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Materials for Pythium Flora of Japan (VI)
Morphology of acquired resistant isolates of *Pythium vanterpoolii*
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Abstract

There were no significant differences in morphology, with special reference to the size of oogonium and oospore, between isolate UOP 393 of *Pythium vanterpoolii* with acquired resistance to metalaxyl and its sensitive parent isolate UOP 392.

Pythium vanterpoolii is the most important pathogen causing Pythium blight of zoysia grass in golf course greens¹⁾. A field isolate UOP 392 of this fungus sensitive to metalaxyl was originally obtained from a basal part of an erect stem of diseased zoysia in the No. 12 green of Meisho Golf Club (Mie Prefecture, Japan) in April 29, 1989. This isolate, together with eight others, became resistant during 14-15 transfers on CMA medium amended with sublethal concentrations of metalaxyl²⁾ and was designated as an acquired resistant isolate UOP 393³⁾. Its resistance, cultural characteristics and virulence were retained for two years although most of the other isolates partially or completely lost their resistance⁴⁾. *P. vanterpoolii* UOP 393 could be maintained for a further year on CMA medium without any great change in these cultural characteristics⁵⁾, and proved to possess acquired resistance under glasshouse conditions⁵⁾.

This paper deals with the detailed description of the oogonium and oospore of the acquired resistant isolate UOP 393, following the method reported previously^{6,7)} and in comparison with the sensitive parent isolate UOP 392.

Table 1. Comparison of mycelial growth rate and colony type between acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392 of *P. vanterpoolii* grown on Bacto-PDA medium at 25°C.

Isolate no.	Exp.	Mycelial growth (Culture days; mm/24hr)			Colony type
		1	2	3	
UOP 393	1	17.8	21.8	23.1	A
	2	17.0	22.4	24.4	A
	Average	17.4	22.1	23.8	
UOP 392	1	20.0	23.5	25.0	A
	2	20.0	24.8	26.4	A
	Average	20.0	24.2	25.7	

Acquired resistant isolate of *Pythium vanterpoolii* UOP 393

General morphology The morphology of this isolate was essentially the same as that reported previously^{8,9)}. In particular, the catenulate sporangia (Fig. 1) were the most characteristic feature of this isolate, as V. & H. Kouyeas⁹⁾ have already pointed out for *P. vanterpoolii*.

Growth rate and colony morphology No significant differences were found in growth rate and colony morphology (Fig. 3) between the acquired resistant (UOP 393) and sensitive parent (UOP 392) isolates (Table 1).

Morphology of oogonium and oospore As shown in Table 2, there were no significant differences in size of oogonium and oospore, and thickness of oospore wall

Table 2. Comparison of size of oogonium and oospore, and thickness of oospore wall between acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392 of *P. vanterpoolii* grown on Bacto-CMA medium at 25°C^{a)}.

Culture period (days)	Diam. (μm) of oogonium		Diam. (μm) of oospore		Thickness (μm) of oospore wall	
	UOP 393	UOP 392	UOP 393	UOP 392	UOP 393	UOP 392
3	22.67 (1.62)	22.85 (1.65)	—	—	—	—
5	22.67 (1.69)	22.59 (1.67)	—	—	—	—
6	22.84 (1.59)	22.67 (1.55)	19.75 (1.02)	20.65 (0.80)	—	—
8	—	—	20.92 (1.12)	20.87 (1.00)	1.86 (0.19)	1.79 (0.29)
20	—	—	20.80 (1.26)	20.71 (1.02)	1.93 (0.19)	2.06 (0.18)
30	—	—	20.92 (1.14)	20.86 (1.14)	2.06 (0.15)	2.08 (0.16)
Average	22.73	22.70	20.60	20.77	1.95	1.98

a) (): Standard deviation, —: not measured.

Table 3-1. Comparison of mycelial growth rate and colony type between hyphal tip cultures of acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392 of *P. vanterpoolii* grown on Bacto-PDA medium at 25°C^{a)}.

Hyphal tip culture no. of UOP 393	Mycelial growth (Culture days; mm/24hr)			Colony type	Hyphal tip culture no. of UOP 392	Mycelial growth (Culture days; mm/24hr)			Colony type
	1	2	3			1	2	3	
	R-1	14.8	17.1			18.5	B	S-1	
R-2	18.0	22.0	23.5	A	S-2	19.8	23.9	24.9	A
R-3	13.8	15.6	16.1	B	S-3	19.5	23.3	24.7	A
R-4	13.0	16.1	17.8	B	S-4	19.8	23.5	24.8	A
R-5	18.8	22.4	23.8	A	S-5	19.5	23.6	24.8	A
R-6	14.8	16.9	18.1	B	S-6	19.5	23.8	24.5	A
R-7	19.0	22.5	23.8	A	S-7	19.5	23.4	24.6	A
R-8	17.0	20.0	20.9	A	S-8	19.0	23.0	24.1	A
R-9	13.5	15.8	16.7	B	S-9	20.0	23.8	24.8	A
R-10	18.0	21.6	22.9	A	S-10	20.0	23.9	25.0	A
R-11	18.3	22.3	23.3	A	S-11	20.2	24.1	25.2	A
Average	16.3 (2.20)	19.3 (2.84)	20.5 (2.94)		Average	19.7 (0.33)	23.6 (0.31)	24.7 (0.27)	

a) (): Standard deviation

Table 3-2. Comparison of mycelial growth rate and colony type between hyphal tip cultures of acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392 of *P. vanterpoolii* grown on Bacto-PDA medium at 25°C^{a)}.

Hyphal tip culture no. of UOP 393	Mycelial growth (Culture days; mm/24hr)			Colony type	Hyphal tip culture no. of UOP 392	Mycelial growth (Culture days; mm/24hr)			Colony type
	1	2	3			1	2	3	
R-21	14.0	17.0	19.2	B	S-21	19.0	24.5	26.2	A
R-22	21.3	26.0	28.0	A	S-22	20.7	26.2	27.4	A
R-23	17.8	23.1	25.2	A	S-23	18.0	24.3	26.3	A
R-24	18.8	23.9	24.9	A	S-24	21.8	26.3	27.5	A
R-25	12.0	17.4	19.5	B	S-25	20.5	25.6	27.1	A
R-26	16.0	20.3	22.6	B	S-26	20.5	26.8	28.7	A
R-27	18.5	23.5	25.2	A	S-27	17.5	23.3	25.7	A
R-28	16.5	20.8	22.3	B	S-28	18.5	23.6	25.1	A
R-29	19.3	23.6	26.1	A	S-29	17.8	23.8	25.8	A
Average	17.1 (2.69)	21.7 (2.90)	23.7 (2.81)		Average	19.4 (1.45)	24.9 (1.23)	26.6 (1.06)	

a) (): Standard deviation

Table 4-1. Comparison of size of oogonium and oospore, and thickness of oospore wall between hyphal tip cultures (R-22, R-26, R-28) of acquired resistant isolate UOP 393 of *P. vanterpoolii* grown on Bacto-CMA medium at 25°C^{a)}.

Culture period (days)	Diam. (μm) of oogonium			Diam. (μm) of oospore			Thickness (μm) of oospore wall		
	R-22	R-26	R-28	R-22	R-26	R-28	R-22	R-26	R-28
3	22.28 (1.73)	23.69 (1.77)	23.83 (1.58)	—	—	—	—	—	—
5	22.58 (1.56)	23.88 (1.84)	23.83 (1.64)	—	—	—	—	—	—
6	22.58 (1.62)	23.63 (1.77)	23.39 (1.77)	21.07 (1.47)	—	—	1.69 (0.25)	—	—
8	—	23.40 (1.81)	23.83 (1.70)	20.79 (1.37)	21.61 (1.34)	21.61 (1.36)	1.81 (0.16)	1.58 (0.23)	1.62 (0.22)
20	—	—	—	20.64 (1.44)	21.51 (1.22)	21.40 (1.34)	1.93 (0.12)	1.82 (0.15)	1.79 (0.14)
30	—	—	—	20.40 (1.56)	21.46 (1.23)	21.49 (1.20)	1.98 (0.10)	1.92 (0.14)	1.92 (0.13)
Average	22.48	23.65	23.72	20.73	21.53	21.50	1.85	1.77	1.78

a) (): Standard deviation, —: not measured.

(Fig. 2) between two isolates.

Hyphal tip cultures from acquired resistant isolate UOP 393 of *P. vanterpoolii*

General morphology The morphology of the hyphal tip cultures was same as that of the parent acquired resistant isolate. The catenulate sporangia (Fig. 1) were the most characteristic feature.

Growth rate and colony morphology No significant differences were found in growth rate among hyphal tip cultures of acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392. Similarly, no remarkable differences were found in growth rate of hyphal tip cultures between acquired resistant isolate UOP 393 and sensitive parent

Table 4-2. Comparison of size of oogonium and oospore, and thickness of oospore wall between hyphal tip culture (R-22) of acquired resistant isolate UOP 393 and those (S-22, S-28) of sensitive parent isolate UOP 392 of *P. vanterpoolii* grown on Bacto-CMA medium at 25°C^{a)}.

Culture period (days)	Diam. (μm) of oogonium			Diam. (μm) of oospore			Thickness (μm) of oospore wall		
	R-22	S-22	S-28	R-22	S-22	S-28	R-22	S-22	S-28
3	22.93 (1.56)	23.04 (1.67)	22.95 (1.67)	—	—	—	—	—	—
5	22.99 (1.52)	23.13 (1.62)	23.06 (1.51)	—	—	—	—	—	—
6	22.83 (1.59)	22.95 (1.53)	22.85 (1.67)	21.09 (1.41)	21.12 (1.42)	20.93 (1.49)	1.62 (0.30)	1.65 (0.29)	1.60 (0.28)
8	—	—	—	20.96 (1.48)	21.14 (1.43)	21.10 (1.42)	1.78 (0.19)	1.72 (0.23)	1.73 (0.19)
20	—	—	—	20.44 (1.29)	20.90 (1.56)	21.12 (1.44)	1.92 (0.13)	1.91 (0.14)	1.94 (0.13)
30	—	—	—	20.24 (1.42)	20.65 (1.83)	20.88 (1.38)	1.97 (0.11)	1.96 (0.12)	1.97 (0.12)
Average	22.92	23.04	22.95	20.68	20.95	21.01	1.82	1.81	1.81

a) (): Standard deviation, —: not measured.

isolate 392 (Tables 3-1, 2). Most of their colonies were arachnoid in habit with profuse aerial mycelium, some with moderate aerial mycelium (Fig. 3).

Morphology of oogonium and oospore As shown in Tables 4-1, 2, there were no significant differences in size of oogonium and oospore, and thickness of oospore wall among hyphal tip cultures of acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392. Similarly, no significant differences were found in morphology of hyphal tip cultures between acquired resistant isolate UOP 393 and sensitive parent isolate UOP 392.

From the results obtained, there were no significant differences in morphology, with special reference to the size of oogonium and oospore, between isolate UOP 393 of *P. vanterpoolii* with acquired resistance to metalaxyl and the sensitive isolate UOP 392.

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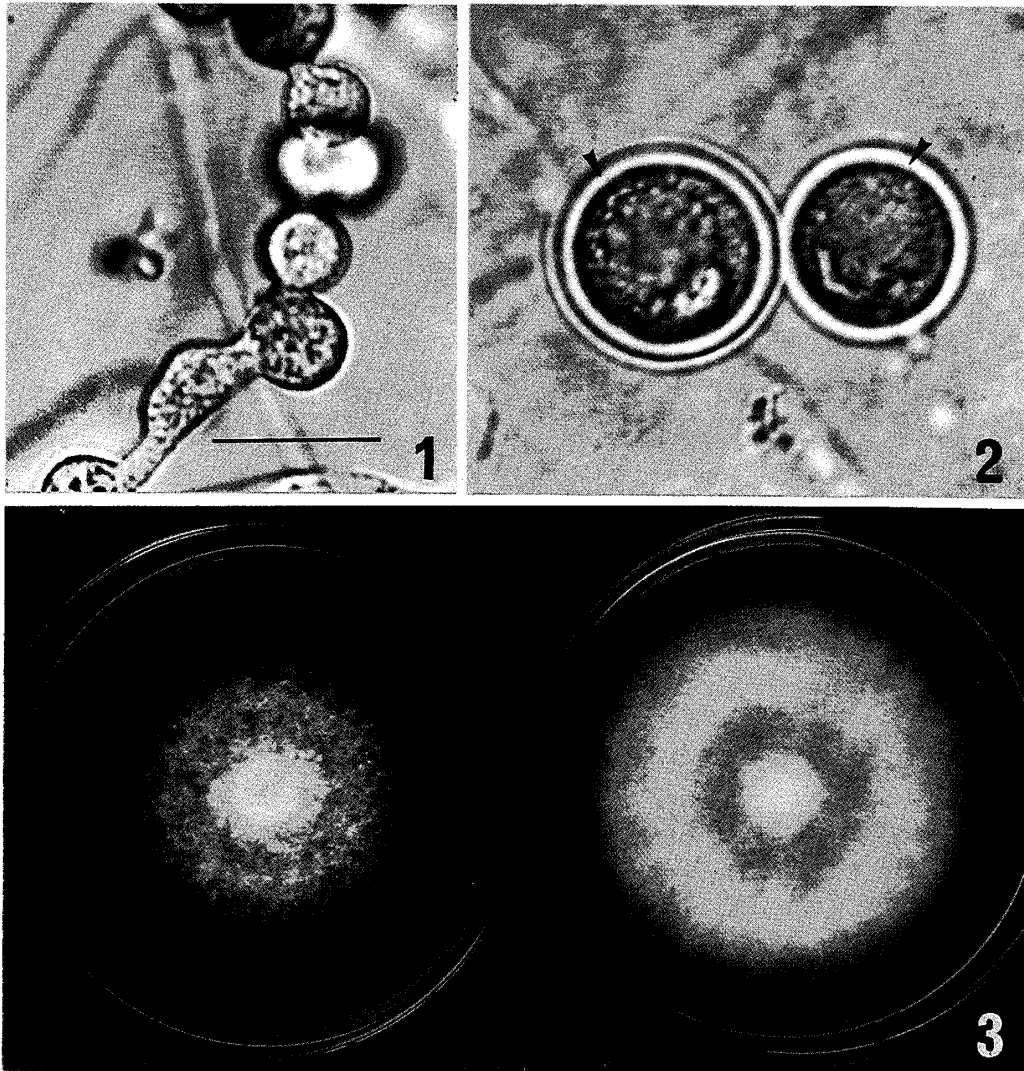


Fig. 1 Catenulate sporangia.

Fig. 2 Plerotic oospores, with relatively thick wall (arrows).

Fig. 3 Colony types A (right) with arachnoid habit and profuse aerial mycelium, and B (left), the same habit and moderate aerial mycelium.

Bar ($20\ \mu\text{m}$) on fig. 1 is also applicable to fig. 2.