

Phellinus sulphurascens and the closely related *P. weirii* in North America

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Abstract: Monokaryotic isolates of *Phellinus sulphurascens*, a fungus originally described from the Primorsk Territory, Russia, are compatible with monokaryotic isolates of, what has been called in North America, the Douglas-fir form of *P. weirii*. *Phellinus weirii*, originally described from Idaho as a root and stem decay fungus of western redcedar, is not compatible with monokaryotic isolates of *P. sulphurascens* or the Douglas-fir form of *P. weirii*. Differences between *P. sulphurascens* and *P. weirii* are noted. Observations on the behavior of *P. weirii* (cedar form) on western redcedar are also reported. Both fungi are referred to the genus *Inonotus*, and the new combination *Inonotus sulphurascens* is proposed.

Key Words: *Inonotus sulphurascens* comb. nov., mating systems, *Phellinus sulphurascens*, *P. weirii*

INTRODUCTION

Phellinus weirii (Murr.) Gilbertson was described by Murrill (1914) from specimens occurring on *Thuja plicata* Donn collected by J. R. Weir from Priest River, Idaho. The host range of the fungus was extended to *T. occidentalis* L. (Hubert, 1931), *Pseudotsuga menziesii* (Mirb.) Franco (Mounce et al., 1940), and *Abies* spp., *Picea* spp., *Pinus* spp., and *Tsuga* spp. (Bier and Buckland, 1947).

The perception that two recognizable forms of *P. weirii* exist is not new. Mounce et al. (1940) noted differences but concluded that the fungus on Douglas-fir was the same as *P. weirii* on western redcedar or a form of it. Buckland et al. (1954) designated isolates from Douglas-fir as “annual *P. weirii*” and those from

cedar as “perennial *P. weirii*.” Clark (1958) determined that “cedar isolates” and “noncedar isolates” may be separated on the basis of cultural characteristics. However, Nobles (1948, 1965) did not distinguish the two forms in axenic culture. Angwin (1989) and Angwin and Hansen (1989, in press) developed a back-pairing method to determine compatibility in monokaryon-monokaryon and monokaryon-heterokaryon (di-mon) pairings and demonstrated a high degree of genetic isolation (incompatibility) between the western redcedar and Douglas-fir forms. Protein banding patterns obtained by polyacrylamide gel electrophoresis (SDS-PAGE) further demonstrated the genetic differences between the two groups. However, because examples of partial compatibility were observed in some monokaryon-monokaryon pairings, Angwin and Hansen (1989, in press) concluded that the groups are best referred to as “intersterility groups.” Banik et al. (in press) provide serological data that appear to effectively separate the two forms. Pairings by Angwin (1989) and Angwin and Hansen (1989, in press) also confirmed the previous reports (Gillet, 1975; Kao, 1978; Hansen, 1979) of heterothallism and demonstrated that the two forms possess a unifactorial multiallelic mating system. Larsen and Lombard (1989) advocated separate nomenclatural recognition at the species level based on differences between the two forms, including cultural characteristics, dimensions (lengths) of setal hyphae in test tube culture, characteristics of germinating basidiospores, and degree of host specificity.

The taxonomy and nomenclature of *Phellinus weirii* were reviewed by Kotlaba and Pouzar (1970). They concluded that names of several xanthochroic polypore species, notably *Phellinus sulphurascens* Pilát described from Siberia, were facultative synonyms of *P. weirii* from North America. Kotlaba and Pouzar (1970) also concluded from their studies that the hyphal system of *P. weirii* was monomitic, as did Lowe (1966). Thus, they advocated the use of the generic name *Inonotus* rather than *Phellinus* and introduced the combination *Inonotus weirii* (Murr.) Kotl. & Pouz. This binomial was later taken up by Domanski (1965, 1975). Both Pegler (1964) and Parmasto (1959) used *Inonotus heinrichii* Bond. & Sing., a name that Kotlaba and Pouzar (1970) cited as a facultative synonym of *I. weirii*. Larsen and Cobb-Pouille (1990) maintained *P. sulphurascens* and *P. weirii* as separate taxa.

The purpose of this communication is to further clarify the taxonomic and nomenclatural position of

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the two forms of *Phellinus weirii* in North America and confirm the unifactorial mating systems previously demonstrated. Our studies show that two separate taxa exist in North America under the name of *P. weirii*. Compatible pairings between *P. sulphurascens* from the Primorsk Territory, Russia, and the Douglas-fir form of *P. weirii* support the conclusion that *P. sulphurascens* is the correct name for the Douglas-fir form. In addition, we confirm the unifactorial mating system of both species.

MATERIALS AND METHODS

Studies of basidiomata of P. sulphurascens and the Douglas-fir and cedar forms of P. weirii. — Nomenclature type specimens were studied for *Phellinus sulphurascens* [HOLOTYPE. SIBERIA: dist. Kansk, on partially burned wood of *Larix sibirica* Ledeb. (= *L. russica* (Endl.) Sabina ex Trautv.), 20-VII-1934, coll. Trozjuk W16; PR 682261], *Xanthochrous glomeratus* subsp. *heinrichii* Pilát (LECTOTYPE. SIBERIA: dist. Tara, on *Abies sibirica* Ledeb., IX-1929, coll. Ziling 1094; PR 187706), *X. heinrichii* forma *nodulosus* Pilát (HOLOTYPE. SIBERIA: dist. Narym, on *Pinus sylvestris* L., IX-1920, coll. Krawtzev W243b; PR 187705), and *P. weirii* [HOLOTYPE. USA. IDAHO: Kaniksu National Forest, on *Thuja plicata* Donn ex D. Don, 1912, J. R. Weir (NY)]. Small portions (about 0.5 cm³) were embedded in plastic, sectioned at 5 µm thickness, and mounted in Permunt³ (Fisher Scientific Co.). Other specimens representing these taxa were sectioned free-hand, treated with 95% ethanol, and immersed in Melzer's reagent (Melzer, 1924). A partial listing of specimens examined, deposited in the Center for Forest Mycology Research (CFMR), is presented in TABLE I. Herbarium designations are those of Holmgren et al. (1981).

Cultures. — Wild-type decay and tissue isolates were obtained from a variety of sources. Decay isolates were obtained from live standing trees and downed logs of western redcedar. Tissue isolates were obtained from fruiting bodies of *P. weirii* (cedar form) associated with the same substrates (live standing trees or downed logs). Some decay isolates used in this study were those used by Clark (1958). Polysporous heterokaryotic and monokaryotic isolates were obtained for both cedar and Douglas-fir forms. Monokaryotic isolates from the Primorsk Territory, Russia, identified in the field as *P. sulphurascens* and confirmed in this laboratory, were provided by Drs. E. Parmasto and R. Peterson at the request of M. J. Larsen. A partial listing of isolates and specimens used in this study is presented in TABLE I.

Basidiospore germination. — Basidiospores were collected on small strips of aluminum foil attached directly underneath fruiting bodies in the field or by suspending portions of fruiting bodies over 2% malt agar (w/v) in the laboratory. Spores were placed in suspension in distilled water with 0.01% Tween 80 (v/v), diluted further to a suitable concentration, and spread on 2% malt agar in petri dishes. Petri dishes flooded with spore suspensions were used to obtain monokaryotic isolates and observe the nature of spore germination. Photomicrographs of basidiospores obtained from FP-134696 on western redcedar (confirmed culturally as the cedar form) and FP-134842 on Douglas-fir (confirmed culturally as the Douglas-fir form), germinating on an agar surface, were prepared with the aid of a Leitz Orthomat camera using Panatomic-X film (Kodak).

Analysis of setal hyphae dimensions. — The length and diameter of 10 setal hyphae associated with wood decayed by "*Phellinus weirii*" were measured from 15 samples each from redcedar and Douglas-fir. Data were grouped by host without prior determination of form and subjected to Analysis of Variance (ANOVA). Also, power calculations were made using the Pearson and Hartley charts for the power of the *F*-test (Scheffe, 1959), thus providing the number of required length and diameter measurements of setal hyphae for discriminating between the two forms of *Phellinus weirii* in North America.

Determination of incompatibility systems of and pairing responses between monokaryons of P. sulphurascens and Douglas-fir and cedar forms of P. weirii. — Fourteen to 15 monokaryotic isolates were crossed in all combinations for both *Phellinus sulphurascens* (3305) and *Phellinus weirii* (cedar form) (FP-135684). Isolates were first cultivated on potato dextrose agar (Difco Co.) and pairings made 3–5 mm apart and incubated in the dark at 24 C. Initial screening for positive matings was done at 6 wk by recognition of the formation of a new heterokaryon through change in culture morphology. When pairings could not be clearly interpreted, a thin strip of agar (about 30–40 × 3–5 mm), extending through both monokaryons and the colony hyphal conformation zone, was removed and placed inverted on a malt agar plate, incubated similarly, and examined periodically every 4–5 days for up to 3 wk for new heterokaryon formation. Newly formed heterokaryons were backcrossed to a nonsib heterokaryon and compared culturally to sib monokaryons. The formation of dark pigment in the confrontation zone and absence of intermingling of hyphae in a backcross and differences in culture morphology between a new heterokaryon and parent monokaryon confirmed a positive mating. To further confirm this method as a test for

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TABLE I. A partial list of specimens and isolates used in this study indicating culture source, host, and location, and specimens where setal hyphae were measured

Specimen	Culture source ^a				Host	Location	Inonotus		Setal hyphae measured
	d	t	sp	ss			wei-rii	phur-ascens	
13	x				<i>Pseudotsuga menziesii</i>	Oregon			x
36	x				<i>Pseudotsuga menziesii</i>	Washington			x
JH-50-WR-df	x				<i>Pseudotsuga menziesii</i>	Washington			x
JH-50-WR-lp	x				<i>Pinus cantorta</i>	Washington			x
JH-53-Ba	x				<i>Picea sitchensis</i>	Oregon			x
104	x				<i>Pseudotsuga menziesii</i>	Idaho			x
121	x				<i>Pinus contorta</i>	Washington			x
195	x				<i>Pinus manticola</i>	British Columbia			x
197	x				<i>Picea sitchensis</i>	Oregon			x
199	x				<i>Tsuga heterophylla</i>	Oregon			x
219	x				<i>Abies concolor</i>	Washington			x
228	x				<i>Larix occidentalis</i>	Washington			x
G-7312				x	<i>Pseudotsuga menziesii</i>	Washington			x
DAOM F-9422				x	<i>Pseudotsuga menziesii</i>	British Columbia			x
FP-91601		x			<i>Pseudotsuga menziesii</i>	Washington			x
FP-105770					<i>Abies</i> sp.	Idaho			x
FP-105771					<i>Abies</i> sp.	Idaho			x
FP-133613					<i>Pseudotsuga menziesii</i>	Oregon			x
Kropp 93BB					<i>Pseudotsuga menziesii</i>	Oregon			x
FP-134842				x	<i>Pseudotsuga menziesii</i>	Idaho			x
FP-134846				x	<i>Pseudotsuga menziesii</i>	Idaho			x
FP-134847		x			<i>Pseudotsuga menziesii</i>	Idaho			x
FP-134848				x	<i>Larix occidentalis</i>	Idaho			x
PW-DF-A3-10'	x				<i>Pseudotsuga menziesii</i>	Oregon			x
PW-DF-A3-20'	x				<i>Pseudotsuga menziesii</i>	Oregon			x
E6-DF-PW	x				<i>Pseudotsuga menziesii</i>	Oregon			x
E8-Th-Pl	x				<i>Thuja plicata</i>	Oregon			x
PW-WRC-Rhodo-KF	x				<i>Thuja plicata</i>	Oregon			x
159	x				<i>Pseudotsuga menziesii</i>	British Columbia			x
FP-135516					<i>Thuja plicata</i>	Idaho	x		x
FP-135682	x	x			<i>Thuja plicata</i>	Idaho	x		
FP-135514				x	<i>Tsuga heterophylla</i>	Idaho	x		
FP-134657		x			<i>Larix occidentalis</i>	Idaho	x		
169	x				<i>Tsuga heterophylla</i>	British Columbia	x		
175	x				<i>Thuja plicata</i>	British Columbia	x		
204	x				<i>Thuja plicata</i>	Idaho	x		
206	x				<i>Abies grandis</i>	Idaho	x		
214	x				<i>Thuja plicata</i>	Idaho	x		
225	x				<i>Thuja plicata</i>	Washington	x		
232	x				<i>Thuja plicata</i>	Alaska	x		
OKM-4742				x	<i>Thuja plicata</i>	Idaho	x		
FP-134614				x	<i>Thuja plicata</i>	Idaho	x		
FP-134652				x	<i>Thuja plicata</i>	Idaho	x		
FP-135684				x	<i>Thuja plicata</i>	Idaho	x		
FP-134696				x	<i>Thuja plicata</i>	Idaho	x		
FP-134599				x	<i>Thuja plicata</i>	Idaho	x		
FP-134603				x	<i>Thuja plicata</i>	Idaho	x		
FP-134604				x	<i>Thuja plicata</i>	Idaho	x		
FP-134951				x	<i>Thuja plicata</i>	Idaho	x		
PW-Cedar-Sicamous					<i>Thuja plicata</i>	British Columbia	x		
FP-134801				x	<i>Thuja plicata</i>	Idaho	x		
AKPw Het-Paul no. 2	x				<i>Thuja plicata</i>	Alaska	x		

TABLE I. A partial list of specimens and isolates used in this study indicating culture source, host, arid location, and specimens where setal hyphae were measured (Continued)

Specimen	Culture source ^a				Host	Location	Inonotus Setal	
	d	t	sp	ss			<i>wei-</i> <i>rui</i>	<i>phur-</i> <i>ascens</i>
AKW Het-Paul 1 B	x				<i>Thuja plicata</i>	Alaska	x	
FP-135440			x		<i>Thuja plicata</i>	Idaho	x	x
FP-135422			x		<i>Thuja plicata</i>	Idaho	x	x
FP-135667	x	x	x	x	<i>Thuja plicata</i>	Idaho	x	
FP-135668		x	x		<i>Thuja plicata</i>	Idaho	x	
FP-135585			x		<i>Pinus ponderosa</i>	Idaho	x	
171	x				<i>Abies lasiocarpa</i>	British Columbia	x	
170	x				<i>Abies grandis</i>	British Columbia		x
32228				x	<i>Larix</i> sp.	Primorsk Territory, Russia	<i>P. sulphurascens</i>	
3305				x	<i>Larix</i> sp. or <i>Picea</i> sp.	Primorsk Territory, Russia	<i>P. sulphurascens</i>	
FP-105643					<i>Pseudotsugamenziesii</i>	Oregon	x	x
FP-104229					<i>Pseudotsuga menziesii</i>	Colorado	x	x
FP-133450					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-105641					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-102114					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-58184					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-134860					<i>Pseudotsuga menziesii</i>	Idaho	x	x
FP-102113					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-102109					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-102111					<i>Pseudotsuga menziesii</i>	Oregon	x	x
FP-134642					<i>Thuja plicata</i>	Oregon	x	x
FP-102108					<i>Thuja plicata</i>	Oregon	x	x
FP-134656					<i>Thuja plicata</i>	Idaho	x	x
FP-135133					<i>Thuja plicata</i>	Idaho	x	x
FP-135443					<i>Thuja plicata</i>	Idaho	x	x
FP-134655					<i>Thuja plicata</i>	Idaho	x	x
FP-135130					<i>Thuja plicata</i>	Washington	x	x
FP-135413					<i>Thuja plicata</i>	Idaho	x	x
FP-135441					<i>Thuja plicata</i>	Idaho	x	x
FP-135419					<i>Thuja plicata</i>	Washington	x	x
FP-134631					<i>Thuja plicata</i>	Washington	x	x
FP-134858					<i>Thuja plicata</i>	Idaho	x	x

^a Decayed wood isolate, d; basidiomata tissue isolate, t; polysporus isolate, sp; single spore isolate, ss.

the formation of a new heterokaryon, six heterokaryons resulting from compatible matings were randomly chosen for hyphal tip isolation, with resultant cultures treated as previously stated.

Confrontations between monokaryons of *P. sulphurascens* (3305) and monokaryons of both the cedar (FP-135684, FP-134696) and Douglas-fir (FP-134842, FP-134848) forms of *P. weirii* were paired and screened in a similar fashion.

RESULTS

Basidiospore germination cedar form.—Germination occurred within 12–24 h subsequent to spore swelling, appearing initially as a single germ tube near the hilar

end of the spore. Following germination and production of juvenile mycelia, an additional germ tube was produced at the distal end at 24–36 h. Some septa were also produced. Branching was not observed during the initial 24 h. Germ tubes and juvenile mycelia during the 12–24 h were 2–3.5 µm in diam.

Basidiospore germination Douglas-fir form.—Germination occurred within 12–24 h subsequent to spore swelling, appearing initially as a single germ tube near the hilar end of the spore. Septa were produced on juvenile mycelia within a few hours of germination with concomitant hyphal branching. Only one germ tube was produced per spore. Germ tubes and juvenile mycelia during the 12–24 h were 4.5–6 µm in diam.

TABLE II. Statistical summary from ANOVA of length and diameter measurements of setal hyphae from wood decaved by *Phellinus weirii* (cedar form and Douglas-fir form)

	Length (µm)		Diameter(µm)	
	Cedar	Douglas-fir	Cedar	Douglas-fir
N	150	150	150	150
Mean	471.7	507.2	6.2	8.1
Standard deviation	99.9	118.5	1.3	2.1
F	2.05		17.25	
P > F	0.1635		0.0003	

Analyses of setal hyphae dimensions. —Results from ANOVA analysis are presented in TABLE II. The numbers of required length and diameter measurements, for significant results leading to form identification, of setal hyphae were determined to be 80 and 12, respectively. These numbers were characterized by a power (probability) of 0.9 and an alpha (significance) of 0.05.

Determination of incompatibility systems and pairing responses between monokaryons of *P. weirii* (cedar form) and *P. sulphurascens*. Our results confirm previous work

TABLE III. Summary of criteria for separating *P. sulphurascens* and *P. weirii*

<i>Phellinus sulphurascens</i>	<i>Phellinus weirii</i>
Usually occurring on conifers other than western redcedar	Usually occurring on western redcedar
In North America, pathogenesis involved with root rot results in death of the host and windthrow associated with a “root ball” (FIG. 4)	Pathogenesis does not result in death of host; stem breakage caused by butt-rot (FIG. 5)
Basidiomata usually annual (FIG. 6)	Basidiomata usually perennial (FIG. 7)
Sporulation of basidiomata in late summer/fall	Sporulation of basidiomata in spring/mid-summer
Basidiospores with one germ tube; germ tubes and juvenile mycelia 4.5-6 µm in diam	Basidiospores eventually with two germ tubes; germ tubes and juvenile mycelia 2-3.5 µm in diam
No columnar tufts of hyphae in test tube cultures at 6 wk	Columnar tufts of hyphae present in test tube cultures at 6 wk
Dimensions of setal hyphae in wood and test tube culture are greater than those in <i>P. weirii</i>	Dimensions of setal hyphae in wood and test tube culture are smaller than those in the North American representatives of <i>P. sulphurascens</i>

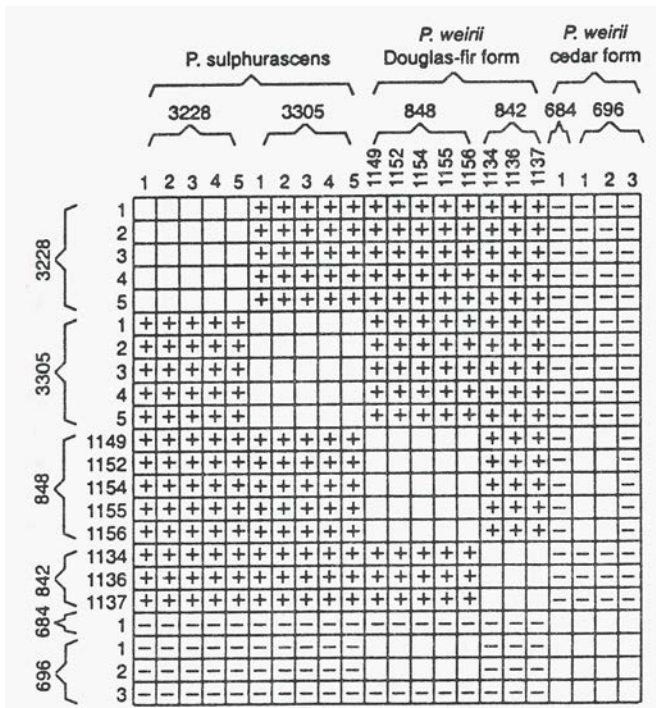


FIG. 1. Compatibility results from interbasidiomata pairings of monokaryotic isolates of *Phellinus sulphurascens* from the Primorsk Territory, Russia, *P. weirii*—Douglas-fir form and *P. weirii*—cedar form from northwestern North America. Compatible pairing, (+); noncompatible pairing, (-). FP nos. 684, 696, 842, and 848 are abbreviated to conserve space; see TABLE II for complete specimen number.

that both the cedar form of *P. weirii* and *P. sulphurascens* possess a unifactorial incompatibility system. The allelomorph and locus (A_1 , A_2) for each monokaryon is identified as follows:

***Phellinus weirii* (cedar form):**

- $A_1 = 1, 2, 3, 7, 9, 10, 11, 16, 18;$
- $A_2 = 5, 8, 13, 15, 19, 20.$

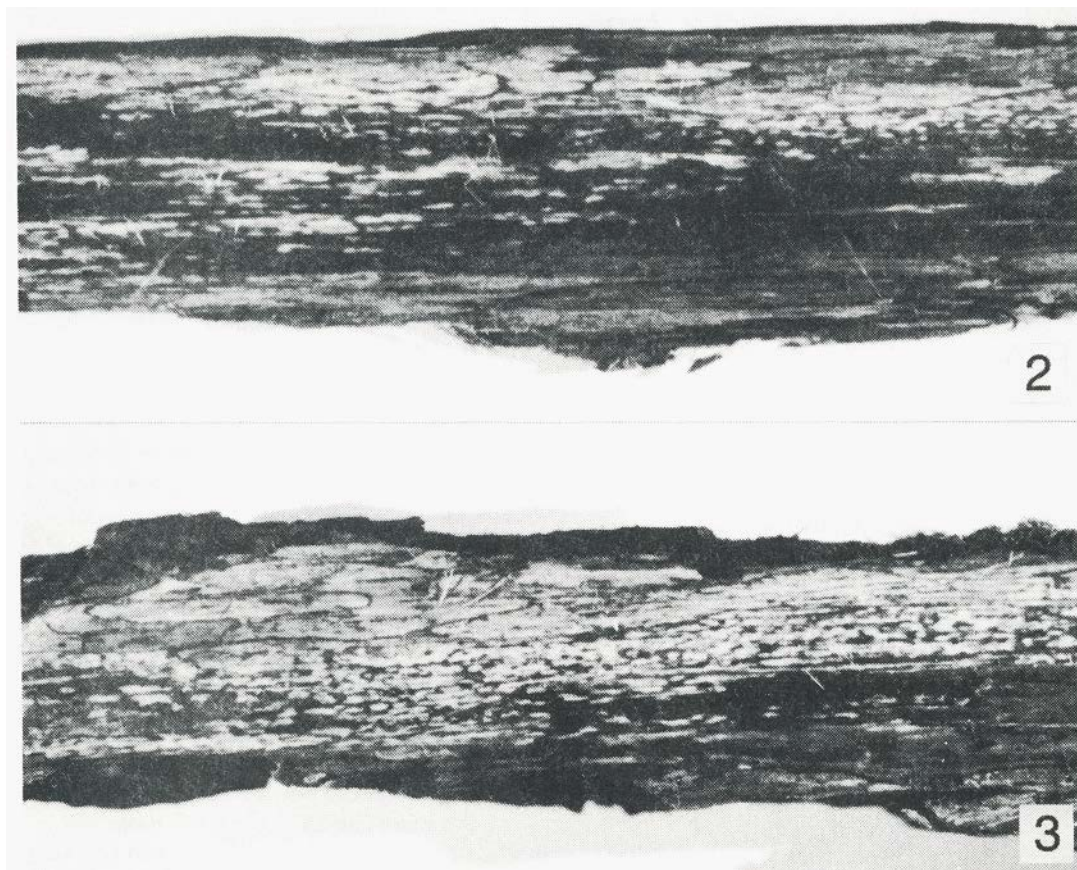
***Phellinus sulphurascens*:**

- $A_1 = 1, 2, 3, 4, 5, 9, 10;$
- $A_2 = 6, 7, 13, 14, 15, 18, 20.$

The pairing responses between monokaryons of *P. sulphurascens* and both forms of *P. weirii* are presented in FIG. 1.

DISCUSSION

Based on compatible pairings between monokaryons of *Phellinus sulphurascens* from Russia and those from the North American Douglas-fir and cedar forms of *P. weirii* (FIG. 1), we conclude that the correct name for the Douglas-fir form is *Phellinus sulphurascens*. The name *Phellinus weirii* is applicable to the cedar form; monokaryotic pairings between *P. weirii* (cedar form)

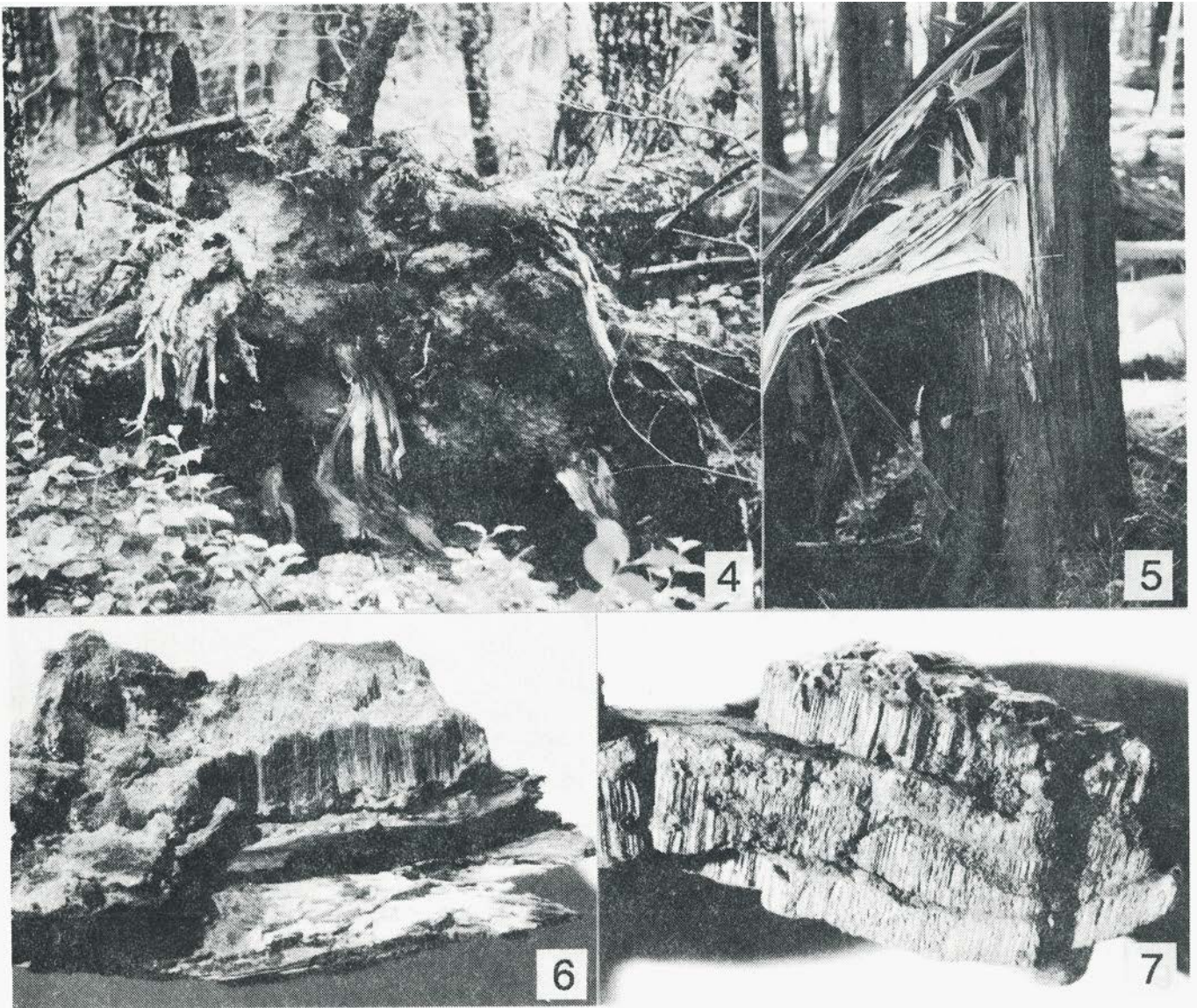


FIGS. 2, 3. Decayed bark of western redcedar from FP-135680 (FIG. 2) and FP-135686 (FIG. 3). Note the flecked white pocket rot and zone lines within the bark, $\times 2$.

and *P. sulphurascens* (and the Douglas-fir form of *P. weirii*) are not compatible. In addition, the differences in cultural characteristics cited by Clark (1958) and Larsen and Lombard (1989), morphological differences associated with germinating basidiospores, significant differences in dimensions of setal hyphae in test tube culture (Larsen and Lombard, 1989), and significant differences ($P > F = 0.0003$, TABLE II) in diameters of setal hyphae in mycelial felts in decayed wood serve to distinguish the two species. However, the data on setal hyphae dimensions presented here were grouped by host which defined form. If form had been confirmed by culture identification, we expect that the significance level (P) would be even smaller. Therefore, fewer diameter measurements of setal hyphae would be required to maintain the same level of probability and significance, thus providing a simple tool for identification. Mounce et al. (1940) also investigated dimensional differences of setal hyphae between the two forms. They reported that in basidiomata, setal hyphae diameters were slightly greater for the cedar form (6–13.5 μm vs 4–10 μm), but in culture, the reverse relationship was observed [3–5 μm vs 4.5–

6(–7) μm]. Other notable characteristics that differentiate the two species in North America are summarized in TABLE III.

Clark (1958), Angwin (1989), and Angwin and Hansen (1989, in press) reported host “cross-over,” where the Douglas-fir form occurs on western redcedar or the cedar form occurs on Douglas-fir and other conifers. However, Clark (1958) noted that *P. weirii* (cedar form) occurred only on other hosts about 10% of the time. Angwin (1989) and Angwin and Hansen (1989, in press) reported a similar percentage for host cross-over for both species. We have seen several examples in the field where both species may use other substrates merely as a means of support for basidiomata formation. Our experience with *P. sulphurascens* in this context has been limited to one observation (FP-134842). However, *P. weirii* on cedar appears quite capable of growing through the upper organic layers of soil profiles, encountering root buttresses of *Tsuga heterophylla*, *Larix occidentalis*, and *Pseudotsuga menziesii* and fruiting on, but not causing decay in, these hosts. Thus, some caution must be exercised with regard to interpretation of host association.

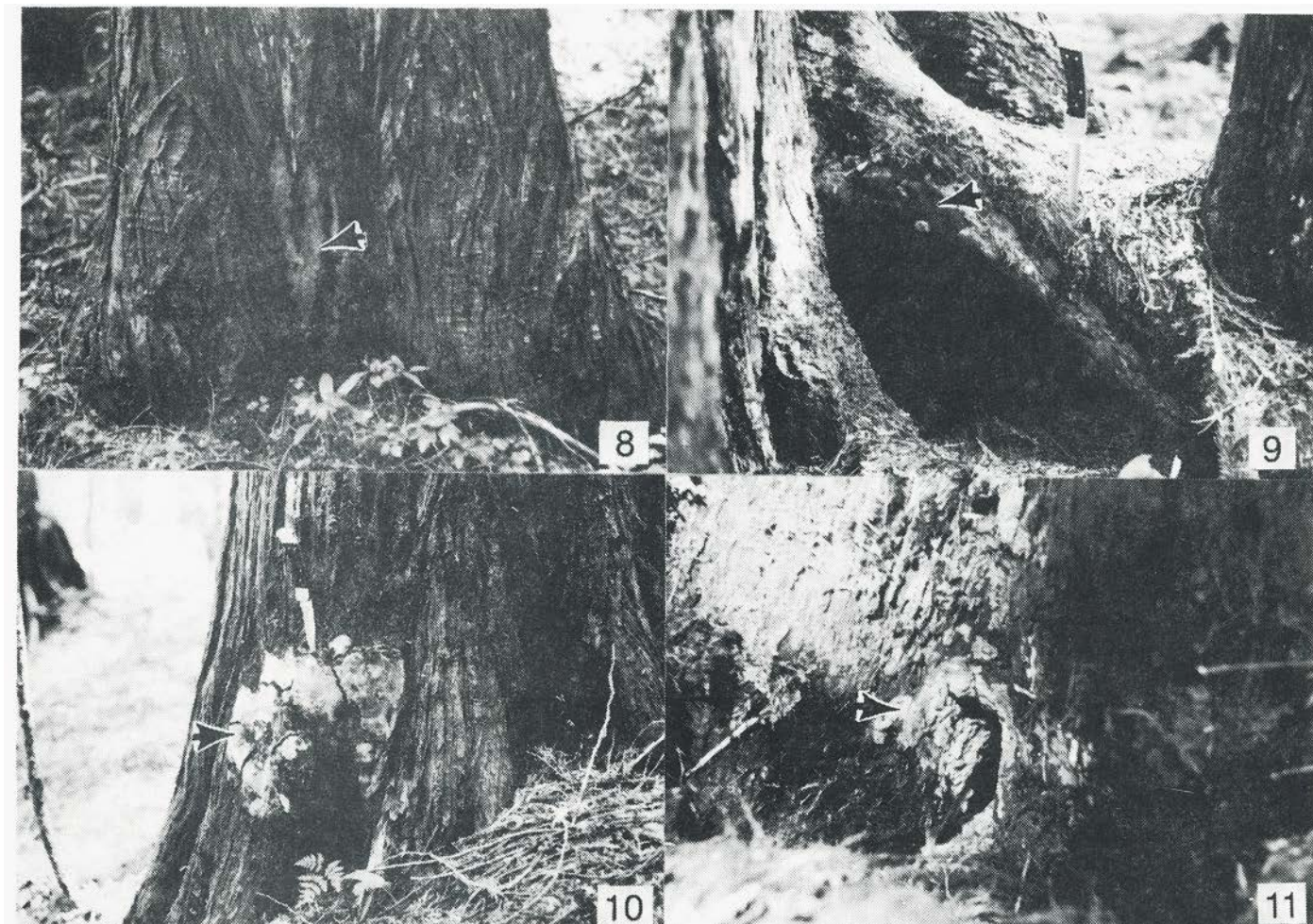


FIGS. 4–7. Characteristic damage (root-ball) to Douglas-fir caused by *Phellinus weirii* Douglas-fir form (FIG. 4), and to western redcedar (stem breakage) caused by *P. weirii* cedar form (FIG. 5). Annual basidioma of *P. weirii* Douglas-fir form (FIG. 6); perennial basidioma of *P. weirii* cedar form (FIG. 7).

Some behavioral characteristics of Phellinus on western redcedar.—The occurrence of perennial fruiting bodies on downed logs and on fluted and buttressed stems at or near the soil level of western redcedar (FIGS. 8–10) is common in riparian ecosystems (e.g., Benton Creek, Priest River Experimental Forest, Idaho; Granite Creek, Kaniksu National Forest, Idaho; Upper Solo Creek, St. Joe National Forest, Washington). As these sites become drier (moving away from the drainage center), the occurrence of basidiomata declines rapidly or they appear to be absent.

We previously described the ability of *P. weirii* (cedar form) on cedar to fruit upon other substrates. In this regard, we observed no visible decay of woody tissue (excluding bark) under associated basidiomata

on live cedar (FIGS. 8–11). The cambial layer appeared intact, and there was no mycelium in the underlying woody tissue (excluding bark) when examined microscopically. Furthermore, the fungus continued to progressively colonize the bark vertically above the point of fruiting. This was confirmed by presence of minute fruiting bodies (3–4 mm across) in cracks and crevices of the bark, brown mycelia in the bark, and a flecked white pocket rot (FIGS. 2, 3). Bark tissue isolates were obtained up to 5 m above ground level and confirmed as *P. weirii* (cedar form). Thus, the fungus presents a unique substrate colonization strategy in a live host. After stem breakage as a result of heartwood decay, cambial host tissue dies, thus removing a barrier, the nature of which is not known, to woody (xylem) tissue



FIGS. 8–11. Variation in habit and basidioma (arrows) morphology on live standing western redcedar. 8, 10. Typical basidioma are depicted in development. The position of those depicted in FIGS. 9 and 11 indicates that basidioma formation is associated with the root crown.

colonization. This strategy may account for such extensive and effused basidiomata, some of which may be up to 4 m long, on the underside of individual logs. Thus, bark inhabiting mycelia may be as important as, or more so than, basidiospores as agents of colonization.

Taxonomy and nomenclature of Phellinus weirii and P. sulphurascens. Upon reviewing the generic position of these two taxa, we find that both *Phellinus* Quél. and *Inonotus* Karst. have been used to accommodate these two species. *Inonotus* was used by Parmasto (1959), Pegler (1964), Kotlaba and Pouzar (1970), and Domanski (1965, 1975), while Gilbertson (1974, 1979) and Gilbertson and Ryvarden (1987) preferred to use *Phellinus*. We conclude from examination of the nomenclatural types of the names in question, and many additional specimens, that the hyphal system of both species is monomitic. [See also Overholts' (1931), Baxter's (1933), and Mounce et al.'s (1940) comments with regard to presence of septa and absence of clamp

connections.] The monomitic hyphal system is the principle criterion of *Inonotus* that separates it from *Phellinus*. Thus, the correct generic placement of both species is in the genus *Inonotus*. The nomenclator for the two species is as follows:

Inonotus sulphurascens* (Pilát) M. Larsen, Lombard, et Clark, *comb. nov.

- ≡ *Phellinus sulphurascens* Pilát, Hull. Soc. Mycol. France 51: 372. 1935 (basionym).
- = *Xanthochrous glomeratus* subsp. *heinrichii* Pilát, Bull. Soc. Mycol. France 48: 28. 1932. *Xanthochrous polymorphus* forma, Bourd., Bull. Soc. Mycol. France 48: 229. 1932; *Xanthochrous*, Pilát, Bull. Soc. Mycol. France 49: 272. 1934; *Inonotus*, Pilát in Kavina et Pilát, Atlas Hub Européen, Vol. 3, p. 575. 1936–1942; *Inonotus*, Bond. & Sing., Ann. Mycol. 39: 56. 1941 (*nom. superfl.*)
- = *Xanthochrous heinrichii* forma *nodulosus* Pilát, Bull. Soc. Mycol. France 51: 376. 1935; *Inonotus heinrichii* forma, Pilát in Kavina & Pilát, Atlas Hub Européen, Vol. 3, p. 576. 1936–1942.

Inonotus weirii (Murr.) Kotlaba & Pouzar, *Česká Mykol.* 24: 146. 1970.

≡ *Fomitiporia weirii* Murr., *Mycologia* 6: 93.1914;
Poria, Murr., *Mycologia* 6: 94. 1914; *Fuscoporia*,
Aoshima, Bull. Gov. Forest Exp. Sta. 59: 61. 1953;
Phellinus, Gilbn., *Fungi That Decay Ponderosa Pine*, p.
170. 1974.

With the advent and increased use of molecular techniques in taxonomy, it may be found that molecular characterization of the nomenclatural types of *Inonotus weirii* and *I. sulphurascens* may lead to the conclusion that these two names represent the same species, thus establishing that the type of *I. weirii* on western redcedar represents a host cross-over of *I. sulphurascens*. If this proves to be correct, then *I. weirii* would be the correct name for the fungus on Douglas-fir and other conifers, and that the fungus causing internal defect of western redcedar (cedar form) would be an undescribed species.

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