Kinds and Distribution of *Pythium* Species Isolated from Soils in Tohoku District*

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Pythium species were obtained from soils and plant roots in various habitats in Tohoku district and the Ryukyu Islands in Japan with a special emphasis on isolation procedures, and also studied for the populations in soil quantitatively in the previous report¹⁾. This is a further study on the kinds and distribution of *Pythium* species in Tohoku district in relation to the previous reports¹⁻⁵⁾. A total of 28 soil samples (Table 1) were collected in September, 1978 and August, 1981. Soil sampling and isolation method were described previously¹⁾. The fungi were cultured on various media including Difco corn meal agar for mycological study. Several soaking solutions including Petri's salt solution were used to study asexual reproduction. All of the fungi were identified following the descriptions by the previous workers^{6,7)}.

A total of 210 *Pythium* isolates were obtained from soils from 26 locations in Tohoku district, and were identified into 14 taxa including H-Zs (a provisional *Pythium* group with zoospore formation from hypha-like sporangia, but without sexual organ) and 13 unidentified isolates (Table 2). No *Pythium* was isolated from two samples (Sample 8 and 24) collected from forest soil near Lake Towada at Kosaka, Akita Pref. and musk melon field at Tendo, Yamagata, but the respective of 26 samples yielded one to five taxa. Most of these taxa were recorded in soils of different parts of Japan^{4,5,8)} and other countries⁹⁻¹³⁾. *Pythium* taxa with numbers of samples yielding each taxon, and of their isolates obtained are listed, and representative isolates and their origin are summarized in Table 2.

Four *Pythium* taxa, i.e., *P. dissotocum* Drechsler, *P. hydnosporum* (Mont.) Schroeter, *P. inflatum* Matthews and H-Zs were identified in this study, and included in the previous *Pythium* list in Tohoku district¹⁾.

Of the 13 unidentified isolates, Isolate 78-2310 and four others were sterile, forming just aseptate *Pythium*-like hyphae, and seven including Isolate 78-2241 formed lobate hyphal swellings without zoospore discharge. Another isolate (Isolate 78-2237) is close to *P. carolinianum* Matthews forming sphaerosporangia without internal proliferation, although zoospore discharge has been very rarely observed.

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Table 1. Soil samples obtained from 28 different locations with various habitats and soil pH values in Tohoku district, Japan

Sample	Location	Habitat	pH	Sample	Location	Habitat	pH
Aomori Pref.				Akita Pref.			
9	Towada	Forest	4.6	1	Akita	Strawberry	4.7
10	Towada	Forest	4.6	2	Taiyuu	Cucumber	4.6
11	Kuroishi	Chinese cabbage	4.6	3	Taiyuu	Japanese hornwort	4.7
12	Kuroishi	Buckwheat	4.6	4	Taiyuu	Japanese hornwort	4.8
13	Iwaki	Fallow (corn) ^{a)}	4.7	5s	Taiyuu	Japanese hornwort	4.7
14	Ajigasawa	Fallow (watermelon)	4.6	6	Omonogawa	Fallow (watermelon)	4.6
15	Kizukuri	Fallow (watermelon)	4.8	7	Omonogawa	Fallow (watermelon)	4.6
16	Kizukuri	Peanut	4.6	8	Kosaka	Forest	5.0
17	Kizukuri	Peanut	4.6	Yamagata Pref.			
18	Hiraka	Radish	4.8	24	Tendou	Musk melon	4.7
Iwate Pref.				25s	Yamagata	Cucumber	4.4
19	Morioka	Tomato	4.7	26	Yamagata	Welsh onion	4.6
20	Morioka	Strawberry	4.6	27s	Yamagata	Buckwheat	4.7
21	Morioka	Apple	4.7	Fukushima Pref.			
22s	Morioka	Alfalfa	4.5	94	Kitashiobara	Eggplant	5.8
23	Tarou	Fallow	4.6				

a) (): previous crop.

Table 2. List of *Pythium* taxa isolated from soils of Tohoku district and numbers of soil samples yielding each taxon and of their total isolates in each taxon with representative isolates and their origin

Species	No. of samples	No. of isolates	Representative isolates and their origin
<i>P. aphanidermatum</i> (Edson) Fitz.	6	12	78-2255 (Sample 20)
<i>P. dissotocum</i> Drechsler	2	3	78-2428 (Sample 4)
<i>P. hydnosporum</i> (Mont.) Schroeter	1	2	81-256 (Sample 94)
<i>P. inflatum</i> Matthews	2	2	78-2324 (Sample 13)
<i>P. intermedium</i> de Bary	2	3	78-2313 (Sample 10)
<i>P. irregulare</i> Buisman	4	8	78-2453 (Sample 17)
<i>P. periplocum</i> Drechsler	1	1	78-2243 (Sample 15)
<i>P. spinosum</i> Sawada	15	37	78-2357 (Sample 22)
<i>P. splendens</i> Braun	3	3	78-2259 (Sample 26)
<i>P. sylvaticum</i> Campbell et Hendrix	23	94	78-2222 (Sample 1)
<i>P. torulosum</i> Coker et Patterson	3	4	78-2307 (Sample 7)
<i>P. ultimum</i> Trow	6	17	78-2314 (Sample 11)
<i>P. vexans</i> de Bary	1	1	78-2360 (Sample 25)
H-Zs ^{a)}	3	10	78-2244 (Sample 15)
<i>Pythium</i> spp.	9	13	78-2323 (Sample 13)

a) A provisional *Pythium* group with zoospore formation from hypha-like sporangia, but without sexual organs.

Table 3. Kinds of *Pythium* species and number of isolates obtained from soils of 28 different locations in Tohoku district

Sample No.	Kind of <i>Pythium</i> ^{a)} and no. of isolates												Miscellaneous ^{b)}
	aph	dis	inf	int	irr	spi	spl	syl	tor	ult	H-Zs		
Aomori Pref.													
9				2				1					
10				1				3					
11	1							4		3			Py. sp., 1
12						1		4			3		
13			1			4		5	2				Py. sp., 2
14						6		1		1			Py. sp., 1
15						1		2			6		per, 1; Py. sp., 4
16					1			2					
17					3	2							
18								4			1		
Iwate Pref.													
19	2							3					
20	3					2		7					
21						1	1						
22s			1			3		4					Py. sp., 1
23					3			2					
Akita Pref.													
1	1					2		7		2			
2						6		6					
3		2				1		6					
4		1						1					
5s						1		8					Py. sp., 1
6						5		1					Py. sp., 1
7						1	1	4	1				Py. sp., 1
8													
Yamagata Pref.													
24													
25s	3							10	1	7			vex, 1
26							1	3		1			
27s	2					1		6		3			Py. sp., 1
Fukushima Pref.													
94					1								hyd, 2
Total isol.	12	3	2	3	8	37	3	94	4	17	10		17

a) Abbreviated as follows: aph, *P. aphanidermatum*; dis, *P. dissotocum*; hyd, *P. hydnosporum*; inf, *P. inflatum*; int, *P. intermedium*; irr, *P. irregulare*; per, *P. periplocum*; spi, *P. spinosum*; spl, *P. splendens*; syl, *P. sylvaticum*; tor, *P. torulosum*; ult, *P. ultimum*; vex, *P. vexans*; H-Zs, a provisional *Pythium* group with zoospore formation from hypha-like sporangia, but without sexual organs.

b) Included *Pythium* taxa obtained only from one location (sample), and Py. sp. (=unidentified *Pythium* species).

Pythium sylvaticum was predominant, and isolated from 23 locations. More than 87% (82 isolates) of the 94 isolates obtained were heterothallic^{12,13}.

Abundant occurrence of *P. spinosum* (Tables 2 and 3) is noteworthy, and isolated from 15 locations in Tohoku district. In addition, 12 isolates of *P. aphanidermatum*, high-temperature favorite *Pythium*, were obtained from six locations, including one isolate each from strawberry field in Akita city (Isolate 78-2223) and Chinese cabbage field in Kuroishi, Aomori Pref. (Isolate 78-2269).

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和 文 摘 要

渡辺恒雄：東北地方の土壌から分離した *Pythium* 菌の種と分布

東北地方の土壌に生息する *Pythium* 菌を、キュウリ種子などによる捕捉法と直接接種法を用いて分離し、種と分布を調査した。供試した 28 カ所の土壌（1～10 試料／県）のうち、十和田湖周辺（秋田県小坂町）の林地と山形県天童市のマスクメロン畑からの 2 試料（試料 8 と 24）を除く各試料からは 1～5 種の *Pythium* 菌が分離でき、合計 210 菌株を得たが、これらは、H-Zs（糸状胞子嚢から遊走子を形成するが、生殖器官は未形成の一群）を含む 14 種に分類・同定できた。最も多く分離されたのは日本の他の地方と同様に *P. sylvaticum* で、とくに雌雄異株が全分離株の 87% 以上を占めた。また *P. spinosum* の広い分布と好高温性菌の *P. aphanidermatum* が秋田、青森の両県を含む東北地方から高い頻度で分離されたことは注目に値する。

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