., Symb. Bot. Ups. 10(5) : 63, 1950; S. Ito, Myc. Fl. Japan 2(4) : 118, 1955; Donk, Fungus 27 : 15, 1957; Christiansen, Dansk Bot. Ark. 19(2) : 194, 1960; Slysh, Syracuse

Univ. Tech. Pub. 83, 73, 1960—*Thelephora quercina* Pers., Syn. Meth. Fung. p. 573, 1801; Nees, Syst. Pilze Schwam. p. 239, 1817; Fr., Syst. Myc. 1 : 442, 1821; Pers., Myc. Eur. 1 : 124, 1822; Fr., Elench. Fung. 1 : 186, 1828; Berk., Engl. Fl. 5(2) : 167, 1836; Rabenhorst, Deut. Krypt. Fl. 1 : 388, 1844—*Corticium quercinum* Pers. ex Fr., Epicr. Myc. p. 563, 1836～1838; Hymen. Eur. p. 653, 1874; Winter, Pilze 1 : 333, 1884

Macroscopic characteristics : Fruit bodies resupinate, widely effused, separable from the substratum, Seashell Pink to Vinaceous-Buff, turning black in KOH, waxy, 300～700 μ thick; hymenial surface even, rigid, pilose, rarely cracking; sterile marginal zones concolorous, thinning out, radiately fibrillose, curling away from the substratum, without mycelial strands (Plate I : A).

Microscopic characteristics : Subiculum hyphae vertically and compactly arranged for the most part, gelatinized, brownish; hyphae difficult to distinguish, mingled with few thin-walled hyphae. Thin-walled hyphae branched, with clamps, not incrusted, 4.0～5.0 μ in diameter (Fig. 13 : D); subhymenium without an obvious layer; hymenium compactly arranged, brownish, 55～80 μ thick; cystidia abundant, hyaline, fusiform, 42～82×9～14 μ, not rooted at the base, with lanceolate apex, thick- and rough-walled, heavily incrusted with coarse and brownish granules (Fig. 13 : C), granular matter dissolves in 5% KOH, non-septate, without clamps, immersed or projecting 10～30 μ, walls do not dissolve in 10% KOH (Fig. 14 : E); gloeocystidia absent; basidia subclavate, 37～45×9～15 μ, with 2～4 sterigmata of 5.0～6.5 μ long (Fig. 13 : B); spores cylindrical, curved, apiculate, smooth, hyaline, non-amyloid, 9～10×3.5～4.5 μ (Fig. 13 : A).

Japanese name : Kawatake (A. Yasuda)

Distribution : Europe, North America and Asia : Japan

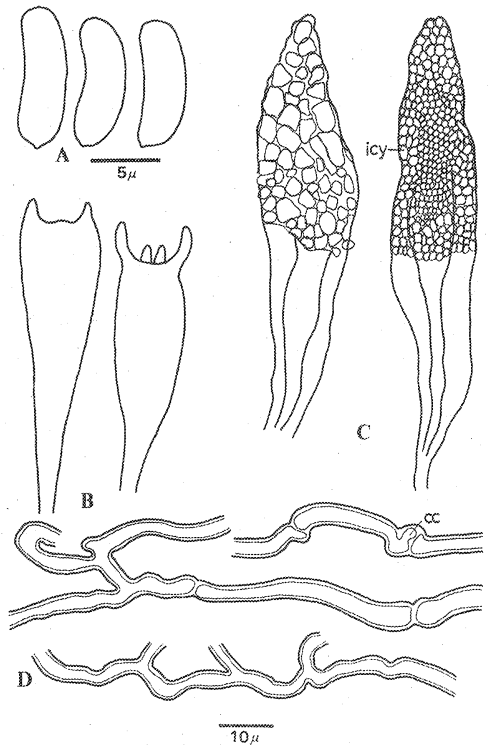


Fig. 13 Microscopic elements of *Peniophora quercina* (Pers. ex Fr.) Cke. (11206-F)
A : Basidiospores B : Basidia C : Incrusted cystidia D : Subiculum hyphae

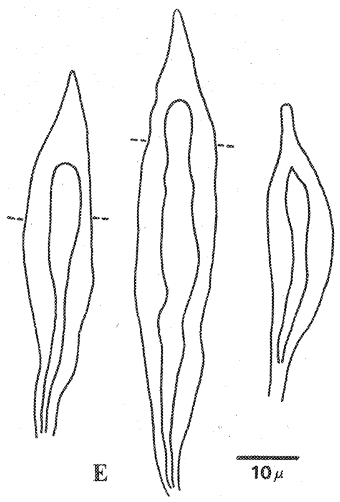


Fig. 14 Microscopic element of *Peniophora quercina* (Pers. ex Fr.) Cke. (11206-F)
E : Unincrusted cystidia (granular matter dissolve in KOH)

Specimens examined : Sôunkyo, Hokkaido, on broad leaved tree, Sept. 11, 1969, Y. H. & H. F. (11206-F); Ex Herb. Lloyd (Det. by C. G. Lloyd) (202737-TNS)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic characteristics of this species are dark brown, rigid and waxy fruit bodies curl away from the substratum when drying. Microscopically, it has no subhymenial layer, having brownish, compact and agglutinated subiculum hyphae, coarsely incrusted cystidia, large and slightly curved spores.

No. 8, *Peniophora cinerea* (Fr.) Cke. is somewhat similar in having waxy fruit bodies but *P. cinerea* has smaller spores (7～8×2.5～3.0μ), smaller cystidia (27～50×7.5～10.0μ) and grayish fruit bodies.

According to Eriksson[69], this species is very common on *Quercus*, *Fagus* and sometimes on *Betula* in South Sweden, and is associated with an intense decay. But in Japan this species is rarely collected.

The first record of this species in Japan was made by P. Hennings based on a collection by M. Shirai. Matsumura[117], Shirai and Miyake[151] listed. The description and the Japanese name were presented by Yasuda[170] in 1918.

No. 8 ***Peniophora cinerea* (Fr.) Cke.**

Grevillea 8 : 20, 1879; Sacc., Syll. Fung. 6 : 643, 1888; Mass., Jour. Linn. Soc. 25 : 148, 1890; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 407, 1912; Burt, Ann. Mo. Bot. Gard. 12 : 348, 1926; Bourd. & Galz., Hymén. de Fr. p. 325, 1928; T. Ito, Bot. Mag. Tokyo 43 : 521, 1929; Eriks., Symb. Bot. Ups. 10(5) : 30, 1950; Talbot, Bothalia 6 : 24, 1951; S. Ito, Myc. Fl. Japan 2(4) : 117, 1955; Cunn., Trans. Royal Soc. New Zealand 83(2) : 256, 1955; Talbot, Bothalia 7 : 147, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 192, 1960; Slysh, Syracuse Univ. Tech. Pub. 83, 76, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 109, 1963; Parmasto, Inves. Natural Hist. Soviet Far East p. 243, 1963; Teng, Eum. China p. 403, 1964—*Thelephora cinerea* Fr., Syst. Myc. 1 : 453, 1821; Elench. Fung. 1 : 221, 1828—*Corticium cinereum* (Fr.) Fr., Epicr. Myc. p. 563, 1836～1838; Hym. Eur. p. 654, 1874

Macroscopic characteristics : Fruit bodies resupinate, at first in small patches, then coalescing and becoming longitudinally effused or remaining more or less discrete, not easily separable from the substratum, Tilleul-Buff to Gray, turning black in KOH, waxy, very thin 75～90μ thick; hymenial surface rigid in appearance, pruinose, cracking when drying; sterile marginal zones concolorous, minutely fibrillose, without mycelial strands (Plate 2 : F).

Microscopic characteristics : Subiculum 30～45μ thick, very compact and gelatinized hyphae vertically arranged to the substratum, mingled with few brownish, thin-walled hyphae. Thin-walled hyphae branched, not incrusted, without clamps, 4.0～6.5μ in diameter (Fig. 15 : E); subhymenial layer absent; hymenium very compactly arranged, hyaline, 25～40μ thick; cystidia abundant, cylindrical to fusiform, 27～50×7.5～10.0μ, not rooted at the base, with obtuse apex, thin- to thick- and smooth-walled, not incrusted or incrusted with granular matter, non-septate, without clamps, immersed or slightly projecting 15～18μ, walls do not dissolve in 10% KOH (Fig. 15 : C & D); gloeocystidia absent; basidia clavate, 15～20×5～8μ, with 4 sterigmata of 3～4μ long (Fig. 15 : B); spores cylindrical, slightly curved, often slightly narrowing toward one end, smooth, hyaline, non-amyloid, 7～8×2.5～3.0 (7×3)μ (Fig. 15 : A).

Japanese name : Haiiro-kawatake (T. Ito)

Distribution : Europe, North and South America, South Africa, New Zealand and Asia :

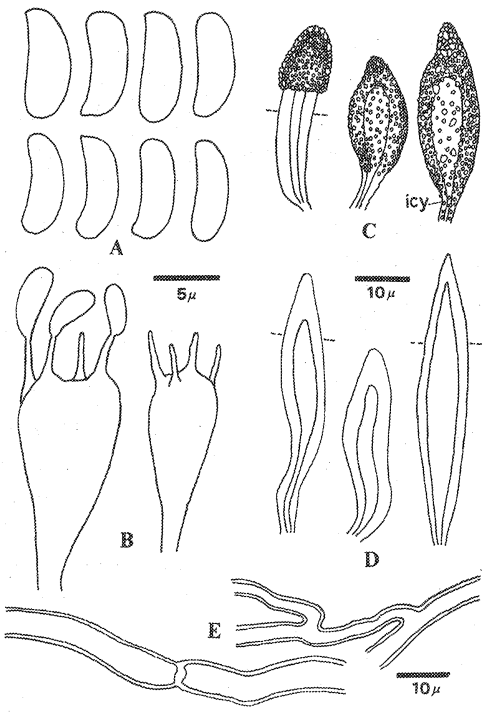


Fig. 15 Microscopic elements of *Peniophora cinerea* (Fr.) Cke. (11188-F)
A : Basidiospores B : Basidia C : Incrusted cystidia D : Unincrusted cystidia
E : Subiculum hyphae

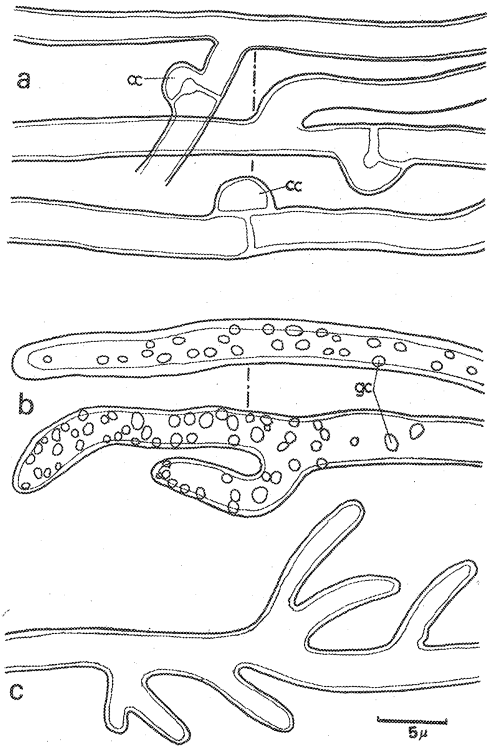


Fig. 16 Mycelium from cultures of *Peniophora cinerea* (Fr.) Cke. (Al 100a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

Kamchatka Peninsula, China and Japan.

Specimens examined : Mt. Mikuma, Awaji Is., on bark of decaying stem and branch of *Rosaceae*, March 17, 1918, J. Matsuzawa (202731-TNS; Yasuda Herb. No. 4) (Det. by E. A. Burt) ; Mt. Mikuma, Awaji Is., on bark of decaying branch of broad leaved tree, Oct. 8, 1918, J. Matsuzawa (202730-TNS) (Det. by A. Yasuda) ; Otoineppu. Hokkaido, on bark of decaying *Tilia japonica*, Sept. 7, 1969, K. A. • Y. H. & H. F. (11188-F) ; Chichibu, Saitama pref., on bark of decaying *Carpinus cordata*, Nov. 11, 1969, K. A. • Y. H. & T. K. (11162-F) ; Uchizume, Kagoshima pref., on bark of decaying branch of *Dicalix lucidus*, Nov. 1962, K. A. (11189-F) ; Kuroki, Kagoshima pref., on fallen twigs of *Prunus* sp., Nov. 14, 1967, T. K. (11190-F) ; Ura, Amami Oshima Is., on bark of slightly decaying stem of *Ilex* sp., Jan. 23, 1968, Y. H. (11191-F) ; Kiyosumi, Chiba pref., on bark of fallen branches of ever green *Quercus*, Apr. 23, 1964, K. A. (11192-F) ; York Co. Ont. Canada, on *Populus*, May 5, 1936, H. S. Jackson (9838-TRT), (TNS), (Det. by H. S. Jackson)

Habitat & type of rot : Associated with a white rot of broad leaved tress.

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 25°C moderately rapid, with mat having a diameter of 47 mm after five days (Table 2), 90 mm after seven days; mat thickened and cottony over the inoculum block, becomes gradually thinner toward the margin; upper surface entirely brownish (Plate 1 : B) ; the underside white to pale yellow; culture having a

sweet odor; the oxidase reaction strongly positive on gallic acid medium and positive on tannic acid medium, with mycelial growth profuse on both gallic acid and tannic acid media (Table 3; Plate 1 : C & D).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, simple-septate, with clamps, branched with wide angles, 2.5～3.5μ in diameter (Fig. 16 : a). Advancing zone : hyphae hyaline, thin- to somewhat thick-walled, branched, with granular contents, 2.5～3.0μ in diameter (Fig. 16 : b). Submerged mycelium : hyphae hyaline, thin-walled, occasionally with numerous branches close together, 3.0～3.5μ in diameter (Fig. 16 : c).

Temperature relations—The optimum growth temperature was 25°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 3 days.

This species has been reported as being widespread all over the world. In Japan it distributes from northern Hokkaido south to Amami archipelago. Gray fruit bodies, brown in section, and cystidia immersed throughout the tissue for an almost entire length are the diagnostic features of the species.

No. 9 ***Peniophora gigantea* (Fr.) Mass.**

Jour. Linn. Soc. 25 : 142, 1890; Karst., Finska Vet.-Soc. Bidrag. Natur och Folk 48 : 422, 1889; Bres., Accad. Agiatii 111, 3 : 113, 1897; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 401, 1912; Yasuda, Bot, Mag. Tokyo 35 : 12, 1921; Rea, Brit. Basid. p. 693, 1922; Burt, Ann. Mo. Bot. Gard. 12 : 216, 1926; Bourd. & Galz., Hymén. de Fr. p. 318, 1928; T. Ito, Bot. Mag. Tokyo 43 : 516, 1929; Pilát, Bull. Soc. Myc. Fr. 51 : 417, 1935; Asahina, Nippon Inkwasyokubutu Dukan p. 381, 1939; Rogers & Jacks., Farlowia 1(2) : 317, 1943; Hemmi & Akai, Wood Rotting Fungi p. 229, 1945; Talbot, Bothalia 6 : 24, 1951; S. Ito, Mycol. Fl. Japan 2(4) : 116, 1955; Slysh, Syracuse Univ. Tech. Pub. 83, 60, 1960; Cunn. N. Z. Dep. Sci. Industr. Res. Bull. 145, 127, 1963; Teng, Eum. China p. 404, 1964—*Thelephora gigantea* Fr., Obs. Myc. 1 : 152, 1815; Syst. Myc. 1 : 448, 1821—*Corticium giganteum* Fr., Epicr. Myc. p. 559, 1836～1838; Hym. Eur. p. 648, 1874; Sacc., Syll. Fung. 6 : 610, 1888—*Phlebia gigantea* (Fr. ex Fr.) Donk, Fungus 27 : 10, 1957; Erikss., Symb. Bot. Ups. 16(1) : 94, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 173, 1960

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum when fresh and easily separable when dry, film-like, Pale Olive-Buff to Pale Olive-Gray, bleached in KOH, waxy, 300～500μ thick; hymenial surface firm, pilose, not cracked; sterile marginal zones whitish, fibrillose, without mycelial strands (Plate 2 : G).

Microscopic characteristics : Subiculum 90～250μ thick, hyphae of subiculum somewhat loosely and longitudinally arranged, forming a distinct basal layer, then ascending, hyaline to pale yellow, thick-walled, without clamps, branched, not incrusted, 5.0～7.5μ in diameter (Fig. 17 : E); subhymenium 50～100μ thick, composed of gelatinized, vertically arranged hyphae, which are hyaline to pale yellow, thick-walled, without clamps, branched, not incrusted, 2.5～5.0μ in diameter (Fig. 17 : D); hymenium compactly arranged, hyaline, 25～50μ thick; cystidia abundant, hyaline, fusiform, projecting 10～50μ, 50～75×10～18μ, not rooted at the base, with acuminate apex, thick- and smooth-walled, with wider lumen, without clamps, heavily incrusted with granular matter at the upper half, granular matter dissolves in 5% KOH, walls do not dissolve in 10% KOH (Fig. 17 : C); Gloeocystidia absent; basidia broadly clavate, 15～20×5.0～6.5μ, with 4 sterigmata of 3.5～5.0μ long (Fig. 17 : B); spores ellipsoid, flattened on one side, prominently apiculate, smooth, hyaline, non-amyloid, 5.0～6.5×2.5～4.0 (6.5×2.5)μ (Fig. 17 : A).

Japanese name : Kami-kawatake (A. Yasuda)

Distribution : Europe, North America, South Africa, New Zealand and Asia : China and Japan (Honshu and Kyushu)

Specimens examined : Sendai, Miyagi pref., on bark of *Pinus densiflora*, Feb. 16, 1919; E. Ochiai (202727-TNS, Yasuda Herb. No. 76), (Det. by E. A. Burt); Meguro, Tokyo, on bark of decaying trunk of *Pinus densiflora*, July 11, 1970, Y. H. (11173-F); Asakawa, Tokyo, on bark of decaying trunks of *Pinus densiflora*, June 20, 1958, Y. H. (11033-F); Shimoda, Shizuoka pref., on bark of decaying *Pinus densiflora*, July 7, 1968, K. A. (11185-F); Uchizume, Kagoshima pref., on bark of decaying *Pinus densiflora*, June 6, 1962, H. F. (11241-F); Ubadake, Ōita pref., on bark of decaying ?conifer, Aug. 11, 1921, A. Yasuda (202725-TNS); Otomo, Iwate pref., on bark of decaying *Pinus densiflora*, Nov. 5, 1920, G. Toba (202726-TNS); Paradis Bay, L. Temagami, T. F. R., Ont. Canada, on *Pinus strobus*, Aug. 19, 1935, J. R. Hansbrough (8771-TRT), (TNS), (Det. by L. O. Overholts).

Habitat & type of rot : Associated with a white rot of various coniferous woods.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C moderately rapid, with mat having a diameter of 85 mm after five days (Table 2), 90 mm after six days; silky at first, then thickened and cottony over the inoculum block, becoming more thickened at the center and forming a very thick and cottony growth which becomes gradually thinner toward the

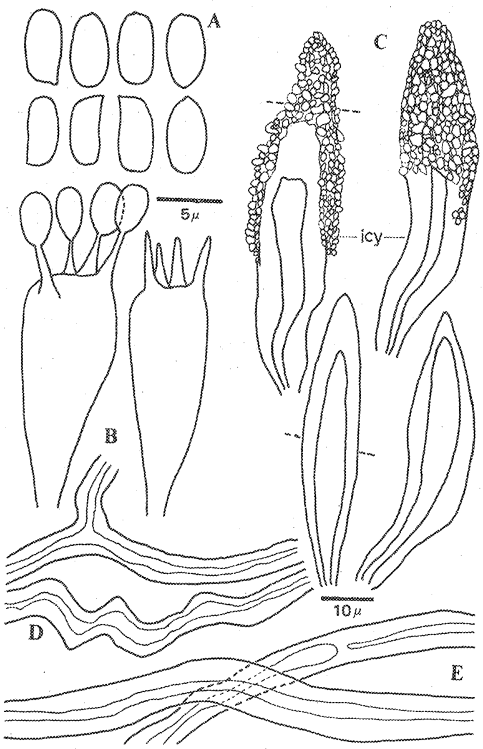


Fig. 17　Microscopic elements of *Peniophora gigantea* (Fr.) Mass. (202727-TNS)
A : Basidiospores　B : Basidia　C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

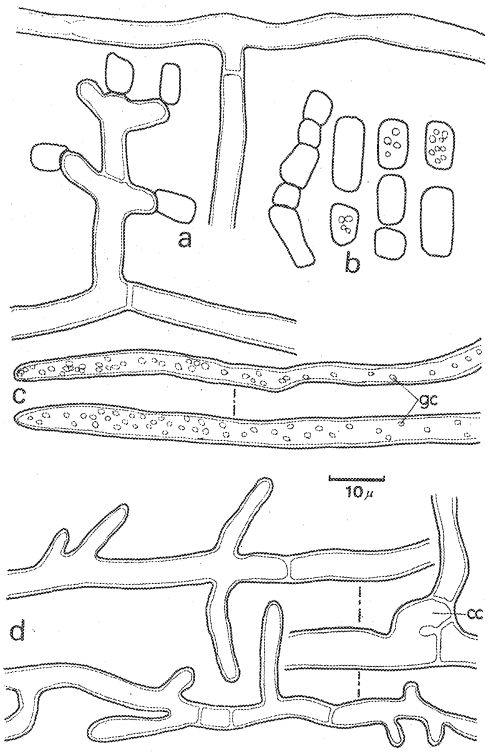


Fig. 18　Mycelium from cultures of *Peniophora gigantea* (Fr.) Mass. (Al 13b)
a : Aerial hyphae and conidiophores
b : Conidia　c : Hyphae from advancing zone
d : Submerged hyphae

margin; upper surface of mat entirely white to pale yellowish brown; the underside of the mat white to pale yellow; culture having an odor of soil; the oxidase reaction positive on gallic acid and tannic acid media, the mycelium showing a trace of growth on gallic acid medium and no growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : i)-hyphae hyaline, thin-walled, septate, branched with wide angles 4.0~5.0μ in diameter ii)-conidiophores numerous each being the end of hyphae or short lateral branch, from which the end is cut off by a simple septum to form conidia (Fig. 18 : a) iii)-conidia very abundant, thin-walled, with dense granular contents, typically cylindric, hyaline, variable in size, 5.0~15.0×4.0~6.5μ (Fig. 18 : b). Advancing zone : hyphae hyaline, thin-walled, with granular contents, 4.0~5.0μ in diameter (Fig. 18 : c). Submerged mycelium : hyphae hyaline, thin-walled, septate, with clamps, occasionally with numerous branches close together, 4.0~5.0μ in diameter (Fig. 18 : d).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 2 days.

This species is easily recognized by its occurrence on bark of only *Pinus* spp. in Japan. Subhymenial hyphae of this species are vertically and compactly arranged, contrasting with the subiculum hyphae which are longitudinally and somewhat loosely arranged.

This species was reported by Bourdot and Galzin[29] on *Pinus strobus* and *Abies pectinata* in France, Burt[41] reported on *Pinus*, *Abies* and *Tsuga* in North America. Talbot[157] reported on several conifers in South Africa. According to Cartwright and Findlay[44], this fungus was found associated with pale yellowish-brown rot of coniferous logs and building timbers in England. Baxter[4] found fungus associated with heart rot of Jack-pine and Boyce[32] reported decay of various conifers and broad leaved trees in U. S. A. In Japan, Hemmi and Akai[83] reported this species causing wood decay.

No. 10 ***Peniophora roumeguerii*** **(Bres.) Hoehn. & Litsch.**

K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 115 : 1581, 1906; do. 116 : 789, 1907; Burt, Ann. Mo. Bot. Gard. 12 : 270, 1926; Bourd. & Galz., Hymén. de Fr. p. 316, 1928; Pilát, Bull. Soc. Myc. Fr. 51 : 420, 1935; Talbot, Bothalia 6 : 22, 1951; Slysh, Syracuse Univ. Tech. Pub. 83, 64, 1960—*Corticium roumeguerii* Bres., Fungi Trid. 2 : 36, 1892—*Phlebia roumeguerii* (Bres.) Donk, Fungus 27 : 9, 1957; Christiansen, Dansk Bot. Ark. 19(2) : 174, 1960

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Pale Olive-Buff to Pale Pinkish Buff, turning Purplish Vinaceous in KOH, waxy, 50~270μ thick; hymenial surface even, rigid in appearance, obvious pilose, deeply cracking; sterile marginal zones concolorous, thinning out, pruinose, indistinct, without mycelial strands (Plate 2 : H).

Microscopic characteristics : Hyphae of subiculum vertically and compactly arranged next to the substratum, hyphae difficult to distinguish, agglutinated toward the hymenium, mingled with few pale yellowish brown, thick-walled, septate, without clamps, branched, not incrusted hyphae of 3.5~5.0μ in diameter (Fig. 20 : E); hymenium very compactly arranged, pale yellowish, 50~90μ thick; cystidia very abundant, throughout the hymenium, arranged in tiers, hyaline, fusiform to conical, 30~60×7.5~10.0μ, not rooted at the base, with tapering apex in fusiform cystidia and with obtuse apex in conical cystidia, both cystidia thick- and rough-walled, with wider to capillary lumen, not incrusted or heavily incrusted with granular matter which dissolves in 5% KOH, non-septate, without clamps, immersed or projecting 10~30μ,

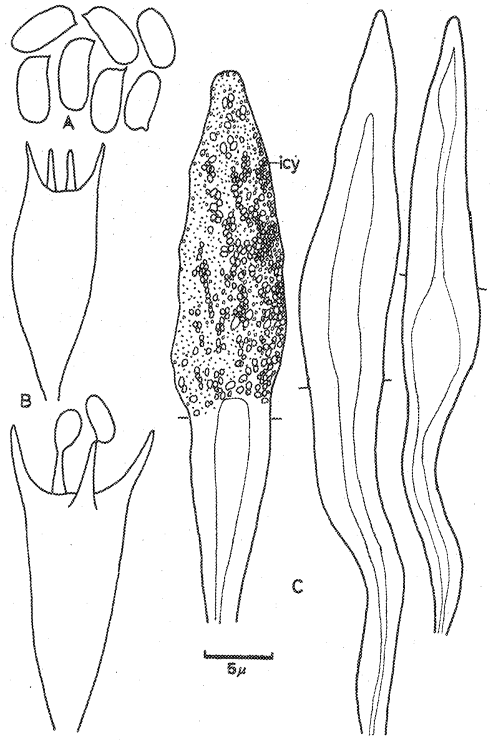


Fig. 19　Microscopic elements of *Peniophora roumeguerii* (Bres.) Hoehn. & Litsch. (11147-F)
A : Basidiospores　B : Basidia
C : Projecting cystidia

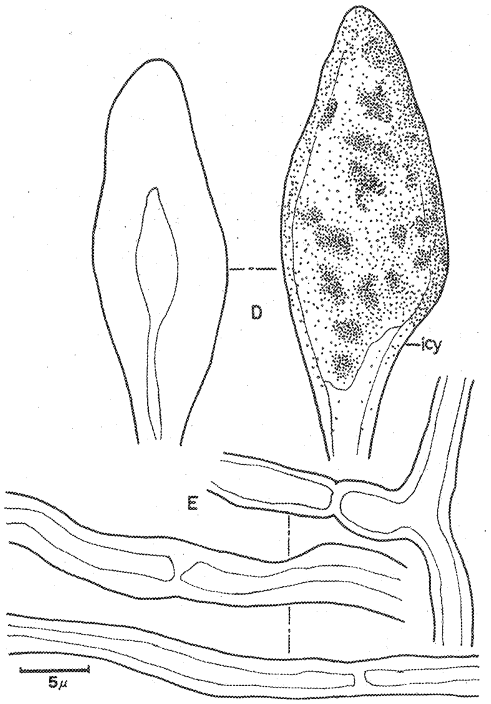


Fig. 20　Microscopic elements of *Peniophora roumeguerii* (Bres.) Hoehn. & Litsch. (11147-F)
D : Immersed cystidia
E : Subiculum hyphae

walls do not dissolve in 10% KOH (Fig. 19 : C & 20 : D); gloeocystidia absent; basidia subclavate, 16～20×6.0～7.5μ, with 4 sterigmata of 4～5μ long (Fig. 19 : B); spores cylindrical, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 4.5～5.0×2.0～2.5 (4.5×2.0)μ (Fig. 19 : A).

Japanese name : Ke-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Honshu and Amami Ôshima Is.)

Specimens examined : Kirizumi, Gumma pref., on bark of decaying trunks of *Quercus mongolica* var. *grosseserrata*, Oct. 2, 1968, Y. H. & H. F. (11147-F); Santaro Pass, Amami Ôshima Is., on decayed wood of *Castanopsis cuspidata* var. *sieboldii*, Jan. 21, 1968, Y. H. (11244-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic characteristics of this species are its gray and rigid fruit bodies which appear velvety by the projecting cystidia on the hymenial surface. Microscopically very abundant cystidia arranged in tiers which immerse at all levels in the hymenium, are very diagnostic.

No. 11　***Peniophora farlowii* Burt**

Ann. Mo. Bot. Gard. 12 : 343, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 63, 1960.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Purple to Vinaceous-Cinnamon, turning Vinaceous-Tawny in KOH,

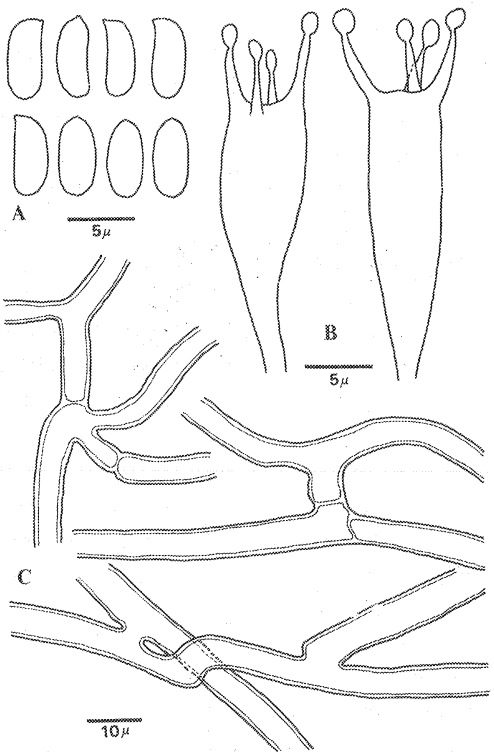


Fig. 21 Microscopic elements of *Peniophora farlowii* Burt (11096-F)
A : Basidiospores B : Basidia
C : Subhymenial hyphae

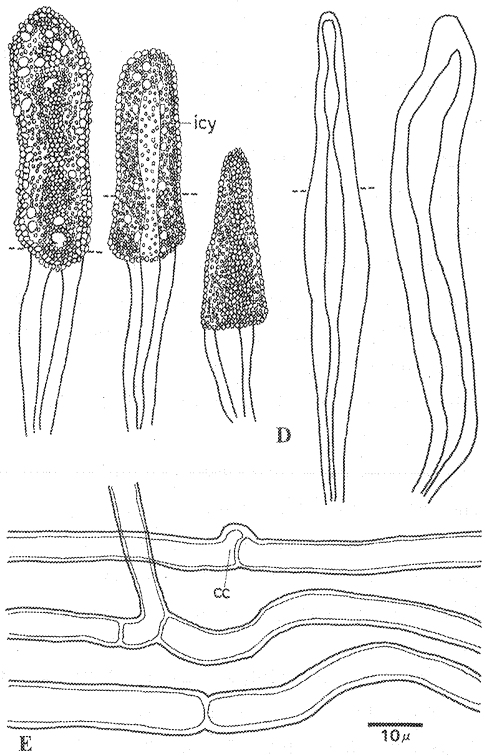


Fig. 22 Microscopic elements of *Peniophora farlowii* Burt (11096-F)
D : Cystidia E : Subiculum hyphae

pelliculose, 280～450μ thick; hymenial surface even, rigid in appearance, pilose, not cracked; sterile marginal zones whitish, thinning out, fibrillose, mycelial strands absent (Plate 2 : I).

Microscopic characteristics : Subiculum 130～300μ thick, composed of longitudinally arranged hyphae which are pale yellow, thin-walled, septate, with clamps, branched, not incrusted, 5.0～6.3μ in diameter (Fig. 22 : E); subhymenium 100～115μ thick, hyphae compactly interwoven, brownish, thin-walled, septate, without clamps, branched, not incrusted, 2.5～5.0μ in diameter (Fig. 21 : C); hymenium, even, compactly arranged, pale yellow, 45～55μ thick; cystidia abundant, cylindrical, 55～95×10～13μ, not rooted at the base, with obtuse apex, thick- and rough-walled, with wider lumen, non-septate, without clamps, heavily incrusted with granular matter which dissolves in 5% KOH, immersed or projecting 15～55μ, walls do not dissolve in 10% KOH (Fig. 22 : D); gloeocystidia absent; basidia clavate, 22～30×5.0～5.5μ, with 4 sterigmata of 4～5μ long (Fig. 21 : B); spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 5.0～5.5×2.0～3.0 (5.5×2.5)μ (Fig. 21 : A).

Japanese name : Fusube-kawatake (nom. nov.)

Distribution : North America and Asia : Japan (Honshu)

Specimen examined : Kirizumi, Gumma pref., on decaying trunk of broad leaved tree, Oct. 2, 1968, Y. H. & H. F. (11096-F)

Habitat & type of rot : Associated with a white rot of broad leaved tree.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 25°C slow, with mat having a diameter of 30 mm after five days (Table 2), 90 mm after eleven days; silky at first, fragile and adherent, then felty, upper surface of mat entirely white; the agar round the inoculum block stained pale brown; culture having a sour odor; the oxidase reaction positive on gallic acid and tannic acid media, with mycelial growth profuse on gallic acid medium and a trace of growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, with clamps, sometimes with double-clamps, branched and with bridging hyphae, 4.0～7.5μ in diameter (Fig. 23 : a). Advancing zone : hyphae hyaline, thin-walled, with granular contents, 2.5～3.0μ in diameter (Fig. 23 : b). Submerged mycelium : hyphae hyaline, thin- to thick-walled, septate, with clamps, sometimes with double-clamps, branched with wide angles, 7.5～12.5μ in diameter (Fig. 23 : c).

Temperature relations—The optimum growth temperature was 25°C, the minimum 10°C, and the maximum 30°C (Table 2). Cultures were killed at 35°C for 4 days and at 40°C for 1 day.

The distinctive characteristics of this species are color change of fruit body from deep purple into brown when treated with potassium hydroxide solution, and brownish subhymenial layer tinged with pale yellow in hymenium and subiculum.

No. 12 ***Peniophora similis*** (BERK. & CURT.) MASS.

Jour. Linn. Soc. 25 : 147, 1890; BURT, Ann. Mo. Bot. Gard. 12 : 336, 1926; T. ITO, Bot. Mag. Tokyo 43 : 518, 1929; S. ITO, Myc. Fl. Japan 2(4) : 117, 1955—*Corticium simile* BERK. & CURT., Jour. Linn. Soc. 10 : 337, 1868; SACC., Syll. Fung. 6 : 631, 1888

Macroscopic characteristics : Fruit bodies resupinate, longitudinally effused, not easily separable from the substratum, Pale Ochraceous Buff to Pale Pinkish Buff, do not change color in KOH, waxy, 250～500μ thick; hymenial surface even, pruinose, deeply cracked in patches and showing the white subiculum in the fissures; sterile marginal zones whitish, thinning out, minutely fibrillose, mycelial strands absent (Plate 3 : A).

Microscopic characteristics : Subiculum composed of very compact and gelatinized hyphae, mingled with few hyaline, thin-walled, septate, branched, not clamped, not incrusted hyphae of 2.5μ in diameter (Fig. 24 : D); subhymenial layer absent; hymenium very compact, even, hyaline, 15～17μ thick; cystidia abundant throughout the textures, hyaline, fusiform to conical, 15～37×5～9μ, not rooted at the base, with obtuse apex, thick- and smooth-walled, with wider lumen, not incrusted or incrusted with granular matter which does not dissolve in 5% KOH, non-septate, without clamps, mostly immersed, rarely projecting 12～20μ, walls do not dissolve in 10% KOH (Fig. 24 : C); gloeocystidia absent; basidia clavate, 12～15×4～5μ, with 2～4 sterigmata of 4～5μ long (Fig. 24 : B); spores broadly ellipsoid, flattened on one side, prominently apiculate, smooth, hyaline, non-amyloid, 4.5～6.0×2.5～3.0 (5×3)μ (Fig. 24 : A).

Japanese name : Ki-kawatake (T. ITO)

Distribution : North America and Asia : Japan (Kyushu and Amami Ôshima Is.)

Specimens examined : Hida, Ôita pref., on bark of decaying *Cyclobalanopsis* sp., March 21, 1920, N. NAKAYAMA (YASUDA Herb. No. 100); Mt. Yuwandake, Amami Ôshima Is., on bark of fallen twigs of *Quercus* sp., Jan. 19, 1968, Y. H. (11176-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

This species is characterized by its pale yellow fruit bodies which are deeply cracked in

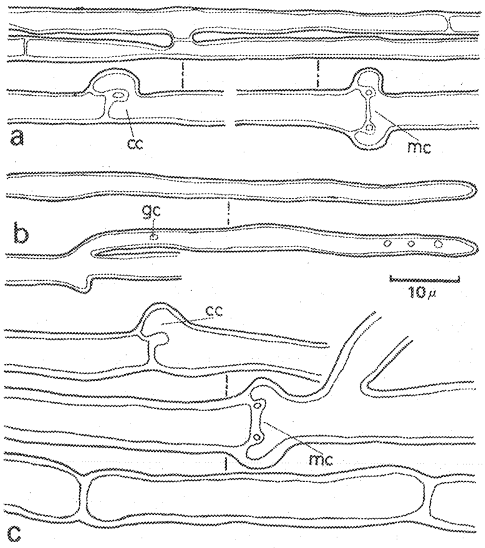


Fig. 23 Mycelium from cultures of *Peniophora farlowii* Burt (Al 75a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

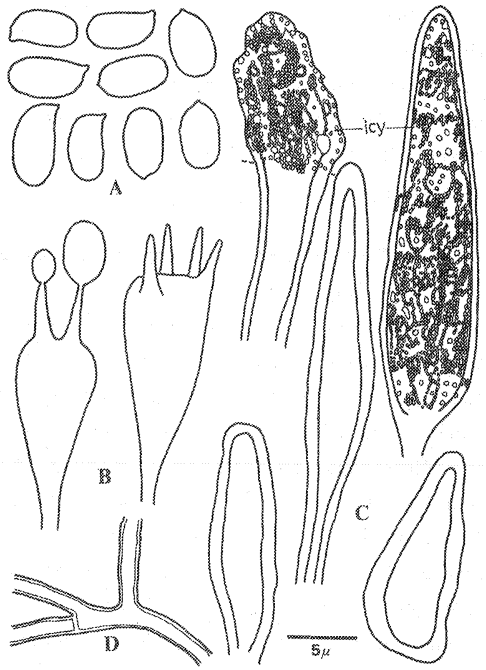


Fig. 24 Microscopic elements of *Peniophora similis* (Berk. & Curt.) Mass. (100-Yasuda)
A : Basidiospores B : Basidia C : Cystidia
D : Subiculum hyphae

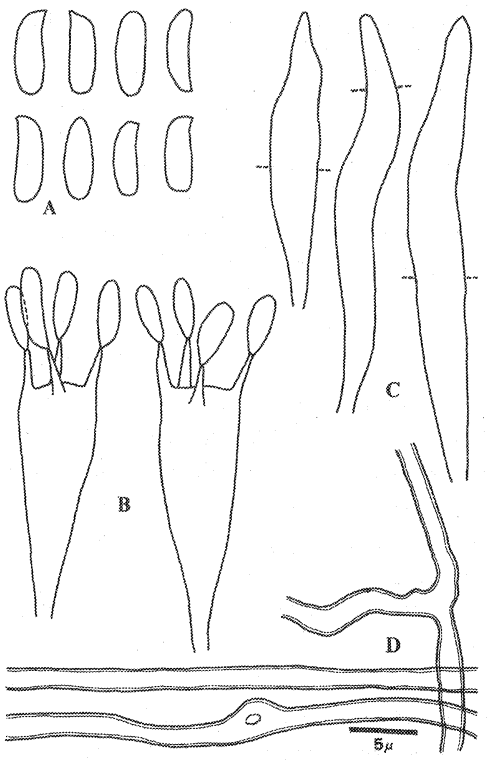


Fig. 25 Microscopic elements of *Peniophora phlebioides* Jacks. & Deard. (11257-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subiculum hyphae

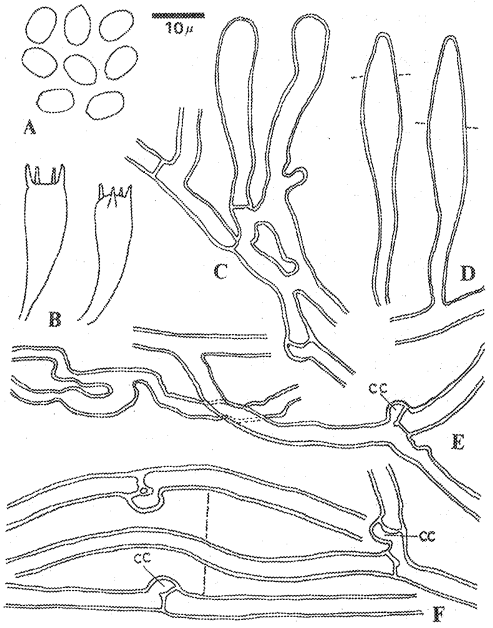


Fig. 26 Microscopic elements of *Peniophora affinis* Burt (10340-F)
A : Basidiospores B : Basidia C : Paraphysis
D : Cystidia E : Subhymenial hyphae
F : Subiculum hyphae

small patches, composed of gelatinized hyphae and very abundant cystidia arise throughout the hymenium and subiculum.

YASUDA sent BURT a specimen (YASUDA Herb. No. 100; Mo. Bot. Gard. Herb. No. 57018) collected in Hida, Ôita pref., Japan for identification which was later identified as this species by BURT[41]. In 1929, T. ITO[91] reported *Peniophora similis* (BERK. & CURT.) MASS., Ki-kawatake based on this specimen.

No. 13 ***Peniophora phlebioides*** JACKS. & DEARD.

Canad. Jour. Res. 27(C) : 150, 1949; SLYSH, Syracuse Univ. Tech. Pub. 83, 84, 1960

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Cartridge Buff to Maize Yellow, do not change color in KOH, waxy, 45～125μ thick; hymenial surface even, rigid in appearance, pruinose, cracked in small patches; sterile marginal zones whitish, thinning out, fibrillose, without mycelial strands (Plate 2 : J).

Microscopic characteristics : Hyphae of subiculum gelatinized, difficult to distinguish, mingled with few hyaline, thin-walled, branched, not incrusted, doubtful clamped hyphae of 1.5～2.5μ in diameter (Fig. 25 : D); subhymenial layer absent; hymenium very compact, hyaline, 18～20μ thick; cystidia abundant, fusiform, 25～37×3.5～5.0μ, not rooted at the base, tapering toward the apex, thin-walled, with wider lumen, not incrusted, non-septate, without clamps, projecting 8～27μ, walls do not dissolve in 10% KOH (Fig. 25 : C); gloeocystidia absent; basidia subclavate, 15～20×4～5μ, with 4 sterigmata of 3～4μ long (Fig. 25 : B); spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 5.0～6.0×2.0～2.5 (6.0×2.5)μ (Fig. 25 : A).

Japanese name : Neriiro-kawatake (nom. nov.)

Distribution : North America and Asia : Japan

Specimen examined : Ueda, Amami Ôshima Is., on bark of decaying broad leaved tree, Jan. 20, 1968, Y. H. (11257-F)

The characteristic features of this species are pale yellow fruit bodies which do not change color when treated with potassium hydroxide solution, and microscopically gelatinized hyphae and hyphoid cystidia.

No. 14 ***Peniophora affinis*** BURT

Ann. Mo. Bot. Gard. 12 : 266, 1926; ROGERS & JACKS., Farlowia 1(2) : 318, 1943; S. ITO, Myc. Fl. Japan 2(4) : 116, 1955; SLYSH, Syracuse Univ. Tech. Pub. 83, 69, 1960; CUNN., N. Z. Dep. Sci. Industr. Res. Bull. 145, 130, 1963—*Membranicium affinis* (BURT) ERIKSS., Symb. Bot. Ups. 16(1): 116, 1958; CHRISTIANSEN, Dansk Bot. Ark. 19(2) : 184, 1960—*Phanerochaete affinis* (BURT) DONK, Persoonia 2(2) : 223, 1962—*Peniophora laevis* BURT, in Peck, Bull. N. Y. St. Mus. 54 : 954, 1902; BURT, Ann. Mo. Bot. Gard. 12 : 257, 1926; BOURD. & GALZ., Bull. Soc. Myc. Fr. 28 : 398, 1912; Hymén. de Fr. p. 307, 1928; PILÁT, Bull. Soc. Myc. Fr. 51 : 420, 1935; T. ITO, Bot. Mag. Tokyo 43 : 519, 1929 teste ROGERS & JACKS., Farlowia 1(2) : 318, 1943

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Cartridge Buff to Light Buff, bleached in KOH, membranous, 120～320μ thick; hymenial surface pruinose, minutely cracked; sterile marginal zones concolorous to white, thinning out, fibrillose, mycelial strands absent (Plate 2 : K).

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged, then ascending, pale yellowish, thin-walled, septate, with clamps at some septa, branched, not

incrusted, 4.0～5.0μ in diameter (Fig. 26 : F); subhymenium 25～75μ thick, hyphae becoming compact toward the hymenium, pale yellowish, thin-walled, septate, with clamps, branched, not incrusted, 2.5～5.0μ in diameter (Fig. 26 : E); hymenium compactly arranged 30～70μ thick (Fig. 26 : C); cystidia abundant, hyaline, fusiform, 30～60×2.5～5.0μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, with wider lumen, non-septate, without clamps, immersed or projecting 10～30μ, incrusted or not incrusted, walls do not dissolve in 10% KOH (Fig. 26 : D); gloeocystidia absent; basidia subclavate, 25～30×4～5μ, with 4 sterigmata of 3～5μ long (Fig. 26 : B); spores ellipsoid, apiculate, smooth, hyaline, non-amyloid, 5.0～6.5×2.5～4.0 (5.0×2.5)μ (Fig. 26 : A).

Japanese name : Hira-kawatake (T. Ito)

Distribution : North America, Europe, New Zealand and Asia : Japan (Honshu, Kyushu and Amami Ôshima Is.)

Specimens examined : Nishihisakata, Gumma pref., on bark of *Quercus serrata*, Aug. 3, 1964, H. F. (10340-F); Ura, Amami Ôshima Is., on bark of decaying *Castanopsis cuspidata*, Jan. 23, 1968, Y. H. (11111-F); Yamanokuchi, Miyazaki pref., on bark of *Quercus serrata*, May 11, 1962, T. Nukumizu (11242-F); N. W. of Burford, Brant County, Ont., Canada, on deciduous wood, Sept. 9, 1937, R. F. Cain (12537-TRT), (TNS), (Det. by R. F. Cain)

Habitat & type of rot : Associated with a white rot of *Quercus* and *Castanopsis*.

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 30°C rapid, with mat having a diameter of 65 mm after five days (Table 2), 90 mm after seven days; silky at first, then cottony, spreading outward as a flat cottony growth marked by radiating strands, nodulose masses of hyphae abundant on the surface of the medium, upper surface of mat entirely white; the underside of the mat pale yellow; culture odorless; the oxidase reaction positive on gallic acid medium and strongly positive on tannic acid medium, with mycelial growth failing on gallic acid medium and profuse in growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, not clamped, branched, with granular contents, 4.0～5.0μ in diameter (Fig. 27 : a). Advancing zone : hyphae hyaline, thin-walled, septate, with granular contents, 2.5～4.0μ in diameter (Fig. 27 : b). Submerged mycelium : hyphae hyaline, thin-walled, branched repeatedly, 4.0～6.5μ in diameter (Fig. 27 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2).

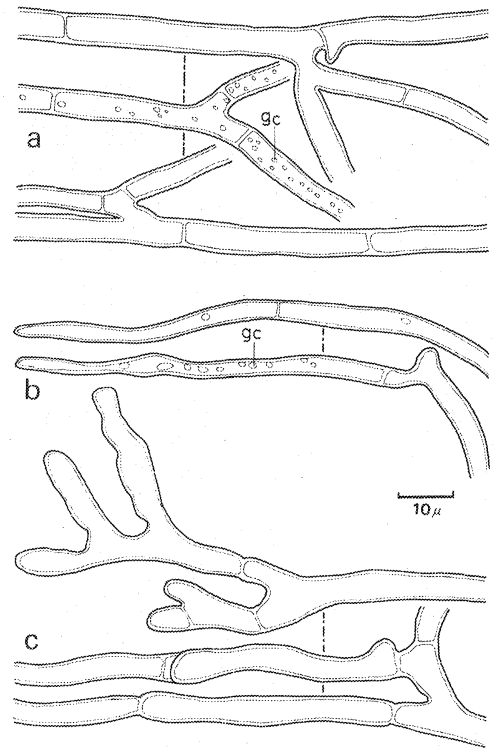


Fig. 27 Mycelium from cultures of *Peniophora affinis* Burt (Al 85a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

Cultures were killed at 40°C for 7 days.

The present species grows only on woods of *Quercus* and *Castanopsis* and is frequently found on barks of bed logs of Shiitake mushroom in Japan.

No. 38, *Membranicium carnosa* (Burt) Hayashi is similar in having yellowish membranous fruit bodies but differs in having thick subiculum layers and turning blue-black in potassium hydroxide solution and microscopically presence of heavily incrusted hyphae in subiculum.

No. 15 ***Peniophora velutina* (DC. ex Fr.) Cke.**

Grevillea 8 : 21, 1879; Sacc., Syll. Fung. 6 : 644, 1888; Mass., Jour. Linn. Soc. 25 : 152, 1890; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 398, 1912; Rea, Brit. Basid. p. 692, 1922; Burt, Ann. Mo. Bot. Gard. 12 : 264, 1926; Bourd. & Galz., Hymén. de Fr. p. 308, 1928; Slysh, Syracuse Univ. Tech. Pub. 83, 71, 1960; Parmasto, Inves. Natural Hist. Soviet Far East p. 242, 1963; Teng, Eum. China p. 403, 1964—*Thelephora velutina* De Candolle, Fl. Fr. 6 : 33, 1815; Fr., Elench. Fung. 1 : 203, 1828—*Athelia velutina* (DC.) Pers., Myc. Eur. 1 : 35, 1822—*Corticium velutinum* (DC. ex Pers.) Fr., Epicr. Myc. p. 561, 1836～1838; Berk., Outl. p. 273, 1860; Fr., Hym. Eur. p. 650, 1874—*Kneiffia velutina* (DC.) Bres., Ann. Myc. 1 : 100, 1903—*Membranicium velutinum* (DC. ex Fr.) Erikss., Symb. Bot. Ups. 16(1) : 116, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 183, 1960—*Phanerochaete velutina* (DC. ex Fr.) Donk, Persoonia 2(2) : 223, 1962

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Ochraceous-Tawny to Orange-Cinnamon, bleached in KOH, membranous to waxy, 50～120μ thick; hymenial surface even, hispid, pruinose, minutely cracked; sterile

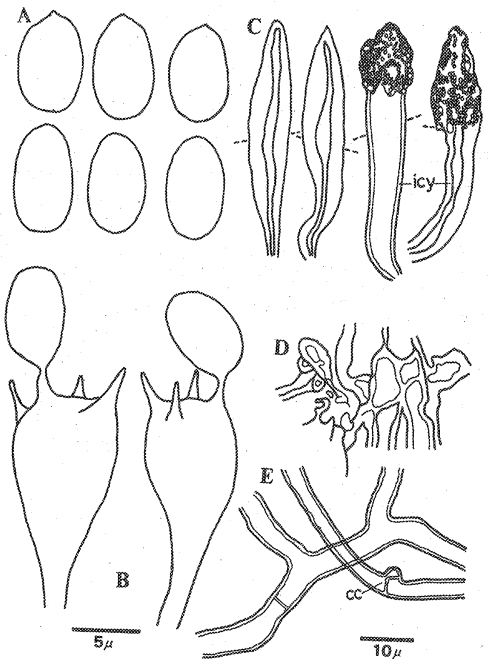


Fig. 28 Microscopic characters of *Peniophora velutina* (DC. ex Fr.) Cke. (10316-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

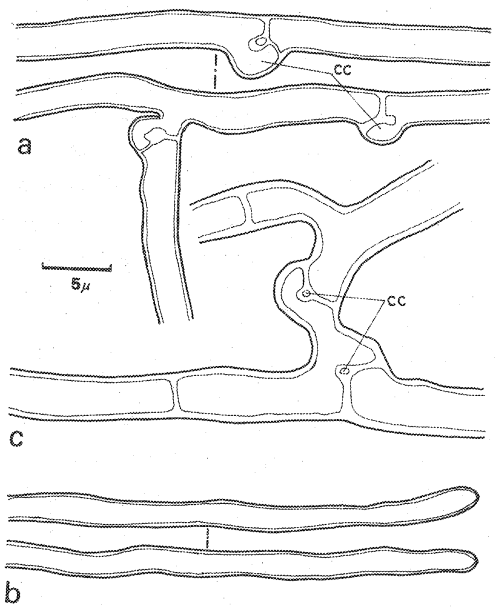


Fig. 29 Mycelium from cultures of *Peniophora velutina* (DC. ex Fr.) Cke. (Al 33a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

marginal zones wide, somewhat whitish, thinning out, fibrillose, without mycelial strands (Plate 3 : B).

Microscopic characteristics : Hyphae of subiculum loosely arranged, pale brownish-yellow, thin-walled, septate, branched, with clamps, not incrusted, 2.5～5.0μ in diameter (Fig. 28 : E); hyphae of subhymenium very gelatinized, obscure, pale brownish-yellow (Fig. 28 : D); hymenium compactly arranged, pale brownish-yellow, 20～35μ thick; cystidia abundant, hyaline, cylindrical to fusiform, 40～50×5.0～12.5μ, not rooted at the base, with tapering or obtuse apex, thick- and rough-walled, sometimes with a capillary lumen, non-septate, without clamps, incrusted with granular matter or not incrusted, projecting 20～30μ beyond the hymenial surface, cystidial walls do not dissolve in 10% KOH (Fig. 28 : C); gloeocystidia absent; basidia broadly clavate, 25～30×5.5～7.0μ, with 4 sterigmata of 3～5μ long (Fig. 28 : B); spores broadly ellipsoid, apiculate, smooth, hyaline, non-amyloid, 7.0～7.5×4.0～5.0 (7.5×5.0)μ (Fig. 28 : A).

Japanese name : Cha-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Kamchatka Peninsula, China and Japan (Honshu)

Specimen examined : Kiyosumi, Chiba pref., on bark of decaying branch of *Morus bombycis*, Dec. 2, 1963, K. A. & Y. H. (10316-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C moderately rapid, with mat having a diameter of 40 mm after five days (Table 2), 90 mm after nine days; thickened and cottony over the inoculum block, spread outward as a flat cottony growth, becoming loose-intertwining at the margin; upper surface of mat entirely white or somewhat pale yellow; the underside of the mat white; culture having a sour odor; the oxidase reaction strongly positive on gallic acid and tannic acid media, with mycelial growth profuse on both media (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, with clamps, branched with wide angles, 2.0～2.5μ in diameter (Fig. 29 : a). Advancing zone : hyphae hyaline, thin-walled, 1.5～2.0μ in diameter (Fig. 29 : b). Submerged mycelium : hyphae hyaline, somewhat thick-walled, with clamps, branched repeatedly, 4.0～4.5μ in diameter (Fig. 29 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 15°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 2 days.

The diagnostic characteristics of this species are membranous to waxy and fawn colored fruit bodies which bleached in potassium hydroxide solution, and microscopically very gelatinized subiculum hyphae with pale brownish yellow tints.

No. 16 ***Peniophora ludoviciana*** **Burt**

Ann. Mo. Bot. Gard. 12 : 244, 1926; Rogers & Jacks., Farlowia 1(2) : 316, 1943; Slysh, Syracuse Univ. Tech. Pub. 83, 88, 1960

Macroscopic characteristics : Fruit bodies resupinate, forming small patches at first, then coalescing and becoming widely effused, sometimes remaining more or less discrete, very thin, not easily separable from the substratum, Raw Sienna to Ochraceous Buff, turning wine-red in KOH, membranous to somewhat waxy, 40～110μ thick; hymenial surface even, pilose, rarely cracked; sterile marginal zones concolorous, thinning out, fibrillose, without mycelial strands (Plate 3 : C).

Microscopic characteristics : Subiculum composed of compactly interwoven hyphae, difficult

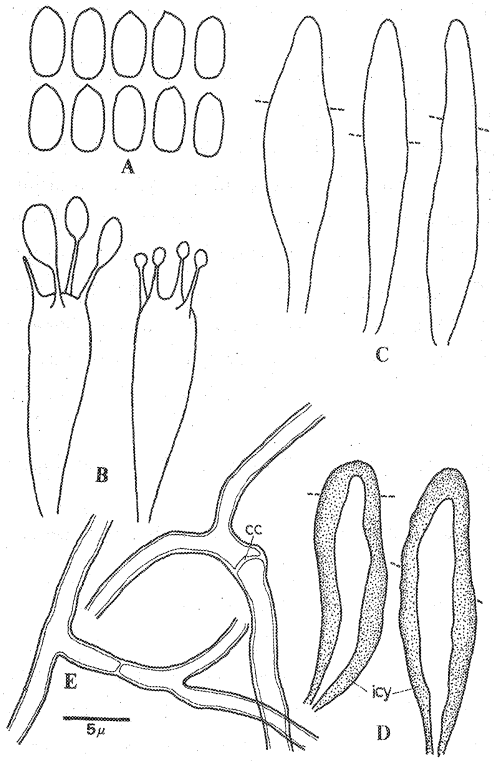


Fig. 30　Microscopic elements of *Peniophora ludoviciana* Burt (11046-F)
A : Basidiospores　B : Basidia
C & D : Cystidia　E : Subiculum hyphae

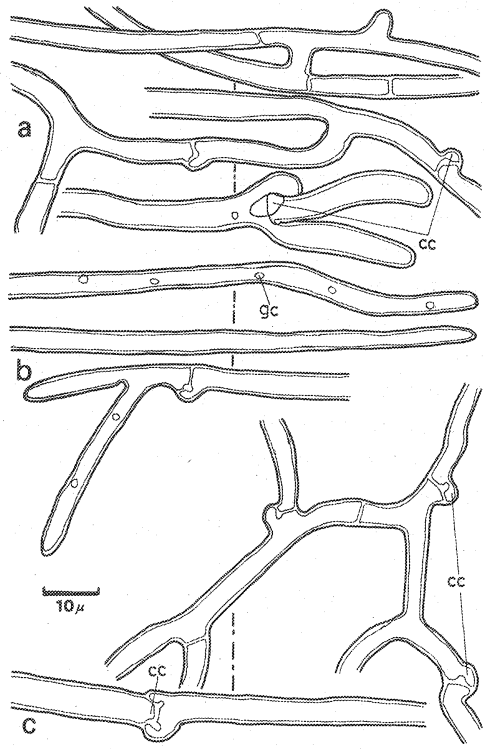


Fig. 31　Mycelium from cultures of *Peniophora ludoviciana* Burt (Al 69a)
a : Aerial hyphae　b : Hyphae from advancing zone　c : Submerged hyphae

to separate, mingled with few pinkish, thin-walled, septate, branched, not incrusted, clamped hyphae of 1.5～4.0μ in diameter (Fig. 30 : E); subhymenial layer absent; hymenium supporting by a scanty subiculum, even, very compact, 17～20μ thick; cystidia frequent, thin-walled (Fig. 30 : C) or thick-walled (Fig. 30 : D), fusiform, 20～33×4.0～6.5μ, not rooted at the base, with tapering or obtuse apex, with wider lumen, not incrusted, non-septate, without clamps, immersed or projecting 4～9μ, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 11～15×4.0～4.5μ, with 4 sterigmata of 3～4μ long (Fig. 30 : B); spores cylindric-ellipsoid, minutely apiculate, smooth, hyaline, non-amyloid, 4.0～4.5×2.0～2.5 (4.5×2.5)μ (Fig. 30 : A).

Japanese name : Kogane-kawatake (nom. nov.)

Distribution : North America and Asia : Japan (Honshu)

Specimens examined : Kozagawa, Wakayama pref., on bark of fallen twigs of broad leaved tree, July 30, 1965, H. F. (11046-F); Kirizumi, Gumma pref., on bark of fallen branches of *Quercus serrata*, Oct. 2, 1965, Y. H. & H. F. (11101, 11102, 11103-F); Nobeyama, Nagano pref., on bark of decaying broad leaved tree, Nov. 11, 1961, K. A. & Y. H. (11256-F); Hatohley, Brant Co., Ont. Canada, on *Acer*, Sept. 19, 1963, R. F. Cain (10589-TRT), (TNS), (Det. by R. Biggs)

Habitat & type of rot : Associated with a white rot of several broad leaved trees.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C rapid, with mat having a diameter of 65 mm after five days (Table 2), 90 mm after seven days; silky at first, then thickened,

felty, adherent, slightly raised at the center; upper surface of mat entirely white; the underside of the mat pale yellow; culture having a sour odor; the oxidase reaction positive on gallic acid and tannic acid media, the mycelium showing a trace of growth on gallic acid medium and profuse growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, with clamps, branched with wide angles, sometimes with bridging hyphae, 4.0～5.0μ in diameter (Fig. 31 : a). Advancing zone : hyphae hyaline, thin-walled, with clamps, with granular contents, 2.5～3.0μ in diameter (Fig. 31 : b). Submerged mycelium : hyphae as in aerial mycelium (Fig. 31 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 15°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 5 days.

The diagnostic characteristics of this species are the fruit bodies forming small patches then confluent, membranous to waxy and golden colored and microscopically 2 types of cystidia and very scanty and somewhat gelatinized subiculum.

No. 4, *Gloeopeniophora incarnata* (Pers. ex Fr.) Hoehn. & Litsch. is somewhat similar macroscopically but differs microscopically in the presence of gloeocystidia. No. 32, *Membranicium filamentosum* (Berk. & Curt.) Christiansen is also similar in its fruit bodies which turn wine-red in potassium hydroxide solution, but differs in having very thick fruit bodies, fawn in section and in having incrusted hyphae without clamps.

No. 17 ***Peniophora burtii*** Romell

In Burt, Ann. Mo. Bot. Gard. 12 : 278, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 63, 1960; Hayashi & Aoshima, Trans. Mycol. Soc. Japan 7(2・3) : 155, 1966—*Phanerochaete burtii* (Romell) Parmasto, Eesti NSV Tead. Akad. Toim., Biol. 16, p. 388, 1967

Macroscopic characteristics : Fruit bodies resupinate, at first in small patches, then coalescing and widely effused, easily separable from the substratum, Marguerite Yellow, do not change color in KOH, membranous, 300～900μ thick; hymenial surface even, downy in appearance, pruinose, minutely cracked; sterile marginal zones concolorous, loosening fibrillose, extending into branching mycelial strands, Apicot Yellow to Mustard Yellow, 0.2～0.4 mm in diameter.

Microscopic characteristics : Hyphae of subiculum vertically and loosely interwoven, hyaline, thin-walled, septate, branched, with clamps, abundantly incrusted with brownish granules which dissolve quickly in 5% KOH, 4.0～7.0μ in diameter, mingled with double-clamped hyphae and bridging hyphae; subhymenial layer 60～110μ thick, hyphae compactly interwoven, hyaline, thin-walled, septate, branched, with clamps, incrusted with brownish granules which dissolve quickly in 5% KOH, 1.5～2.5μ in diameter; hymenium even, compactly arranged, 25～45μ thick; cystidia scarce, hyaline, fusiform, 35～55×4～5μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, non-septate, without clamps, often finely incrusted, cystidial walls do not dissolve in 10% KOH, projecting 15～30μ; gloeocystidia absent; basidia narrow clavate, 20～30×4～5μ, with 4 sterigmata of 3～4μ long; spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 5.0×2.5μ.

Japanese name : Usuki'himo-kawatake (Y. Hayashi & K. Aoshima)

Distribution : North America and Asia : Japan (Honshu and Shikoku)

Specimens examined : Asakawa, Tokyo, on fallen branches of *Pinus densiflora*, Aug. 4, 1964, T. K. (10336-F); Nobeyama, Nagano pref., on decaying wood of *Betula* sp., Nov. 1961, K. A. & Y. H. (11076-F); Ôtsuki, Kochi pref., on bark of decaying broad leaved tree, Aug. 26, 1968,

M. Tsuji (11087-F)

Habitat & type of rot : Associated with a white rot of fallen branches of conifer and broad leaved trees.

The diagnostic characteristics of this species are forming yellowish mycelial strands, easily separable from the substratum and soft membranous fruit bodies, and the hyphae of subiculum has double clamped hyphae and also bridging hyphae.

This species resembles No. 27, *Amphinema byssoides* (Pers. ex Fr.) Erikss., in having mycelial strands and yellowish brown fruit bodies which do not change color in potassium hydroxide solution, but differs in the presence of the clamped cystidia. No. 32, *Membranicium filamentosum* (Berk. & Curt.) Christiansen is also similar in forming mycelial strands, but fruit bodies turn wine-red in potassium hydroxide solution. No. 34, *Membranicium sanguineum* (Fr.) Erikss. and No. 33, *Membranicium sulphurinum* (Karst.) Hayashi are also similar in having mycelial strands, but differ in the reactions in potassium hydroxide solution.

No. 18 ***Peniophora pilosa*** **Burt**

Ann. Mo. Bot. Gard. 12 : 291, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 78, 1960; Weresub, Can. Jour. Bot. 39 : 1492, 1961

Macroscopic characteristics : Fruit bodies resupinate, longitudinally effused, not easily separable from the substratum, Pale Yellow-Orange to Light Ochraceous-Buff, do not change color in KOH, waxy, 700～1,200 μ thick; hymenial surface even, rigid in appearance, pilose by the projecting cystidia, deeply cracked in reticulation and showing the white subiculum in the fissures; sterile marginal zones wide, somewhat whitish, thinning out, cottony, without mycelial strands (Plate 3 : D).

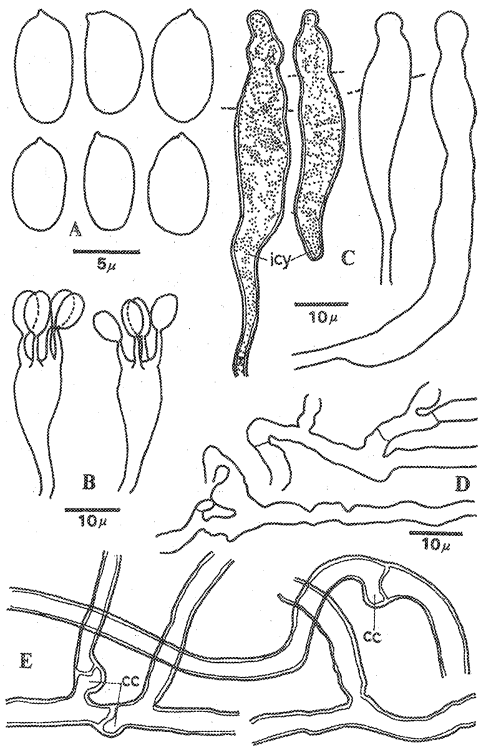


Fig. 32 Microscopic elements of *Peniophora pilosa* Burt (11140-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

Microscopic characteristics : Hyphae of subiculum loosely arranged, hyaline, thin-walled, septate, with clamps at every septa, branched, not incrusted, 3.0～5.0 (3.5) μ in diameter (Fig. 32 : E); subhymenium composed of 2 or 3 layers, hyphae narrow and agglutinated which are hyaline, thin-walled, septate, clamps not seen, branched, not incrusted, 2.5～5.0 (2.5) μ in diameter (Fig. 32 : D); hymeniun even, compactly arranged, hyaline, 40～65 μ thick; cystidia abundant, hyaline, cylindrical to fusiform, projecting 13～18 μ, 30～85×7.5～10.0 μ, not rooted at the base, with flexuous stem, constricted near the tip and terminating in an ovoid-shaped body, thin- and smooth-walled, with wider lumen, not incrusted, non-septate, without clamps, cystidial walls do not dissolve in 10%

KOH (Fig. 32 : C) ; gloeocystidia absent; basidia narrowly clavate, 25～30×7.5～9.0μ, with 4 sterigmata of 2～3μ long (Fig. 32 : B) ; spores oval, minutely apiculate, smooth, hyaline, pseudoamyloid, 6.5～8.0×3.5～4.0 (7.5×3.5)μ (Fig. 32 : A).

Japanese name : Ami-kawatake (nom. nov.)

Distribution : North America and Asia : Japan (Honshu)

Specimen examined : Nobeyama, Nagano pref., on Ericaceae, Nov. 1961, K. A. & Y. H. (11140-F)

Habitat & type of rot : Associated with a white rot of fallen branches of broad leaved trees.

The distinctive characteristics of this species are yellow to orange and waxy fruit bodies which are cracked in reticulations and microscopically subiculum hyphae with clamps and presence of capitate cystidia with flexuous stems.

Basidiospores of this species assume obviously hyaline and clearly pseudoamyloid. Weresub[168] found this fact saying "The spores also approach those of *Coniophora* in structure, but they appear to be colorless and are distinctly pseudoamyloid. Reference to pseudoamyloidity in the colorless spores of resupinates is rare".

4) ***Tubulicrinis* Donk ex Weresub**

Can. Jour. Bot. 39 : 1456, 1961—*Tubulicrinis* Donk, Fungus 26 : 13, 1956; Christiansen, Dansk Bot. Ark. 19(2) : 130, 1960

Fruit bodies resupinate, annual, thin, not easily separable from the substratum, white to whitish, waxy to membranous; hymenial surface mostly pilose; sterile marginal zones indeterminate; mycelial strands absent; subiculum composed of narrow hyphae, becoming agglutinated and indistinct, hyphae mostly hyaline, with clamps, thin- to thick-walled; subhymenial layer ascending; cystidia originating from the subiculum hyphae, cylindrical to fusiform, rooted or not rooted at the base, with stems thick-walled, capitate and with thin-walled apex, not incrusted or heavily incrusted, walls dissolve in 10% KOH; basidia clavate; basidiospores globose to cylindrical, smooth, hyaline, non-amyloid.

Habitat : Usually on very rotten wood.

Place : Corticiaceae

Genotype : *Peniophora gracillima* Ell. & Everh. ex Rogers & Jacks.

Japanese name : Nameshi-kawatake Zoku (nom. nov.)

This genus is characterized by its unique cystidia which are rooted at the base, thick-walled, walls dissolving in 10% potassium hydroxide solution.

As to selection of the type species of the genus, the author considered that Weresub[168] has done *Peniophora gracillima* Ell. & Everh. ex Rogers & Jacks.

KEY TO THE SPECIES

1. Cystidia with capillary lumen 2
1. Cystidia without capillary lumen 5
   2. Cystidia rooted at the base 3
   2. Cystidia not rooted at the base 4
      3. Cystidia forming a thin-walled apical ovoid body, fruit bodies turning dusky in KOH ..... No. 19 *T. gracillima*
      3. Cystidia forming a thin-walled apical bulb, fruit bodies do not change color

in KOH ..... No. 20 *T. propinqua*

4. Cystidia mostly not forming thin-walled apex, coarsely incrusted at the top ..... No. 21 *T. crassa*

5. Fruit bodies turning wine-red in KOH, spores 4～5×2～3μ ..... No. 22 *T. vinacea*

No. 19 ***Tubulicrinis gracillima*** **(ELL. & EVERH. ex ROGERS & JACKS.) HAYASHI, comb. nov.**

Peniophora gracillima ELL. & EVERH. ex ROGERS & JACKS., Farlowia 1(2) : 317, 1943; CUNN., Trans. Royal. Soc. New Zealand 83(2) : 290, 1955; TALBOT, Bothalia 7 : 147, 1958; SLYSH, Syracuse Univ. Tech. Pub. 83, 43, 1960; WERESUB, Can. Jour. Bot. 39 : 1456, 1961—*Peniophora gracillima* ELL. & EVERH. sp. nov. herbarium name.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, easily separable from the substratum, Light Ochraceous-Buff to Light Buff, turning dusky in KOH, pelliculose, 170～300μ thick; hymenial surface even, rigid in appearance, pilose, deeply cracking in small patches and showing the white subiculum in the fissures; sterile marginal zones wide, concolorous, thinning out, indeterminate, without mycelial strands (Plate 3 : E).

Microscopic characteristics : Hyphae of subiculum vertically and compactly arranged, hyaline, thin- to thick-walled, clamps not seen, branched with wide angles, not incrusted, 3.0～3.5μ in diameter (Fig. 34 : E); subhymenium 50～60μ thick, narrow hyphae loosely interwoven, composed of hyaline, thin- to thick-walled, branched, with clamps, not incrusted hyphae of 2.0～2.5μ in diameter (Fig. 34 : D); hymenium compactly arranged, 50～75μ thick; cystidia abundant, hyaline, cylindrical, 75～170×7.5～12.5μ, rooted at the base, with obtuse apex, thick- and smooth-walled, with a capillary lumen expanding abruptly and forming a thin-walled apical ovoid body of 9.5～11.0×5.5～6.5μ, incrusted at the tip, granular matter dissolves in 5% KOH, non-septate, without clamps, immersed in subiculum to hymeninum or projecting

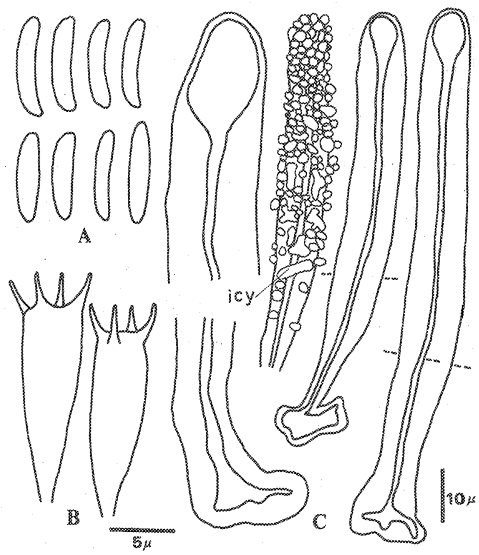


Fig. 33 Microscopic elements of *Tubulicrinis gracillima* (ELL. & EVERH. ex ROGERS & JACKS.) HAYASHI, comb. nov. (11184-F)
A : Basidiospores B : Basidia C : Cystidia

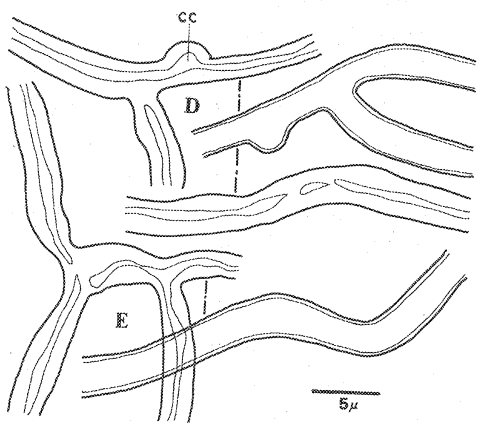


Fig. 34 Microscopic elements of *Tubulicrinis gracillima* (ELL. & EVERH. ex ROGERS & JACKS.) HAYASHI, comb. nov. (11184-F)
D : Subhymenial hyphae
E : Subiculum hyphae

65～75μ, cystidial walls dissolve in 10% KOH (Fig. 33 : C) ; gloeocystidia absent ; basidia clavate, 12～20×3.5～4.0μ, with 4 sterigmata of 2.5～3.0μ long (Fig. 33 : B) ; spores slender, cylindrical, flattened on one side, slightly curved, smooth, hyaline, non-amyloid, 6.5×1.5～2.5μ (Fig. 33 : A).

Japanese name : Nameshi-kawatake (A. Yasuda)

Distribution : Europe, North America, South Africa, New Zealand and Asia : Japan (Honshu)

Specimens examined : Sendai, Miyagi pref., on decaying branch of broad leaved tree, Oct. 1, 1916, A. Yasuda (2021723-TNS) ; Chichibu, Saitama pref., on bark and wood of decaying branch of *Quercus serrata*, Nov. 11, 1969, K. A. • Y. H. & T. K. (11184-F) ; Nobeyama, Nagano pref., on bark of decaying branch of *Quercus* sp., Sept. 15, 1961, K. A. (11194-F) ; Bear Island, L. Temagami, T. F. R. Ontario, Canada, on *Fraxinus nigra*, Aug. 9, 1937, A. J. Skolko, (TNS), (11933-TRT), (Det. by H. S. Jackson).

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic characteristics of this species are waxy and pale yellowish fruit bodies which turn dusky in potassium hydroxide solution, deeply cracking in small patches, slender spores, and cystidia having capillary lumen abruptly expanding and forming a thin-walled apical ovoid body, with walls dissolve in 10% potassium hydroxide solution.

No. 20, *Tubulicrinis propinqua* (Bourd. & Galz.) Donk is distinguished from this species in having whitish fruit bodies which do not change color in potassium hydroxide solution, lacking subhymenial layers and the cystidia forming a thin-walled apical bulb.

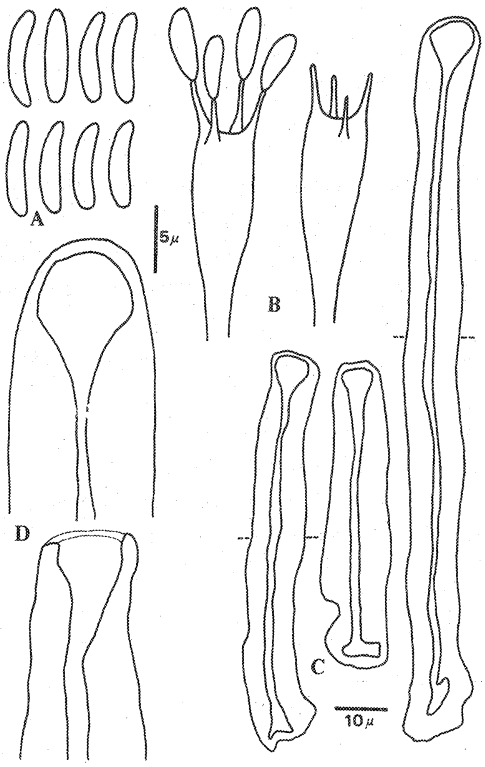
Yasuda[178] identified a specimen collected at Sendai (2021723-TNS) as *Peniophora glebulosa* (Fr.) Bres. which was identified by the author as this species.

No. 20 ***Tubulicrinis propinqua*** **(Bourd. & Galz.) Donk**

Fungus 26 : 14, 1956—*Peniophora propinqua* Bourd. & Galz., Hymén. de Fr. p. 288, 1928 ; Slysh, Syracuse Univ. Tech. Pub. 83, 43, 1960—*Peniophora propinqua* (Bourd. & Galz.) Laurila, Ann. Bot. Soc. Zool.-Bot. Fennicae Vanamo 10(4) : 8, 1939 ; Weresub, Taxonomic analysis of sect. Tubuliferae B. & G. of the genus *Peniophora* Cke. p. 43, 1957 ; Can. Jour. Bot. 39 : 1460, 1961

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, inconspicuous, not easily separable from the substratum, white to Cartridge-Buff, do not change color in KOH, membranous, 150～230μ thick ; hymenial surface even, pilose, deeply cracking in small patches and showing the white subiculum in the fissures ; sterile marginal zones wide, concolorous, thinning out, without mycelial strands (Plate 3 : F).

Microscopic characteristics : Subiculum composed of loosely and irregularly arranged hyphae, which are hyaline, mostly thin-walled, septate, with clamps, branched with wide angles, not incrusted, 1.5～2.0μ in diameter, mingled with few thick-walled, branched, not incrusted hyphae (Fig. 36 : E), becoming compact and indistinct toward the hymenium ; hymenium compactly arranged, hyaline, 13～18μ thick ; cystidia abundant, hyaline, originating near the substratum and throughout the subiculum and hymenium, cylindrical, 63～150×10.0～12.5μ, rooted at the base (Fig. 36 : F), obtuse, sometimes slightly held down and enlarged at the apex (Fig. 35 : D), thick- and smooth-walled, with a capillary lumen expanding abruptly and forming a thin-walled apical bulb of 5～8×6～8μ, incrusted near the tip, granular matter dissolves in 5% KOH, non-septate, without clamps, immersed in subiculum and hymenium or projecting 25～63μ, walls dissolve in 10% KOH (Fig. 35 : C) ; gloeocystidia absent ; basidia



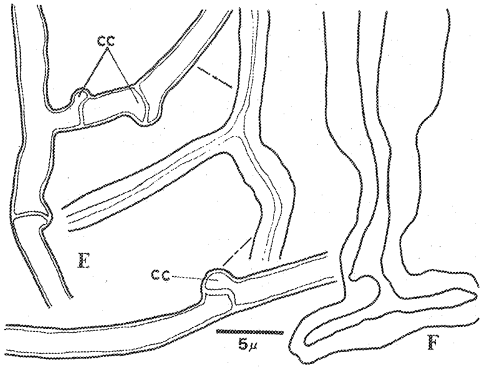


Fig. 36　Microscopic elements of *Tubulicrinis propinqua* (Bourd. & Galz.) Donk (11186-F)
E : Subiculum hyphae
F : Base of cystidium

Fig. 35　Microscopic elements of *Tubulicrinis propinqua* (Bourd. & Galz.) Donk (11186-F)
A : Basidiospores　B : Basidia　C : Cystidia
D : Apex of cystidia

clavate, 15～20×4～5μ, with 4 sterigmata of 2.5～3.0μ long (Fig. 35 : B); spores cylindrical, flattened on one side, slightly curved, smooth, hyaline, non-amyloid, 5.5～6.5×1.5～2.0 (6.5×1.5)μ, (Fig. 35 : A).

Japanese name : Shiro' nameshi-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Hokkaido and Honshu)

Specimens examined : Numanohara-Sōunkyo, Hokkaido, on decaying stem of *Sorbus commixta*, Sept. 11, 1968, Y. H. & H. F. (11186-F); Sugadaira, Nagano pref., on decaying wood of *Quercus serrata*, Oct. 3, 1969, Y. H. (11252-F).

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic characteristics of this species are white, membranous and deeply cracking fruit bodies having no subhymenial layer. Having characteristic cystidia and slender spores are also diagnostic.

No. 21　***Tubulicrinis crassa* (Burt ex Peck) Hayashi, comb. nov.**

Peniophora crassa Burt ex Peck, N. Y. State Museum Rept. 54 : 155, 1901; Rogers & Jacks., Farlowia 1(2) : 326, 1943; Weresub, Can. Jour. Bot. 31 : 768, 1953; Can. Jour. Bot. 39 : 1472, 1961—*Peniophora crassa* Burt, Ann. Mo. Bot. Gard. 12 : 286, 1926; Weresub, Taxonomic analysis of sect. Tubuliferae B. & G. of the genus *Peniophora* Cke., p. 69, 1957; Eriksss., Symb. Bot. Ups. 16(1) : 122, 1958; Slysh, Syracuse Univ. Tech. Pub. 83, 37, 1960

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Ochraceous-Salmon to Pinkish-Cinnamon, do not change color in KOH, pelliculose, very thick, 450～1,400μ thick; hymenial surface rigid in appearance, pilose, deeply

cracking in crater-form and showing the white subiculum in the fissures; sterile marginal zones concolorous, thinning out, fibrillose, without mycelial strands (Plate 3 : G).

Microscopic characteristics : Subiculum 250~1,000μ thick, composed of longitudinally and loosely arranged hyphae, which are hyaline, thin- to thick-walled, clamps indistinct, branched repeatedly with wide angles, not incrusted, 2.5~5.0 (3.8)μ in diameter (Fig. 38 : E); subhymenium 70~200μ thick, somewhat narrow hyphae vertically and compactly arranged, other characters same as in subiculum hyphae, 1.5~3.8 (2.5)μ in diameter (Fig. 38 : D); hymenium very compact, hyaline, 70~200μ thick; cystidia abundant, hyaline, cylindrical, immersed or projecting 45~55μ, 75~165×6.5~11.5μ, not rooted at the base, with obtuse apex, thick- and smooth-walled, with a capillary lumen sometimes expanding gradually toward the tip, often coarsely incrusted around the apex, non-septate, without clamps, walls dissolve in 10% KOH (Fig. 37 : C); gloeocystidia absent; basidia cylindrical, 25~37×3.5~5.0μ, with 2~4 sterigmata of 1.0~3.0μ long (Fig. 37 : B); spores cylindrical, curved, smooth, hyaline, non-amyloid, 5.0~6.5×1.5 (6.0×1.5)μ (Fig. 37 : A).

Japanese name : Kabe-kawatake (nom. nov.)

Distribution : North America, Europe and Asia : Japan (only in Hokkaido)

Specimens examined : Ootaki, Hokkaido, on decaying wood of *Picea jezoensis*, June, 1954, K. A. (11148-F); Yamabe, Hokkaido, on decaying trunk of *Abies sachalinensis*, Oct. 2, 1968, K. A. (11174-F).

Habitat & type of rot : Associated with a ? brown rot.

This species is readily recognized by its clay colored and thick membranous fruit bodies, having slender basidia and curved, cylindrical spores, and having cystidia with a capillary lumen and with walls that dissolve in 10% potassium hydroxide solution.

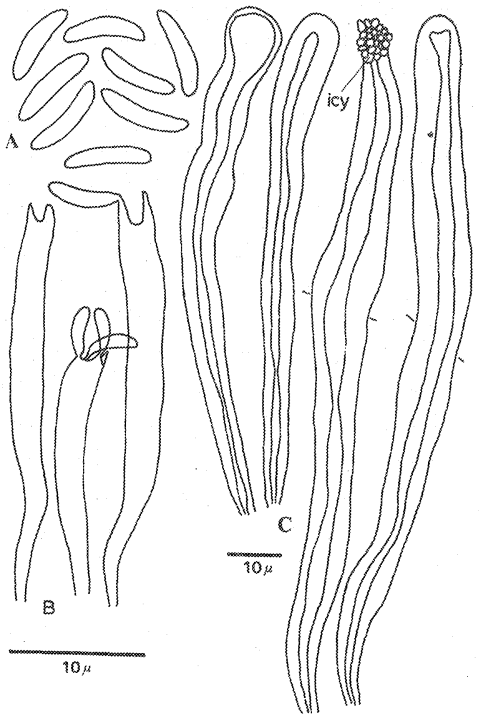


Fig. 37 Microscopic elements of *Tubulicrinis crassa* (Burt ex Peck) Hayashi, comb. nov. (11148-F)
A : Basidiospores B : Basidia C : Cystidia

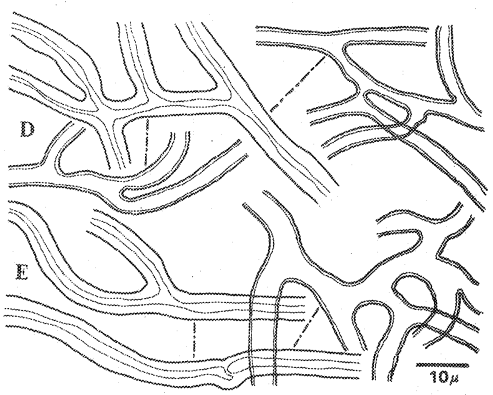


Fig. 38 Microscopic elements of *Tubulicrinis crassa* (Burt ex Peck) Hayashi, comb. nov. (11148-F)
D : Subhymenial hyphae
E : Subiculum hyphae

According to BURT[41] and WERESUB[168], this species occurs only on coniferous wood (*Abies, Pinus, Picea, Pseudotsuga, Tsuga, Thuja*) in North America. In Japan, collected only in Hokkaido on *Picea jezoensis* and decaying *Abies sachalinensis.*

No. 22 ***Tubulicrinis vinacea*** **HAYASHI, sp. nov.**

Fructificatio aurea, 200～2,000μ crassa, pruinosa, vinacea in KOH; subhymenium a agglutinatum; subiculum ex hyphis fibrilosae non incrustata 1.5～4.0μ crassa composita, aliquando corpera clavatis 20～45×6.5～7.5μ praesentis; cystidia fusiformia, brunneola, granulata, incrustata, 20～45×4～10μ, granulae et tunicae tabidae in KOH; basidia clavata, 23～25×4～5μ; sterigmata 2～4 in numero, 2.5～3.0μ longae; basidiosporae late ellipsoideae, 4～5×2～3μ, laeves, tenuiter tunicatae.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, sometimes very thick (200～2,000μ), not easily separable from the substratum, Mustard Yellow to Primuline Yellow, turning Blackish Red-Purple in KOH, pelliculose; hymenial surface even, rigid in appearance, farinose, deeply cracked showing the pale yellow subiculum in the fissures; sterile marginal zones broad, Sudan Brown, thinning out, cottony, without mycelial strands (Plate 3 : H).

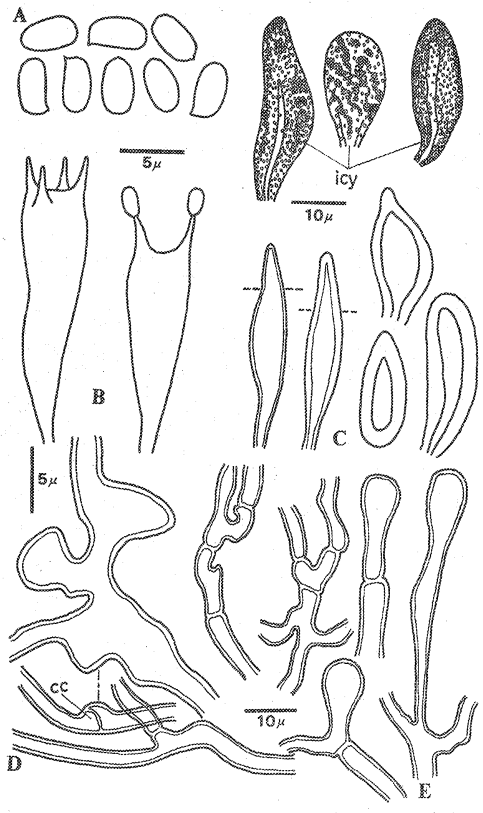


Fig. 39 Microscopic elements of *Tubulicrinis vinacea* HAYASHI, sp. nov. (10200-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

Microscopic characteristics : Subiculum composed of loosely interwoven hyphae, which are pale yellow, thin-walled, septate, with clamps, branched, not incrusted, 1.5～4.0μ in diameter, sometimes clavate bodies of 20～45×6.5～7.5μ present (Fig. 39 : E); subhymenium 80～130μ thick, pale yellow, very compact, mostly agglutinated, mingled with few thin-walled, septate, branched, not incrusted and clamped hyphae of 1.5～4.0μ in diameter, between subiculum and subhymenium 2～3 very compact and gelatinized layers present (Fig. 39 : D); hymenium compact, pale yellow, 35～40μ thick; cystidia abundant, throughout the section, fusiform, immersed or protruding 4～20μ, 20～45×4～10μ, not rooted at the base, with obtuse apex, thick- and smooth-walled, with wider lumen, incrusted with brownish granules which dissolve quickly in 5% KOH, non-septate, cystidial walls dissolve in 10% KOH (Fig. 39 : C); gloeocystidia absent; basidia clavate, 23～25×4～5μ, with 2～4 sterigmata of 2.5～3.0μ long (Fig. 39 : B); spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid. 4～5×2～3 (4×2)μ (Fig. 39 : A).

Japanese name : Nise'kogane-kawatake (nom. nov.)

Distribution : Japan (Kyushu)

Specimen examined : Uchizume, Kagoshima pref., on bark of decaying stem of *Castanopsis* sp., Oct. 18, 1963, K. A. & H. F. (10200-F)

Habitat & type of rot : Associated with a white rot of fallen trunks of *Castanopsis*.

The present new species in characterized by the following features : a golden color of fruit body which turns wine-red in potassium hydroxide solution, but sections at first wine-red, then bleach to pale yellow in potassium hydroxide solution, a gelatinized subhymenial layer and presence of the clavate bodies in subiculum tissue.

No. 38, *Membranicium carnosa* (Burt) Hayashi is very similar, but fruit body turns blue in potassium hydroxide solution.

No. 16, *Peniophora ludoviciana* Burt is very similar macroscopically which turns wine-red in potassium hydroxide solution, but differs in having cystidia which do not dissolve in 10% potassium hydroxide solution, and in the absence of clavate bodies in the subiculum tissue.

Peniophora guttulifera (Karst.) Sacc. is distinguished from the present species in having no clavate bodies in the subiculum tissue and in having larger (40～80×8～17 μ) and persistent cystidia, and larger spores (10～14×3～5 μ).

Peniophora vesiculosa Cunn. and *P. utriculosa* Cunn. have clavate bodies in subiculum tissue but are quite different in other features.

5) ***Hyphodontia*** **Eriksson.**

Symb. Bot. Ups. 16(1) : 101, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 216, 1960

Fruit bodies resupinate, annual, broadly effused, thin, soft membranous, white to ochraceous ; hymenial surface even or tuberculate, pruinose to pilose; mycelial strands absent or present ; subiculum hyphae distinct, somewhat fibrillose, narrow, thin-walled, septate, usually not incrusted, distinctly clamped; cystidia hyphoid, thin-walled, usually septate or clamped with capitate apex, usually heavily incrusted with coarse crystals, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia usually smaller, clavate; spores ovate to rarely globose, non-amyloid.

Habitat : Occurrence on decayed conifers and broad leaved trees.

Place : Corticiaceae.

Genotype : *Gonatobotrys pallidula* Bres.

Japanese name : Usu-kawatake Zoku (nom. nov.)

The most distinctive characters of this genus are very thin and membranous fruit bodies, even to tuberculate hymenial surface, and hyphoid cystidia with capitate apex.

The genus *Membranicium* resembles this in its membranous texture, but does not have clamped hyphae and capitate apex of cystidia.

KEY TO THE SPECIES

1. Cystidia with two types 2
1. Cystidia with one type 3
   2. Cylindrical cystidia incrusted and with clamps ..... No. 23 *H. pallidula*
   2. Cylindrical cystidia unincrusted and without clamps ..... No. 24 *H. alutaria*
3. Cystidia septate ..... No. 25 *H. laxa*

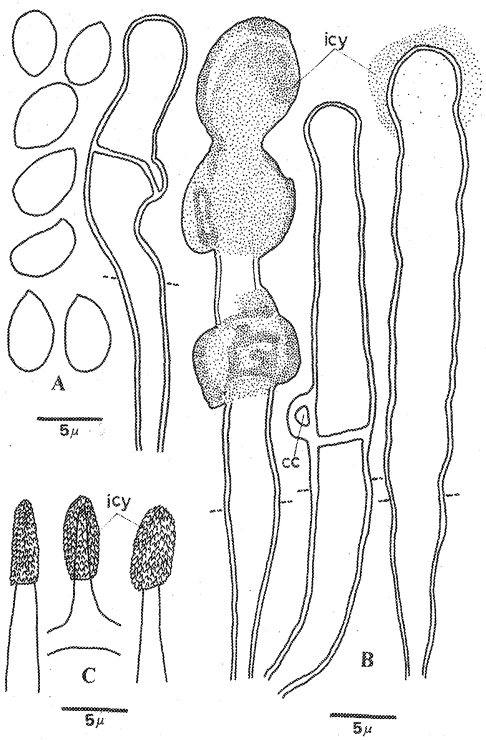
3. Cystidia non-septate……No. 26 *H. sambuci*

No. 23 ***Hyphodontia pallidula*** (BRES.) ERIKSS.

Symb. Bot. Ups. 16(1) : 104, 1958; CHRISTIANSEN, Dansk Bot. Ark. 19(2) : 221, 1960; PARMASTO, Inves. Natural Hist. Soviet Far East p. 241, 1963—*Gonatobotrys pallidula* BRES., Ann. Mycol. 1 : 127, 1903—*Gloeocystidium pallidulum* (BRES.) HOEHN. & LITSCH., Oesterr. Bot. Zeitschr. 58 : 471, 1908—*Peniophora pallidula* (BRES.) BRES., in BOURD. & GALZ., Bull. Soc. Myc. FR. 28 : 390, 1912; Hymén. de FR. p. 296, 1928; PILÁT, Bull. Soc. Myc. FR. 51 : 419, 1935; ROGERS & JACKS., Farlowia 1(2) : 313, 1943; SLYSH, Syracuse Univ. Tech. Pub. 83, 50, 1960

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Capucin Buff to Chamois, bleached in KOH, soft membranous, 50～270μ thick; hymenial surface downy in appearance, farinose, not cracking, with globules (110～200 ×100～140μ); sterile marginal zones concolorous, thinning out, arachnoid, without mycelial strands (Plate 3 : I).

Microscopic characteristics : Subiculum scanty, hyphae ascending from the substratum, composed of brownish hyphae which are thin-walled, septate, clamped, branched, not incrusted, 2.0～3.5μ in diameter (Fig. 41 : E); subhymenial layer absent; hymenium loosely arranged and indistinct; cystidia of two kinds, the one abundant, hyaline, cylindrical, projecting 30～45μ, 37～63μ long, 5～6μ wide at the base and 4～6μ wide at the neck, not rooted at the base, with two or three swellings at the stem, with swelling apex covered with numerous small drops of mucilage which do not dissolve in 5% KOH, "BOURD. & GALZ.[29] : á parois minces, 1～4 septées, cá et lá éntranglées ou renflées en boules, souvent incrustées en manchon d'une



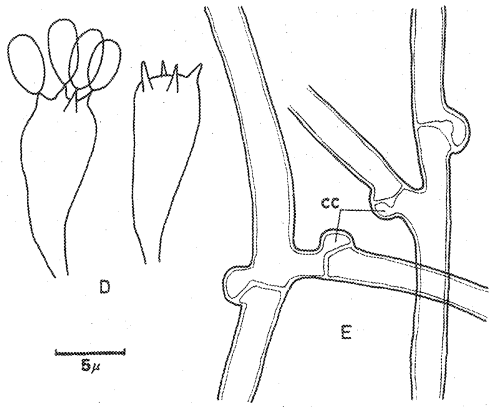


Fig. 41 Microscopic elements of *Hyphodontia pallidula* (BRES.) ERIKSS. (11265-F)
D : Basidia E : Subiculum hyphae

Fig. 40 Microscopic elements of *Hyphodontia pallidula* (BRES.) ERIKSS. (11265-F)
A : Basidiospores B : Septate cystidia
C : Button-like cystidia

substance résineuse", thin- and smooth-walled, wider lumen, typically septate, often with a clamp connections, cystidial walls do not dissolve in 10% KOH (Fig. 40 : B); the other arises from the hymenial surface, hyaline, button-like, 11~16μ long, 1.5~2.5μ wide at the base and 2.5~3.0μ wide at the incrusted part, thin- and smooth-walled, incrusted round the tip, non-septate, without clamps (Fig. 40 : C); gloeocystidia absent; basidia rare, clavate, 15~17×4.5~5.0μ, with 4 sterigmata of 1.0~1.5μ long (Fig. 41 : D); spores oval, minutely apiculate, smooth, hyaline, non-amyloid, 4.5~5.5×3.0~3.5 (5×3)μ (Fig. 40 : A).

Japanese name : Nendo-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Honshu)

Specimens examined : Asakawa, Tokyo, on decaying wood of broad leaved tree, Oct. 25, 1965, K. A. (11265-F); Bear Island L. Temagami T. F. R., Ontario, Canada, on *Pinus* sp., July 31, 1936, R. Biggs (10304-TRT), (TNS), (Det. by R. Biggs)

Habitat : Occurring on very rotten wood of broad leaved trees.

Hyphodontia pallidula (Bres.) Erikss. can be readily distinguished from other species by the yellowish brown and cottony fruit bodies, and presence of two distinct types of cystidia.

No. 24, *Hyphodontia alutaria* (Burt) Erikss. is somewhat similar in having yellowish brown and membranous fruit bodies but differs in its unincrusted cystidia without clamps.

No. 24 ***Hyphodontia alutaria* (Burt) Erikss.**

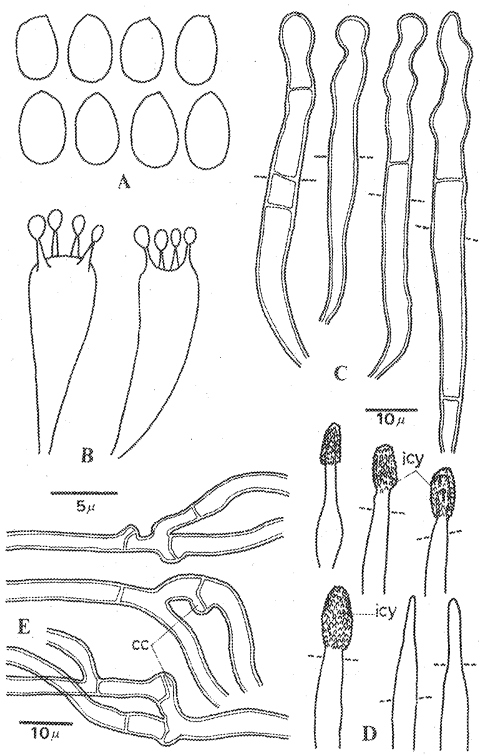


Fig. 42 Microscopic elements of *Hyphodontia alutaria* (Burt) Erikss. (11187-F)
A : Basidiospores B : Basidia
C : Septate cystidia D : Button-like cystidia
E : Subiculum hyphae

Symb. Bot. Ups. 16(1) : 106, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 219, 1960—*Peniophora alutaria* Burt, Ann. Mo. Bot. Gard. 12 : 332, 1926

Macroscopic characteristics : Fruit bodies resupinate, forming small patches, then confluent, discontinuous, not easily separable from the substratum, Cartridge Buff, bleached in KOH, membranous, 110~160μ thick; hymenial surface rough, pliose, with globular masses, not cracking; sterile marginal zones concolorous, thinning out, arachnoid, without mycelial strands (Plate 3 : J).

Microscopic characteristics : Subiculum 60~100μ thick, composed of longitudinally and somewhat loosely arranged hyphae, which are hyaline, thin-walled, septate, with clamps, branched, not incrusted, 2.5~4.0 (3.5)μ in diameter (Fig. 42 : E); hymenium loosely arranged, flexuous, 30~45μ thick; cystidia of two kinds, the one abundant, hyaline, cylindrical, projecting 20~45μ, 35~75×5.0~6.5μ, not rooted at the base, with few constrictions of the cystidial stem and with swelling as capitate apex, thin- and smooth-walled, not incrusted, 1~3 septate,

without clamps, cystidial walls do not dissolve in 10% KOH (Fig. 42 : C); the other hyaline, button-like, protruding 10～15μ, 23～35×4～5μ, tapering, thin- and smooth-walled, non-septate, without clamps, incrusted sometimes around the apex, with granular matter dissolving in 5% KOH, cystidial walls do not dissolve in 10% KOH (Fig. 42 : D); gloeocystidia absent; basidia clavate, 20～25×5～6μ (Fig. 42 : B); spores oval, minutely apiculate, smooth, hyaline, non-amyloid, 4.5～6.0×3.0～4.0 (5.0×3.5)μ (Fig. 42 : A).

Japanese name : Usu-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Hokkaido)

Specimens examined : Otoineppu, Hokkaido, on decaying log of *Picea jezoensis*, Sept. 7, 1969, K. A. • Y. H. & H. F. (11187, 11248-F); Nisecharo-Sôunkyo, Hokkaido, on decaying log of *Picea jezoensis*, Sept. 12, 1969, Y. H. & H. F. (11246, 11247-F)

Habitat & type of rot : Associated with a white rot of conifers and broad leaved trees.

The diagnostic characteristics of this species are clay colored and membranaceous fruit bodies, which have an even to flexuous hymenial surface, and microscopically narrow and clamped hyphae and presence of two distinct types of cystidia.

No. 25 ***Hyphodontia laxa*** **(BURT) HAYASHI, comb. nov.**

Peniophora laxa BURT, Ann. Mo. Bot. Gard. 12 : 224, 1926; SLYSH, Syracuse Univ. Tech. Pub. 83, 56, 1960

Macroscopic characteristics : Fruit bodies resupinate, widely and longitudinally effused but remaining more or less discrete, 90～200μ thick, loosely attached and easily separable from the substratum, white to Cartridge Buff, do not change color in KOH, pelliculose; hymenial surface even, downy in appearance, farinose, not cracking; sterile marginal zones whitish, thinning out, radiately fibrillose, forming mycelial strands, whitish, 0.3～0.7 mm in diameter (Plate 4 : F).

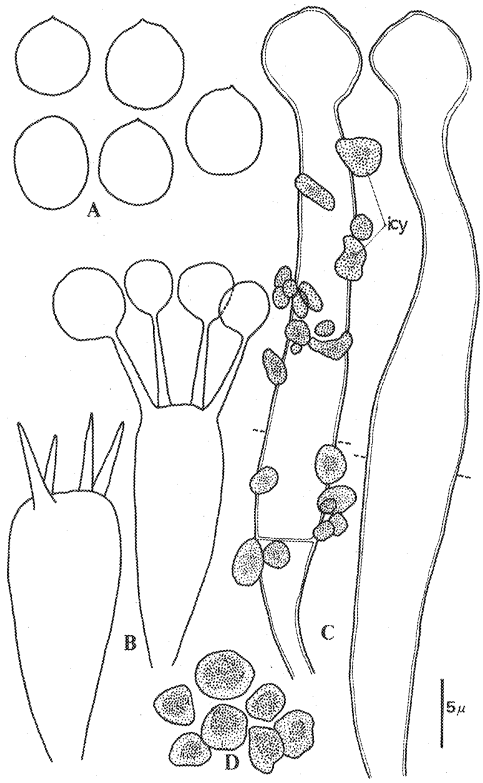
Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged next to the substratum, with abundant crystals scattered throughout, 3～4μ in diameter (Fig. 43 : D), hyphae hyaline, thin-walled, septate, with clamps and branchings, 2.5～3.5μ in diameter, often incrusted with large mass of crystals of 2.5～4.0μ in diameter (Fig. 44 : F); subhymenium 30～40μ thick, hyphae becoming compactly and vertically arranged toward the hymenium, other characters same as in subiculum hyphae (Fig. 44 : E); hymenium compactly arranged, hyaline, 30～40μ thick; cystidia few, hyaline, cylindrical, 40～65×5～7μ, not rooted at the base, with stems constricted of 3～4μ in diameter at the neck, capitate and 6～7μ in diameter at the apex, thin- and smooth-walled, distinctly broadened lumen, not incrusted or often incrusted with coarse granules, rarely septate near the base, without clamps, protruding 18～40μ beyond the hymenial surface, cystidial walls do not dissolve in 10% KOH (Fig. 43 : C); gloeocystidia absent; basidia broadly clavate, 20～25×6～10μ, with 4 sterigmata of 5～11μ long (Fig. 43 : B); spores copious, globose to subglobose, minutely apiculate, smooth, hyaline, non-amyloid, 5.5～6.5×5.5～6.5 (6×6)μ, (Fig. 43 : A).

Japanese name : Shiro'himo-kawatake (nom. nov.)

Distribution : North America and Asia : Japan (Honshu)

Specimen examined : Kiyosumi, Chiba pref., on bark of decaying *Abies firma*, Oct. 24, 1967, K. A. • Y. H. & H. F. (11245-F)

Habitat : Occurring on dead wood of conifers.



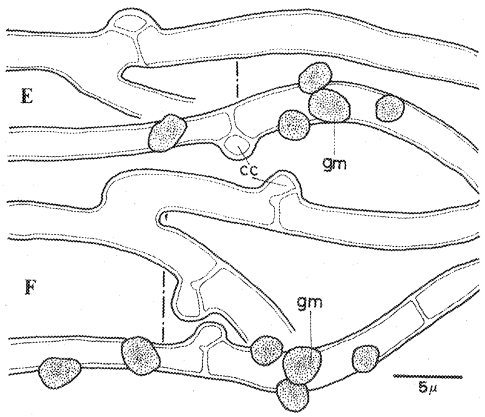


Fig. 44 Microscopic elements of *Hyphodontia laxa* (Burt) Hayashi, comb. nov. (11245-F)
E : Subhymenial hyphae
F : Subiculum hyphae

Fig. 43 Microscopic elements of *Hyphodontia laxa* (Burt) Hayashi, comb. nov. (11245-F)
A : Basidiospores B : Basidia C : Cystidia
D : Crystals

This species is characterized by forming whitish mycelial strands, and microscopically by having globose spores and swelling cystidia.

According to Slysh[156], North American specimen has clamped cystidia.

No. 26 ***Hyphodontia sambuci*** **(Pers.) Erikss.**

Symb. Bot. Ups. 16(1) : 104, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 217, 1960; Parmasto, Inves. Natural Hist. Soviet Far East p. 241, 1963—*Corticium sambuci* Pers., Roemer Neues Mag. Bot. 1 : 111, 1794; Fr., Epicr. Myc. p. 565, 1836~1838; Berk., Outl. Brit. Fung. p. 276, 1860; Fr., Hym. Eur. p. 660, 1874; Mass., Jour. Linn. Soc. 27 : 137, 1890; Wakef., Trans. Brit. Myc. Soc. 4 : 115, 1913; Rea, Brit. Basid. p. 677, 1922—*Thelephora sambuci* (Pers.) Pers., Syn. Meth. Fung. p. 581, 1801; Myc. Eur. 1 : 152, 1822—*Hypochnus sambuci* (Pers.) Sacc., Syll. Fung. 6 : 656, 1888—*Peniophora sambuci* (Pers.) Burt, Ann. Mo. Bot. Gard. 12 : 233, 1926; Rogers & Jacks., Farlowia 1(2) : 325, 1943; Cunn., Trans. Royal. Soc. New Zealand 83(2) : 282, 1955; Slysh, Syracuse Univ. Tech. Pub. 83, 80, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 128, 1963.

Macroscopic characteristics : Fruit bodies resupinate, longitudinally effused, not easily separable from the substratum, Chalk-White, turning pale yellow in KOH, pelliculose, 100~120μ thick; hymenial surface downy in appearance, pruinose, rarely cracking; sterile marginal zones wide, whitish, thinning out and indeterminate, fibrillose, without mycelial strands (Plate 3 : K).

Microscopic characteristics : Subiculum 35~65μ thick, hyphae vertically and loosely arranged next to the substratum, very compact layer present between the subiculum and

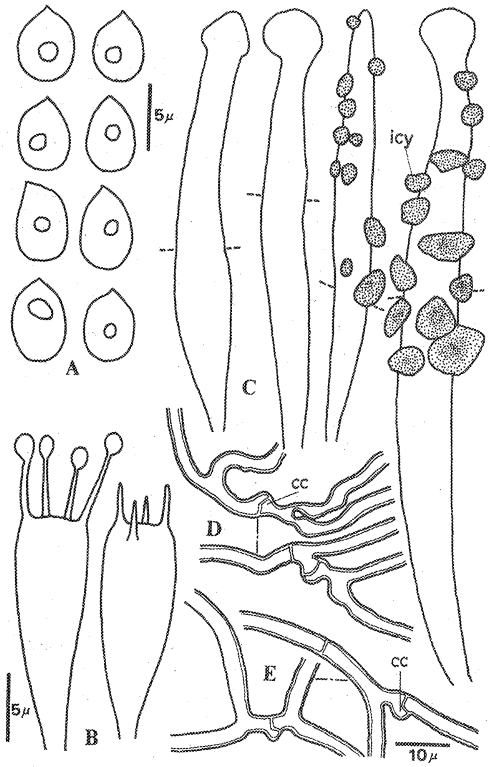


Fig. 45　Microscopic elements of *Hyphodontia sambuci* (Pers.) Erikss. (11243-F)
A : Basidiospores　B : Basidia　C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

subhymenial layer, composed of hyaline, thin-walled, septate, branched with wide angles, with clamps at some septa and not incrusted hyphae of 2.5～4.0μ in diameter (Fig. 45 : E); subhymenial layer 25～60μ thick, very compact and coherent, vertically arranged, mingled with hyaline, thin-walled septate, branched, clamped, not incrusted hyphae of 2.5～4.0μ in diameter (Fig. 45 : D); hymenium even, hyaline, compactly arranged, 25～35μ thick; cystidia abundant, hyaline, cylindrical, 25～50×4～5μ, slightly swelling at the stem, not rooted at the base, only slightly attenuate toward the neck, abruptly expanding toward the tip to form an apical bulb of 2.5～3.0μ in diameter, thin- and smooth-walled, usually incrusted with coarse matter which does not dissolve in 5% KOH, non-septate, without clamps, projecting 10～23μ, cystidial walls do not dissolve in 10% KOH (Fig. 45 : C); Gloeocystidia absent; basidia clavate, 15～20×4.5～5.0μ, with 4 sterigmata of 3～4μ long (Fig. 45 : B); spores oval, apiculate, smooth, hyaline, non-amyloid, 4.5～5.5×3.5～4.5(5.0×3.5)μ, (Fig. 45 : A).

Japanese name : Shiro-kawatake (nom. nov.)

Distribution : Europe, North America, New Zealand and Asia : Kamchatka Peninsula and Japan.

Specimens examined : Mt. Yuwan, Amami Ôshima Is., on bark of living branch of *Chamaecyparis obtusa*, Jan. 18, 1968, Y. H. (11243-F); Bear Is., L. Temagami, T. F. R., Ont. Canada, on *Acer* sp., Aug. 11, 1936, R. Biggs (10772-TRT), (TNS), (Det. by R. Biggs)

Habitat & type of rot : Associated with a white rot of broad leaved tree.

The diagnostic characteristics of this species are thin and whitish fruit bodies, presence of the capitate cystidia and ovate spores.

This species has been reported from Sweden, Germany, Austria, Italy, England, Belgium, France, U. S. A., Canada and New Zealand.

6) ***Amphinema* Karst.**

Bidr. Kaenn. Finl. Nat. Folk 51 : 228, 1892; Hedwigia 32 : 61, 1893; Donk, Taxon 6 : 19, 1957; Erikss., Symb. Bot. Ups. 16(1) : 111, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 228, 1960.

Fruit bodies resupinate, annual, broadly effused, pelliculose, forming mycelial strands; hyphae with clamps; cystidia with clamps; gloeocystidia absent; basidia clavate; spores

hyaline to rarely colored, smooth, non-amyloid.

Habitat & type of rot : Growing on wood associated with a white rot of conifers and broad leaved trees.

Place : Corticiaceae.

Genotype : *Diplonema sordescens* P. Karst.

Japanese name : Watage-kawatake Zoku (nom. nov.)

Amphinema Karst. is characterized by the soft membranous fruit bodies with mycelial strands, and microscopically narrow hyphae branched with wide angles and with clamps at every septum, and clamped cystidia.

Three species recognized in the world. In Japan, only *Amphinema byssoides* (Pers. ex Fr.) Erikss. has been found.

No. 27 ***Amphinema byssoides* (Pers. ex Fr.) Erikss.**

Symb. Bot. Ups. 16(1) : 112, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 228, 1960—*Thelephora byssoides* Pers., Syn. Meth. Fung. p. 577, 1801—*Thelephora byssoides* Pers. ex Fr., Syst. Myc. 1 : 452, 1821—*Corticium byssoideum* (Pers. ex Fr.) Fr., Hym. Eur. p. 659, 1874—*Hypochnus byssoideus* (Pers. ex Fr.) Quél., Bull. Soc. Myc. Fr. 26 : 231, 1879—*Coniophora byssoidea* (Pers. ex Fr.) Karst., Finska Vet.-Soc. Bidrag Natur och Folk 37 : 160, 1882; Sacc., Syll. Fung. 6 : 652, 1888; Burt, Ann. Mo. Bot. Gard. 4 : 263, 1917—*Peniophora byssoides* (Pers. ex Fr.) Bres., in Brinkm., Westf. Prov.-Ver. Jahresbr. 26 : 130, 1898; Hoehn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 117, 1084, 1908; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 390, 1912; Hymén. de Fr. p. 297, 1928; Pilát, Bull. Soc. Myc. Fr. 51 : 418, 1935; Rogers & Jacks., Farlowia 1(2) : 275, 1943; Slysh, Syracuse Univ. Tech. Pub. 83, 48, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 132, 1963; Hayashi, Trans. Myc. Soc. Japan 10(2) : 84, 1969—*Coniophorella byssoidea* (Pers. ex Fr.) Bres., Ann. Myc. 1 : 111, 1903; Sacc., Syll. Fung. 17 : 183, 1905.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, easily separable from the substratum, Buff-Yellow to Colonial Buff, do not change color in KOH, pelliculose, 170～350μ thick; hymenial surface even, downy in appearance, pilose, not cracking; sterile marginal zones concolorous, thinning out, arachnoid, forming mycelial strands of 0.1～0.5 mm in diameter.

Microscopic characteristics : Subiculum compactly arranged next to the substratum, hyphae yellowish, thin-walled, septate, branched, with clamps at every septum, sometimes with granular matter heavily incrusted, 2.5～4.0 (3.8)μ in diameter, mingled with septate hyphae; subhymenium 25～50μ thick, hyphae becoming loosely arranged, similar to subiculum hyphae; hymenium compactly arranged, 37～50μ thick; cystidia abundant, yellowish, cylindrical, immersed or projecting 10～65μ, 45～125×4.0～7.5μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, often finely incrusted, with 1～5 clamp connections at the septa, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia broadly clavate, 14～23×5～9 (14×6)μ, with 4 sterigmata of 2.0～4.0μ long; spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline or pale yellow, non-amyloid, 4.0～6.0×2.0～3.0 (5×3)μ.

Japanese name : Ki'watage-kawatake (Y. Hayashi)

Distribution : Europe, North America, New Zealand and Asia : Japan (Hokkaido, Honshu)

Specimens examined : Nobeyama, Nagano pref., on decaying twigs of *Larix leptolepis*, Nov. 11, 1961, K. A. & Y. H. (11145-F); do., on decaying stem of *Larix leptolepis*, Oct. 15, 1961, K.

A. (11144-F); Numanohara-Sôunkyo, Hokkaido, on bark and wood of decaying *Picea jezoensis*, Sept. 11, 1969, Y. H. & H. F. (11182, 11193, 11250, 11251-F); Nisecharo-Sôunkyo, Hokkaido, on bark and wood of decaying *Picea jezoensis*, Sept. 11, 1969, Y. H. & H. F. (11249-F); Otoineppu, Hokkaido, on bark of decaying *Abies sachalinensis*, Sept. 7, 1969, K. A. • Y. H. & H. F. (11183-F); near Lake Shikotsu, Hokkaido, on bark of *Picea jezoensis*, Sept. 21, 1962, Y. H. (11240-F); Coeur d'Alene, Idaho, U. S. A., June 21, 1916, J. R. Weir (202742-TNS), (TNS), (Det. by E. A. Burt)

Habitat & type of rot : Associated with a white rot of fallen branches and decaying trunks of *Picea*, *Abies* and *Larix*.

The distinctive characteristics of this species are buff cottony fruit bodies and forming concolorous mycelial strands, presence of yellowish and abundantly clamped hyphae, septate and slender cystidia.

7) ***Fibricium*** **Eriksson.**

Symb. Bot. Ups. 16(1) : 112, 1958.

Fruit bodies resupinate, annual, broadly effused, whitish, pelliculose; hyphae dimitic, non-amyloid; cystidia conical to cylindrical, incrusted or not incrusted, cystidial walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate or somewhat urn-shaped; spores smooth, hyaline, non-amyloid.

Habitat & type of rot : Growing on wood associated with a white rot.

Place : Corticiaceae.

Genotype : *Corticium greschikii* Bres.

Japanese name : Shiro-kawatake Zoku (nom. nov.)

Fibricium Eriksson. is characterized by the dimitic hyphal system, somewhat urn-shaped basidia and by having no gloeocystidia and non-amyloid spores.

KEY TO THE SPECIES

1. Fruit bodies pelliculose 2
1. Fruit bodies membranous 5
2. Fruit bodies change color in KOH 3
2. Fruit bodies do not change color in KOH 4
3. Spores ellipsoid, 5~6×2.5~3.0μ ..... No. 28 *F. greschikii*
4. Cystidia clamped, spores cylindrical, 9~11×3.0~3.5μ ..... No. 29 *F. subtestaceum*
4. Cystidia clamped, spores ellipsoid, 7~10×4~5μ ..... No. 30 *F. subcarneum*
5. Fruit bodies do not change color in KOH 6
6. Spores subglobose, 5.5~7.0×5.0~7.0μ ..... No. 31 *F. lauta*

No. 28 ***Fibricium greschikii*** **(Bres.) Eriksson.**

Symb. Bot. Ups. 16(1) : 114, 1958—*Corticium greschikii* Bres., Revue Myc. 12, 109, 1890—*Peniophora greschikii* (Bres.) Bourd. & Galz., Hymén. de Fr. p. 300, 1928; Rogers & Jacks., Farlowia 1(2) : 310, 1943; Slysh, Syracuse Univ. Tech. Pub. 83, 87, 1960.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, Cartridge Buff to Light Buff, turning pale brown in KOH, pelliculose, 160~400μ thick; hymenial surface even, rigid in appearance, pruinose, cracking; sterile marginal zones wide, whitish, thinning out,

fibrillose, without mycelial strands (Plate 3 : L).

Microscopic characteristics : Subiculum hyphae loosely interwoven, yellowish, composed of two kinds of hyphae, the one thin-walled, septate, with clamps and branchings, often bridging, not incrusted, the other thick-walled, septate, without clamps, branching, sometimes bridging, not incrusted, 1.5～3.5μ in diameter (Fig. 47 : F); subhymenial hyphae becoming compactly arranged, similar to the subiculum hyphae (Fig. 47 : E); hymenium compactly arranged, 20～25μ thick; cystidia rare, immersed cystidia fusiform, 20～45×7.5～10μ, not rooted at the base, with obtuse apex, somewhat thick-walled, incrusted with granular matter which does not dissolve in 5% KOH (Fig. 46 : C), protruding cystidia cylindrical, 50～85×5.0～7.5μ, not rooted at the base, tapering, thin- and smooth-walled, with wider lumen, not incrusted, non-septate, without clamps, projecting 15～30μ, cystidial walls do not dissolve in 10% KOH (Fig. 46 : D); gloeocystidia absent; basidia urn-shaped to subclavate, 20～25×3～5μ, with 2～4 sterigmata of 1.5～2.0μ long (Fig. 46 : B); spores ellipsoid, flattened on one side, minutely apiculate, smooth, hyaline, non-amyloid, 5.0～6.0×2.5～3.0 (6×3)μ (Fig. 46 : A).

Japanese name : Ito-kawatake (nom. nov.)

Distribution : Europe, North America and Asia : Japan (Honshu)

Specimen examined : Matsunoyama Niigata pref., on bark of fallen branches of *Acanthopanax sciadophylloides*, Sept. 13, 1964, K. A. & Y. H. (11175-F)

Habitat & type of rot : Associated with a white rot of broad leaved tree.

The diagnostic characteristics of this species are pelliculose and yellowish fruit bodies which turn pale brown in potassium hydroxide solution, and presence of fusiform and cylindrical cystidia.

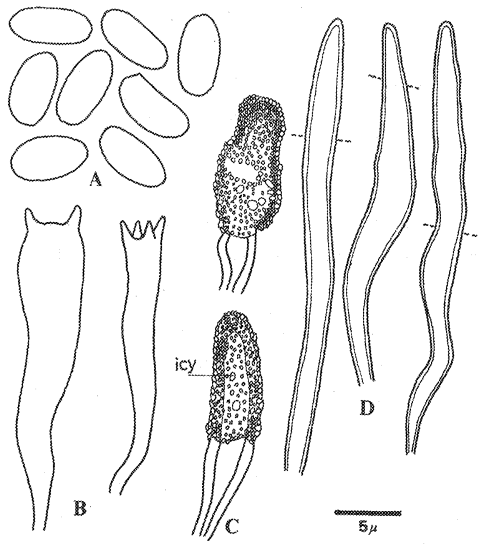


Fig. 46 Microscopic elements of *Fibricium greschikii* (Bres.) Erikss. (11175-F)
A : Basidiospores B : Basidia
C : Immersed cystidia D : Projecting cystidia

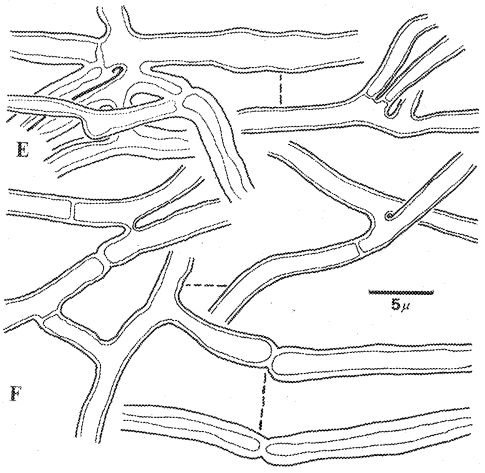


Fig. 47 Microscopic elements of *Fibricium greschikii* (Bres.) Erikss. (11175-F)
E : Subhymenial hyphae
F : Subiculum hyphae

No. 29 ***Fibricium subtestaceum*** (LITSCH.) **HAYASHI, comb. nov.**

Peniophora subtestacea LITSCH., Oesterr. Bot. Zeitschr. 77 : 132, 1928; SLYSH, Syracuse Univ. Tech. Pub. 83, 48, 1960; HAYASHI, Trans. Mycol. Soc. Japan 10(2) : 83, 1969.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Pale Yellow-Orange to Light Buff, do not change color in KOH, pelliculose, 500～1,000μ thick; hymenial surface tuberculate, downy in appearance, pilose, deeply cracking in small patches and showing the white subiculum in the fissures; sterile marginal zones concolorous, thinning out, arachnoid, indeterminate, mycelial strands absent.

Microscopic characteristics : Subiculum 200～600μ thick, composed of longitudinally and loosely arranged hyphae, which are hyaline, non-amyloid, thin- and thick-walled, branched with wide angles, not incrusted, 5.0～7.5μ in diameter, thin-walled hyphae with clamps, thick-walled hyphae without clamps, sometimes thick-walled apical bulb of 5.0～11.5μ in diameter present; subhymenial layer 35～100μ thick, hyphae becoming vertically and compactly arranged toward the hymenium, hyphae hyaline, non-amyloid, thin-walled. septate, with clamps, branched, not incrusted, 3.5～5.0μ in diameter, sometimes thin-walled apical bulb of 5.0～7.5μ in diameter present; hymenium 40～55μ thick, compactly arranged, hill-like, not interrupted at top of a hill; cystidia presence in even and hill-like parts, originating near the subiculum, cylindrical, 60～170×7.5～13.5μ, not rooted at the base, sometimes constricted at the septum, with obtuse apex, incrusted with coarse granules, thick-walled, typically 1～5 septate, often with 1～3 clamps at the septa, projecting 7.5～13.5μ, cystidial walls do not dissolve in 10% KOH; gloeocystidia absent; basidia arise together with cystidia in even and hill-like parts, urn-shaped to subclavate, 15～30×5.0～6.5μ, with 2～4 sterigmata of 5.0～7.5μ long; spores cylindrical, slightly curved, minutely apiculate, smooth, hyaline, non-amyloid 9.0～11.0×3.0～3.5 (10×3)μ.

Japanese name : Ko'ibo-kawatake (Y. HAYASHI)

Distribution : Europe, North America and Asia : Japan.

Specimen examined : Ishihara, Amami Ôshima Is., on decaying stem of *Machilus* sp., Jan. 21, 1968, Y. H. (11142-F)

Habitat & type of rot : Associated with a white rot of *Machilus* sp.

The most distinctive characters of this species are pale yellow, tuberculate and cracking fruit bodies, which have dimitic subiculum and monomitic subhymenial hyphae, clamped cystidia and large spores.

No. 30, *Fibricium subcarneum* HAYASHI is somewhat similar in having dimitic subiculum hyphae and septate, clampet cystidia, but differing in having Seashell Pink-colored and arachnoid fruit bodies, and smaller spores (8×4μ).

No. 30 ***Fibricium subcarneum*** **HAYASHI, sp. nov.**

Fructificatio tenuis, arachnoidea, carnea, 300～400μ crassa; hyphae subiculi non-amyloideae, fibuligerae, dimiticae, crasse et tenuiter tunicatae 4.0～5.0μ et 2.5～5.0μ crassae; cystidia cylindracea, 3～7 septata, 1～3 fibuligera, 80～125×6～9μ; gloeocystidia absentia; basidia subclavata, 23～33×5.0～7.0μ; sterigmata 2～4, arcuatae, 2.5～5.0μ longae; basidiosporae late ellipsoideae, 7～10×4～5μ, hyalinae, laevigatae, non-amyloideae.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Purple to Seashell Pink, do not change color in KOH, pelliculose, 300～

400μ thick; hymenial surface even, downy in appearance, pilose, arachnoid, minutely cracking; sterile marginal zones concolorous, thinning out, fibrillose, without mycelial strands (Plate 3 : M).

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged next to the substratum, then ascending, hyaline, non-amyloid, thin- to thick-walled, septate, rarely clamped, branched with wide angles, not incrusted, thin-walled hyphae 2.5～5.0 (5.0)μ in diameter, thick-walled hyphae 4.0～5.0 (5.0)μ in diameter (Fig. 49 : F); subhymenium 75～100μ thick, hyphae vertically and compactly arranged, hyaline, non-amyloid, thin-walled, septate, with clamps at some septa, branched with wide angles, not incrusted, 2.5～4.0 (3.8)μ in diameter (Fig. 49 : E); hymenium even, compact, hyaline, 40～50μ thick; cystidia rare, cylindrical, 80～125×6～9μ, not rooted at the base, with obtuse apex, rather thick-walled, 3～7 septate, with 1～3 clamp connections at the septa, hyaline, not incrusted, walls do not dissolve in 10% KOH, immersed or projecting 20～90μ above the hymenial surface (Fig. 48 : C); gloeocystidia absent; paraphysis 20～28×5.0～6.5μ (Fig. 49 : D); basidia urn-shaped to subclavate, 23～33×5.0～7.5 (28×6.5)μ, with 4 sterigmata of 2.5～5.0μ long (Fig. 48 : B); spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 7～10×4～5 (8×4)μ (Fig. 48 : A).

Japanese name : Hadairo-kawatake (nom. nov.)

Distribution : Japan (Honshu)

Specimen examined : Kirizumi, Gumma pref., of decaying wood of *Acer* sp. Oct. 2, 1968, Y. H. & H. F. (11097-F)

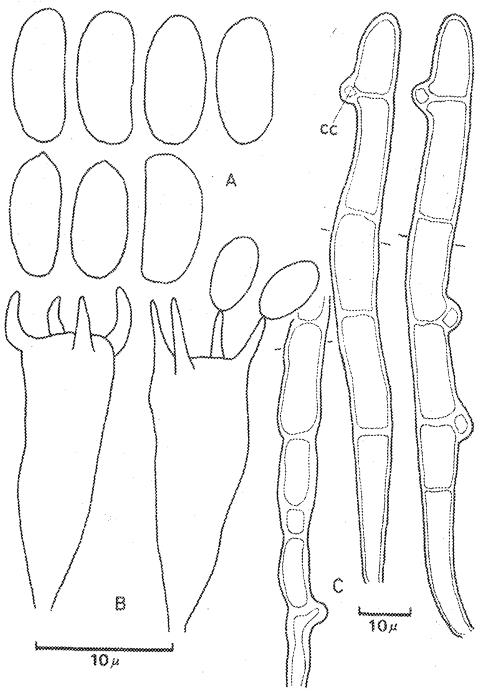


Fig. 48 Microscopic elements of *Fibricium subcarneum* Hayashi, sp. nov. (11097-F)
A : Basidiospores B : Basidia
C : Cystidia

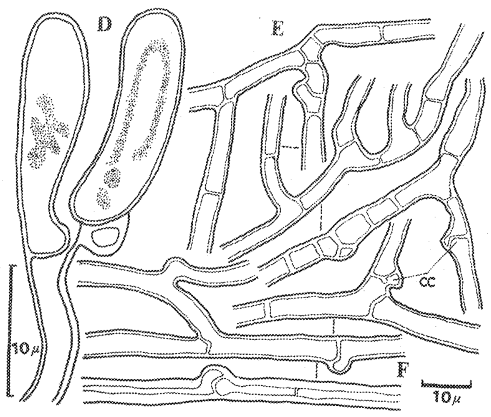


Fig. 49 Microscopic elements of *Fibricium subcarneum* Hayashi, sp. nov. (11097-F)
D : Paraphysis E : Subhymenial hyphae
F : Subiculum hyphae

Habitat & type of rot : Associated with a white rot of *Acer* sp.

The most distinctive characters of this species are its Seashell Pink-colored and arachnoid fruit bodies. Microscopically non-amyloid and dimitic subiculum hyphae, and septate, clamped cystidia are also diagnostic.

No. 27, *Amphinema byssoides* (Pers. ex Fr.) Erikss. is somewhat similar in having clamped cystidia but differs from the present species in having buff membranous fruit bodies, mycelial strands, smaller spores (5×3μ) and thin-walled hyphae with clamps at every septum.

No. 31 ***Fibricium lauta*** **(Jacks.) Hayashi, comb. nov.**

Peniophora lauta Jacks., Canad. Jour. Res. 26(c) : 129, 1948; Slysh, Syracuse Univ. Tech. Pub. 83, 53, 1960.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, more or less easily separable from the substratum, Cartridge Buff, do not change color in KOH, membranous, 150～250μ thick; hymenial surface even, downy in appearance, pruinose, not cracking; sterile marginal zones concolorous, thinning out, without mycelial strands (Plate 4 : A).

Microscopic characteristics : Without an obvious subiculum, hyphae vertically and loosely interwoven, hyaline, mostly thin-walled, septate, with clamps, branched, not incrusted, 3.5～5.0 (5.0)μ in diameter, mingled with thick-walled, septate, without clamps, branched, not incrusted hyphae (Fig. 50 : D); without subhymenial layer; hymenium compactly arranged, hyaline, 40～50μ thick; cystidia rare, hyaline, cylindrical, immersed or projecting 20～50μ, 80～115×7.5～10.0μ, not rooted at the base, tapering toward the apex, thin-walled, with wider lumen, not incrusted, non-septate, without clamps, walls do not dissolve in 10% KOH (Fig. 50 : C); gloeocystidia absent; basidia urn-shaped to clavate, 20～25×6.5～7.0μ, with 4 sterigmata of 5.0～6.5μ long (Fig. 50 : B); spores subglobose, minutely apiculate, smooth, hyaline, non-amyloid, 5.5～7.0×5.0～7.0 (6.5×6.5)μ, (Fig. 50 : A).

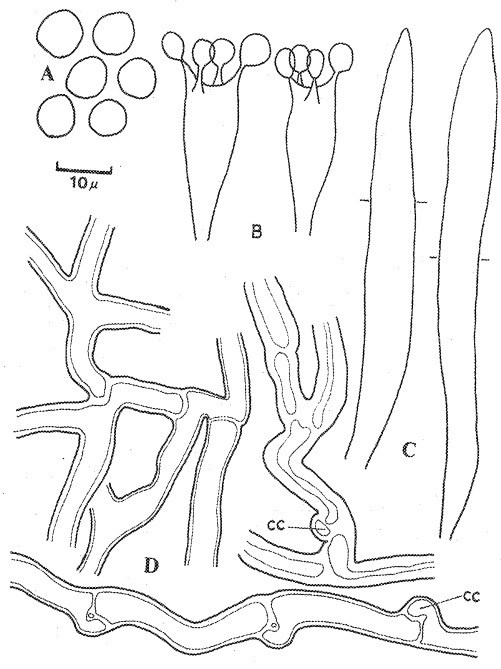


Fig. 50 Microscopic elements of *Fibricium lauta* (Jacks.) Hayashi, comb. nov. (11180-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subiculum hyphae

Japanese name : Kona-kawatake (nom. nov.)

Distribution : North America and Asia : Japan (Hokkaido)

Specimen examined : near Lake Shikotsu, Hokkaido, on decaying trunk of *Picea jezoensis*, Sept. 19, 1962, Y. H. (11180-F)

Habitat & type of rot : Associated with a white rot of conifers and broad leaved trees.

The diagnostic characteristics of this species are pale yellow, very thin and typically pelliculose fruit bodies which have unique hyphae and globose spores.

Jackson[92] collected on wood of *Thuja*

and broad leaved trees in Ontario, Canada and Oregon, U. S. A. In Japan, the author collected once on *Picea* in Hokkaido. It seems likely to be a boreal species.

8) ***Membranicium*** **Erikss.**

Symb. Bot. Ups. 16(1) : 115, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 180, 1960.

Fruit bodies resupinate, annual, membranaceous; subiculum hyphae without clamps, subhymenial layer compactly arranged; cystidia fusiform to cylindrical, non-septate, without clamps, cystidial walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate; basidiospores ellipsoid, smooth, hyaline, non-amyloid.

Habitat & type of rot : Growing on wood associated with a white rot of broad leaved trees and conifers.

Place : Corticiaceae.

Genotype : *Peniophora cremea* Bres.

Japanese name : Maku-kawatake Zoku (nom. nov.)

Oxidase reaction : Mostly positive.

The most important concepts of the genus *Membranicium* Erikss. are membranous fruit bodies and subiculum hyphae without clamps.

Donk[66] proposed that *Phanerochaete* Karst. em. Donk was a valid name for *Membranicium* Erikss.

KEY TO THE SPECIES

1. Fruit bodies change color in KOH 2
1. Fruit bodies do not change color in KOH 5
2. Mycelial strands present 3
2. Mycelial strands absent 4
3. Fruit bodies turning wine-red in KOH ..... No. 32 *M. filamentosum*
3. Fruit bodies turning Army Brown in KOH ..... No. 33 *M. sulphurinum*
3. Fruit bodies bleached in KOH, in section yellowish ..... No. 34 *M. sanguineum*
3. Fruit bodies bleached in KOH, in section brownish ..... No. 35 *M. martianum*
4. Fruit bodies orange, turning brown in KOH ..... No. 36 *M. viticola*
4. Fruit bodies pink, turning brown in KOH ..... No. 37 *M. versicolor*
4. Fruit bodies turning blue in KOH, in section yellowish ..... No. 38 *M. carnosa*
4. Fruit bodies turning purple in KOH, in section yellowish brown ..... No. 39 *M. ravenelii*
4. Fruit bodies turning purple in KOH, in section hyaline ..... No. 40 *M. flavido-alba*
5. Mycelial strands present ..... No. 41 *M. niveum*
5. Mycelial strands absent ..... No. 42 *M. cremeum*

No. 32 ***Membranicium filamentosum*** **(Berk. & Curt.) Christiansen**

Dansk Bot. Ark. 19(2) : 183, 1960—*Corticium filamentosum* Berk. & Curt., Grevillea 1 : 179, 1873; Sacc., Syll. Fung. 6 : 619, 1888—*Peniophora filamentosa* (Berk. & Curt.) Burt, in Coker, Jour. Elisha Mitchell Sci. Soc. 36 : 162, 1921; Burt, Ann. Mo. Bot. Gard. 12 : 320, 1926; Bourd. & Galz., Hymén. de Fr. p. 311, 1928; T. Ito, Bot. Mag. Tokyo 43 : 521, 1929; Talbot, Bothalia 6 : 23, 1951; S. Ito, Myc. Fl. Japan 2(4) : 114, 1955; Cunn., Trans. Royal Soc. N. Z. 83 : 279, 1955; Slysh, Syracuse Univ. Tech. Pub. 83, 67, 1960; Cunn., N. Z. Dept. Sci. Industr. Res. Bull.

145, 126, 1963; Parmasto, Inves. Natural Hist. Soviet Far East p. 242, 1963—*Phanerochaete filamentosa* (Berk. & Curt.) Donk, Persoonia 2(2) : 223, 1962.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, easily separable from the substratum, Seashell Pink to Pale Ochraceous-Salmon, turning Daphne Pink to Deep Hellebore Red in KOH, membranous, 300～1,000μ thick; hymenial surface even, downy in appearance, pilose, cracked and showing the brownish subiculum in the fissures; sterile marginal zones Bittersweet Pink, thinning out, fibrillose or rhizomorphic, curling away from the substratum, forming mycelial strands, concolorous, 0.2～1.3 mm in diameter (Plate 4 : B).

Microscopic characteristics : Subiculum 100～500μ thick, hyphae loosely interwoven, hyaline (in section pale yellowish brown), thin-walled, septate, without clamps, branched, with bridging hyphae, abundantly incrusted with brownish granules which dissolve quickly in 5% KOH, 3.0～6.5 (5.0) μ in diameter (Fig. 52 : E); subhymenium 40～100μ thick, composed of compactly arranged hyphae, which are hyaline, thin-walled, septate, without clamps, branched, incrusted with brownish granules which dissolve quickly in 5% KOH, 2.5～6.5 (4.0) μ in diameter (Fig. 51 : D); hymenium compactly arranged, hyaline, 20～45μ thick; cystidia abundant, hyaline, fusiform, immersed or projecting 10～40μ, 40～70×5～12μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, with wider lumen, heavily incrusted with granular matter which dissolves in 5% KOH, non-septate, without clamps, cystidial walls do not dissolve in 10% KOH (Fig. 51 : C); gloeocystidia absent; basidia broadly clavate, 13～15×4.5～6.5μ, with 2～4 sterigmata of 4～5μ long (Fig. 51 : B); spores ellipsoid, apiculate, smooth, hyaline non-

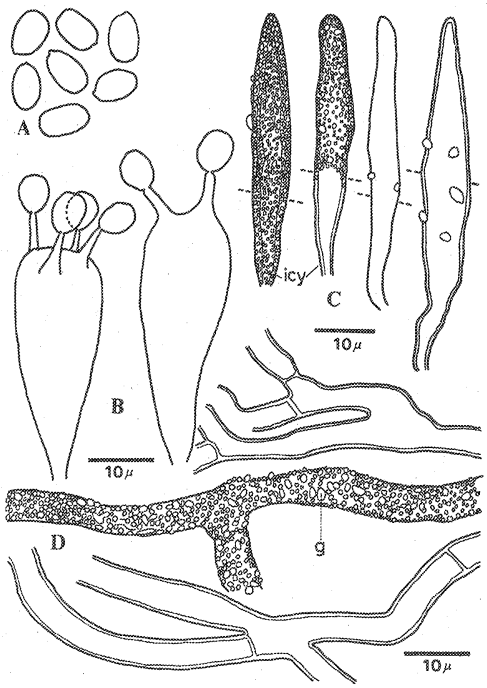


Fig. 51 Microscopic elements of *Membranicium filamentosum* (Berk. & Curt.) Christiansen (11048-F)
A : Basidiospores　B : Basidia　C : Cystidia
D : Subhymenial hyphae

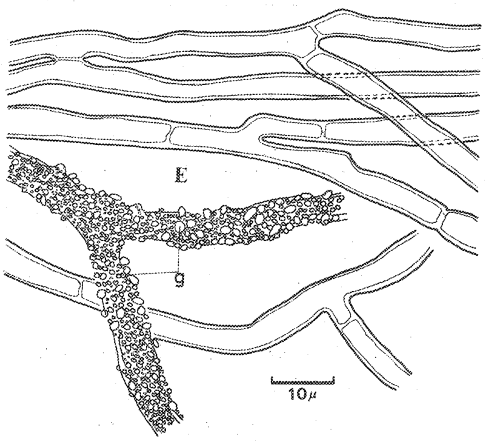


Fig. 52 Microscopic element of *Membranicium filamentosum* (Berk. & Curt.) Christiansen (11048-F)
E : Subiculum hyphae

amyloid, 3~4×2.0~2.5 (3.5×2.0) μ (Fig. 51 : A).

Japanese name : Ki'himo-kawatake (nom. nov.)

Distribution : North America, Europe, South Africa, New Zealand and Asia : Japan (Honshu and Kyushu)

Specimens examined : Kozagawa, Wakayama pref., on bark of fallen branches of *Myrica ?rubra*, July 30, 1967, H. F. (11048, 11179-F); Uchizume, Kagoshima pref., on bark of decaying trunks of broad leaved tree, Oct. 18, 1963, K. A. & H. F. (10241-F); Asakawa, Tokyo, on fallen branches of *Castanopsis* sp., July 29, 1966, Y. H. & H. F. (10774-F); do., Nov. 7, 1968, H. F. (11099-F); Kawakami, Mie pref., on decaying trunk of broad leaved tree, Sept. 7, 1965, K. A.・Y. H. & H. F. (10801-F); Ashu, Kyoto pref., on bark of fallen branches of *Quercus* sp., July 26, 1968, K. A. & Y. H. (11069-F); do., on bark of decaying trunk of broad leaved tree, July 27, 1968, K. A. & Y. H. (11070, 11071, 11072-F); do., on bark at the root of living broad leaved tree, July 27, 1968, K. A. & Y. H. (11077-F); Agematsu, Nagano pref., on decaying stem of *Quercus* sp., Aug. 20, 1962, K. A.・Y. H. & H. F. (11074-F); Nobeyama, Nagano pref. on decaying trunk of broad leaved tree, Nov. 1961, K. A. & Y. H. (11075-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees giving yellowish colorations to the affected woods.

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 30°C slow, with mat having a diameter of 32 mm after five days (Table 2), 90 mm after eleven days; silky at first, spreading as a thin, adherent, usually with the surface growth, loose, cottony, sometimes forming mycelial strands; upper surface of mat at first pale yellow then Orange-Buff, the underside of the mat white to pale yellow; culture having a distinct, sharp, fruity odor; the oxidase reaction positive on gallic acid and tannic acid media, the mycelium shows no growth on gallic acid medium and failing on tannic acid medium (Table 3).

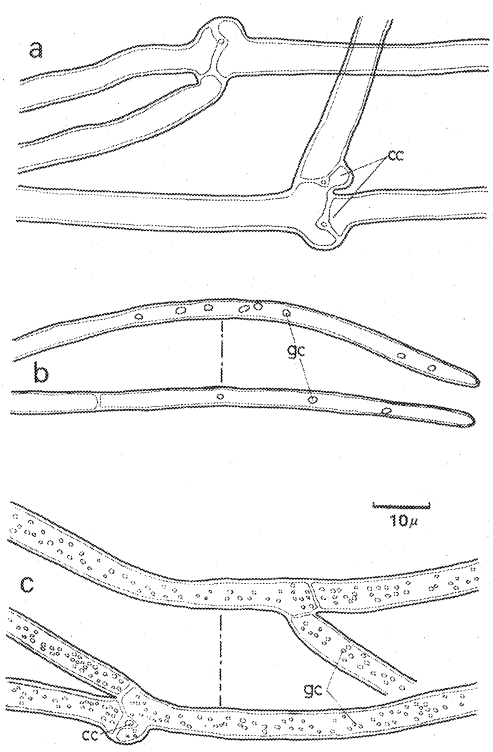


Fig. 53 Mycelium from cultures of *Membranicium filamentosum* (Berk. & Curt.) Christiansen (A1 70a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

Microscopic characters—Aerial mycelium : hyphae pale yellow, thin-walled, septate, the clamp connections with numerous branches originating at and between septa, heavily incrusted with granular matter which quickly dissolves by the action of 5% KOH, 4.0~6.5 μ in diameter (Fig. 53 : a). Advancing zone : hyphae yellowish brown, thin-walled, septate, with granular contents, heavily incrusted with granular matter which quickly dissolves in 5% KOH, 2.5 μ in diameter (Fig. 53 : b). Submerged mycelium : hyphae as in aerial hyphae, 4.0~9.0 μ

in diameter (Fig. 53 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 1 day.

This species is usually collected on wood of *Quercus* and *Castanopsis*, and recognized in forming mycelial strands, and in having a yellowish brown fruit body which turns wine-red in potassium hydroxide solution.

Peniophora filamentosa (Berk. & Curt.) Burt—Ki-kawatake was reported by T. Ito[91] for the first time in Japan based on the specimen in Yasuda Herbarium (Collected by N. Nakayama, at Hida, Ôita pref., Sept. 12, 1920), but in this report, T. Ito presented the same Japanese name to *Peniophora filamentosa* (Berk. & Curt.) Burt and *Peniophora similis* (Berk. & Curt.) Mass. S. Ito[90] reported *Peniophora filamentosa* (Berk. & Curt.) Burt—Ki'himo-kawatake according to Yasuda, but the description of this species of Yasuda is lacking.

Burt[41] determined the specimen of the Yasuda Herbarium No. 113 (Mo. Bot. Gard. Herb. No. 59463) as *Peniophora filamentosa* (Berk. & Curt.) Burt.

No. 19, *Peniophora burtii* Romell, No. 33, *Membranicium sulphurinum* (Karst.) Hayashi and No. 34, *Membranicium sanguineum* (Fr.) Erikss. are similar in having mycelial strands but easily distinguished macroscopically in having different color reactions in potassium hydroxide solution.

No. 33 ***Membranicium sulphurinum* (Karst.) Hayashi, comb. nov.**

Tomentella sulphurina Karst., Finl. Nat. Folk Bidr. 48 : 420, 1889—*Hypochnus sulphurinus* (Karst.) Sacc., Syll. Fung. 9 : 243, 1891—*Peniophora sulphurina* (Karst.) Hoehn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 115, 1573, 1906; Slysh, Syracuse Univ. Tech. Pub. 83, 62, 1960; Hayashi, Trans. Mycol. Soc. Japan 10(2) : 86, 1969—*Phanerochaete sulphurina* (Karst.) Donk, Persoonia 2(2) : 223, 1962.

Macroscopic characteristics : Fruit bodies resupinate, longitudinally effused, not easily separable from the substratum, Massicot Yellow to Ivory Yellow, turning Army Brown in KOH, pelliculose, 150～350μ thick; hymenial surface rigid in appearance, pruinose, cracked and showing the pale yellow subiculum in the fissures; sterile marginal zones concolorous, thinning out, fibrillose or rhizomorphic, forming mycelial strands, concolorous, 0.05～0.1 mm in diameter.

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged, pale yellow, mostly thin-walled, septate, without clamps, branched with wide angles, heavily incrusted with granular matter which dissolves quickly in 5% KOH, 4.0～7.5μ in diameter, mingled with few thick-walled and septate hyphae; subhymenium 18～25μ thick, composed of compactly interwoven hyphae, which are pale yellow, thin-walled, septate, without clamps, branched, heavily incrusted with granular matter which dissolves quickiy in 5% KOH, 2.5～4.0μ in diameter; hymenium compactly arranged, pale yellow, 25～40μ thick; paraphysis 15～20×3.0～4.5μ; cystidia frequent, hyaline, cylindrical, 25～40×4～5μ, not rooted at the base, with obtuse apex, thin- to thick- and smooth-walled, with wider lumen, not incrusted or heavily incrusted with granular matter which dissolves in 5% KOH, non-septate, without clamps, immersed or projecting 10～18μ, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 15～18×5.0～5.5μ, sterigmata of 3.0～3.5μ long; spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 4.5～5.0×2.0～2.5μ.

Japanese name : Awaki'himo-kawatake (Y. Hayashi)

Distribution : North America, Europe and Asia : India and Japan.

Specimen examined : The Outer Gardens of the Meiji Shrine, Tokyo, on bark of fallen branches of *Cyclobalanopsis myrsinaefolia*, Aug. 2, 1968, K. A. & T. K. (11080-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C very rapid, with mat having a diameter of 90 mm after five days (Table 2); silky at first, adherent, nodulose masses of hyphae abundant on the surface of the medium, thickened and woolly over the inoculum block, forming a very thick felty growth that becomes gradually thinner toward the margin, with the marginal region thin; upper surface of mat at first white, then Sulphur-Yellow, the underside of the mat at first white, but showing a delicate tinge of salmon color; culture having a distinct, muscovado sugar odor; the oxidase reaction positive on gallic acid medium and strongly positive on tannic acid medium, with mycelial growth failing on gallic acid medium and the mycelium profuse on tannic acid medium (Table 3).

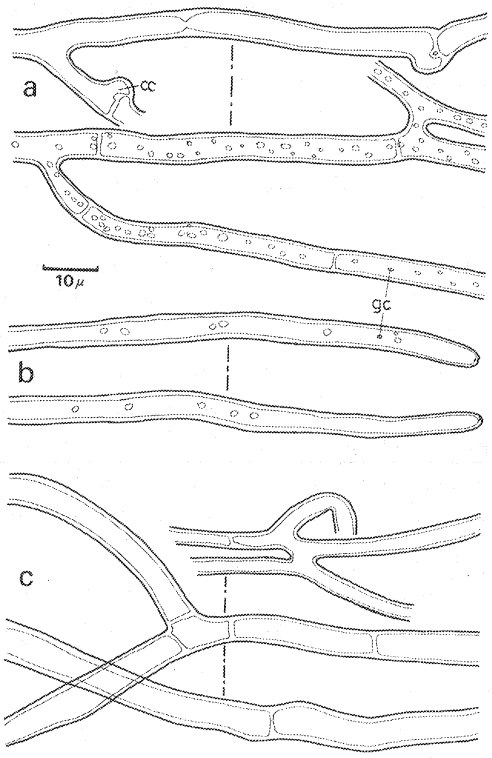


Fig. 54 Mycelium from cultures of *Membranicium sulphurinum* (Karst.) Hayashi, comb. nov. (Al 71a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

Microscopic characters—Aerial mycelium : hyphae pale yellow, thin-walled, septate, with clamps, branching with wide angles, with granular contents, sometimes incrusted with granular matter, 4.0~5.0μ in diameter (Fig. 54 : a). Advancing zone : hyphae pale yellow, thin-walled, with granular contents, 2.5~4.0μ in diameter (Fig. 54 : b). Submerged mycelium as in aerial mycelium (Fig. 54 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 10 days.

The distinctive characteristics of this species are its sulphur-yellow fruit bodies which turn dark violet in potassium hydroxide solution and forming concolorous mycelial strands.

No. 32, *Membranicium filamentosum* (Berk. & Curt.) Christiansen is somewhat similar microscopically but differs in the color of the fruit body which changes when treated with potassium hydroxide solution.

No. 34, *Membranicium sanguineum* (Fr.) Eriksss. is also similar in having mycelial strands but differs in having Salmon-Orange fruit body which bleached in potassium hydroxide solution, and microscopically in having not incrusted hyphae and cystidia.

No. 34 ***Membranicium sanguineum*** **(FR.) ERIKSS.**

Symb. Bot. Ups. 16(1) : 116, 1958; CHRISTIANSEN, Dansk Bot. Ark. 19(2) : 181, 1960—*Thelephora sanguinea* FR., Elench. Fung. 1 : 203, 1828—*Corticium sanguineum* FR., Epicr. Myc. p. 561, 1836～1838; BERK., Outl. p. 273, 1860; FR., Hym. Eur. p. 650, 1874; SACC., Syll. Fung. 6 : 612, 1888; QUÉL., Flore Myc. p. 9, 1888; WAKEF., Trans. Brit. Myc. Soc. 4 : 119, 1913—*Peniophora sanguinea* (FR.) HOEHN. & LITSCH., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 115 : 1588, 1906; BOURD. & GALZ., Bull. Soc. Myc. Fr. 28 : 395, 1912; BURT, Ann. Mo. Bot. Gard. 12 : 274, 1926; BOURD. & GALZ., Hymén. de Fr. p. 312, 1928; ROGERS and JACKS., Farlowia 1(2) : 319, 1943; SLYSH, Syracuse Univ. Tech. Pub. 83 : 61, 1960; HAYASHI & AOSHIMA, Trans. Mycol. Soc. Japan 7(2・3) : 154, 1966—*Phanerochaete sanguinea* (FR.) DONK, Persoonia 2(2) : 223, 1962.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Mars Orange when young, Salmon Orange to Orange-Pink, bleached in KOH, pelliculose, 250～500μ thick; hymenial surface even, downy in appearance, farinose, cracked and showing the shiny subiculum in the fissures; sterile marginal zones concolorous, thinning out, fibrillose, extending into branching mycelial strands, concolorous, up to 1 mm in diameter and 10 cm long.

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged, slightly yellowish brown which bleached in 5% KOH, thin-walled, septate, without clamps, branched with wide angles, not incrusted, 2.5～7.5μ in diameter, sometimes constricted at the septa and bridging hyphae present; subhymenium 130～160μ thick, composed of vertically and compactly arranged yellowish-brown hyphae, which bleached in 5% KOH, thin-walled, septate, without clamps, branched, not incrusted, 2.5～5.0μ in diameter; between subiculum and subhymenium very compact, red colored and 15～25μ thick layer present; hymenium loosely arranged, 130～160μ thick; cystidia frequent, fusiform, hyaline, projecting 15～40μ, 30～60×4.0～6.5μ, not rooted at the base, flexuous, thin-walled, with wider lumen, not incrusted, non-septate, without clamps, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 25～30×5.0～6.5μ, with 2～4 sterigmata of 5.0～6.5μ long; spores ellipsoid, minutely apiculate, smooth, hyaline, non-amyloid 5.0～6.5×2.5 (5.0×2.5)μ.

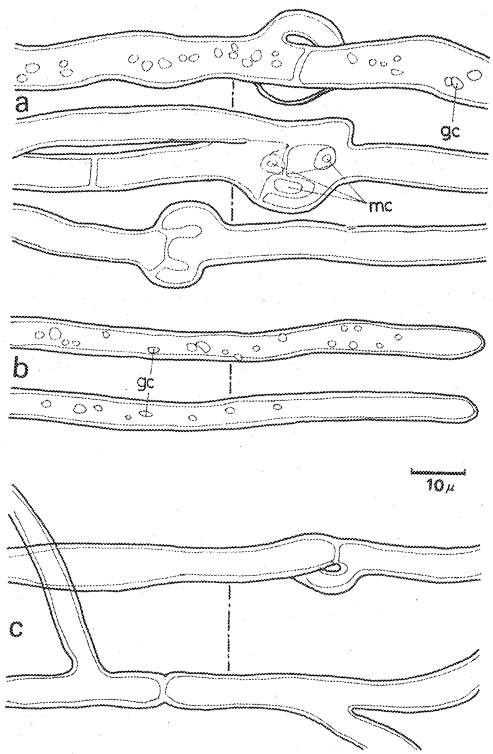


Fig. 55 Mycelium from cultures of *Membranicium sanguineum* (FR.) ERIKSS. (Al 74a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

Japanese name : Masuiro-kawatake (Y. HAYASHI & K. AOSHIMA)

Distribution : Europe, North America and Asia : Japan (Honshu)

Specimens examined : Ôsugidani, Mie pref., on decaying trunk of *Quercus* sp., Sept.

20, 1965, K. A. • Y. H. & H. F. (10709-F); Kirizumi, Gumma pref., on decaying trunk of *Quercus* sp., Oct. 2, 1968, Y. H. & H. F. (11094-F); Ebino, Miyazaki pref., of decaying trunk of broad leaved tree, Nov. 9, 1967, T. K. (11143-F)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C slow, with mat having a diameter of 30 mm after five days (Table 2), 90 mm after eleven days; silky at first, fragile, then spreading outward as a flat cottony growth marked by radiating strands; upper surface of mat entirely white; the underside of the mat white; culture odorless, or with a faint sweet odor; the oxidase reaction positive on gallic acid and tannic acid media, the mycelium shows no growth on gallic acid medium and profuse on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae very thick, hyaline, thin-walled, septate, branched, with multiple clamp connections, with granular contents, 7.5~10.0μ in diameter (Fig. 55 : a). Advancing zone : hyphae hyaline, thin-walled, with granular contents, 4.0μ in diameter (Fig. 55 : b). Submerged mycelium : hyphae hyaline, thin-walled, septate, with clamps and branching with wide angles, 5.0~7.5μ in diameter (Fig. 55 : c).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 3 days.

This species is characterized by the unique color of the hymenial surface, having concolorous mycelial strands and forming a red colored layer between the subiculum and subhymenium.

No. 17, *Peniophora burtii* Romell is somewhat similar in having mycelial strands but it has colorless subiculum in section which does not change color in potassium hydroxide solution, and clamped subiculum hyphae.

No. 32, *Membranicium filamentosum* (Berk. & Curt.) Christiansen are also similar in having mycelial strands but it has yellowish brown color in section which changes into wine-red when treated with potassium hydroxide solution, and in having hyphae incrusted with brownish granules.

No. 35 ***Membranicium martianum* (Berk. & Curt.) Hayashi, comb. nov.**

Corticium martianum Berk. & Curt., Grevillea 1 : 179, 1873; Sacc., Syll. Fung. 6 : 633, 1888; Mass., Jour. Linn. Soc. 27 : 144, 1891—*Peniophora martiana* (Berk. & Curt.) Burt, Ann. Mo. Bot. Gard. 12 : 330, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 65, 1960; Hayashi & Aoshima, Trans. Mycol. Soc. Japan 4(6) : 156, 1964.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, more or less easily separable from the substratum, Grenadine Pink to Ferruginous, bleached in KOH, pelliculose, 100~300μ thick; hymenial surface rigid, farinose, deeply cracked and showing the yellowish, fibrillose subiculum in the fissures; sterile marginal zones concolorous, fibrillose or rhizomorphic, forming concolorous mycelial strands, 0.2~0.6 mm in diameter.

Microscopic characteristics : Hyphae of subiculum longitudinally and somewhat loosely arranged next to the substratum, yellowish brown, mostly thin-walled, septate, without clamps, branched with wide angles, not incrusted, 3.5~8.0μ in diameter, mingled with few thick-walled hyphae of 3.5~7.0μ in diameter and with sometimes constricted to 1.0~3.5μ in diameter; subhymenium composed of vertically and compactly arranged hyphae, similar to subiculum hyphae, thin-walled hyphae 1.0~4.5μ, thick-walled hyphae 3.5~5.5μ and with constricted to

1.0μ in diameter; cystidia abundant, hyaline, cylindrical to fusiform, 40～72×2.5～7.0μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, with wider lumen, incrusted with coarse granules, non-septate, without clamps, projecting 5.5～18μ, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 18～42×3.5～7.0μ, with 4 sterigmata of 3～4μ long; spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 4.5～7.0 ×2.0～3.0μ.

Japanese name : Shu-kawatake (Y. Hayashi & K. Aoshima)

Distribution : North America and Asia : Japan (Honshu)

Specimens examined : Mt. Fuji, Yamanashi pref., on bark of decaying branch of broad leaved tree, Aug. 1955, K. A. (10092-F); Nobeyama, Nagano pref., on decaying trunk of *Larix leptolepis*, Nov. 1961, K. A. & Y. H. (11177-F); Kirizumi, Gumma pref., on stump of *Aesculus turbinata*, Oct. 2, 1968.

Habitat & type of rot : Associated with a white rot of *Larix* and broad leaved trees.

The diagnostic characteristics of this species are blood-red colored fruit bodies and forming concolorous mycelial strands.

No. 36, *Membranicium viticola* (Schw.) Hayashi is somewhat similar in texture but differs in having no mycelial strands, soft and orange colored fruit bodies and presence of incrusted hyphae in subiculum.

No. 36 ***Membranicium viticola* (Schw.) Hayashi, comb. nov.**

Thelephora viticola Schw., Leipzig Naturforsch. Ges. Schr. 1 : 107, 1822—*Corticium viticola* (Schw.) Fr., Epicr. Myc. p. 561, 1836～1838; Mass., Jour. Linn. Soc. 27 : 146, 1891—*Peniophora viticola* (Schw.) Hohn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 116 : 779, 1907; Burt, Ann. Mo. Bot. Gard. 12 : 322, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 60, 1960; Hayashi & Aoshima, Trans. Mycol. Soc. Japan 4(6) : 155, 1964—*Phanerochaete viticola* (Schw.) Parmasto, Eesti NSV Tead. Akad. Toim., Biol. 16, 388, 1967.

Macroscopic characteristics : Fruit bodies resupinate, forming small patches then confluent or remaining more or less discrete, not easily separable from the substratum, Ochraceous-Orange, turning Claret Brown at first finally bleached in KOH, pelliculose, 200～900μ thick; hymenial surface even, downy in appearance, pruinose, cracked, sterile marginal zones wide, Yellow Ocher, thinning out and indeterminate, radiately fibrillose, without mycelial strands.

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged next to the substratum, yellowish brown, mostly thin-walled, septate, without clamps, branched with wide angles, abundantly incrusted with brownish granules which dissolve quickly in 5% KOH, 2.5～4.5μ in diameter, mingled with few thick-walled hyphae of 3.5～5.5μ in diameter and constricted to 1.0～2.0μ in diameter; subhymenium 50～270μ thick, composed of vertically and compactly arranged hyphae, similar to the subiculum hyphae, thin-walled hyphae 2.0～3.5μ, thick-walled hyphae 2.5～4.5μ and constricted to 1.0～3.0μ in diameter; hymenium compactly arranged, cream colored, 27～36μ thick; cystidia hyaline, clavate, immersed or projecting up to 50μ, 25～60×5～6μ, not rooted at the base, with obtuse or rarely flexuous apex, thin- and smooth-walled, not incrusted, with wider lumen, non-septate, without clamps, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 18～47×4.5～7.0μ, with 4 sterigmata of 3～4μ long; spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 7～9×4.5～6.5 (8×4.5)μ.

Japanese name : Hiiro-kawatake (Y. Hayashi & K. Aoshima)

Distribution : Europe, North America and Asia : Japan (Honshu)

Specimens examined : Kamikôchi, Nagano pref., on bark of decaying *Abies veitchii*, Aug. 1951, K. A. (2952-F) ; Ôshika, Nagano pref., on bark of decaying *Betula* sp., Aug. 20, 1950, K. A. (10094-F) ; Numata, Gumma pref., on bark of decaying *Abies firma*, Aug. 1956, K. A. (10095-F).

Habitat & type of rot : Associated with a white rot of coniferous and broad leaved trees.

This species is readily recognized by its orange colored and membranous fruit bodies.

No. 35, *Membranicium martianum* (Berk. & Curt.) Hayashi is somewhat similar in having same color and texture of the fruit body but differs from the present species in having smaller spores (4.5~7.0×2~3μ), and thin (100~300μ thick) fruit bodies.

According to Burt[41], he collected on decaying barks and woods of *Vitis, Abies, Acer* and *Fagus*.

No. 37 ***Membranicium versicolor* (Bres.) Hayashi, comb. nov.**

Corticium versicolor Bres., Fungi Trid. 2 : 61, 1898—*Peniophora versicolor* (Bres.) Sacc. & Syd., Syll. Fung. 16 : 193, 1902; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 403, 1912; Yasuda, Bot. Mag. Tokyo 34 : 195, 1920; Shirai & Hara, List. Jap. Fungi p. 246, 1927; Bourd. & Galz., Hymén. de Fr. p. 322, 1928; T. Ito, Bot. Mag. Tokyo 43 : 521, 1929; Hemmi & Akai, Wood Rotting Fungi p. 230, 1945; Erikss., Symb. Bot. Ups. 10(5) : 18, 1950; S. Ito, Myc. Fl. Japan 2(4) : 117, 1955.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Seashell Pink to Light Ochraceous-Salmon, turning Amber Brown in KOH, waxy, 65~180μ thick; hymenial surface even, downy in appearance, pruinose, deeply cracked and showing the concolorous subiculum in the fissures; sterile marginal zones wide, concolorous, thinning out, radiately fibrillose, without mycelial strands (Plate 4 : C).

Microscopic characteristics : Subiculum 70~140μ thick, composed of very compact and gelatinized hyphae, mingled with few pale yellowish brown, thin-walled, septate, without clamps, branched, not incrusted hyphae of 4.0~5.0μ in diameter (Fig. 56 : D) ; subhymenial layer absent; hymenium even, compactly arranged, yellowish brown, 40~60μ thick; cystidia very abundant throughout the hymenium and subiculum, fusiform to cylindrical, 25~38×9.0~11.5μ, not rooted at the base, with obtuse apex, thick- and smooth-walled, heavily incrusted with granular matter or not incrusted, with wider lumen, non-septate, without clamps, immersed or projecting 7~25μ, walls do not dissolve in 10% KOH (Fig. 56 : C) ; gloeocystidia absent; basidia clavate, 25~35×7.5~12.5μ, with 4 sterigmata of 5μ long (Fig. 56 : B) ; spores ellipsoid, flattened on one side, prominently apiculate, smooth, hyaline non-

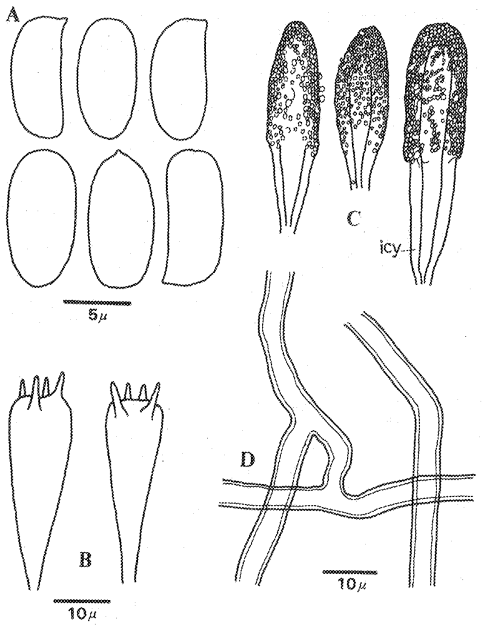


Fig. 56 Microscopic elements of *Membranicium versicolor* (Bres.) Hayashi, comb. nov. (202733-TNS)
A : Basidiospores B : Basidia C : Cystidia
D : Subiculum hyphae

amyloid, 9～10×4～5 (9×4)μ (Fig. 56 : A).

Japanese name : Sabi-kawatake (A. Yasuda)

Distribution : Europe (known only from Italy and France) and Asia : Japan (Awaji Is.)

Specimen examined : Mt. Mikuma, Awaji Is., Hyogo pref., on broad leaved tree, Feb. 4, 1919, J. Matsuzawa (202733-TNS, Yasuda Herb. No. 78)

Habitat & type of rot : Associated with a white rot of broad leaved trees.

This species is characterized by somewhat waxy and pinkish to salmon fruit bodies which turns brown in potassium hydroxide solution, and microscopically by the cystidia scattered throughout the section.

No. 38 ***Membranicium carnosa*** **(Burt) Hayashi, comb. nov.**

Peniophora carnosa Burt, Ann. Mo. Bot. Gard. 12 : 325, 1926; Talbot, Bothalia 7 : 147, 1958; Slysh, Syracuse Univ. Tech. Pub. 83, 68, 1960; Hayashi & Aoshima, Trans. Mycol. Soc. Japan 7(2・3) : 156, 1966—*Phanerochaete carnosa* (Burt) Parmasto, Eesti NSV Tead. Akad. Toim., Biol., 16, 388, 1967.

Macroscopic characteristics : Fruit bodies resupinate, widely effused, not easily separable from the substratum, Naples Yellow to Hay's Green, turning Lily Green in KOH, membranous, 300～800μ thick; hymenial surface even, firm in appearance, pilose, cracked and showing the fibrillose subiculum in the fissures; sterile marginal zones concolorous, thinning out, fibrillose, mycelial strands absent.

Microscopic characteristics : Hyphae of subiculum longitudinally and loosely arranged next to the substratum, then ascending, pale yellow, thin-walled, septate, without clamps, branched, incrusted with granular matter which dissolves in 5% KOH, 4.0～6.5μ in diameter; hyphae of subhymenium vertically and very compactly arranged, pale yellow, similar to subiculum hyphae; hymenium even, compactly arranged, pale yellow, 40～60μ thick; cystidia abundant, fusiform to cylindrical, projecting 13～38μ, 45～65×5.0～7.5μ, not rooted at the base, with obtuse apex, thin- and smooth-walled, with wider lumen, non-septate, without clamps, not incrusted, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 30～38×5.0～6.5μ, with 4 sterigmata of 3～4μ long; spores ellipsoid, minutely apiculate, smooth, hyaline, non-amyloid, 5.0～6.5×2.5～4.0 (5×4)μ.

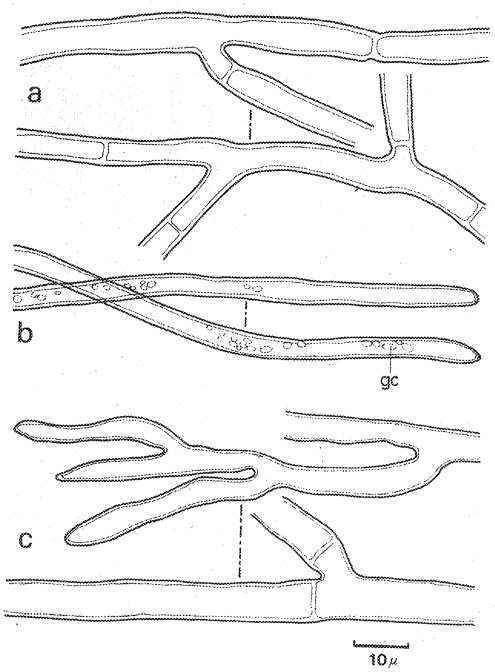


Fig. 57 Mycelium from cultures of *Membranicium carnosa* (Burt) Hayashi, comb. nov. (Al 39a)
a : Aerial hyphae　b : Hyphae from advancing zone　c : Submerged hyphae

Japanese name : Ooki-kawatake (Y. Hayashi & K. Aoshima)

Distribution : North America, South Africa and Asia : Japan (Honshu)

Specimens examined : Mt. Ontake,

Nagano pref., on bark of stump of *Thujopsis dolabrata*, Sept. 6, 1963, Y. H. & H. F. (10132-F); Portage du Fort, Que. Canada, on conifer, July 12, 1961, K. A. (72475-DAOM); Bear Is., L. Temagami, T. F. R., Ont., Canada, on *Corylus rostrata*, Aug. 3, 1937, H. S. Jackson, (TNS), (12684-TRT); Priest River, Idaho, U. S. A., on *Abies grandis*, Sept. 1915, J. R. Weir (202740-TNS)

Habitat & type of rot : Associated with a white stringy rot of coniferous woods.

Cultural characteristics :

Growth characters—Growth on potato dextrose agar at 25°C slow, with mat having a diameter of 17 mm after five days (Table 2), 90 mm after sixteen days; silky at first, then cottony, usually with the surface growth loose, indistinctly reticulate, sometimes with the growth cottony over and around the inoculum block; upper surface of mat entirely white; the underside of the mat white; culture odorless; no mycelial growth on gallic acid and tannic acid media, the mycelium showing no growth on gallic acid and tannic acid media (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, clamps not seen, branched with wide angles, 3.5~5.0μ in diameter (Fig. 57 : a). Advancing zone : hyphae hyaline, thin-walled, with granular contents, 2.5~4.0μ in diameter (Fig. 57 : b). Submerged mycelium : hyphae hyaline, thin-walled, septate, clamps not seen, occasionally with numerous branches close together, 5.0~7.5μ in diameter (Fig. 57 : c).

Temperature relations—The optimum growth temperature was 25°C, the minimum 15°C, and the maximum 30°C (Table 2). Cultures were killed at 35°C for 4 days and 40°C for 1 day.

This species is easily recognized in that the fruit body changes its color from light yellow into blue black when treated with potassium hydroxide solution, and microscopically hyphae having no clamps and incrusted with granular matter which dissolves quickly in 5% potassium hydroxide solution and the presence of not incrusted cystidia. The oxidase reaction is negative on gallic acid and tannic acid media.

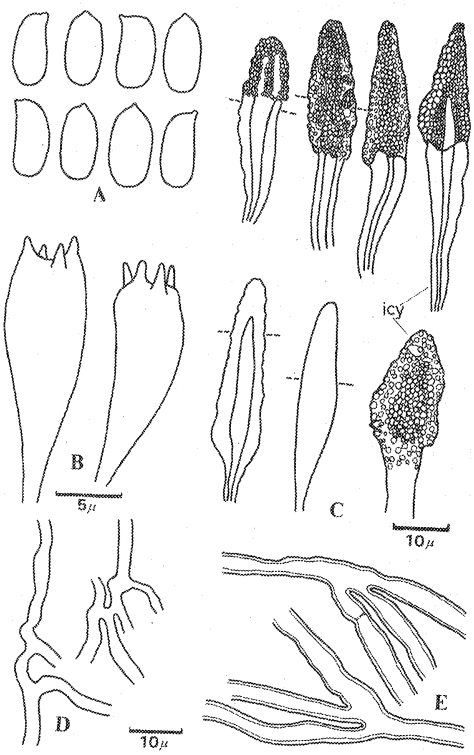


Fig. 58 Microscopic elements of *Membranicium ravenelii* (Cke.) Hayashi, comb. nov. (202743-TNS)
A : Basidiospores B : Basidia C : Cystidia
D : Subhymenial hyphae
E : Subiculum hyphae

No. 39 ***Membranicium ravenelii* (Cke.) Hayashi, comb. nov.**

Peniophora revenelii Cke., Grevillea 8 : 21, 1879; Sacc., Syll. Fung. 6 : 643, 1888; Mass., Jour. Linn. Soc. 25 : 150, 1890; Burt, Ann. Mo. Bot. Gard. 12 : 269, 1926; T. Ito, Bot. Mag. Tokyo 43 : 517, 1929; S. Ito, Myc. Fl. Japan 2(4) : 115, 1955; Teng, Eum. China p. 403, 1964.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Pale Pinkish Buff to Pale Ochraceous-Buff, turning pale purple

in KOH, waxy, 100～150μ thick; hymenial surface even, rigid in appearance, farinose, cracked; sterile marginal zones concolorous, thinning out, without mycelial strands (Plate 4 : D).

Microscopic characteristics : Subiculum compact and coherent, hyphae difficult to distinguish, mingled with few hyaline, thin-walled, septate, without clamps, branched, not incrusted hyphae of 2.5～5.0μ in diameter (Fig. 58 : E); subhymenial layer indistinct, with somewhat modified hyphae, 2.5μ in diameter (Fig. 58 : D); hymenium compactly arranged, hyaline, 12～25μ thick; cystidia very abundant throughout the hymenium and subiculum, fusiform, 25～50×7.5～12.5μ, with obtuse apex, thick- and smooth-walled, incrusted with granular matter which does not dissolve in 5% KOH, not distinctly broadened, non-septate, without clamps, immersed or projecting 3～16μ, walls do not dissolve in 10% KOH (Fig. 58 : C); gloeocystidia absent; basidia clavate, 12～25×5.0～7.5μ, with 4 sterigmata of 1.5～2.0μ long (Fig. 58 : B); spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 5.0～6.0×2.5～3.0 (5.5×2.5)μ (Fig. 58 : A).

Japanese name : Kuriimu-kawatake (T. Ito)

Distribution : North America and Asia : China and Japan.

Specimen examined : Mt. Mikuma, Awaji Is., Hyogo pref., on decaying *Carpinus* sp., Jan. 10, 1919, J. Matsuzawa (202743-TNS, Yasuda Herb. No. 39), (Det. by E. A. Burt).

Habitat & type of rot : Associated with a white rot of broad leaved tree.

The diagnostic features of this species are the color change of fruit bodies from cream into purple when treated with potassium hydroxide solution. Subiculum is composed of gelatinized hyphae, having no obvious subhymenial layer, throughout the section and mostly immersed cystidia are also diagnostic.

In Japan only one specimen (Yasuda Herb. No. 39) is known which was collected by J. Matsuzawa in Awaji Is., and determined by E. A. Burt (Mo. Bot. Gard. Herb. No. 56156).

No. 40 ***Membranicium flavido-alba*** **(Cke.) Hayashi, comb. nov.**

Peniophora flavido-alba Cke., Grevillea 8 : 21, 1879; Sacc., Syll. Fung. 6 : 644, 1888; Mass., Jour. Linn. Soc. 25 : 151, 1890; Hoehn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 116 : 51, 1907; Burt, Ann. Mo. Bot. Gard. 12 : 248, 1926; Slysh, Syracuse Univ. Tech. Pub. 83, 65, 1960; Hayashi & Aoshima, Trans. Myc. Soc. Japan 7(2・3) : 157, 1966.

Macroscopic characteristics : Fruit bodies resupinate, widely effused, not easily separable from the substratum, Cartridge Buff to Warm Buff, turning Royal Purple in KOH, membranous, 100～300μ thick; hymenial surface even, downy in appearance, pilose, minutely cracked; sterile marginal zones concolorous, thinning out, indeterminate, without mycelial strands.

Microscopic characteristics : Subiculum composed of compactly arranged hyphae, hyphae hyaline, thin-walled, septate, without clamps, branched, not incrusted, 4.0～5.0 (5.0)μ in diameter; subhymenial hyphae similar to subiculum hyphae, 2.5～5.0 (3.8)μ in diameter; hymenium compactly arranged, even, hyaline, 30～60μ thick; cystidia abundant, fusiform, 30～200×7.5～15.0μ, not rooted at the base, tapering toward the apex, thick- and rough-walled, with not distinctly broadened lumen, non-septate, without clamps, heavily incrusted with granular matter which dissolves in 5% KOH, cystidial walls do not dissolve in 10% KOH, immersed or projecting 25～100μ; gloeocystidia absent; basidia clavate, 20～25×5.0～7.5μ, with 4 sterigmata of 2.5～3.5μ long; spores ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 5.0～7.5×4.0～5.0 (7.5×4.0)μ.

Japanese name : Kin'iro-kawatake (Y. Hayashi & K. Aoshima)

Distribution : North America and Asia : Japan (Honshu).

Specimens examined : Nippara, Tokyo, on decaying wood of Sabiaceae (?*Meliosma*), May 26, 1962, Y. H. & H. F. (10326-F); Tateyama, Toyama pref., on bark of *Quercus serrata* (bed log of Shiitake mushroom), May 27, 1964, Shigeyoshi, Ito (10324-F); Asakawa, Tokyo, on bark of decaying branch of Rosaceae, July 1962, H. F. (10320-F); do., on bark of fallen branches of *Quercus* sp., June 26, 1964, T. K. (10346-F); Amagi, Shizuoka pref., on bark of fallen branches of *Fagus crenata*, Nov. 1961, T. K. (10770-F); Kamakura, Kanagawa pref., on bark of decaying branch of broad leaved tree, May 29, 1965, Y. H. & H. F. (11203-F).

Habitat & type of rot : Associated with a white rot of broad leaved trees.

The diagnostic features of this species are the color change of fruit body from yellow into deep violet when treated with potassium hydroxide solution, and the texture composed of thin-walled, without clamps and not incrusted hyphae.

According to Burt[41] and Slysh[156] this fungus is the widespread species in eastern North America occurring on bark of decaying branch of various broad leaved trees. In Japan, this species has been collected on woods of *Fagus* and *Quercus* and is considered to be injurious fungi in "Shiitake mushroom" cultivation.

No. 41 ***Membranicium niveum*** **(Karst.) Hayashi, comb. nov.**

Kneiffia nivea Karst., Hedw. 35 : 173, 1896; Sacc., Syll. Fung. 14 : 210, 1899—*Peniophora nivea* (Karst.) Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 394, 1912; Hymén. de Fr. p. 318, 1928; Slysh, Syracuse Univ. Tech. Pub. 83, 79, 1960; Hayashi, Trans. Mycol. Soc. Japan, 10(2) : 87, 1969.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, not easily separable from the substratum, Safrano Pink, do not change color in KOH, membranous, 250~500μ thick; hymenial surface even, rigid in appearance, farinose, rarely cracked; sterile marginal zones wide, yellowish, thinning out, radiately fibrillose to rhizomorphic, forming mycelial strands, Safrano Pink, 0.3~0.6 mm in diameter.

Microscopic characteristics : Hyphae of subiculum loosely arranged next to the substratum, hyaline, mostly thick-walled, without clamps, branching with wide angles, not incrusted, 5.0~6.5μ in diameter, mingled with few thin-walled, septate hyphae; subhymenium 35~50μ thick, very gelatinized, hyphae difficult to distinguish; hymenium compactly arranged, hyaline, 65~90μ thick; cystidia abundant, hyaline, cylindrical to fusiform, 50~115×10.0~16.5μ, not rooted at

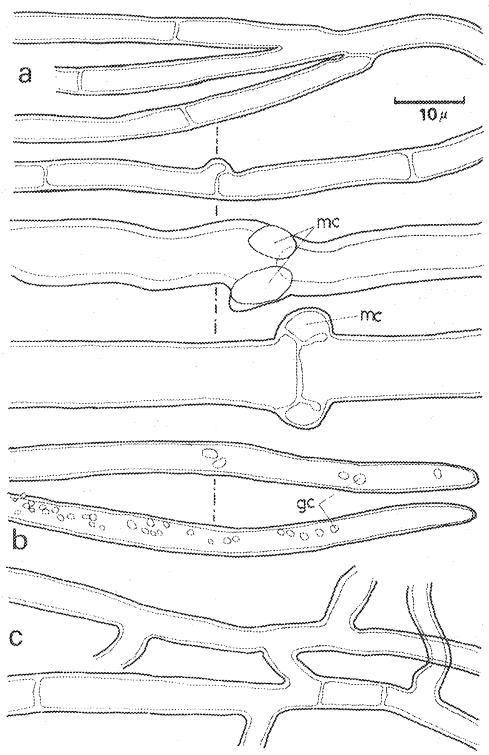


Fig. 59 Mycelium from cultures of *Membranicium niveum* (Karst.) Hayashi, comb. nov. (Al 77a)
a : Aerial hyphae b : Hyphae from advancing zone c : Submerged hyphae

the base, with obtuse apex, thick- and smooth-walled, not distinctly broadened, incrusted with granular to coarse matter which does not dissolve in 5% KOH, non-septate, without clamps, immersed or projecting 15~75μ, walls do not dissolve in 10% KOH; gloeocystidia absent; basidia clavate, 13~20×4~6μ, with 4 sterigmata of 3~4μ long; spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 4.5~6.0×2.5~3.0 (6×3)μ.

Japanese name : Usubeni-kawatake (Y. Hayashi)

Distribution : Europe, North America and Asia : Japan (Honshu).

Specimen examined : Kirizumi, Gumma pref., on decaying trunk of broad leaved tree, Oct. 2, 1968, Y. H. & H. F. (11093-F).

Habitat & type of rot : Associated with a white rot of fallen broad leaved trees.

Cultural characteristics :

Growth characters—Growth on malt extract agar at 25°C slow, with mat having a diameter of 21 mm after five days (Table 2), 90 mm after eleven days; silky at first, fragile, appearing as reticulate then thickened and felty; upper surface entirely white; the underside of mat white; culture odorless; the oxidase reaction weakly positive on gallic acid medium and positive on tannic acid medium, the mycelium no growth on gallic acid medium and failing on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, sometimes somewhat thick-walled, septate, branched, with clamps, sometimes with multiple clamp connections, 5.0~11.3μ in diameter (Fig. 59 : a). Advancing zone : hyphae hyaline, thin-walled, with granular contents, 4.0~5.0μ in diameter (Fig. 59 : b). Submerged mycelium : hyphae hyaline, thin-walled, septate, clamps not seen, branched repeatedly with wide angles, 4.0~7.5μ in diameter (Fig. 59 : c).

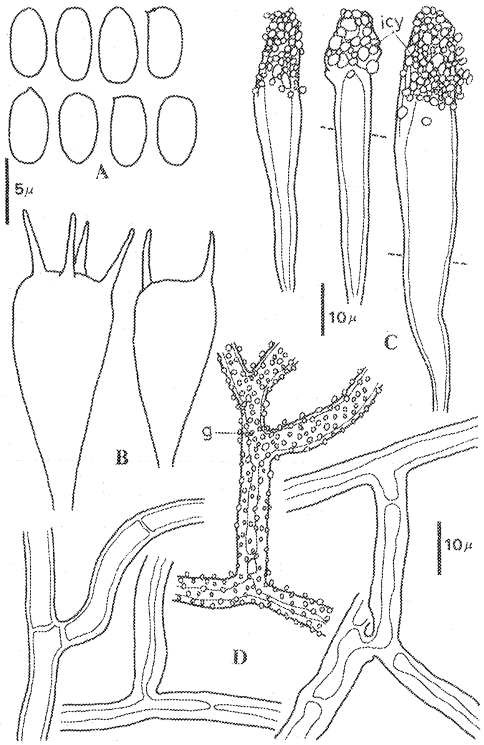
Temperature relations—The optimum growth temperature was 25°C, the minimum 10°C, and the maximum 30°C (Table 2). Cultures were killed at 35°C for 4 days and at 40°C for 3 days.

The diagnostic characteristics of this species are its saffron colored fruit bodies, forming concolorous mycelial strands and presence of the agglutinated subhymenial layer. Cystidia of this species are mostly embedded, incrusted with granular to coarse matter which does not dissolve in 5% potassium hydroxide solution.

No. 42 ***Membranicium cremeum*** (**Bres.**) **Erikss.**

Symb. Bot. Ups. 16(1) : 116, 1958; Christiansen, Dansk Bot. Ark. 19(2) : 184, 1960—*Corticium cremeum* Bres., Fung. Trid. 2 : 63, 1898—*Peniophora cremea* (Bres.) Sacc. & Syd., Syll. Fung. 16 : 195, 1902; Bourd. & Galz., Bull. Soc. Myc. Fr. 28 : 396, 1912; Wakef., Trans. Brit. Myc. Soc. 5 : 131, 1914; Rea, Brit. Basid. p. 691, 1922; Burt, Ann. Mo. Bot. Gard. 12 : 261, 1926; Bourd. & Galz., Hymén. de Fr. p. 303, 1928; T. Ito, Bot. Mag. Tokyo 43 : 520, 1929; Rogers & Jacks., Farlowia 1(2) ; 314, 1943; Talbot, Bothalia 6 : 25, 1951; S. Ito, Myc. Fl. Japan 2(4) : 115, 1955; Cunn., Trans. Royal. Soc. New Zealand 83(2) : 277, 1955; Talbot, Bothalia 7 : 147, 1958; Slysh, Syracuse Univ. Tech. Pub. 83, 69, 1960; Cunn., N. Z. Dep. Sci. Industr. Res. Bull. 145, 125, 1963; Parmasto, Inves. Natural Hist. Soviet Far East p. 242, 1963; Teng, Eum. China p. 404, 1964—*Phanerochaete cremea* (Bres.) Donk, Persoonia 2(2) : 223, 1962.

Macroscopic characteristics : Fruit bodies resupinate, broadly effused, easily separable from the substratum, Pale Ochraceous-Salmon to Pale Ochraceous-Buff, do not change color in KOH, membranous, 500~600μ thick; hymenial surface even, downy in appearance, farinose, deeply



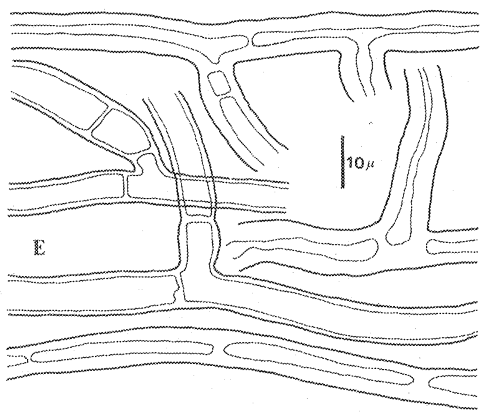


Fig. 61 Microscopic element of *Membranicium cremeum* (Bres.) Erikss. (11181-F)
E : Subiculum hyphae

Fig. 60 Microscopic elements of *Membranicium cremeum* (Bres.) Erikss. (11181-F)
A : Basidiospores B : Basidia C : Cystidia
D : Subhymenial hyphae

cracked and showing the radiate fibrillose subiculum in the fissures; sterile marginal zones wide, white, thinning out, radiately fibrillose, without mycelial strands (Plate 4 : E).

Microscopic characteristics : Hyphae of subiculum vertically and loosely arranged next to the substratum, hyaline, mostly thick-walled, sometimes septate, without clamps, branched with wide angles, not incrusted, 6.5~7.5μ in diameter (Fig. 61 : E); subhymenial layer 150~200μ thick, forming 2 to 4 compactly arranged layers, hyphae compactly interwoven, hyaline, mostly thick-walled, without clamps, branched with wide angles, incrusted with granular matter which dissolves quickly in 5% KOH, 4.5~6.5μ in diameter (Fig. 60 : D); hymenium compactly arranged, hyaline, 50~80μ thick; cystidia rare, hyaline, fusiform to cylindrical, 40~115×4~9μ, not rooted at the base, tapering toward the apex, thin- and smooth-walled, with wider lumen, incrusted with coarse granules around the tip, granular matter does not dissolve in 5% KOH, non-septate, without clamps, immersed or projecting 10~45μ, cystidial walls do not dissolve in 10% KOH (Fig. 60 : C); gloeocystidia absent; basidia broadly clavate, 20~25×4~6μ, with 2~4 sterigmata of 3~4μ long (Fig. 60 : B); spores broadly ellipsoid, flattened on one side, apiculate, smooth, hyaline, non-amyloid, 4.5~5.5×2.5~3.0 (5.0×2.5)μ (Fig. 60 : A).

Japanese name : Usukiiro-kawatake (T. Ito)

Distribution : Europe, North America, South Africa, New Zealand and Asia : Kamchatka Peninsula, China and Japan (Honshu and Shikoku)

Specimens examined : Ôtoyo, Kôchi pref., on trunk of *Quercus serrata*, Aug. 15, 1962, Y. Mitani (11181-F); Kirizumi, Gumma pref., on bark of decaying branch of broad leaved tree, Oct. 2, 1968, Y. H. & H. F. (11095-F); Asakawa, Tokyo, on bark of decaying branch of broad leaved tree, Apr. 15, 1964, H. F. & T. K. (11202-F); do. June 26, 1964, T. K. (11204-F).

Habitat & type of rot : Associated with a white rot of broad leaved trees.

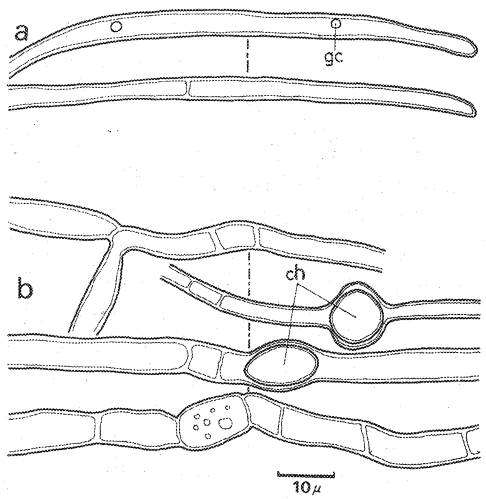


Fig. 62 Mycelium from cultures of *Membranicium cremeum* (Bres.) Erikss. (Al 76a)
a : Hyphae from advancing zone
b : Aerial hyphae, submerged hyphae and chlamydospores

Cultural characteristics :

Growth characters—Growth on malt extract agar at 30°C very rapid, with mat having a diameter of 90 mm after five days (Table 2); silky at first, then thickened and cottony over inoculum block, with the margin raised; mat entirely white; the underside of the mat pale yellow; culture having a pear odor; the oxidase reaction positive on gallic acid and tannic acid media, the mycelium no growth on gallic acid medium and profuse growth on tannic acid medium (Table 3).

Microscopic characters—Aerial mycelium : hyphae hyaline, thin-walled, septate, without clamps, branched, 2.5～6.5μ in diameter (Fig. 62 : b); Advancing zone : hyphae hyaline, thin-walled, septate, 2.0～2.5μ in diameter (Fig. 62 : a). Submerged mycelium : i) hyphae hyaline, thin-walled, septate, without clamps, branched with wide angles, 2.5～6.5μ in diameter ii) chlamydospores abundant, numerous shaped, hyaline, the walls slightly thickened, sometimes with dense granular contents, variable in size, 7.5～19.0×6.5～9.0μ (Fig. 62 : b).

Temperature relations—The optimum growth temperature was 30°C, the minimum 10°C, and the maximum 35°C (Table 2). Cultures were killed at 40°C for 10 days.

This species is characterized by its thick membranous fruit bodies which are deeply cracked, presence of 2～4 compact layers in subhymenium, and the thick-walled, without clamps hyphae becoming incrusted toward the hymenium.

The present species occurs frequently on bark of the bed logs of "Shiitake mushroom" and on area exposed by stripped-off bark.

9) **Unknown species**

No. 43 ***Peniophora aspera*** **(Pers.) Sacc.**

Fl. Ital. Crypt. Hymen. p. 1182, 1916; Hayashi, Trans. Mycol. Soc. Japan 10(2) : 82, 1969.

The specimen (11098-F) determined by Hayashi[82] was reexamined and the author could not identify this specimen as *Peniophora aspera* (Pers.) Sacc. *Peniophora aspera* (Pers.) Sacc. and *Odontia setigera* (Fr.) Miller are conspecific according to Rogers and Jackson. It requires more detailed studies on the original specimens of two "taxa" to clarify the concept of the two species.

No. 44 ***Peniophora nuda*** **(Fr.) Bres.**

Acad. Agiatti Atti III, 3 : 114, 1897—*Thelephora nuda* Fr., Syst. Myc. 1 : 447, 1821.

Yasuda sent the specimen of Yasuda Herbarium No. 125 (Mt. Tsukikuma, Ôita pref., July 21, 1921, N. Nakayama) to Burt and asked for identification. Burt[41] recorded the distribution of this species in Japan based on this specimen (Mo. Bot. Gard. Herb. 59471).

T. Ito[91] gave a description of *Peniophora nuda* (Fr.) Bres. based on the Yasuda's specimen, and gave a Japanese name of Tsukushi-kawatake. Thereafter, K. Hara[79] and S. Ito[90] listed this species.

The author could not find the Yasuda's specimen (No. 125) in the TNS, and could not examine the exact Japanese distribution record.

No. 45 ***Peniophora discoidea* P. Henn.**

Bot. Jahrb. 28 : 268, 1901.

Hennings[84] described *Peniophora discoidea* P. Henn. based on a specimen collected by M. Shirai on *Quercus* sp. at Nikko. Thereafter, J. Matsumura[117], T. Ito[91], Shirai & Miyake[154], Shirai & Hara[155], Hara[79] and S. Ito[90] listed this species. The type specimen is said to have been burned out in Berlin, the identity of the species unknown.

No. 46 ***Peniophora quercina* (Fr.) Cke. var. *komabensis* (P. Henn.) Hoehn. & Litsch.**

K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 116, 744, 1907—*Corticium komabensis* P. Henn., Engler's Jahrb. 32 : 38, 1902.

T. Ito[91] listed this variety based on a specimen collected at Komaba on *Quercus* sp., S. Ito[90] listed this variety and gave a Japanese name Komaba-kawatake. The type specimen is said to have been burned out in Berlin, the identity of the species unknown.

IV Cultural studies

The descriptions of cultures are based on culture collections in the Laboratory of Forest Mycology, Government Forest Experiment Station, isolated from specimens deposited in the Mycological Herbarium, Government Forest Experiment Station. The collection from which cultures were obtained are listed in Table 1.

A) Cultural characters :

The descriptions of cultural characters were made for both macroscopic and microscopic characters. Potato dextrose agar and malt extract agar media* were used for all species examined.

Each isolate was grown on potato dextrose agar or malt extract agar media in a test tube for 3 weeks. From this actively growing culture a piece of aerial hyphae was transferred to the center of each of five 9-cm petri dishes containing about 30 cc of potato dextrose agar or malt extract agar. The cultures were incubated in the dark at 0°, 5°, 10°, 15°, 20°, 25°, 30°,

* Potato dextrose agar and malt extract agar media were prepared according to the following formulae :

Potato dextrose agar (Eiken Che. Co. Ltd.)

Potato dextrose "Eiken"	200 g
Dextrose	20 g
Agar "Eiken"	15 g
Water	1000 cc

pH 5.6±0.1

Malt extract agar

Malt powder	20 g
Agar	25 g
Water	1000 cc

pH 5.0

Table 1. Source of isolates of species of *Peniophora* Cke. and its allied genera

Fungi	Culture No.	Specimen No.	Host	Source of isolation	Locality	Date
Gloeocystidiellum laevigatum	Al 37a	10335-F	*Chamaecyparis obtusa*	Basidiospores	Asakawa, Tokyo	July 14, 1964
G. subsimilis	Al102a	11164-F	*Prunus maximowiczii*	Basidiospores	Chichibu, Saitama pref.	Nov. 11, 1969
Gloeopeniophora violaceo-livida	Al 65a	10995-F	*Prunus verecunda*	Basidiospores	Wada, Nagano pref.	Aug. 1, 1965
Peniophora cinerea	Al100a	11162-F	*Carpinus cordata*	Basidiospores	Chichibu, Saitama pref.	Nov. 11, 1969
P. gigantea	Al 13b	11173-F	*Pinus densiflora*	Basidiospores	Meguro, Tokyo	June 2, 1970
P. farlowii	Al 75a	11096-F	broad leaved tree	Basidiospores	Kirizumi, Gumma pref.	Oct. 2, 1968
P. affinis	Al 85a	11111-F	*Castanopsis cuspidata*	Basidiospores	Ura, Amami Ôshima Is.	Jan. 23, 1968
P. velutina	Al 33a	10316-F	*Morus bombycis*	Basidiospores	Kiyosumi, Chiba pref.	Dec. 2, 1963
P. ludoviciana	Al 69a	11046-F	broad leaved tree	Basidiospores	Kozagawa, Wakayama pref.	July 30, 1967
Membranicium filamentosum	Al 70a	11048-F	*Myrica ?rubra*	Basidiospores	Kozagawa, Wakayama pref.	July 30, 1967
M. sulphurinum	Al 71a	11080-F	*Cyclobalanopsis myrsinaefolia*	Basidiospores	Meiji Shrine, Tokyo	Aug. 2, 1968
M. sanguineum	Al 74a	11004-F	broad leaved tree	Basidiospores	Kirizumi, Gumma pref.	Oct. 2, 1968
M. carnosa	Al 39a	10132-F	*Thujopsis dolabrata*	Basidiospores	Mt. Ontake, Nagano pref.	Sep. 6, 1963
M. niveum	Al 77a	11093-F	broad leaved tree	Basidiospores	Kirizumi, Gumma pref.	Oct. 2, 1968
M. cremeum	Al 76a	11095-F	broad leaved tree	Basidiospores	Kirizumi, Gumma pref.	Oct. 2, 1968

35° and 40°C, respectively. They were examined and described every other day for 3 weeks.

The records for each isolate include data on the rate of growth, form, character of the hyphae, color, odor of the mat. In addition, the records contain descriptions accompanied by camera lucida drawings of the microscopic characters of the aerial and submerged mycelia and mycelia in the advancing zone. Mycelia for microscopic examination were mounted in a 5% aqueous solution of potassium hydroxide and an aqueous solution of phloxine was added. These cultural characteristics were described for each species, and they are presented in Table 3.

As shown in Table 3, several species were recognized to have the following characteristics on both media actively growing at optimum growth temperature after 3 weeks.

1) Color of the upper surface of the mat was mostly white, *Gloeocystidiellum laevigatum* (Fr.) Hayashi was pale orange, *Peniophora cinerea* (Fr.) Cke. was brownish (Plate 1 : B), *Membranicium filamentosum* (Berk. & Curt.) Christiansen was orange-buff, and *M. sulphurinum* (Karst.)

Table 2. Averaged mat diameters grown at constant temperatures 5 days after inoculation

Fungi	Culture No.	°C / Media	0	5	10	15	20	25	30	35	40
Gloeocystidiellum laevigatum	Al 37a	PDA	0—	0+	0+	0+	27	61	90	85	0—
		MEA	0+	0+	0+	0+	25	60	85	75	0—
G. subsimilis	Al 102a	PDA	0+	0+	2	3	3	3	3	0+	0—
		MEA	0+	0+	2	5	6	7	6	0+	0—
Gloeopeniophora violaceo-livida	Al 65a	PDA	0+	0+	14	24	45	60	48	5	0—
		MEA	0+	0+	8	19	34	52	40	5	0—
Peniophora cinerea	Al 100a	PDA	0+	0+	9	17	40	47	45	4	0—
		MEA	0+	0+	6	14	32	43	40	3	0—
P. gigantea	Al 13b	PDA	0+	0+	0+	12	30	40	58	3	0—
		MEA	0+	0+	7	14	37	77	85	5	0—
P. farlowii	Al 75a	PDA	0+	0+	4	12	15	10	0+	0—	0—
		MEA	0+	0+	10	14	24	30	8	0—	0—
P. affinis	Al 85a	PDA	0+	0+	6	12	39	60	65	22	0+
		MEA	0+	0+	4	10	28	35	55	19	0+
P. velutina	Al 33a	PDA	0+	0+	0+	5	7	24	35	20	0—
		MEA	0+	0+	0+	7	13	33	40	35	0—
P. ludoviciana	Al 69a	PDA	0—	0+	0+	0+	5	7	8	3	0—
		MEA	0+	0+	0+	3	11	37	65	3	0—
Membranicium filamentosum	Al 70a	PDA	0+	0+	4	5	8	19	32	8	0—
		MEA	0+	0+	0+	3	6	13	19	6	0—
M. sulphurinum	Al 71a	PDA	0+	0+	5	14	37	62	78	45	0+
		MEA	0+	0+	9	19	39	70	90	60	0+
M. sanguineum	Al 74a	PDA	0+	0+	3	3	14	18	25	3	0—
		MEA	0+	0+	7	13	15	20	30	5	0—
M. carnosa	Al 39a	PDA	0+	0+	0+	4	10	17	6	0—	0—
		MEA	0+	0+	0+	0+	7	8	3	0—	0—
M. niveum	Al 77a	PDA	0+	0+	3	3	5	13	3	0—	0—
		MEA	0+	0+	6	8	19	21	6	0—	0—
M. cremeum	Al 76a	PDA	0+	0+	0+	0+	45	77	85	81	0—
		MEA	0+	0+	5	9	47	80	90	85	0+

1. PDA : Potato dextrose agar. MEA : Malt extract agar.
2. Measurements of mat diameters in millimeters represent averages of all cultures of a species grown in quintuple.
3. + : Culture survived when returned to its optimum temperature.
   — : Culture not survived when returned to its optimum temperature.

Hayashi was sulphur yellow.

2) Culture having a distinct odor or odorless, namely, *Gloeocystidiellum laevigatum* (Fr.) Hayashi gave apple odor, *Gloeopeniophora violaceo-livida* (Sommerf.) Hayashi, *Peniophora farlowii* Burt, *P. velutina* (DC. ex Fr.) Cke. and *P. ludoviciana* Burt presented sour odor, *Peniophora cinerea* (Fr.) Cke., *Membranicium sulphurinum* (Karst.) Hayashi and *M. cremeum* (Bres.) Erikss. issued sweet odor, *Peniophora gigantea* (Fr.) Mass. having soil odor and *Membranicium filamentosum*

Table 3. Cultural characteristics of species of the genus *Peniophora* Cke. and its allied genera 3 weeks after inoculation at their optimum temperatures

Fungi	Culture No.	Mycelial mat			Hyphae			Conidia	Chlamido-spores
		Color		Odor					
		Upper surface	Underside		Color	Walls	Clamps		
Gloeocystidiellum laevigatum	Al 37a	pale orange	brown	apple	hyaline	thin	not seen	−	−
G. subsimilis	Al 102a	white	pale yellow	odorless	hyaline	thin	with	−	−
Gloeopeniophora violaceo-livida	Al 65a	white	pale yellow	sour	hyaline	thin	with	−	−
Peniophora cinerea	Al 100a	brownish	white to pale yellow	sweet	hyaline	thin	with	−	−
P. gigantea	Al 13b	white to pale yellowish brown	white to pale yellow	soil	hyaline	thin	with	+	−
P. farlowii	Al 75a	white	pale brown	sour	hyaline	thin	double	−	−
P. affinis	Al 85a	white	pale yellow	odorless	hyaline	thin	without	−	−
P. velutina	Al 33a	white to pale yellow	white	sour	hyaline	thin	with	−	−
P. ludoviciana	Al 69a	white	pale yellow	sour	hyaline	thin	with	−	−
Membranicium filamentosum	Al 70a	orange-buff	white to pale yellow	fruity	pale yellow	thin	with	−	−
M. sulphurinum	Al 71a	sulphur yellow	salmon	muscovado sugar	pale yellow	thin	with	−	−
M. sanguineum	Al 74a	white	white	odorless	hyaline	thin	multiple	−	−
M. cornosa	Al 39a	white	white	odorless	hyaline	thin	not seen	−	−
M. niveum	Al 77a	white	white	odorless	hyaline	thin	multiple	−	−
M. cremeum	Al 76a	white	pale yellow	pear	hyaline	thin	without	−	+

+ : Conidia or chlamidospores present. − : Conidia or chlamidospores absent.

(Berk. & Curt.) Christiansen had fruity odor. The other five species were odorless.

3) *Membranicium filamentosum* (Berk. & Curt.) Christiansen formed mycelial strands at the loose margin.

4) Hyphae of *Membranicium filamentosum* (Berk. & Curt.) Christiansen and *M. sulphurinum* (Karst.) Hayashi were pale yellow, and the other thirteen species were hyaline.

5) Four species, *Gloeocystidiellum laevigatum* (Fr.) Hayashi, *Peniophora affinis* Burt, *Membranicium carnosa* (Burt) Hayashi and *M. cremeum* (Bres.) Erikss. were without clamps, and eleven species were with clamps, especially *Peniophora farlowii* Burt, *Membranicium sanguineum* (Fr.) Erikss. and *M. niveum* (Karst.) Hayashi had double or multiple clamps.

6) *Peniophora gigantea* (Fr.) Mass. had conidiospores, and *Membranicium cremeum* (Bres.) Erikss. had chlamidospores.

B) Oxidase reaction :

In a study of wood-decaying fungi Bavendamm[3] found that those species causing white rot formed a "dark diffusion zone" or "corona" under the fungus mat grown on media containing a small amount of gallic or tannic acid, though those causing brown cubical rot gave no such reaction. The occurrence of brown diffusion zone is the result of oxidation of the acid. It is the so-called Bavendamm reaction. Bavendamm also pointed out the effect of various concentrations of the acids on growth of the several species and suggested the use of such reactions for identification should be consistent for a great number of species.

Such a test as the oxidase reaction, which separates the species into two distinct groups, is, when combined with numerous macroscopic and microscopic characters, very useful.

Method—The oxidase test[58] was made by growing the fungus to be tested on potato dextrose agar to which gallic or tannic acid was added. Gallic acid medium was prepared by the addition of 0.5 per cent of gallic acid to potato dextrose agar. Potato dextrose agar was autoclaved for 20 minutes at the pressure of 15 pounds. Heating gallic or tannic acid with agar causes hydrolysis of the agar, therefore the two cannot be autoclaved together. When the potato dextrose had cooled, the gallic acid was added and thoroughly mixed. The resulting gallic acid medium was then quickly poured into 9 cm petri dishes, about 20 cc to each dish. The dishes were spread in a single layer to insure rapid cooling. Gallic acid medium has a tawny-olive appearance. Tannic acid medium was prepared in a similar manner, using 0.5 per cent tannic acid. This medium has a milky-white appearance.

Gallic and tannic acids appear toxic to some fungi. For this reason large pieces of inoculum, 5～6 mm square were used.

Observations upon the intensity of reaction and growth of mycelium were made 5 days after incubation in the dark at optimum growth temperatures of 25° or 30°C. Most fungi that reacted with the acid media gave conclusive results after 7 days.

The appearance and reaction of the brown diffusion zone as well as the time required for its development, varied widely among different species. The following system was used to record the reactions of the different species to gallic and tannic acid media :

− : Negative, no brown discoloration of agar.

+ : Diffusion zone light to dark brown, formed under inoculum and visible from under-side of dish.

++ : Diffusion zone light to dark brown, extending a short distance beyond the margin of the mat and visible from the upper side.

+++ : Diffusion zone very intense, dark brown, forming a wide corona around mat.

Table 4. Oxydase reaction and growth of mycelia of species of *Peniophora* Cke. and its allied genera 5 days after inoculation at their optimum temperatures

Fungi	Culture No.	On gallic acid medium		On tannic acid medium	
		Reaction	Growth	Reaction	Growth
Gloeocystidiellum laevigatum	Al 37a	−	47	++	Tr.
G. subsimilis	Al 102a	+	Tr.	+	Tr.
Gloeopeniophora violaceo-livida	Al 65a	+	35	++	27
Peniophora cinerea	Al 100a	+++	32	++	28
P. gigantea	Al 13b	+	Tr.	+	0
P. farlowii	Al 75a	++	15	+	0
P. affinis	Al 85a	+	9	++	30
P. velutina	Al 33a	+++	18	+++	20
P. ludoviciana	Al 69a	++	Tr.	+++	42
Membranicium filamentosum	Al 70a	+	0	+	8
M. sulphurinum	Al 71a	+	5	+++	57
M. sanguineum	Al 74a	+	0	++	21
M. carnosa	Al 39a	−	0	−	0
M. niveum	Al 77a	+	0	+	12
M. cremeum	Al 76a	+	0	+	44

Type of wood decay is all white rot.

Among the species of fungi, interesting growth differences were shown on potato dextrose agar containing 0.5 per cent of gallic or tannic acid. These differences were caused by the toxicity of the acids. The following system was used to record rate of growth :

0 : No growth.

Tr. : Trace, growth confined to inoculum.

5, 10 etc. : Colony diameter in millimeters.

Growth and reaction 5 days after inoculation of fungi on gallic and tannic acids media are presented in Table 4.

Of the 15 species tested, one species, *Membranicium carnosa* (Burt) Hayashi showed negative reaction and showed no mycelial growth on both media. The fungi were killed and brown diffusion zone did not form on either medium. This species causes a white stringy rot of coniferous woods in the field. The other 13 species were associated with white rot, giving consistently positive oxidase reactions. The last one species, *Gloeocystidiellum laevigatum* (Fr.) Hayashi was positive on tannic acid medium but on gallic acid medium was negative.

C) Temperature relations :

The cultures of 15 species of the genus *Peniophora* Cke. and its allied genera were examined on potato dextrose agar and malt extract agar media, at temperatures ranging from 0° to 40°C with intervals of 5°C, for 5 days.

The results are presented in Table 2.

As shown in Table 2, several species grew all over the surface of 9-cm petri dishes at

their optimum growth temperatures after 5 days.

1) The optimum growth temperatures were either 25°C or 30°C according to species.
2) After 5 days at 0°, 5°C, cultures grew when returned to optimum growth temperatures.
3) After 5 days at 40°C, cultures of most species did not grow when returned to optimum growth temperatures. Cultures of *Membranicium sulphurinum* (Karst.) Hayashi and *Peniophora affinis* Burt were killed by incubation at 40°C for 10 days in the former and for 7 days in the latter.
4) *Membranicium carnosa* (Burt) Hayashi, *Membranicium niveum* (Karst.) Hayashi and *Peniophora farlowii* Burt were very weak to high temperatures and all the cultures were killed by incubation at 35°C for 4 days.

V Conclusive summary

Peniophora Cke. is the genus of fungi belonging to the resupinate wood rotting fungi of family Corticiaceae.

In 1879, Cooke[48] separated this genus based upon the sixteen species having cystidia out of the genus *Corticium*, family Corticiaceae. Many of those resupinate fungi with cystidia which had been reported by numerous research workers before Cooke under the genera *Corticium*, *Phlebia*, *Thelephora* and *Stereum* were recombined into the genus *Peniophora* Cke.

Cooke, when creating the genus *Peniophora*, did not designate a type species but simply described the sixteen species as "the species within genus *Corticium* possessing cystidia", so that the genus *Peniophora* Cke. became a genus containing various different conceptions.

In 1912, Bourdot and Galzin[29] made an attempt to divide the species of genus *Peniophora* Cke. into seven groups according to their macroscopic and microscopic characteristics. This idea had a great influence on the research of *Peniophora* fungi, and developed into a trend to attach the "groups" by Bourdot and Galzin an importance equivalent to genera.

Karsten[97][98], by newly establishing *Diplonema* Karst., *Gloeocystidium* Karst., *Peniophorella* Karst. and *Amphinema* Karst., recombined several of the species of genus *Peniophora* Cke. into these genera. Hoehnel and Litschauer[87] and Rick[144], each made an attempt for a reclassification of the genus *Peniophora* Cke. by newly establishing *Gloeopeniophora* Hoehn. & Litsch. and *Gloeopeniophorella* Rick, respectively.

Based upon the "groups" of Bourdot and Galzin, other attempts were made to reclassify the species of genus *Peniophora* Cke., in which Donk[62] proposed a new establishment of the genus *Tubulicrinis* Donk, and Eriksson[69] of *Hyphodontia* Eriks., *Fibricium* Eriks. and *Membranicium* Eriks. Donk[62][63][66] further tried to make a blanket reclassification throughout the genus *Peniophora* Cke. by emending *Gloeocystidiellum* Donk, *Phlebia* Fr., *Hyphoderma* Wallr., *Peniophora* Cke. and *Phanerochaete* Karst.

The beginning of research in Japan on the species of genus *Peniophora* Cke. was made by Hennings[84] in 1901 when he reported on a species collected by Shirai at Nikko as *Peniophora discoidea* P. Henn. Later, reports were made on fourteen species and one variety as indigenous to Japan by Hennings[85], Yasuda[170]-[173] and T. Ito[91]. It was Yasuda[170] who gave the Japanese name "Kawatake Zoku" to the genus *Peniophora* Cke.

Researches on the genus *Peniophora* today follow two directions simultaneously : The one, while recognizing heterogeneity in the conception of the genus *Peniophora* Cke. treats the species under this genus, and the other, giving a value equivalent to genera to the "groups"

of BOURDOT and GALZIN, treats the species under this conception.

The author examined some five hundred collections of resupinate Corticiaceae taken from the sub-frigid forests all through the warm temperate forests in Japan, gave the genus *Peniophora* CKE. a new interpretation, and recorded eight genera, forty-five species and one variety thereof. They are three new species, thirty-one new records and sixteen new combinations.

The eight genera adopted follow :

1) ***Gloeocystidiellum*** **DONK em. DONK**—Main features of the species belonging to this genus are the presence of amyloid spores and gloeocystidia, and two species are indigenous to Japan.
2) ***Gloeopeniophora*** **HOEHN. & LITSCH.**—Main features of the species belonging to this genus are the presence of gloeocystidia, and four species are indigenous to Japan.
3) ***Peniophora*** **CKE.**—Main features of the species belonging to this genus are the presence of membranous to waxy fruit bodies and hyphae with clamps, and twelve species are indigenous to Japan.
4) ***Tubulicrinis*** **DONK ex WERESUB**—Main features of the species belonging to this genus is the presence of cystidia soluble in ten per cent potassium hydroxide solution, and four species are indigenous to Japan.
5) ***Hyphodontia*** **ERIKSS.**—Main features of the species belonging to this genus are the presence of hyphoid, thin-walled and septate cystidia with expanding apex, and four species are indigenous to Japan.
6) ***Amphinema*** **KARST.**—Main features of the species belonging to this genus are the presence of mycelial strands and clamped cystidia, and one species is indigenous to Japan.
7) ***Fibricium*** **ERIKSS.**—Main features of the species belonging to this genus are the presence of dimitic hyphae and somewhat urn-shaped basidia, and four species are indigenous to Japan.
8) ***Membranicium*** **ERIKSS.**—Main features of the species belonging to this genus are the presence of membranous texture and hyphae without clamps, and eleven species are indigenous to Japan.

Indigenous species of the genus *Peniophora* CKE. and its allied genera are the following eight genera and forty-two species. Three species and one variety are not identifiable :

I. *Gloeocystidiellum* DONK em. DONK　Shibu-kawatake Zoku (nom. nov.)
1. *Gloeocystidiellum laevigatum* (FR.) HAYASHI, comb. nov. (basinym, *Thelephora laevigata* FR. in Elench. Fung. I : 224, 1828)　Shibu-kawatake (nom. nov.)
2. *Gloeocystidiellum subsimilis* HAYASHI, sp. nov.　Niseki-kawatake (nom. nov.)

II. *Gloeopeniophora* HOEHN. & LITSCH.　Shiracha-kawatake Zoku (nom. nov.)
3. *Gloeopeniophora violaceo livida* (SOMMERF.) HAYASHI, comb. nov. (basinym, *Thelephora violaceo-livida* SOMMERF. in Lapp. p. 283, 1826)　Usucha-kawatake (HAYASHI & AOSHIMA)
4. *Gloeopeniophora incarnata* (PERS. ex FR.) HOEHN. & LITSCH.　Niku-kawatake (YASUDA)
5. *Gloeopeniophora mutata* (PECK) HAYASHI, comb. nov. (basinym, *Corticium mutatum* PECK in N. Y. State Mus. Rep. 43 : 67, 1890)　Shiracha-kawatake (YASUDA)
6. *Gloeopeniophora aurantiaca* (PERS.) HOEHN. & LITSCH.　Ezo-kawatake (nom. nov.)

III. *Peniophora* CKE.　Kawatake Zoku (YASUDA)
7. *Peniophora quercina* (PERS. ex FR.) CKE.　Kawatake (YASUDA)
8. *Peniophora cinerea* (FR.) CKE.　Haiiro-kawatake (T. ITO)
9. *Peniophora gigantea* (FR.) MASS.　Kami-kawatake (YASUDA)
10. *Peniophora roumeguerii* (BRES.) HOEHN. & LITSCH.　Ke-kawatake (nom. nov.)
11. *Peniophora farlowii* BURT　Fusube-kawatake (nom. nov.)

12. *Peniophora similis* (Berk. & Curt.) Mass. Ki-kawatake (T. Ito)
13. *Peniophora phlebioides* Jacks. & Deard. Neriiro-kawatake (nom. nov.)
14. *Peniophora affinis* Burt Hira-kawatake (T. Ito)
15. *Peniophora velutina* (DC. ex Fr.) Cke. Cha-kawatake (nom. nov.)
16. *Peniophora ludoviciana* Burt Kogane-kawatake (nom. nov.)
17. *Peniophora burtii* Romell Usuki'himo-kawatake (Hayashi & Aoshima)
18. *Peniophora pilosa* Burt Ami-kawatake (nom. nov.)

IV. *Tubulicrinis* Donk ex Weresub Nameshi-kawatake Zoku (nom. nov.)

19. *Tubulicrinis gracillima* (Ell. & Everh. ex Rogers & Jacks.) Hayashi, comb. nov. (basinym, *Peniophora gracillima* Ell. & Everh. ex Rogers & Jacks. in Farlowia I(2) : 317, 1943) Nameshi-kawatake (Yasuda)
20. *Tubulicrinis propinqua* (Bourd. & Galz.) Donk Shiro'nameshi-kawatake (nom. nov.)
21. *Tubulicrinis crassa* (Burt ex Peck) Hayashi, comb. nov. (basinym, *Peniophora crassa* Burt in Ann. Mo. Bot. Gard. 12 : 286, 1926) Kabe-kawatake (nom. nov.)
22. *Tubulicrinis vinacea* Hayashi, sp. nov. Nise'kogane-kawatake (nom. nov.)

V. *Hyphodontia* Erikss. Usu-kawatake Zoku (nom. nov.)

23. *Hyphodontia pallidula* (Bres.) Erikss. Nendo-kawatake (nom. nov.)
24. *Hyphodontia alutaria* (Burt) Erikss. Usu-kawatake (nom. nov.)
25. *Hyphodontia laxa* (Burt) Hayashi, comb. nov. (basinym, *Peniophora laxa* Burt in Ann. Mo. Bot. Gard. 12 : 224, 1926) Shiro'himo-kawatake (nom. nov.)
26. *Hyphodontia sambuci* (Pers.) Erikss. Shiro-kawatake (nom. nov.)

VI. *Amphinema* Karst. Watage-kawatake Zoku (nom. nov.)

27. *Amphinema byssoides* (Pers. ex Fr.) Erikss. Ki'watage-kawatake (Hayashi)

VII. *Fibricium* Erikss. Shiro-kawatake Zoku (nom. nov.)

28. *Fibricium greschikii* (Bres.) Erikss. Ito-kawatake (nom. nov.)
29. *Fibricium subtestaceum* (Litsch.) Hayashi, comb. nov. (basinym, *Peniophora subtestacea* Litsch. in Oesterr. Bot. Zeitschr. 77 : 132, 1928) Ko'ibo-kawatake (Hayashi)
30. *Fibricium subcarneum* Hayashi, sp. nov. Hadairo-kawatake (nom. nov.)
31. *Fibricium lauta* (Jacks.) Hayashi, comb. nov. (basinym, *Peniophora lauta* Jacks. in Canad. Jour. Res. 26(c) : 129, 1948) Kona-kawatake (nom. nov.)

VIII. *Membranicium* Erikss. Maku-kawatake Zoku (nom. nov.)

32. *Membranicium filamentosum* (Berk. & Curt.) Christiansen Ki'himo-kawatake (nom. nov.)
33. *Membranicium sulphurinum* (Karst.) Hayashi, comb. nov. (basinym, *Tomentella sulphurina* Karst. in Finl. Nat. Folk. Bidr. 48 : 420, 1889) Awaki'himo-kawatake (Hayashi)
34. *Membranicium sanguineum* (Fr.) Erikss. Masuiro-kawatake (Hayashi & Aoshima)
35. *Membranicium martianum* (Berk. & Curt.) Hayashi, comb. nov. (basinym, *Corticium martianum* Berk. & Curt. in Grevillea I : 179, 1873) Shu-kawatake (Hayashi & Aoshima)
36. *Membranicium viticola* (Schw.) Hayashi, comb. nov. (basinym, *Thelephora viticola* Schw. in Leipzig. Naturforsch. Ges. Schr. I : 107, 1822) Hiiro-kawatake (Hayashi & Aoshima)
37. *Membranicium versicolor* (Bres.) Hayashi, comb. nov. (basinym, *Corticium versicolor* Bres. in Fungi Trid. 2 : 61, 1898) Sabi-kawatake (Yasuda)
38. *Membranicium carnosa* (Burt) Hayashi, comb. nov. (basinym, *Peniophora carnosa* Burt in Ann. Mo. Bot. Gard. 12 : 325, 1926) Ooki-kawatake (Hayashi & Aoshima)
39. *Membranicium ravenelii* (Cke.) Hayashi, comb. nov. (basinym, *Peniophora ravenelii* Cke. in Grevillea 8 : 21, 1879) Kuriimu-kawatake (T. Ito)

40. *Membranicium flavido-alba* (Cke.) Hayashi, comb. nov. (basinym, *Peniophora flavido-alba* Cke. in Grevillea 8 : 21, 1879) Kin'iro-kawatake (Hayashi & Aoshima)
41. *Membranicium niveum* (Karst.) Hayashi, comb. nov. (basinym, *Kneiffia nivea* Karst. in Hedwigia 35 : 173, 1896) Usubeni-kawatake (Hayashi)
42. *Membranicium cremeum* (Bres.) Erikss. Usukiiro-kawatake (T. Ito)

The indigenous species of the genus *Peniophora* Cke. and its allied genera have macroscopic, microscopic and cultural characteristics and relations with their host plants as described below :

I. Macroscopic characteristics

Although the macroscopic characteristics are not very much conspicuous due to the fact that the fruit bodies are annual and resupinate, with the cystidia protruding on hymenium, the surface of the hymenium is uniformly powdery. The color of hymenial surface is rich in variety ranging from white to brown and thus does not constitute a decisive factor in the identification of species, but some of the species show a conspicuous change in their coloration by the application of five per cent potassium hydroxide solution. This change in coloration being due to the change in color of hyphae of fruit body tissue, it serves as an important feature for the identification of species. Not very many have mycelial strands, but they are found in a few species. The existence of the mycelial strands, together with the nature of cystidia, constitutes a characteristic of the genus *Amphinema* Karst.

II. Microscopic characteristics

Due to the fewness of macroscopic characteristics, the microscopic characteristics constitute decisive factors for the identification of genera and species.

1) Cystidia : By the existence of this organ, strict discrimination is made from those of genus *Corticium*. It is therefore most important to confirm the existence of cystidia and make comparative study on the characteristics of their forms. Their shape, size, capitate, root-shaped base, existence and solubility of granular matter, existence of septa and clamps, thickness of wall, solubility in ten per cent potassium hydroxide solution, etc. serve as important characteristics. The solubility of the wall of cystidia is characteristic to genus *Tubulicrinis* Donk ex Weresub.
2) Gloeocystidia : Buried in the tissue of fruit bodies, the existence of the gloeocystidia can be confirmed with the benzaldehyde reagent. They are clavate, thin-walled, lacking is septa, contain oil drops, and do not attach granular matter. The existence of gloeocystidia is an important characteristic of genus *Gloeopeniophora* Hoehn. & Litsch., and along with the existence of spores showing the amyloid reaction, constitutes the characteristic of genus *Gloeocystidiellum* Donk em. Donk.
3) Fruit body tissue : The fruit bodies consist of the subiculum in which hyphae are loosely arranged parallel to the substratum, and the subhymenial layer thickly arranged longitudinally on the subiculum. The hymenial layer is formed on the subhymenial layer. In rare cases, the subhymenial layer is lacking, and the hymenium directly exsists on the subiculum layer, and also in other rare cases species exist in which subhymenial layers are so closely attached with each other that no hyphae are recognizable. These differences in the arrangement of hyphae serve as important characteristics of genera and species.
4) Hyphae : Fruit bodies of most of the species are composed of thin-walled hyphae. Rarely there are found those composed of two distinct types of hyphae, thin- and thick-walled, and this is the characteristic for the genus *Fibricium* Erikss. In some species the surface of hyphae is incrusted with granular matter, and the granular matter is sometimes soluble in

potassium hydroxide solution. These features do not serve as characteristics for genera, but as an important ones for species identification.

5) Basidia and basidiospores : Basidia are clavate and have four sterigmata. Rarely, kinds with urn-shaped basidia are found, and this is the characteristic of the genus *Fibricium* Erikss. Basidiospores are hyaline and smooth, mostly ellipsoid to oval, but sometimes globose. Some show the amyloid reaction, and this represents a characteristic of the genus *Gloeocystidiellum* Donk em. Donk.

III. **Cultural characteristics**

1) Mycelial mat : The mycelial strands, color, odor, and existence of conidia, chlamidospores, clamps and double clamps on cultured hyphae are the characteristics for species.

2) Oxidase reaction (Bavendamm reaction) : Out of the fifteen test species, thirteen species showed positive reactions on the gallic acid and tannic acid media, coinciding with those of white rot under the natural conditions. *Gloeocystidiellum laevigatum* showed a positive reaction on the tannic acid medium and a negative reaction on the gallic acid medium, and the type of decay is white rot. In *Membranicium carnosa*, its hyphae did not grow on both of the culture media so that no reaction was recognized, but the type of decay showed white stringy rot.

3) Temperature relations : Growth was made at 10°～30° (35°)C on the potato dextrose agar and malt extract agar culture media, and the optimum growth temperature being 25°～30°C, these belong to the intermediate-temperature group. Below 10°C growth is either very poor or none at all. When cultured hyphae were kept at 40°C, most of the fungi were killed within five days, while *Peniophora affinis* perished in seven days, and *Membranicium sulphurinum* in 10 days.

IV. **Host plants**

The northern types prevail in those plants indigenous to Japan, and many of them are common in Europe and North America. In most cases, they grow on both coniferous and broad-leaved woods, but some grow exclusively on the one or the other kind of the above-mentioned woods. *Gloeopeniophora aurantiaca* is distributed in the sub-frigid regions and grows only on *Alnus* spp. The fungi of this genus in general grow on stumps, branches, logs, building timbers, bed logs for mushroom culture and so on, but none attacks living trees. *Tubulicrinis crassa* showed a decay type apparently of brown rot from decayed wood, but all the others induce white rot of heart-wood or sap-wood.

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Explanation of plates

Plate 1

A : Fruit bodies of *Peniophora quercina* (Pers. ex Fr.) Cke. (11206-F) × 1.3
B～D : Cultures of *Peniophora cinerea* (Fr.) Cke. (Al 100 a)
B : Mycelial mat on potato dextrose agar, after 2 weeks at 25°C.
C : Oxydase reaction on tannic acid medium, after 5 days at 30°C.
D : Oxydase reaction on gallic acid medium, after 5 days at 30°C.

Plate 2

A : Fruit bodies of *Gloeocystidiellum laevigatum* (Fr.) Hayashi, comb. nov. (10335-F) × 1.1
B : Fruit bodies of *Gloeocystidiellum subsimilis* Hayashi, sp. nov. (11164-F) × 1.0
C : Fruit bodies of *Gloeopeniophora incarnata* (Pers. ex Fr.) Hoehn. & Litsch. (10199-F) × 1.0
D : Fruit bodies of *Gloeopeniophora mutata* (Peck) Hayashi, comb. nov. (11253-F) × 1.0
E : Fruit bodies of *Gloeopeniophora aurantiaca* (Bres.) Hoehn. & Litsch. (11254-F) × 1.1
F : Fruit body of *Peniophora cinerea* (Fr.) Cke. (11188-F) × 0.9
G : Fruit body of *Peniophora gigantea* (Fr.) Mass. (202727-TNS) × 1.1
H : Fruit body of *Peniophora roumeguerii* (Bres.) Hoehn. & Litsch. (11147-F) × 1.0
I : Fruit body of *Peniophora farlowii* Burt (11096-F) × 1.0
J : Fruit bodies of *Peniophora phlebioides* Jacks. & Deard. (11257-F) × 1.0
K : Fruit body of *Peniophora affinis* Burt (10340-F) × 1.0

Plate 3

A : Fruit bodies of *Peniophora similis* (Berk. & Curt.) Mass. (11176-F) × 1.0
B : Fruit body of *Peniophora velutina* (DC. ex Fr.) Cke. (10316-F) × 1.1
C : Fruit bodies of *Peniophora ludoviciana* Burt (11046-F) × 1.0
D : Fruit bodies of *Peniophora pilosa* Burt (11140-F) × 1.0
E : Fruit bodies of *Tubulicrinis gracillima* (Ell. & Everh. ex Rogers & Jacks.) Hayashi, comb. nov. (11184-F) × 1.0
F : Fruit body of *Tubulicrinis propinqua* (Bourd. & Galz.) Donk (11186-F) × 1.0
G : Fruit body of *Tubulicrinis crassa* (Burt ex Peck) Hayashi, comb. nov. (11148-F) × 1.0
H : Fruit body of *Tubulicrinis vinacea* Hayashi, sp. nov. (10200-F) × 1.0
I : Fruit bodies of *Hyphodontia pallidula* (Bres.) Erikss. (11265-F) × 1.0
J : Fruit body of *Hyphodontia alutaria* (Burt) Erikss. (11187-F) × 1.0
K : Fruit bodies of *Hyphodontia sambuci* (Pers.) Erikss. (11243-F) × 0.9
L : Fruit bodies of *Fibricium greschikii* (Bres.) Erikss. (11175-F) × 1.0
M : Fruit body of *Fibricium subcarneum* Hayashi, sp. nov. (11097-F) × 0.9

Plate 4

A : Fruit bodies of *Fibricium lauta* (Jacks.) Hayashi, comb. nov. (11180-F) × 1.0
B : Fruit body of *Membranicium filamentosum* (Berk. & Curt.) Christiansen (11048-F) × 1.0
C : Fruit body of *Membranicium versicolor* (Bres.) Hayashi, comb. nov. (202733-TNS) × 0.9
D : Fruit body of *Membranicium ravenelii* (Cke.) Hayashi, comb. nov. (202743-F) × 1.0
E : Fruit body of *Membranicium cremeum* (Bres.) Erikss. (11181-F) × 1.0
F : Fruit bodies of *Hyphodontia laxa* (Burt) Hayashi, comb. nov. (11245-F) × 1.0

日本産 *Peniophora* Cke. およびその近縁属菌の研究

林　　康　夫[1]

摘　　要

Peniophora（カワタケ）属は Corticiaceae（コウヤクタケ）科に属する背着性の木材腐朽菌の1属で，1879年 Cooke[48] は Corticiaceae 科の *Corticium* 属菌のなかで，のう状体を有する16種を基礎に本属を設立した。Cooke 以前多くの研究者によって *Corticium*, *Phlebia*, *Thelephora*, *Stereum* 属のもとに報告されてきた背着性でのう状体を有する菌は，Cooke の *Peniophora* 属に組みかえられた。

Cooke は *Peniophora* 属を設立する際，基準種を指定せず単に "*Corticium* 属のなかでのう状体を有する種" として16種を原記載に記載したのみであったため，*Peniophora* 属は種々雑多な概念を含んだ属となった。

1912年，Bourdot and Galzin[29] は *Peniophora* 属菌を肉眼的・顕微鏡的特徴から7 Group にグループ別けを試みた。この思想はその後の *Peniophora* 属菌の研究に大きな影響を与え，研究の1つの方向は Bourdot and Galzin の "Group" に属的価値を見い出す研究へ発展した。

Karsten[98][100] は *Diplonema* Karst., *Gloeocystidium* Karst., *Peniophorella* Karst. および *Amphinema* Karst. 属を新設して，*Peniophora* 属菌の数種をこれらの属に組みかえた。

Hoehnel and Litschauer[89] は *Gloeopeniophora* Hoehn. & Litsch. 属を，Rick[144] は *Gloeopeniophorella* Rick 属を新設して，*Peniophora* 属菌の組みかえを試みた。

Bourdot and Galzin の "Group" を根拠にして，Donk[62] は *Tubulicrinis* Donk 属を，Eriksson[69] は *Hyphodontia* Eriks., *Fibricium* Eriks. および *Membranicium* Eriks. 属を新設して，*Peniophora* 属菌の組みかえを試みた。

Donk[62][63][66] はさらに *Gloeocystidiellum* Donk, *Phlebia* Fr., *Hyphoderma* Wallr., *Peniophora* Cke. および *Phanerochaete* Karst. 属を改訂して，*Peniophora* Cke. 属菌のすべてにわたって組みかえを試みている。

本邦における *Peniophora* 属菌の研究は，1901年 Hennings[84] によって，白井が日光で採集した菌を *Peniophora discoidea* P. Henn. として報告されたのが最初である。その後，Hennings[85]，安田[170]~[178] および伊藤(篤)[91] によって本邦産の14種1変種が報告されている。また *Peniophora* Cke. 属にカワタケの和名を与えたのは安田[170] である。

今日の *Peniophora* 属菌の研究は，*Peniophora* Cke. 属の概念の異質性は認めながらも，本属の下に種を取り扱う方向と，Bourdot and Galzin の "Group" に属的価値を与えるとともに，その概念のもとに種を取り扱う方向とがとられている。

筆者は本邦の亜寒帯林から暖帯林にわたる約500点の背着性 Corticiaceae の採集品を検討するとともに，*Peniophora* 属に近代的解釈を加え，日本産として8属，45種，1変種を記録した。これらは新種：3種，日本未記録種：31種，新組合せ種：16種である。

採用した属はつぎの8属である。

1) *Gloeocystidiellum* Donk em. Donk—gloeocystidia とアミロイド胞子を有する種が所属する。本邦産2種。

1973年8月18日受理

(1) 保 護 部

2) *Gloeopeniophora* Hoehn. & Litsch.—gloeocystidia を有する種が所属する。本邦産4種。
3) *Peniophora* Cke.—子実体組織が膜質ないしろう質，菌糸にクランプを有する種が所属する。本邦産12種。
4) *Tubulicrinis* Donk ex Weresub—のう状体が10% KOH 溶液によって溶解する種が所属する。本邦産4種。
5) *Hyphodontia* Erikss.—のう状体が薄膜，菌糸状，隔膜を有し，先端が膨大する種が所属する。本邦産4種。
6) *Amphinema* Karst.—菌糸束とクランプを付けたのう状体を有する種が所属する。本邦産1種。
7) *Fibricium* Erikss.—dimitic 菌糸を有する種が所属する。本邦産4種。
8) *Membranicium* Erikss.—子実体組織は膜質，実質の菌糸はクランプを欠く種が所属する。本邦産11種。

本邦産の *Peniophora* およびその近縁属菌は次ぎの8属42種で，不明種は3種1変種である。

Ⅰ. ***Gloeocystidiellum* Donk em. Donk　シブカワタタケ属**（新称）
1. *Gloeocystidiellum laevigatum* (Fr.) Hayashi　シブカワタケ（新称）
2. *Gloeocystidiellum subsimilis* Hayashi　ニセキカワタケ（新種）

Ⅱ. ***Gloeopeniophora* Hoehn. & Litsch.　シラチャカワタケ属**（新称）
3. *Gloeopeniophora violaceo-livida* (Sommerf.) Hayashi　ウスチャカワタケ（林・青島）
4. *Gloeopeniophora incarnata* (Pers. ex Fr.) Hoehn. & Litsch.　ニクカワタケ（安田）
5. *Gloeopeniophora mutata* (Peck) Hayashi　シラチャカワタケ（安田）
6. *Gloeopeniophora aurantiaca* (Pers.) Hoehn. & Litsch.　エゾカワタケ（新称）

Ⅲ. ***Peniophora* Cke.　カワタケ属**（安田）
7. *Peniophora quercina* (Pers. ex Fr.) Cke.　カワタケ（安田）
8. *Peniophora cinerea* (Fr.) Cke.　ハイイロカワタケ〔伊藤(篤)〕
9. *Peniophora gigantea* (Fr.) Mass.　カミカワタケ（安田）
10. *Peniophora roumeguerii* (Bres.) Hoehn. & Litsch.　ケカワタケ（新称）
11. *Peniophora farlowii* Burt　フスベカワタケ（新称）
12. *Peniophora similis* (Berk. & Curt.) Mass.　キカワタケ〔伊藤(篤)〕
13. *Peniophora phlebioides* Jacks. & Deard.　ネリイロカワタケ（新称）
14. *Peniophora affinis* Burt　ヒラカワタケ〔伊藤(篤)〕
15. *Peniophora velutina* (DC. ex Fr.) Cke.　チャカワタケ（新称）
16. *Peniophora ludoviciana* Burt　コガネカワタケ（新称）
17. *Peniophora burtii* Romell　ウスキヒモカワタケ（林・青島）
18. *Peniophora pilosa* Burt　アミカワタケ（新称）

Ⅳ. ***Tubulicrinis* Donk ex Weresub**　ナメシカワタケ属（新称）
19. *Tubulicrinis gracillima* (Ell. & Everh. ex Rogers & Jacks.) Hayashi　ナメシカワタケ（安田）
20. *Tubulicrinis propinqua* (Bourd. & Galz.) Donk　シロナメシカワタケ（新称）
21. *Tubulicrinis crassa* (Burt ex Peck) Hayashi　カベカワタケ（新称）
22. *Tubulicrinis vinacea* Hayashi　ニセコガネカワタケ（新種）

Ⅴ. ***Hyphodontia* Erikss.**　ウスカワタケ属（新称）
23. *Hyphodontia pallidula* (Bres.) Erikss.　ネンドカワタケ（新称）
24. *Hyphodontia alutaria* (Burt) Erikss.　ウスカワタケ（新称）
25. *Hyphodontia laxa* (Burt) Hayashi　シロヒモカワタケ（新称）
26. *Hyphodontia sambuci* (Pers.) Erikss.　シロカワタケ（新称）

Ⅵ. ***Amphinema* Karst.　ワタゲカワタケ属**（新称）

5)　担子基および担胞子：担子基は棍棒状で4個の小柄を有する。まれにつぼ形の担子基を有する種類が存在し，これは *Fibricium* Erikss. 属の特徴となる。担胞子は無色・透明，平滑でほとんどの種類は楕円形ないし卵形で，まれに球形の種類がある。アミロイド反応を有するものがあり，この性質は *Gloeocystidiellum* Donk em. Donk 属の特徴である。

Ⅲ. 培　　養

1)　菌叢：菌叢に現われる菌糸束・色・におい，培養菌糸上の分生胞子・厚膜胞子・クランプおよび複合クランプの存在は種における特徴である。

2)　酸化酵素反応：供試15種のうち13種は没食子酸およびタンニン酸培地上で陽性の反応を示し，自然状態における白色朽と一致した。*Gloeocystidiellum laevigatum* はタンニン酸培地上で陽性，没食子酸培地上で陰性の反応を示し，腐朽性は白色朽である。

Membranicium carnosa は両培地上で菌糸が発育せず，反応は認められなかったが，腐朽性は繊維状白色朽を示す。

3)　発育温度：ジャガイモおよび麦芽煎汁寒天培地上で 10°～30°(35°)C でよく発育し，適温は 25°～30°C で好中間温度群に属する。10°C 以下では発育がきわめて悪いか，まったく認められない。培養菌糸を 40°C に保つとほとんどの菌は5日以内に死滅し，*Peniophora affinis* は7日後に，*Membranicium sulphurinum* は10日後に死滅する。

Ⅳ. 宿主植物

本邦産の種類は北方系が多く，ヨーロッパ・北アメリカと共通種が多い。多くの種類は針葉樹・広葉樹双方に生じ，まれにいずれか一方にのみ生ずる。*Gloeopeniophora aurantiaca* は亜寒帯に分布し，*Alnus* spp. のみに生ずる。種類は切株，枝，丸太，建築材，シイタケ・ナメコの榾木などに生じ，生立木を侵害する菌はみられない。*Tubulicrinis crassa* は腐朽材からは褐色朽と思われる腐朽型を示したが，それ以外の菌はすべて心材または辺材の白色朽を基因する。

27. *Amphinema byssoides* (Pers. ex Fr.) Erikss. キワタゲカワタケ（林）

Ⅶ. ***Fibricium*** **Erikss. シロカワケタ属**（新称）

28. *Fibricium greschikii* (Bres.) Erikss. イトカワタケ（新称）
29. *Fibricium subtestaceum* (Litsch.) Hayashi コイボカワタケ（林）
30. *Fibricium subcarneum* Hayashi ハダイロカワタケ（新種）
31. *Fibricium lauta* (Jacks.) Hayashi コナカワタケ（新称）

Ⅷ. ***Membranicium*** **Erikss. マクカワタケ属**（新称）

32. *Membranicium filamentosum* (Berk. & Curt.) Christiansen キヒモカワタケ（新称）
33. *Membranicium sulphurinum* (Karst.) Hayashi アワキヒモカワタケ（林）
34. *Membranicium sanguineum* (Fr.) Erikss. マスイロカワタケ（林・青島）
35. *Membranicium martianum* (Berk. & Curt.) Hayashi シュカワタケ（林・青島）
36. *Membranicium viticola* (Schw.) Hayashi ヒイロカワタケ（林・青島）
37. *Membranicium versicolor* (Bres.) Hayashi サビカワタケ（安田）
38. *Membranicium carnosa* (Burt) Hayashi オオキカワタケ（林・青島）
39. *Membranicium ravenelii* (Cke.) Hayashi クリームカワタケ〔伊藤(篤)〕
40. *Membranicium flavido-alba* (Cke.) Hayashi キンイロカワタケ（林・青島）
41. *Membranicium niveum* (Karst.) Hayashi ウスベニカワタケ（林）
42. *Membranicium cremeum* (Bres.) Erikss. ウスキイロカワタケ〔伊藤(篤)〕

本邦産の *Peniophora* およびその近縁属菌の肉眼的，顕微鏡的，培養上の特徴および宿主植物との関係はつぎのとおりである。

Ⅰ．肉眼的特徴

子実体は1年生で背着性のため，肉眼的特徴は比較的少ないが，子実層にのう状体が突出しているため子実層の表面は一様に粉状を呈する。子実層表面の色は白色から褐色と変化に富み，種の同定上決定的要素とはならないが，5% KOH 溶液により著しい色調の変化を示す種類がある。この色調の変化は子実体組織の菌糸が変色しておこるもので，重要な種類の特徴である。菌糸束を有する種類は少ないが，数種のものに存在する。菌糸束の存在は，のう状体の性質と合わせて *Amphinema* Karst. 属の特徴となる。

Ⅱ．顕微鏡的特徴

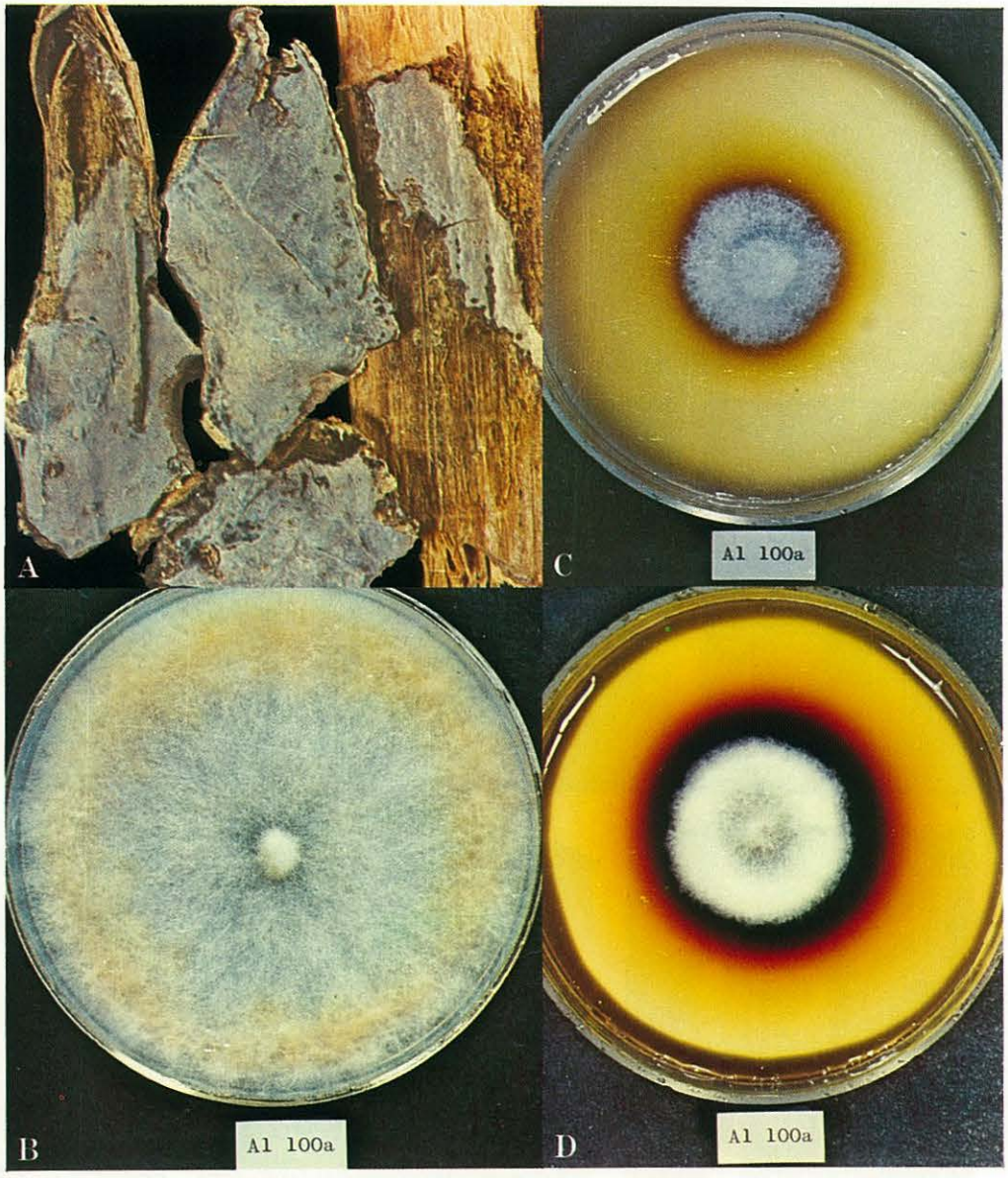
肉眼的特徴がきわめて少ないため，顕微鏡的特徴は属，種の決定的な要因である。

1) のう状体：この器管の存在によって *Corticium* 属菌と厳密に区別する。したがって，のう状体の存在を確認し，形態の特徴を比較研究することはもっとも重要である。形，大きさ，先端の膨大，根状の基部，粒状物の存在とその溶解性，隔膜とクランプの存在，膜の厚さと 10% KOH 溶液による溶解性などが重要な特徴となる。のう状体の膜の溶解性は *Tubulicrinis* Donk ex Weresub 属の特徴である。

2) 粘のう体：子実体の組織内に埋没し，Benzaldehyde 試薬により存在が確認できる。棍棒状，薄膜，隔膜はなく，油滴を含み，粒状物を付着しない。粘のう体の存在は重要な *Gloeopeniophora* Hoehn. & Litsch. 属の特徴であり，アミロド反応を示す胞子の存在と合わせて *Gloeocystidiellum* Donk em. Donk 属の特徴である。

3) 子実体組織：子実体は基物に対して菌糸が横にゆるく配列する実質と，実質の上に縦に密に配列する子実層近接部の菌糸層からなりたち，子実層は子実層近接部の層の上に形成される。まれに子実層近接部の層を欠き，子実層は実質の上に直接形成され，また，まれに子実層近接部の層は膠着して菌糸を認め難い種類が存在する。これらの菌糸の配列の相違は重要な属および種の特徴である。

4) 菌糸：ほとんどの種類の子実体は薄膜菌糸からなりたつ。まれに薄膜・厚膜2種の菌糸からなりたつ種類があり，これは *Fibricium* Erikss. 属の特徴となる。種によって菌糸の表面は粒状物におおわれ，この粒状物は KOH 溶液によって溶解する。これらの特徴は属の特徴とはならないが，重要な種の特徴となる。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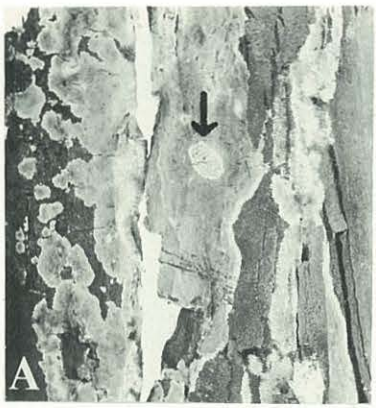
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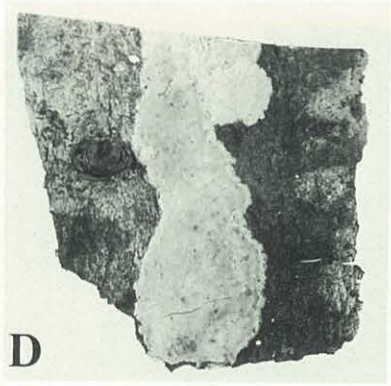
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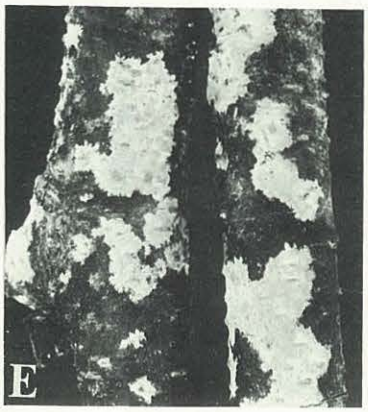
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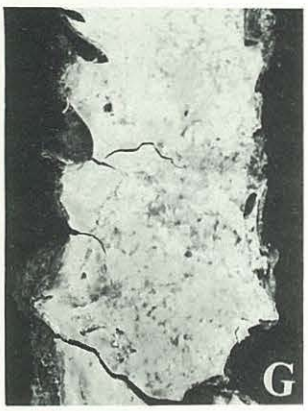
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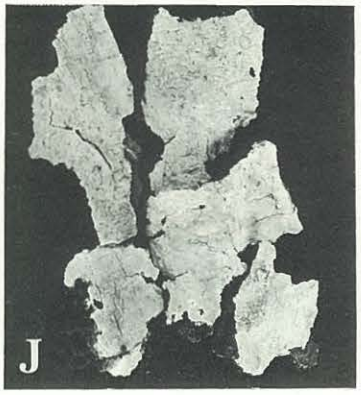
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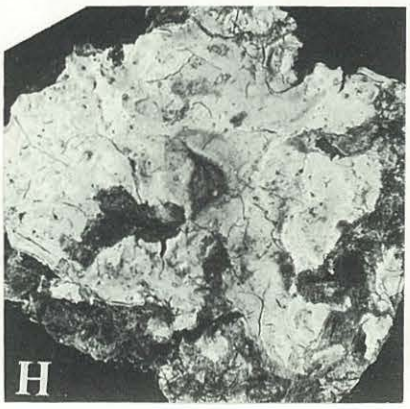
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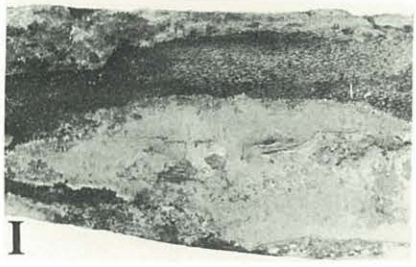
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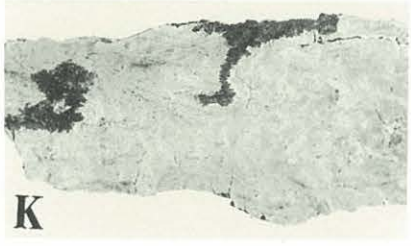
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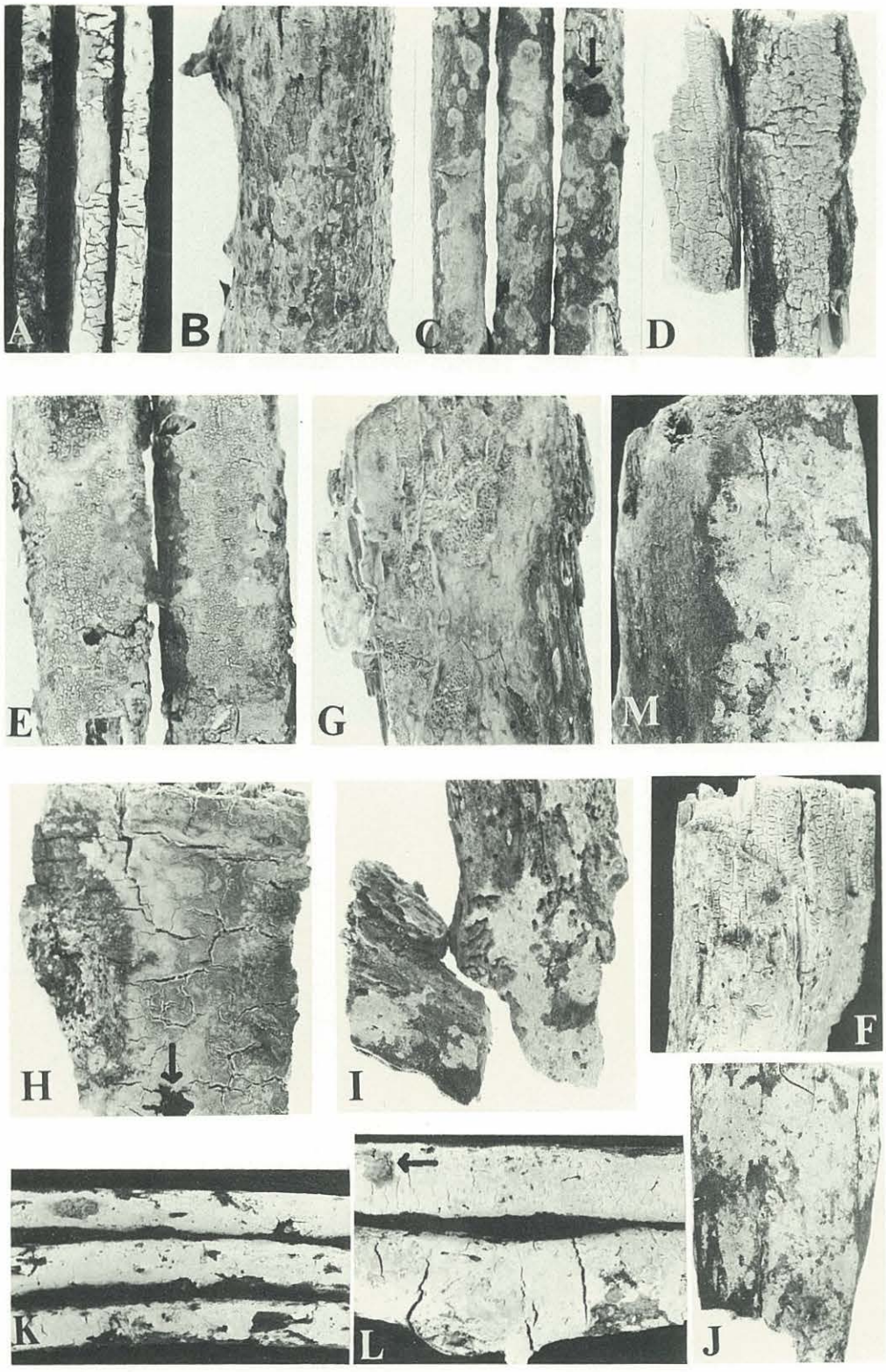
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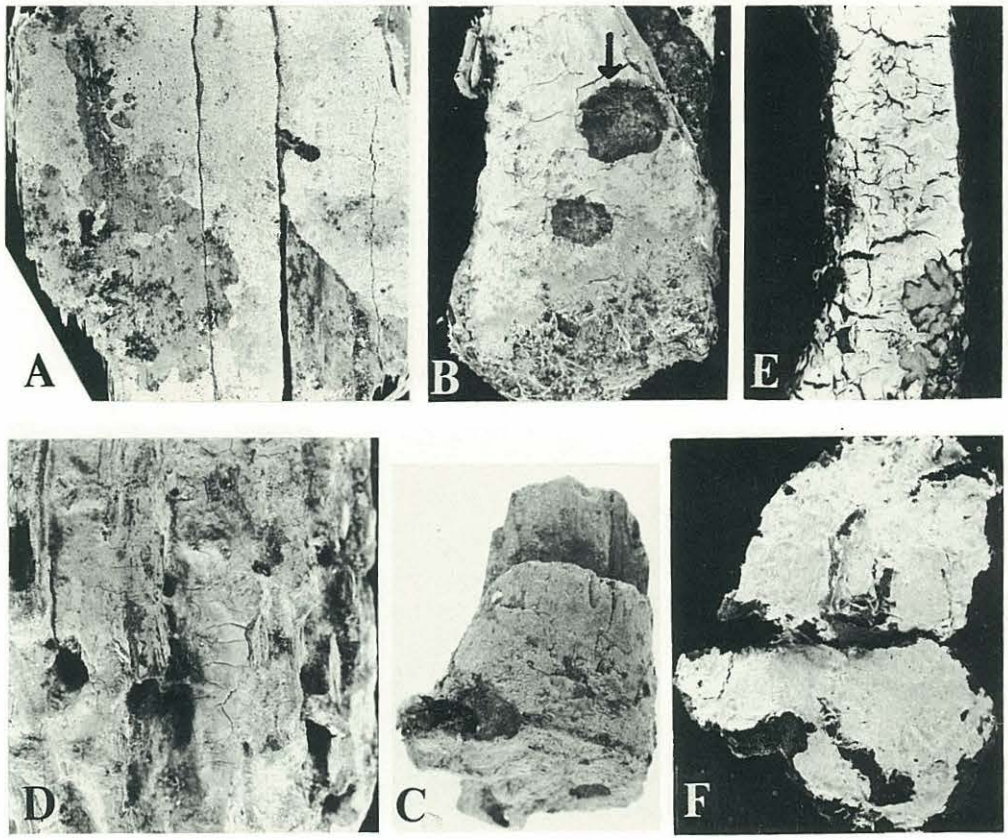
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