コフキタケの単相菌糸と複相菌糸によるブナ材の腐朽[1)]

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緒　　言

木材腐朽菌のある種のものは同じ種類のものでもその培養系統の違いによつて材質腐朽力にかなりの相異が見られる。この事実は多くの腐朽菌の種類について多くの研究者によつて確かめられている。ある種の腐朽菌ではこの相異は菌の侵している寄主樹木の種類によつて起るという報告もあるが，現在ではこれは個体変異であつて，場所による変異とか，寄主樹木による変異であるという考え方は一般に否定的である。しからばこの腐朽力の違いは単なる種間の彷彿変異であり，全く遺伝的な素質を持たないものであろうか？

この報告はコフキタケ（*Elfvingia applanata* (Pers.) Karst.）を用いてこれらの点の解明を目的としたものである。

コフキタケは広葉樹の生立木，伐採木の腐朽菌で，最も広汎な分布をもち，多くの菌学者，病理学者および林業家の間で広く知られているが，筆者（1，2）は本菌の担胞子が休眠期をもち，高温処理が休眠打破に効果があることおよび本菌は遺伝的に4極性を示す腐朽菌であることをすでに報告した。

本研究に対して御指導，御鞭韃を賜わつた林業試験場今関六也保護部長および永井行夫菌類研究室長に深甚の謝意を表する。アメリカのコロラド大学 R. W. Davidson 博士はこの原稿に目を通され，有益な助言を与えられた。同氏に深く謝意を捧げる次第である。

単相菌糸による材の腐朽

材料と方法： コフキタケの単一胞子培養は前に使つた（1，2）ものと全く同一のもので，2つの子実体からえたものである。これら2つの子実体の性因子はすでにそれぞれ $A_1A_2B_1B_2$ および $A_1A_3B_3B_4$ と表わした（2）。腐朽実験はガラス瓶（高さ 18 cm，直径 8 cm）の中にブナ鋸屑 40 g と，米糠 20 g と，水 100 cc を入れて培養基を作り，この上にブナ辺材（1本の丸太の外側から取つたもの）の試験片（6×1.5×1 cm）を4個づつ置いた。試験片は培養基上におく前に前もつて絶乾重量を測定した。このガラス瓶を蒸気殺菌してからコフキタケの単相

1) この報告の大要はアメリカの植物病理学会機関誌 "Phytopathology" に近く印刷の予定になつている。紙面の制限から意に満たない点があつたので，改めて書き直したものである。

2) 保護部菌類研究室

菌糸を接種し，20—28°C の培養室に 6 カ月おいた（1952 年 4 月 5 日—10 月 5 日）。菌を接種後 3 週間で大部分の単相菌糸は培養基中に繁殖し，試験材上に生育した。腐朽実験終了後には試験片を瓶から取り出して，表面の菌糸を取り除き，絶乾重量を測定して，重量減少率を計算した。単相菌糸の中には培養基中にはよく生育したが，菌糸が試験片を包む程度に発育しないものもあつた。これらの試験材は上部と下部の両方が同様に侵されないので，結果の纏めには除いた。

結果： Table 1 は 1 つの子実体から得た単相菌糸によつて腐朽された試験片の重量減少率を示す。この表から分るように同一の子実体[3] からえた 64 の単相菌糸の腐朽力にはそれぞれ相当の違いがみられる。No. h—49 は腐朽力が最も強大で，試験片の重量減少率は 82.20 パーセントに達する。これに反し，No. h—15 はわずかに 10.39 パーセントを算するにすぎない。

Fig. 1 はこの 64 の単相菌糸の材質腐朽力を単相菌糸の性因子に分けて並べたものであるが，この表から単相菌糸の腐朽力とそれらの性因子の間には差がみられないことが分る。

Fig. 2 は単相菌糸の数とそれらの腐朽力との曲線であるが，この曲線は正規分布曲線を描くので，同一の子実体からの単相菌糸間にみられる腐朽力の違いは単なる彷徨変異であることが認められる。

Table 2 は前に担胞子を採取した子実体とは別の子実体[4] からの単相菌糸による試験片の重量減少率を示したものである。

この表からも明らかなごとく，単相菌糸の腐朽力はそれぞれ個体によつて違いがみられる。

複相菌糸による材の腐朽

材料と方法： 前の実験に用いた単相菌糸のそれぞれ対の 2 つを掛合せて 47 系統の複相菌糸をえた。また，本邦各地から集めた本菌の子実体の組織から分離した 8 つの複相菌糸の培養系統をえたが，この分離源は次の通りである。

培養系統—（a）：ブナ枯倒木上の子実体，山梨県南都留郡鳴沢村，X—1949，青島。培養系統—（c）：ダケカンバ枯倒木上の子実体，長野県北安曇郡上高地，VIII—1951，青島。培養系統—（d）：ダケカンバ枯倒木上の子実体，長野県北安曇郡上高地，VIII—1951，青島。培養系統—（e）：ダケカンバ枯倒木上の子実体，長野県北安曇郡上高地，VIII—1951，青島。培養系統—（g）：イチヰガシ切株上の子実体，東京都目黒，VI—1951，青島。培養系統—（h）：イチヰガシ生立木上の子実体，東京都目黒，VI—1951，青島。培養系統—（j）：ブナ枯倒木上の子実体，長野県北安曇郡中土村，VIII—1951，青島。培養系統—（k）：常緑カシの 1 種の生立木上の子実体，東京都小石川，IX—1948，青島。

3) この子実体の組織から分離した複相菌糸を培養系統—（h）で表わす。
4) この子実体の組織から分離した複相菌糸を培養系統—（g）で表わす。

複相菌糸の材質腐朽力を決定する方法と実験開始および終了の時期は前の単相菌糸の場合と全く同様である。

結果：Table 3 と Fig. 3 はこれらの子実体の組織から分離した8つの分離系統によるそれぞれの試験片の重量減少率を示す。

この表から明らかなように，これら8つの培養系統の間には腐朽力の相異に有意差が存在することが分る。3つの培養系統（c, d, e）は近くの場所で，同一樹種上の子実体から（同一樹木上ではない）同じ年に分離した培養系統であるが，これらの間にもそれぞれ腐朽力に差がある。

前の実験に使用した子実体—（h）からの単相菌糸を掛合せて作つた 44 の複相菌糸の材質腐朽力を検討した。Table 4 はこれらの菌糸によるブナ試験材の重量減少率を示す。この場合にも材質腐朽力にかなりの差があることが分る。

2つの型の複相菌糸（$A_1B_1 \times A_2B_2$，$A_1B_2 \times A_2B_1$）の材質腐朽力を Fig. 4 に示す。この表から次のようなことが分る。すなわち，もしも複相菌糸が同一の性因子（$A_1A_2B_1B_2$）を持つているならば，単相菌糸の性因子とそれに由来した複相菌糸の材質腐朽力との間には関連性がない。

複相菌糸培養系統，No. h—40 × No. h—16 は材質腐朽力が最も強大で，試験材の重量減少率は 57.63 パーセントに達するが，No. h—62 × No. h—42 は最も弱く，15.90 パーセントにすぎない。

Fig. 5 は複相菌糸の数とその材質腐朽力との関係を示したものである。この表から，もしも複相菌糸が同一子実体からの担胞子に由来した場合には，複相菌糸の材質腐朽力の違いは彷徨変異であることが分る。

単相菌糸培養系統，h—49 は最も強い材質腐朽力（82.20%）を持ち，h—45 は中間的な腐朽力（53.51%）を持つているに反し，この 2 つを掛合せてえられた複相菌糸培養系統，No. h—49 × No. h—45 の材質腐朽力（32.49%）は強大でない。

単相菌糸培養系統，No. h—42 の材質腐朽力（48.44%）は No. h—45 の材質腐朽力（53.51%）よりも弱いが，複相菌糸培養系統，No. h—49 × No. h—42 の材質腐朽力（46.45%）は No. h—49 × No. h—45 の腐朽力（32.49%）よりも強大である。

単相菌糸培養系統，No. h—15 の材質腐朽力は最も弱く（10.39%），No. h—62 の材質腐朽力はかなり弱いが（29.29%），これらを掛合せてえられた複相菌糸培養系統，No. h—15 × No. h—62 の材質腐朽力は強大（42.25%）である。

単相菌糸培養系統，No. h—60 の材質腐朽力（54.80%）は No. h—62 の腐朽力（29.29%）よりも強大であるが，複相菌糸培養系統，No. h—15 × No. h—60 の腐朽力（31.46%）は No. h—15 × No. h—62 の腐朽力（42.25%）よりも弱い。

これら上記の結果から次のような結論がえられる。すなわち，複相菌糸の材質腐朽力はもし

それらが同一の子実体の担胞子に由来する場合には，親の単相菌糸の材質腐朽力には全く無関係で，複相菌糸のそれぞれ独自の材質腐朽力を示す。すなわち，同一の子実体の担胞子に由来する場合には単相菌糸の材質腐朽力の大小は複相菌糸に遺伝しない。

前の実験に使つた子実体と異なる子実体—(g) からの 4 つの和合型の単相菌糸をそれぞれ掛合せてえた 2 つの複相菌糸培養系統の材質腐朽力を検討した。 Table 4 はこれら 2 つの複相菌糸による試験材の重量減少率を示す。この表から明らかなように，この子実体—(g) の担胞子からの複相菌糸培養系統は前の子実体—(h) の担胞子からの複相菌糸培養系統のいかなるものよりも強い材質腐朽力を示した。

ここで重要な事実は，前の 2 つの子実体の組織からそれぞれ分離した培養系統—(g) と培養系統—(h)[5] は材質腐朽力に差があるということである。 前者による試験片の重量減少率は 64.23 パーセントで，後者は 40.19 パーセントにすぎない。この両者の腐朽力の差は危険率 5 %で有意である。この事実と前の結果から次のように結論することができる。すなわち，子実体の組織から分離した複相菌糸培養系統の材質腐朽力は，その子実体の担胞子に由来する複相菌糸培養系統の材質腐朽力を示す値を与える。

子実体—（g）の担胞子からの単相菌糸培養系統，No. g—1 と No. g—7 の材質腐朽力はそれぞれ No. g—2 および No. g—6 の材質腐朽力よりも強大である。 これに反し，複相菌糸培養系統，No. g—1 × No. g—7 の材質腐朽力（62.80%）は No. g—2 × No. g—6 の材質腐朽力（67.99%）よりも弱い。この結果はさらに， 前に記した単相菌糸の材質腐朽力は，もしもそれらが同一の子実体の担胞子に由来した場合には，それらを掛合せてえられた複相菌糸には遺伝しないという結論を支持するものである。

2 つの異なる子実体の担胞子を掛合せてえられた複相菌糸培養系統， No. g—1 × No. h—116 による試験片の重量減少率は 49.68 パーセントである。この値は培養系統—（h）の材質腐朽力（40.19%）に比してやや大きく， 培養系統—（g）の材質腐朽力（64.23%）に比して小さい。単相菌糸培養系統，No. g—1 は 66.42 パーセントの重量減少率を与え，No. h—116 は 74.33 パーセントであり，これら 2 つの単相菌糸培養系統はともに強い材質腐朽力をもつているが，掛合せてえられた複相菌糸の腐朽力はさほど強大ではない。

論議および結論

材質腐朽性の担子菌の単相菌糸による木材の腐朽は Verrall (11) によつて最初に報告されている。 彼によると *Betula* に生じていたニセホクチタケ (*Phellinus igniarius* (L.) Quél) の単相菌糸培養系統は麦芽煎汁寒天培養基上では発育にかなりの差がみられるが， 材質腐朽力には差を見出せなかつた。しかし，*Populus* および *Carpinus* に生じていた子実体

5) 培養系統—（g）および培養系統—（h）の性因子はそれぞれ $A_1A_3B_3B_4$ および $A_1A_2B_1B_2$ である。

からの単相菌糸培養系統は材質腐朽力にかなりの差があることをみている。MOUNCE およびMACRAE (8) はツガサルノコシカケ（*Fomitopsis pinicola* (SCHW.) KARST.）の単相菌糸培養系統の中にはシトカトウヒの試験材をかなり速やかに腐朽させるものもあるが，中にはほとんど腐朽させないものもあることを観察している。これらの結果はコフキタケによる筆者の実験結果とかなりよく一致しているが，筆者はコフキタケの個々の単相菌糸培養系統の材質腐朽力にはきわめて大きな違いが存在することを確かめた。

コフキタケの単相菌糸はブナ材をかなり速やかに腐朽させる力をもつているが，64の単相菌糸培養系統（同一の子実体からの担胞子に由来している）の材質腐朽力は試験片の重量減少率で表わすと 10.39 から 82.20 パーセントの開きがみられる。Fig. 1 からこれらの単相菌糸培養系統のそれぞれの性因子と材質腐朽力の間には関係がないことが明らかである。

Fig. 2 に示したごとく，単相菌糸培養系統の数と，それらの材質腐朽力との曲線は正規分布曲線を描く。

同一種の腐朽菌でも分離系統の違いによつて，複相菌糸の材質腐朽力に違いがあるという事実は多数の研究者によつて確かめられている。SCHMITZ(10) はツガサルノコシカケの４つの異なつた分離系統の間には材質腐朽力に差があつたと報告し，さらにこの菌には生理的変異現象があり，これは寄主樹木の影響であろうと報告している。MOUNCE (7) は同一菌について，この材質腐朽力の違いは寄主樹木の影響というよりも個体変異であろうと述べている。OWENS (9) はマツノカタハタケ（*Cryptoderma pini* (THORE) IMAZ.）は培養系統の違いによつて材質腐朽力に差があることを確かめ，VERRALL(11)もニセホクチタケも培養系統の違いによつて材質腐朽力に違いがあることを報告している。彼はさらにニセホクチタケには寄主樹木による違いによつて３つの型が存在することを報告したが，これらは形態的のみならず，生理的および材質腐朽力の点でも異なるものである。CHILDS (3) はカイメンタケ（*Phaeolus schweinitzii* (FR.) PAT.）も培養系統によつて材質腐朽力に差があるとし，HILBORN (4) はツリガネタケ（*Fomes fomentarius* (L.) KICKX）にも材質腐朽力のそれぞれ異なる培養系統が存在することを確定している。彼はさらにこの違いは単なる個体変異で，寄主樹木や場所による影響ではないと述べている。

筆者はコフキタケの子実体から分離した８つの培養系統の間にも材質腐朽力にそれぞれかなりの差のあることを確かめた。これら８つのうち，３つは同地方で同じ時期に同じ寄主（ダケカンバ）（ただし，同じ樹木ではない）に生じていた子実体から分離したものであるが，これら３つの培養系統の間にも材質腐朽力の差がみられる。また，これらの８つの培養系統のうち，２つは同じ寄主樹木に生じ，同じ地方で採つた子実体の組織から分離した培養系統であるが，やはり腐朽力には差がみられる。これらの結果から，コフキタケの複相菌糸培養系統間に存在する材質腐朽力の違いは個体変異であり，寄主樹木や場所による影響ではないことが分る。

同一の子実体の担胞子に由来した 44 の複相菌糸培養系統の間にもそれぞれ材質腐朽力にかなりの相異がみられる。それらは 56.63 から 15.90 パーセントの試験材の重量減少率を示した。この変異の巾は単相菌糸のそれよりも小さい。

筆者はさらに，もしも同一の子実体からの担胞子に由来する場合には，複相菌糸培養系統の材質腐朽力と2つの性因子による型（$A_1B_1 \times A_2B_2$ および $A_1B_2 \times A_2B_1$）との間には何の関係も見出せないことを確かめた。

ともに強い材質腐朽力をもつ和合性の2つの単相菌糸培養系統を掛合せても必ずしも強大な腐朽力をもつ複相菌糸が得られるとはかぎらず，反対に弱い材質腐朽力をもつ和合性の2つの単相菌糸培養系統を掛合せても，必ずしも弱い腐朽力しかもたない複相菌糸がえられるとはかぎらない。複相菌糸培養系統間にみられる材質腐朽力の違いは接合前の単相菌糸の材質腐朽力を基礎としては説明できない。

Table 4 に示したごとく，子実体—（g）の担胞子に由来した2つの複相菌糸培養系統は子実体—（h）の担胞子に由来した複相菌糸培養系統のいかなるものよりも材質腐朽力が強い。これに反し，この2つの複相菌糸培養系統の親である4つの単相菌糸培養系統は子実体—（h）の担胞子に由来した単相菌糸よりも必ずしも大きな腐朽力を示さない。子実体—（g）の担胞子からの単相菌糸培養系統1つと，子実体—（h）の担胞子からの単相菌糸培養系統1つを掛合わせてえられた複相菌糸培養系統は培養系統—（g）と培養系統—（h）の中間的腐朽力を示す。ここで重要な事実は培養系統—（g）は培養系統—（h）に比して腐朽力が強大であることである（5% の危険率で有意）。これらの上記の事実から次のように結論することができる。すなわち，複相菌糸培養系統の材質腐朽力は，それが由来した2つの和合性の単相菌糸の材質腐朽力の大小には関係なしに，親に当る複相菌糸の材質腐朽力に影響される。いいかえれば，ある複相菌糸の材質腐朽力の大小はそれからの単相菌糸には現われないでこの単相菌糸が和合して生ずる複相菌糸の材質腐朽力に遺伝する。

Verrall (11) はニセホクチタケの単相菌糸培養系統は親に当る子実体の組織から分離した複相菌糸培養系統よりも材質腐朽力は弱いと報告している。Kaufert (6) はツバヒラタケ（*Pleurotus corticatus* Fr.）の複相菌糸は *Tilia* の鋸屑を単相菌糸よりも 90—150 日では速やかに腐朽させるが，210 日には単相菌糸も複相菌糸と同程度の腐朽を起すと述べている。伊藤 (5) はベツコウタケ（*Fomitopsis rhodophaea* (Lév.) Imaz.）の単相菌糸はハンテンボクの材を複相菌糸と同程度に腐朽させると報告した。

コフキタケについては単相菌糸培養系統の中には複相菌糸を凌駕する材質腐朽力を示したものもあるが，Fig. 1 および4に示したごとく，もしも同一の子実体からの担胞子に由来した場合には，単相菌糸培養系統も複相菌糸培養系統の間にもそれぞれ大きな違いがみられる。複相菌糸は単相菌糸よりも生長が早く，試験片を密に包み，最後には黒褐色の革質の菌糸で試験片の

表面を包囲する。それ故，試験片への酸素の供給は単相菌糸の場合よりも少ないはずである。この理由から単相菌糸と複相菌糸の材質腐朽力を比較するのは本菌については危険である。しかし，単相菌糸培養系統間の材質腐朽力の変異の巾（10.39—82.20%）は複相菌糸培養系統のそれ（15.90—57.63%）よりも著しく大きいといえる。

摘　　要

コフキタケ（*Elfvingia applanata* (Pers.) Karst.）の単相菌糸と複相菌糸の材質腐朽力を遺伝的に分析した。

本菌の単相菌糸の材質腐朽力は個体間に著しい差があるが，性因子と材質腐朽力の間には関連性がない。同一の子実体からの担胞子に由来した単相菌糸のそれぞれの材質腐朽力と，その単相菌糸の数との曲線は正規分布曲線を描く。

異なる子実体の組織から分離した本菌の複相菌糸培養系の間にはそれぞれ材質腐朽力に大きな差がある。これらの分離系の間に存在する材質腐朽力の違いは個体変異であつて，寄主や場所による変異ではないことを示した。

同一の子実体に由来した単相菌糸を交配してえられた複相菌糸の間にも材質腐朽力にそれぞれ大きな差異が存在する。複相菌糸の材質腐朽力とそれらの数との曲線は正規分布曲線を描く。同一の子実体の担胞子に由来した複相菌糸の２つの型の間には材質腐朽力に何等の差異も見出せない。

２つの強い材質腐朽力を持つた単相菌糸を交配させても強い材質腐朽力をもつた複相菌糸がえられるとはかぎらず，弱い材質腐朽力をもつた単相菌糸の場合も同様である。同一の子実体からの担胞子に由来した場合には，複相菌糸間に存在する材質腐朽力の差異は単なる彷彿変異にすぎない。

材質腐朽力の強い系統の子実体からの単相菌糸を掛合わせてえられた複相菌糸は強い材質腐朽力をもつ。また，１つは腐朽力の強い系統の子実体からの単相菌糸，１つは弱い系統の子実体からの単相菌糸を掛合わせてえられた複相菌糸は両者の中間的の腐朽力を与える。

単相菌糸と複相菌糸の腐朽力の違いは明瞭ではないが，変異の巾は単相菌糸の方が複相菌糸よりもはるかに大きいといえる。

Kiyowo Aoshima: Decay of beech wood by the haploid and diploid mycelia of *Elfvingia applanata* (Pers.) Karst. (*Fomes applanatus*)

Résumé

Introduction

There have been many investigations of wood-decay caused by the fungus *Elfvingia applanata* (Pers.) Karst. (*Fomes applanatus*), in the field as well as in the laboratory, in many countries. The fungus which has a wide distribution, damages many species of broad-leaved trees and, less frequently, of coniferous trees both standing and felled.

Most investigations on wood-decay caused by various species of wood-rotting fungi, including this fungus, have been carried out by the pure culture method, using diploid mycelia isolated from tissue of the fruit body, from rot, or from basidiospores.

The writer (1) has previously indicated that basidiospores of *Elfvingia applanata* have a long dormant period and that high temperature treatment induced earlier germination. It has also been established (2) that the fungus is a heterothallic and a tetrapolar species. In the present paper wood-rotting abilities of haploid as well as diploid mycelia of *Elfvingia applanata* will be genetically analized.

The writer wishes to express his sincere thanks to Mr. R. Imazeki and Mr. Y. Nagai of the Government Forest Experiment Station, Meguro, Tokyo for their continued interest and encouragement toward the investigation. The writer also express his cordial appreciation to Mr. R. W. Davidson of Colorado A & M College, Fort Collins, Colorado for his kind suggestion and criticism offered to him and for his kindness in reading the manuscript. Thanks are also due to Mr. T. Kobayashi and Mr. Y. Hayashi who helped the writer in the laboratory work.

Decay by haploid mycelia

Materials and methods: Single spore isolates used in the present experiment were identical with those used previously (1), (2), being obtained from 2 fruit bodies growing on different hosts. The sexual factors of the 2 fruit bodies were designated $A_1A_2B_1B_2$ and $A_1A_3B_3B_4$, respectively. Decay tests were made in glass bottles (18 cm high, 8 cm in diameter), each containing 40 gm of sawdust of beech wood, 20 gm of rice bran and 100 cc of water. Four test blocks of the outer sap-wood of *Fagus crenata*, 6 × 1.5 × 1 cm were placed beneath this medium in a bottle. These test blocks had first been oven dried and weighed. After sterilization for 30 min. at 15 lb steam pressure, the test bottles were

Table 1.—Percentage of loss in weight of wood-blocks destroyed by the haploid isolates derived from the basidiospores of fruit body—(h) of *Elfvingia applanata* (PERS.) KARST.

Haploid isolate	Sexual factor	Per cent of loss in weight		Average	Haploid isolate	Sexual factor	Per cent of loss in weight		Average
h—87	A_1B_1	1	76.30	77.48	h—6	A_1B_1	1	47.02	37.24
		2	79.93				2	41.05	
		3	76.21				3	31.11	
		4	77.49				4	29.81	
h—116	A_1B_1	1	71.87	74.33	h—120	A_1B_1	1	38.57	35.79
		2	74.79				2	36.65	
		3	76.40				3	33.85	
		4	74.24				4	34.11	
h—105	A_1B_1	1	69.89	66.53	h—14	A_1B_1	1	35.77	35.53
		2	69.02				2	32.35	
		3	64.24				3	34.19	
		4	62.98				4	39.81	
h—97	A_1B_1	1	67.21	63.89	h—44	A_1B_1	1	30.03	34.57
		2	61.90				2	39.24	
		3	62.17				3	32.19	
		4	64.30				4	36.83	
h—32	A_1B_1	1	59.48	61.18	h—18	A_1B_1	1	28.32	28.28
		2	67.27				2	27.58	
		3	62.64				3	35.07	
		4	55.31				4	22.20	
h—89	A_1B_1	1	56.71	55.41	h—28	A_1B_1	1	15.16	18.57
		2	55.95				2	21.98	
		3	53.59						
h—54	A_1B_1	1	51.26	51.26	h—49	A_1B_2	1	83.52	82.20
		2	51.71				2	80.00	
		3	51.88				3	83.84	
		4	50.20				4	80.43	
h—73	A_1B_1	1	56.29	49.03	h—30	A_1B_2	1	77.01	75.77
		2	41.49				2	75.05	
		3	45.24				3	75.25	
		4	53.09						
h—95	A_1B_1	1	52.42	43.73	h—24	A_1B_2	1	82.78	71.95
		2	38.05				2	69.94	
		3	38.51				3	64.00	
		4	45.95				4	71.07	
h—23	A_1B_1	1	49.07	43.50	h—99	A_1B_2	1	57.92	64.13
		2	40.85				2	68.30	
		3	42.42				3	63.74	
		4	41.65				4	66.54	
h—70	A_1B_1	1	46.35	43.47	h—107	A_1B_2	1	70.52	63.99
		2	36.82				2	65.12	
		3	39.20				3	63.49	
		4	51.49				4	56.84	
h—40	A_1B_1	1	50.65	43.39	h—60	A_1B_2	1	46.54	54.80
		2	48.16				2	55.83	
		3	43.47				3	50.56	
		4	41.26				4	66.27	
h—50	A_1B_1	1	45.30	42.92	h—64	A_1B_2	1	54.69	54.03
		2	46.96				2	54.86	
		3	43.02				3	52.19	
		4	36.39				4	54.37	
h—98	A_1B_1	1	41.57	42.91	h—92	A_1B_2	1	50.00	52.18
		2	37.94				2	47.14	
		3	44.55				3	52.68	
		4	47.58				4	58.88	
h—19	A_1B_1	1	46.06	42.71	h—A	A_1B_2	1	50.59	47.88
		2	44.69				2	41.87	
		3	36.36				3	45.33	
							4	53.75	
h—94	A_1B_1	1	39.71	38.47	h—88	A_1B_2	1	52.23	44.77
		2	36.53				2	39.05	
		3	39.85				3	34.04	
		4	37.81						

(Table 1, continued)

Haploid isolate	Sexual factor		Per cent of loss in weight	Average	Haploid isolate	Sexual factor		Per cent of loss in weight	Average
h—57	A_1B_2	1	39.77	36.60	h—104	A_2B_1	1	20.85	24.51
		2	37.76				2	22.54	
		3	27.97				3	27.01	
		4	40.92				4	27.64	
h—108	A_1B_2	1	27.41	31.38	h—112	A_2B_1	1	21.19	21.92
		2	36.73				2	23.92	
		3	32.53				3	27.65	
		4	28.84				4	14.91	
h—71	A_1B_2	1	36.47	30.60	h—83	A_2B_1	1	8.46	12.81
		2	31.05				2	11.28	
		3	25.74				3	18.69	
		4	29.14						
h—62	A_1B_2	1	34.56	29.29	h—15	A_2B_1	1	7.96	10.39
		2	28.57				2	12.82	
		3	28.86						
		4	25.19						
h—67	A_1B_2	1	25.27	28.16	h—63	A_2B_2	1	77.82	76.04
		2	26.79				2	72.64	
		3	28.18				3	77.68	
		4	32.41						
h—48	A_1B_2	1	9.35	11.93	h—1	A_2B_2	1	71.81	75.13
		2	13.86				2	71.75	
		3	12.59				3	75.69	
							4	81.25	
h—75	A_2B_1	1	75.48	65.59	h—68	A_2B_2	1	63.83	64.97
		2	64.64				2	66.34	
		3	59.61				3	61.91	
		4	62.63				4	67.78	
h—52	A_2B_1	1	57.87	60.16	h—29	A_2B_2	1	63.04	64.86
		2	54.56				2	65.20	
		3	57.66				3	62.52	
		4	70.53				4	68.66	
h—13	A_2B_1	1	59.14	54.36	h—17	A_2B_2	1	44.50	58.99
		2	51.23				2	59.96	
		3	58.96				3	62.42	
		4	48.13				4	69.09	
h—45	A_2B_1	1	46.30	53.51	h—5	A_2B_2	1	47.05	57.39
		2	50.57				2	65.61	
		3	60.88				3	59.51	
		4	56.30						
h—21	A_2B_1	1	58.63	48.90	h—113	A_2B_2	1	50.28	50.26
		2	46.43				2	56.49	
		3	36.54				3	52.29	
		4	54.06				4	41.97	
h—25	A_2B_1	1	45.98	48.88	h—96	A_2B_2	1	46.27	49.37
		2	47.47				2	52.67	
		3	53.19				3	47.23	
							4	51.31	
h—42	A_2B_1	1	40.66	48.44	h—47	A_2B_2	1	43.13	48.12
		2	43.41				2	41.86	
		3	61.26				3	54.03	
							4	53.47	
h—33	A_2B_1	1	48.61	47.75	h—11	A_2B_2	1	45.31	40.72
		2	39.81				2	38.13	
		3	45.54				3	38.72	
		4	57.03						
h—69	A_2B_1	1	53.65	43.44	h—12	A_2B_2	1	34.16	34.30
		2	39.05				2	33.96	
		3	42.28				3	33.09	
		4	38.77				4	36.00	
h—115	A_2B_1	1	35.51	35.55	h—41	A_2B_2	1	11.41	15.43
		2	31.89				2	19.46	
		3	32.72						
		4	42.07						

seeded with mycelium from each agar culture of monosporous mycelia of *Elfvingia applanata* and kept in a culture room at temperatures from 20 to 28°C for 6 months (April 5 — October 5, 1952). Three weeks after inoculation, most of the haploid mycelia developed in the media and grew over the wood blocks. On October 6, the wood blocks were removed from the bottles, oven dried and weighed. Percentage of loss in weight was then culculated. Some of the haploid mycelia grew in the media but did not cover the wood blocks. As these wood blocks appeared not to have been invaded equally on the upper and underside by the mycelia, they were excluded from the calculations.

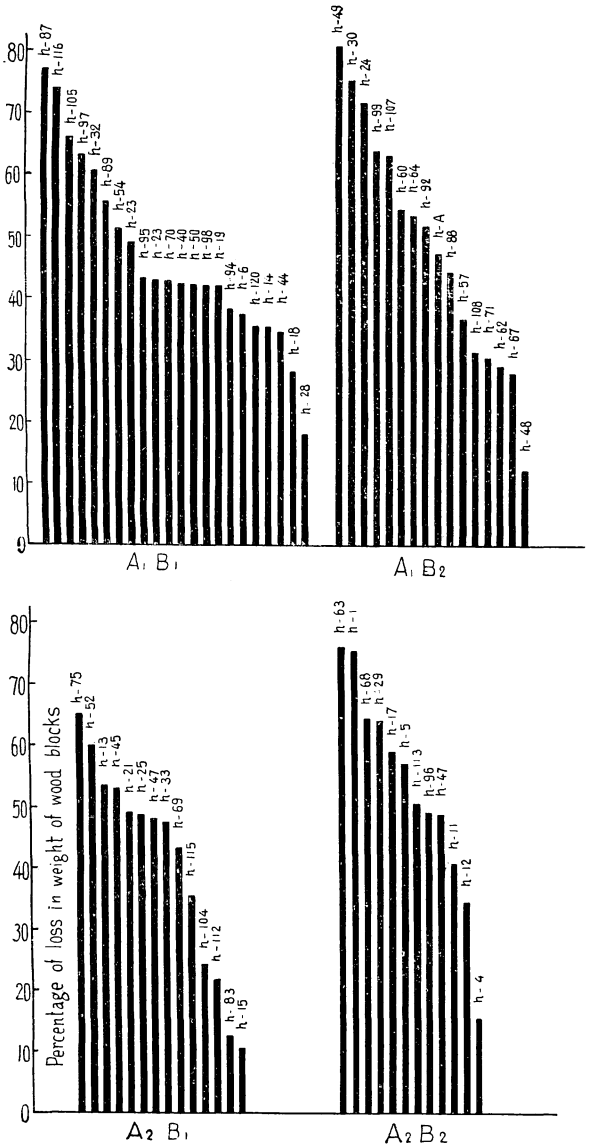

Fig. 1 Percentage of loss in weight of wood blocks decayed by the haploid isolates derived from the basidiospores of fruit body—(h) of *Elfvingia applanata* (PERS.) KARST.

Results: Table 1 shows the percentage of loss in weight of these wood blocks rotted by the haploid mycelia derived from 1 fruit body[1] arranged by sexual factors.

The ability to cause decay of wood of each of the 64 haploid mycelia derived from the same fruit body varied widely. Monosporous isolate, No. h—49 destroyed the 4 wood blocks most vigorously and their average percentage of loss in weight reached 82.20, whereas monosporous isolate, No. h—15 gave an average of only 10.29 per cent loss.

Fig. 1 shows graphically the wood-rotting ability of 64 haploid mycelia arranged by sexual factors and the lack of any relationship between sexual factors of haploid mycelia and their rotting ability. Fig. 2 shows the numbers of haploid mycelia plotted against their ability to cause decay, as indicated in percentage of loss in weight of wood blocks. From this curve it can be seen that variation

1). Tissue culture from this fruit body is designated as Isolate—(h).

of rotting ability of wood between each of the monosprous mycelia from the same fruit body is merely a fluctuation.

Table 2 shows the percentage of loss in weight by the haploid mycelia derived from the different fruit body.[2] It is apparent in this table that the rotting ability of haploid mycelia of this fungus varies in degree, depending on individual characteristics.

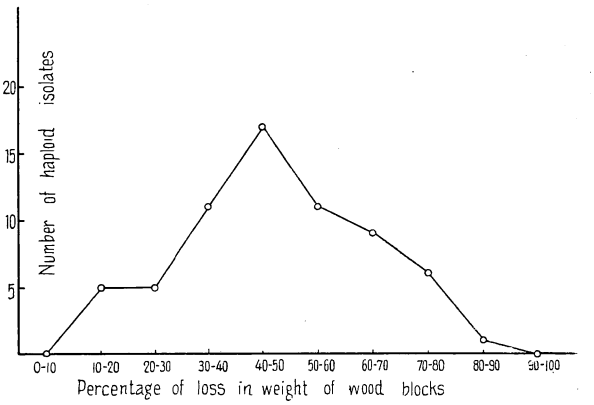

Fig. 2　Relation of percentage of loss in weight of wood blocks and number of haploid isolates.

Table 2.—Percentage of loss in weight of wood-blocks destroyed by the haploid isolates derived from the basidiospores of fruit body-(g) of *Elfvingia* applanata (PERS.) Karst.

Haploid isolate	Sexual factor	Per cent of loss in weight	Average	Haploid isolate	Sexual factor	Per cent of loss in weight	Average
g—7	A_1B_3	1 75.41 2 78.71 3 76.72 4 74.67	75.87	g—6	A_3B_3	1 57.71 2 52.69 3 48.39 4 52.69	52.87
g—1	A_3B_4	1 71.81 2 64.15 3 61.89 4 67.84	66.42	g—2	A_1B_4	1 48.65 2 44.10 3 37.76 4 52.00	45.63

Decay by diploid mycelia

Materials and methods: Forty-seven diploid mycelia were obtained by pairing 2 of the haploid mycelia used in the preceding experiments. Also, 8 diploid mycelia isolated by the writer from various localities in Japan were employed as follows: Isolate—(a), tissue culture from fruit body on *Fagus crenata*, Minamitsuru-gun, Yamanashi pref., Oct., 1949; Isolate—(c), tissue culture from fruit body on *Betula Ermanii communis*, Kamikochi, Nagano pref., Aug., 1951; Isolate—(d), tissue culture from fruit body on *Betula Ermanii communis*, Kamikochi, Nagano pref., Aug., 1951; Isolate—(e), tissue culture from fruit body on *Betula Ermanii communis*, Kamikochi, Nagano pref., Aug., 1951; Isolate—(g), tissue culture from fruit body on *Quercus myrsinaefolia*, Meguro, Tokyo, June, 1951; Isolate—(h), tissue culture from fruit body on *Quercus myrsinaefolia*, Meguro, Tokyo, June, 1951; Isolate—(j), tissue culture from fruit body on *Fagus crenata*, Nakatsuchi, Kitaazumi-gun, Nagano pref., Aug., 1951; Isolate—(k), tissue culture from fruit body on *Quercus sp.*, Koishikawa, Tokyo, Sept., 1948.

The method of determining ability of the diploid mycelia to cause decay and the date of beginnig and end of this experiment were the same as in the preceding experiment.

2). Tissue culture from this fruit body is designated as Isolate—(g).

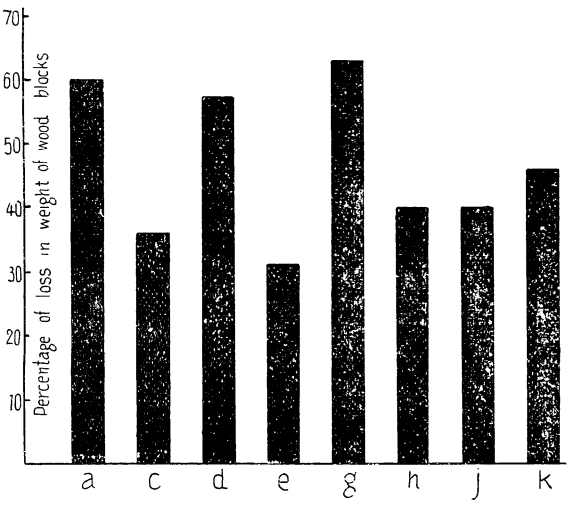

Fig. 3 Percentage of loss in weight of wood blocks of 8 diploid mycelia isolated from tissue of each of 8 fruit bodies on different hosts and from various localities in Japan.

Results: Table 3 and Fig. 3 show the percentage of loss in weight of wood blocks attacked by these 8 cultures of diploid mycelia isolated from tissues of each fruit body.

From this table it may be noted that, among these 8 isolates, there exist some significant differences in ability to cause decay. It is also shown that 3 cultures (c, d, e) isolated from sporophores on the same host species in the same year at the same locality, but not from the same tree vary in their ability to cause decay of wood.

Forty-four diploid myce-

Table 3.—Percentage of loss in weight of wood-blocks destroyed by the diploid mycelia isolated from tissues of each of the different fruit bodies of *Elfvingia applanata* (PERS.) KARST.

Isolate	Per cent of loss in weight	Average	Isolate	Per cent of loss in weight	Average
a	1 57.77 2 57.31 3 62.36 4 63.89	60.33	g	1 56.38 2 62.45 3 67.92 4 70.16	64.23
c	1 45.59 2 30.61 3 32.96 4 35.76	36.23	h	1 36.38 2 45.27 3 40.61 4 38.53	40.19
d	1 62.93 2 59.86 3 55.49 4 51.49	57.44	j	1 41.31 2 39.70 3 39.02 4 41.63	40.42
e	1 30.28 2 30.51 3 31.77 4 32.45	31.25	k	1 44.96 2 41.54 3 50.54 4 49.15	46.54

lia derived from the pairing of monosporous mycelia used in the preceding experiment from fruit body--(h) were tested for ability to cause decay of wood. Table 4 shows the percentage of loss in weight of wood blocks of *Fagus crenata* caused by these mycelia. In this case there was also considerable variation in ability to cause decay of wood.

Wood-rotting ability of 2 types of diploid mycelia ($A_1B_1 \times A_2B_2$ and $A_1B_2 \times A_2B_1$) is shown graphically in Fig. 4. From this figure, it will be seen that there is no significant correlation between the sexual factors of haploid mycelia from which the diploid mycelia have been derived and the ability of the resulting diploid mycelia to cause decay of wood, if the diploid mycelia have the same composition of sexual factors ($A_1A_2B_1B_2$).

Table 4.—Percentage of loss in weight of wood-blocks destroyed by the diploid mycelia derived from pairing of monosporous mycelia of fruit body-(h) of *Elfvingia applanata* (PERS.) KARST.

Diploid isolate	Sexual factor	Per cent of loss in weight	Average	Diploid isolate	Sexual factor	Per cent of loss in weight	Average
h—62× h—13	$A_1B_2 \times A_2B_1$	1 36.69 2 28.69 3 30.63 4 37.04	33.26	h—48× h—15	$A_1B_2 \times A_2B_1$	1 42.75 2 29.25 3 30.51 4 32.47	33.74
h—62× h—15	$A_1B_2 \times A_2B_1$	1 45.01 2 40.52 3 40.72 4 42.77	42.25	h—48× h—42	$A_1B_2 \times A_2B_1$	1 27.08 2 21.38 3 17.74 4 27.02	23.31
h—62× h—42	$A_1B_2 \times A_2B_1$	1 20.78 2 18.00 3 10.68 4 14.15	15.90	h—48× h—45	$A_1B_2 \times A_2B_1$	1 24.40 2 29.57 3 21.72 4 30.09	26.45
h—62× h—45	$A_1B_2 \times A_2B_2$	1 26.97 2 27.91 3 23.32 4 28.30	26.72	h—48× h—9	$A_1B_2 \times A_2B_1$	1 46.87 2 50.51 3 49.91 4 41.59	47.22
h—62× h—9	$A_1B_2 \times A_2B_1$	1 40.74 2 33.59 3 37.89 4 44.73	39.24	h—49× h—42	$A_1B_2 \times A_2B_1$	1 55.98 2 46.05 3 45.45 4 33.31	46.45
h—57× h—13	$A_1B_2 \times A_2B_1$	1 39.64 2 35.63 3 39.75 4 43.24	39.57	h—49× h—45	$A_1B_2 \times A_2B_1$	1 29.49 2 34.95 3 32.95 4 32.55	32.49
h—57× h—15	$A_1B_2 \times A_2B_1$	1 31.48 2 27.79 3 27.30 4 33.02	29.89	h—49× h—9	$A_1B_2 \times A_2B_1$	1 24.27 2 24.52 3 25.32	24.70
h—57× h—42	$A_1B_2 \times A_2B_1$	1 30.08 2 35.89 3 28.26 4 40.79	33.75	h—14× h—11	$A_1B_1 \times A_2B_2$	1 48.70 2 46.55 3 51.26 4 48.99	48.87
h—57× h—45	$A_1B_2 \times A_2B_1$	1 33.73 2 34.08 3 37.85 4 32.84	34.60	h—14× h—12	$A_1B_1 \times A_2B_2$	1 33.10 2 30.99 3 28.87 4 36.92	32.47
h—57× h—9	$A_1B_2 \times A_2B_1$	1 35.61 2 28.35 3 27.03 4 38.89	32.47	h—14× h—17	$A_1B_1 \times A_2B_2$	1 29.19 2 29.93 3 28.38 4 29.16	29.17
h—60× h—13	$A_1B_2 \times A_2B_1$	1 39.43 2 40.14 3 49.83 4 49.08	44.62	h—3 × h—12	$A_1B_1 \times A_2B_2$	1 27.44 2 27.95 3 23.48 4 25.14	26.00
h—60× h—15	$A_1B_2 \times A_2B_1$	1 30.22 2 32.29 3 27.47 4 35.85	31.46	h—3 × h—16	$A_1B_1 \times A_2B_2$	1 29.12 2 29.87 3 30.89 4 38.37	32.06
h—60× h—42	$A_1B_2 \times A_2B_1$	1 55.45 2 39.26 3 40.28 4 50.37	46.34	h—3 × h—17	$A_1B_1 \times A_2B_2$	1 34.85 2 31.50 3 28.99 4 22.02	29.34
h—60× h—45	$A_1B_2 \times A_2B_1$	1 39.65 2 38.31 3 34.56 4 39.43	37.99	h—3 × h—41	$A_1B_1 \times A_2B_2$	1 48.10 2 52.47 3 60.23 4 67.03	56.96
h—48× h—13	$A_1B_2 \times A_2B_1$	1 59.39 2 50.80 3 46.11 4 59.43	53.93	h—50× h—11	$A_1B_1 \times A_2B_2$	1 33.72 2 29.54 3 28.21 4 32.35	30.95

Diploid isolate	Sexual factor	Per cent of loss in weight	Average	Diploid isolate	Sexual factor	Per cent of loss in weight	Average
h—50× h—12	$A_1B_1 \times A_2B_2$	1 41.59 2 36.07 3 33.36 4 39.89	38.97	h—40× h—17	$A_1B_1 \times A_2B_2$	1 46.06 2 33.26 3 32.77 4 39.62	37.92
h—50× h—16	$A_1B_1 \times A_2B_2$	1 27.01 2 22.66 3 25.72 4 32.54	26.98	h ×40× h—41	$A_1B_1 \times A_2B_2$	1 39.66 2 44.06 3 37.00 4 47.96	42.17
h—50× h—17	$A_1B_1 \times A_2B_2$	1 41.77 2 31.46 3 34.46 4 37.56	36.31	h—44× h—11	$A_1B_1 \times A_2B_2$	1 25.33 2 30.79 3 33.56 4 27.38	29.26
h—50× h—41	$A_1B_1 \times A_2B_2$	1 38.20 2 40.87 3 38.34 4 38.57	38.99	h—44× h—12	$A_1B_1 \times A_2B_2$	1 23.12 2 26.29 3 21.69 4 31.36	25.61
h—40× h ×11	$A_1B_1 \times A_2B_2$	1 56.12 2 49.64 3 48.15 4 51.67	51.40	h—44 × h—16	$A_1B_1 \times A_2B_2$	1 48.81 2 43.95 3 52.93 4 56.01	50.42
h—40× h—12	$A_1B_1 \times A_2B_2$	1 40.34 2 33.92 3 31.25 4 29.32	33.71	h—44× h—17	$A_1B_1 \times A_2B_2$	1 51.88 2 52.37 3 44.73 4 40.66	47.41
h—40× h—16	$A_1B_1 \times A_2B_2$	1 65.66 2 50.75 3 54.73 4 59.41	57.63	h—44× h—41	$A_1B_1 \times A_2B_2$	1 44.31 2 32.86 3 47.92 4 28.60	38.42

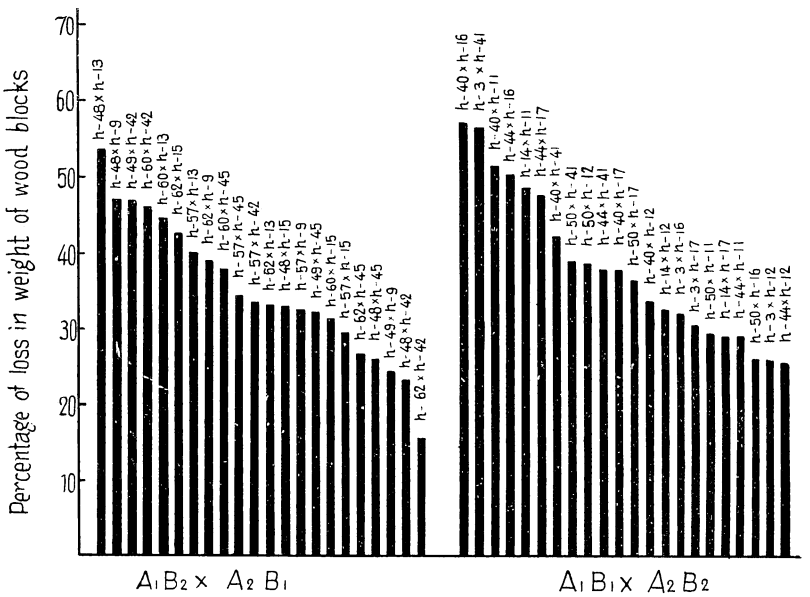

Fig. 4　Percentage of loss in weight of wood blocks destroyed by the diploid mycelia derived from pairing of monosporous mycelia of fruit body-(h).

Diploid isolate, No. h—40 × No. h—16 was foremost in wood-rotting ability, with 57.63 per cent, while No. h—62 × No. h—42 was the least with 15.90 per cent. Fig. 5 shows the relation between the number of diploid isolates and their ability to cause decay of wood. From this it can be concluded that the

variation of ability to cause decay of wood among the diploid mycelia from the same fruit body is a fluctuation. Furthermore, the diploid isolate, No. h—49 × No. h—45 is not so capable in causing wood decay (32.49%) as were haploid isolates, No. h—49, the strongest of all the haploid mycelia with 82.20 per cent, and No. h—45, a moderately strong decayer with 53.51 per cent.

No. h—49 × No. h—42 (46.45%) is stronger in ability to cause decay than No. h—49 × No. h—45 (32.49%), where No. h—42 (48.44%) is weaker in ability to cause decay of wood than No. h—45(53.51%).

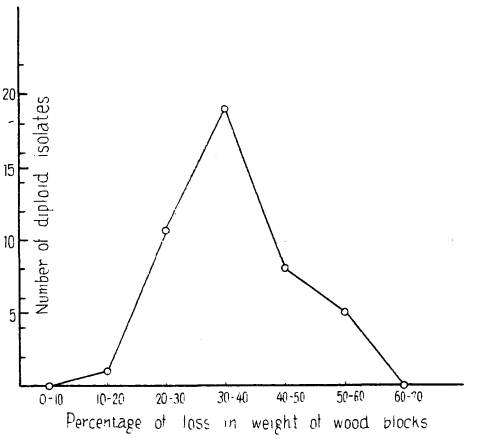

Fig. 5　Relation of percentage of loss in weight of wood blocks and number of diploid isolates.

No. h—15 × No. h—62 is strong with 42.25 per cent, where No. h—15 is the weakest of all the haploid mycelia with 10.39 percent and No. h—62 is moderately weak with 29.29 per cent.

No. h—15 × No. h—60 (31.46%) is weaker in ability to cause decay than No. h—15 × No. h—62 (42.25%), where No. h—60 (54.80%) is much stronger than No. h—62 (29.29%). The results lead to the conclusion that, within the same source, the wood-rotting ability of diploid mycelia is not indicated by the decay ability of the parent monosporous mycelia from which they have been derived.

Two diploid mycelia derived from 4 mating types of monosporous mycelia from the fruit body—(g) were tested for ability to cause decay. Table 4 shows the percentage of loss in weight of wood blocks rotted by these 2 diploid mycelia. Both of diploid mycelia caused greater weight loss of wood blocks than any of the diploid mycelia derived from the fruit body—(h). The percentage of loss in weight for the 2 diploid mycelia, No. g—1 × No. g—7 and No. g—2 × No. g—6 amounted to 62.80 and 67.99 per cent, respectively.

Two diploid mycelia isolated from the tissues of each of the 2 fruit bodies, Isolate—(g) and Isolate—(h)[3] differ in their ability to cause decay (Table 3, Fig. 3). Isolate—(g) caused 64.23 per cent loss in weight and Isolate—(h) 40.19 per cent. This difference is significant at the 5 per cent level. Comparing this with results presented above, it can be concluded, that the decay ability of diploid isolates derived from tissue of fruit body, is indicative of the ability of the diploid mycelia derived from the basidiospores to cause decay.

Ability to cause decay of wood of the 2 haploid mycelia, No. g—1 and No. g—7 is greater than those of No. g—2 and No. g—6. On the other hand, wood-rotting ability of the 2 diploid mycelia, No. g—1 × No. g—7 (62.80%) is less than that of the diploid mycelia, No. g—2 × No. g—6 (67.99%). These results further suggest that ability to cause decay of diploid mycelia, within the same source, is not indicated by the decay ability of the parent monosporous mycelia.

The diploid mycelium derived from the 2 basidiospores of different fruit bodies, No. g—1 × No. h—116 caused 49.68 per cent in loss in weight of wood blocks. This value is moderately strong compared with that of the diploid

3). Isolate—(g) is designated as $A_1A_3B_3B_4$ and Isolate-(h), $A_1A_2B_1B_2$.

Table 5.—Percentage of loss in weight of wood-blocks destroyed by the diploid mycelia derived from pairing of monosporous mycelia of fruit body—(g) and fruit body—(h) of *Elfvingia applanata*

Diploid isolate	Sexual factor	Per cent of loss in weight	Average
g—1 × g—7	$A_3B_4 \times A_1B_3$	1 68.14 2 60.23 3 61.80 4 61.06	62.80
g—2 × g—6	$A_1B_4 \times A_3B_3$	1 66.01 2 64.55 3 73.46 4 67.96	67.99
g—1 × h—116	$A_3B_4 \times A_1B_1$	1 48.12 2 52.70 3 48.22	49.68

mycelia derived from the fruit body—(h) (40.19%), but weak comparing with that from the fruit body—(g) (64.23%). Haploid mycelia, No. g—1 has a wood-rotting ability of 66.42 per cent and No. h—116 that of 74.33 per cent. These 2 monosporous mycelia both have pronounced ability to cause decay, but the diploid mycelia derived from the pairing of these monosporous mycelia (one from the fruit body of strong ability and another from that of weak ability), was only moderately able to cause decay of wood.

Discussion

Observation on wood decay by the haploid mycelia of wood-rotting Basidiomycetes was reported for the first time by VERRALL (11). He has reported that among the haploid cultures of *Phellinus* (*Fomes*) *igniarius* (L.) QUEL. from birch the wood decaying proclivities did not vary significantly, although there were differences in rate of growth on malt agar. The haploid cultures from aspen and ironwood, however, vary considerably in the amount of decay caused. MOUNCE and MACRAE (8) observed that some of the monosporous mycelia of *Fomitopsis* (*Fomes*) *pinicola* (SCHW.) KARST. destroyed the wood blocks of *Picea sitchensis* fairly rapidly, but others caused very little decay. These results are rather similar to that of the present writer's experiment in which it is indicated that large variation exists between the wood-rotting ability of haploid mycelia of *Elfvingia applanata*.

The writer has indicated that the haploid mycelia of *Elfvingia applanata* destroyed the wood blocks of *Fagus crenata* considerably, but that the wood-rotting ability of each of 64 haploid mycelia differed greatly ranging from 10.39 to 82.20 in percentage of loss in weight of wood blocks. From Fig. 1 it is evident that no correlations exist between wood-rotting ability of haploid mycelia and their sexual factors.

As shown in Fig. 2, the numbers of haploid isolates as plotted against wood-rotting ability follows a normal distribution curve.

There are differences of wood-rotting ability among the diploid isolates. SCHMITZ (10) found differences of wood-rotting ability among 4 isolates of *Fomitopsis* (*Fomes*) *pinicola* (SCHW.) KARST., and concluded that in this species physiological variation existed which might be the results of host influence. MOUNCE (7) worked with the same fungus and concluded that the difference was the result of individual variation rather than host influence. OWENS (9) also

found that there existed variation of ability to cause decay among the isolates of *Cryptoderma* (*Fomes*) *pini* (THORE) IMAZ. VERRALL (11) investigated *Phellinus* (*Fomes*) *igniarius* (L.) QUEL. and that there existed variation of wood-rotting ability among the isolates. He also stated that there were 3 distinct groups in this species, which differ among themselves in morphological as well as physiological characteristics and in ability to cause decay of wood, from the standpoint of host relationship. CHILDS (3) found that different isolates of *Phaeolus* (*Polyporus*) *schweinitzii* (FR.) PAT. varied from one another in ability to cause decay of wood. HILBORN (4) pointed out that the isolates of *Fomes fomentarius* (L.) KICKX differed among themselves in their ability to cause decay of wood, and that this was the result of individual variation and not correlated with any host or locality influence.

Differences in wood-rotting ability exist among 8 isolates of *Elfvingia applanata* (Table 3). Three of these were isolated from tissues of each of the fruit bodies grown on the same host (*Betula Ermanii communis*) at the same locality, but not on the same tree, and collected on the same date. There is also difference in ability to cause decay among these 3 isolates. Two of 8 isolates from the same host and locality were also different in their ability to cause decay. It can therefore be concluded that the difference in ability to cause decay of wood existing among the isolates of *Elfvingia applanata* is the result of individual variation, and not correlated with any locality influence. There is also considerable variation in ability to cause decay of wood among 44 diploid mycelia derived from the basidiospores from the same source. They range from 56.63 to 15.90 per cent in loss in weight of wood blocks. This range of variation is smaller than that of haploid mycelia.

Furthermore, the writer has pointed out that there exists no significant difference in ability to cause decay of wood between the 2 types of diploid mycelia ($A_1B_1 \times A_2B_2$ and $A_1B_2 \times A_2B_1$).

Diploid mycelia derived from the 2 monosporous mycelia, both with strong decaying ability, do not always have much ability to cause decay of wood. Similarly, it was also ascertained that diploid mycelia from the monosporous mycelia, both with weak ability, do not always have weak ability to cause decay of wood. The considerable difference of ability to cause decay existing among the diploid mycelia can not be explained on the basis of the decay ability of the haploid strains from which they were derived.

Two diploid mycelia from the basidiospores of another fruit body—(g) (Table 4) have more ability to cause decay than any of the diploid mycelia from the basidiospores of the fruit body—(h), while the 4 monosporous mycelia have no greater ability to cause decay than many of the monosporous mycelia from fruit body—(h).

Diploid mycelia derived from 2 basidiospores, one from fruit body—(h) and the other from fruit body—(g), have wood-rotting ability intermediate between that of diploid mycelia from fruit body—(h) and fruit body—(g). Here, it must be mentioned that wood-rotting ability of Isolate—(g) is significantly greater than that of Isolate—(h). From the fact mentioned above, it can be concluded that the wood-rotting ability of diploid mycelia is inherited from the parent diploid mycelia, regardless of the ability to cause decay of 2 mating types of monosporous mycelia.

VERRALL (11) has reported in his study on variation in *Phellinus igniarius* that the haploid cultures of this fungus decay wood more slowly than the dicaryotic tissue cultures of the parent fruiting bodies. KAUFERT (6) has reported that the dicaryotic mycelia of *Pleurotus corticatus* FR. decay basswood sawdust

more rapidly than haploid mycelia in tests lasting 90—150 days. When the decay period was lengthened to 210 days, however, the haploid mycelia caused as much decay as the parent dicaryotic mycelium or compatible matings of haploid mycelia. Ito (5) has reported that haploid mycelia of *Fomitopsis* (*Fomes*) *rhodophaea* (Lév.) Imaz. destroyed the wood blocks of *Liriodendron tulipifera* as quickly as the diploid mycelia.

Considerable difference existed (Fig. 2, 5) between the wood-rotting ability of haploid and diploid mycelia of *Elfvingia applanata*, if they are derived from the same source. The diploid mycelia grew on the wood blocks more compactly and rapidly than the haploid mycelia, covering the wood blocks with brownish black and felty mycelia. Therefore, it is possible that the oxygen supply to the wood blocks is somewhat inhibited in the case of diploid mycelia. For this reason comparison cannot be made between the ability of haploid mycelia to cause decay and that of diploid mycelia without some chance of error. However, it can be pointed out that the variation range of ability to cause decay of haploid mycelia (10.39—82.20%) is much greater than that of the diploid mycelia (15.90—57.63%).

Summary

Wood-rotting ability of monosporous mycelia as well as diploid ones of *Elfvingia applanata* (Pers.) Karst. was genetically analized.

Ability to cause decay of wood of monosporous mycelia of this fungus varied extensively according to their individual characteristics. Furthermore, no correlation existed between their known sexual factors and their ability to cause decay of wood. Numbers of monosporous mycelia as plotted against their ability to cause decay of wood followed a normal distribution curve, provided that they were derived from basidiospores of the same fruit body.

Eight diploid mycelia isolated from tissues of each of the 8 fruit bodies of this fungus varied in ability to cause decay of wood. Variations in ability to cause decay of wood existing among these isolates were demonstrated to be the results of individual variation and not correlated with any host and locality influence.

There was also variation of ability to cause decay of wood among the diploid mycelia derived from pairing monosporous mycelia from the basidiospores of the same source. Numbers of diploid mycelia as plotted against their ability to cause decay gave a normal distribution curve. This variation was also indicated to be the result of fluctuation. No significant difference of ability to cause decay of wood existed between the 2 types of diploid mycelia, providing all the haploid mycelia were derived from the same fruit body.

Diploid mycelia derived from 2 monosporous mycelia having pronounced ability to cause decay did not always do so consistently. Results indicated that the differences in ability to cause decay existing among the diploid mycelia, derived from the basidiospores of the same source, are the result of natural fluctuation.

Diploid mycelia from 2 paired monosporous mycelia obtained from a fruit body whose isolate had strong ability to cause decay also caused high decay loss. Diploid mycelia derived from 2 monosporous mycelia, one from a sporophore whose isolate had strong ability to cause decay and the other from one of weak ability, are intermediate in their ability to cause decay, in relation to those of the diploid isolates indicated above.

Difference in ability to cause decay between haploid and diploid mycelia is not clear in this species because of difficulties in obtaining a satisfactory method of comparing decay ability. However, the variation range of haploid mycelia, within the same source, is obviously greater than that of the diploid mycelia.

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Literature cited

1) Aoshima, K.: Germination of the basidiospores of *Elfvingia applanata* (Pers.) Karst. (*Fomes applanatus*). Gov. For. Exp. Sta. Bull. 67: 1—18. (1954)
2) Aoshima, K.: Sexuality of *Elfvingia applanata* (Pers.) Karst. (*Fomes applanatus*). Nagaoa 3: 5—11. (1953)
3) Childs, T. W.: Variability of *Polyporus schweinitzii* in culture. Phytopath. 27: 29—50. (1937)
4) Hilborn, M. T.: The biology of *Fomes fomentarius*. Maine Agr. Exp. Sta. Bull. 409: 161—214. (1942).
5) Ito, K.: Heterothallism of *Polyporus rhodophaeus* Lév. Jour. Japan. Forest. Soc. 26: 185—191 (in Japanese). (1938)
6) Kaufert, F. H.: The biology of *Pleurotus corticatus* Fr. Minn. Agr. Exp. Sta. Tech. Bull. 114. (1936)
7) Mounce, I.: Studies in Forest Pathology. II. The biology of *Fomes pinicola* (Schw.) Cooke. Canada Dept. Agr. Bull. 111. (1929)
8) Mounce, I. and Macrae, R.: Interfertility phenomena in *Fomes pinicola*. Canad. Jour. Res. C, 16: 354—376. (1938)
9) Owens, C. E.: Studies on the wood-rotting fungus, *Fomes pini*. II. Cultural characteristics. Amer. Jour. Bot. 23: 235—254. (1936)
10) Schmitz, H.: Studies in wood decay. V. Physiological specialization in *Fomea pinicola* Fr. Amer. Jour. Bot. 12: 163—177. (1925)
11) Verrall, A. F.: Variation in *Fomes igniarius* (L.) Gill. Minn. Agr. Exp. Sta. Tech. Bull. 117. (1936)

Explanation of plates

Plate 1.

A. Mycelia of haploid isolate, No. h—22 in a bottle at the end of decay experiment.
B. Mycelia of haploid isolate, No. h—26 in a bottle at the end of decay experiment.

Plate 2.

A. Mycelia of diploid isolate, No. h—3 × No. h—26 in a bottle at the end of decay experiment.
B—D. Wood-blocks of *Fagus crenata* decayed by the haploid and diploid isolates.
B. 1. Haploid isolate, No. h—15; 2. Haploid isolate, No. h—62; 3. Diploid isolate, No. h—15 × No. h—62; 4. Control; 5. Diploid isolate, No. h—50 × No. h—16; 6. Diploid isolate, No. h—60 × No. h—15.
C. 1. Haploid isolate, No. g—6; 2. Haploid isolate, No. g—2; 3. Diploid isolate, No. g—2 × No. g—6; 4. Control.
D. 1. Control; 2. Haploid isolate, No. h—45; 3. Diploid isolate, No. h—45 × No. h—49; 4. Haploid isolate, No.h—87; 5. Haploid isolate, No. h—92; 6. Diploid isolate, No. h—42 × No. h—49.


A


B

-Plate 2—