Karyological Characters of the Fungi Causing Rice Sclerotiosis*

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稲垣公治・牧野 精**: イネを侵す菌核病菌の核学的観察*

In many literatures there are some confusions in the taxonomic distinction among the several species of *Rhizoctonia* and *Sclerotium* causing rice sclerotiosis. The main objective of the present karyological experiments is to contribute to the taxonomy of these fungi causing rice sclerotiosis.

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Materials and methods: Karyological characters of hyphal cells were examined with 46 isolates of the different sclerotial fungi isolated mainly from rice plants. Namely, 12 isolates of *Pellicularia sasakii* (Shirai) S. Ito including 9 from Japan, 2 from Thailand and 1 from USA, 6 of *Pellicularia filamentosa* (Pat.) Rogers collected from Japan, 4 of *Rhizoctonia oryzae* Ryker et Gooch¹⁾ from Thailand, 11 of *Sclerotium oryzae-sativae* Sawada including 6 from Japan, 1 from Laos and 4 from Thailand (3 of which were identified as this species according to the cultural characteristics), 3 of *Sclerotium hydrophilum* Saccardo from Japan and from Thailand, 4 of *Sclerotium fumigatum* Nakata and 1 of *Sclerotium orizicola* Nakata et Kawamura from Japan. Regarding the rice culm-rot-inducing fungi, 2 isolates of *Magnaporthe salvinii* (Cattaneo) Krause et Webster²⁾ and 3 of *Curvularia irregularis* (Cralley et Tullis) Hara from Japan were employed.

Each isolate was cultured on potato sucrose agar at 30 C, except *Pellicularia filamentosa* which was kept at 28 C. After 3~4 days hyphal filaments were picked up on a cover glass which was coated previously with albumine. HCl-Giemsa method was applied as the nuclear staining of these fungi. Three hundred hyphal cells were observed for each isolate, though the culm-rot-inducing fungi were examined on 200~300 cells.

Results and conclusion: The number of nuclei in a hyphal cell examined by means of Giemsa staining was almost similar to that by Feulgen staining previously reported.

A. *Pellicularia sasakii*: As shown in Table 1, the isolates examined were proved to contain 6~8 nuclei in each hyphal cell (Fig. 1). The results are in accordance with those reported by Fukano³⁾ and Hashioka *et al.*⁴⁾. Isolate No. 7 collected in USA and No. 39 from Hyogo showed comparatively higher mean values than the others; No. 46 from Wakayama, No. 40 and No. 42 from Thailand showed somewhat lower mean values. The number of nuclei in each hyphal cell varies in such a wide range from 1 to 31, though it does not seem to concern with locality.

B. *Pellicularia filamentosa*: Among 6 isolates derived from the different crops and tree, the

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Table 1. Number of nuclei per hyphal cell of the different fungi causing rice-sclerotiosis

Fungus species	Isolate No.	Host	Mean value	Range
<i>Pellicularia sasakii</i>	2	Rice	7.44 $\pm$ 2.38	1—18
	7	do	8.34 $\pm$ 3.08	2—31
	11	do	7.04 $\pm$ 2.26	1—16
	16	do	7.65 $\pm$ 2.73	2—19
	33	do	7.21 $\pm$ 2.73	2—18
	34	do	7.32 $\pm$ 2.73	2—20
	38	do	7.19 $\pm$ 2.29	2—18
	39	do	7.94 $\pm$ 3.58	1—27
	40	do	6.78 $\pm$ 2.38	1—16
	42	do	6.95 $\pm$ 2.33	1—15
	46	do	6.48 $\pm$ 2.53	1—22
	53	do	7.21 $\pm$ 2.69	2—22
<i>Pellicularia filamentosa</i>	M— 1	Eggplant	5.40 $\pm$ 1.84	1—15
	M— 3	White clover	6.10 $\pm$ 1.69	3—13
	M— 4	Tomato	6.44 $\pm$ 2.21	2—16
	I— 64	Beet	6.00 $\pm$ 2.35	1—21
	I—109	Flax	9.01 $\pm$ 2.67	2—22
	I—115	Locust tree (<i>Robinia pseudoacacia</i>)	6.86 $\pm$ 2.44	2—20
<i>Rhizoctonia oryzae</i>	10	Rice	6.73 $\pm$ 2.61	2—24
	11	do	6.13 $\pm$ 2.83	1—33
	12	do	4.88 $\pm$ 1.45	1—9
	13	do	5.57 $\pm$ 2.14	2—16
<i>Sclerotium oryzae-sativae</i>	1	Rice	2.03 $\pm$ 0.59	1—4
	T— 6	do	2.03 $\pm$ 0.72	1—4
	L— 12	do	1.86 $\pm$ 0.58	1—4
	T— 17	do	1.93 $\pm$ 0.58	1—4
	T— 20	do	2.02 $\pm$ 0.62	1—4
	T— 28	do	1.81 $\pm$ 0.71	1—4
	A— 1	do	2.03 $\pm$ 0.72	1—4
	A— 2	do	2.13 $\pm$ 0.51	1—4
	N— 1	do	1.95 $\pm$ 0.55	1—4
	N— 2	do	2.09 $\pm$ 0.55	1—4
	N— 3	do	1.97 $\pm$ 0.44	1—4
<i>Sclerotium hydrophilum</i>	1	Rice	2.01 $\pm$ 0.34	1—5
	2	do	2.02 $\pm$ 0.29	1—4
	3	do	2.00 $\pm$ 0.46	1—4
<i>Sclerotium fumigatum</i>	1	Rice	2.10 $\pm$ 0.44	1—4
	2	do	2.03 $\pm$ 0.32	1—4
	3	Dayflower	2.17 $\pm$ 0.53	1—4
	4	Barnyard grass	2.06 $\pm$ 0.45	1—4
<i>Sclerotium orizicola</i>		Rice	5.87 $\pm$ 1.94	1—12
<i>Magnaporthe salvinii</i> (Conidial state)	1	Rice	1.20 $\pm$ 0.47	1—3
	2	do	1.06 $\pm$ 0.24	1—2
<i>Curvularia irregularis</i>	1	Rice	1.09 $\pm$ 0.24	1—3
	2	do	1.05 $\pm$ 0.24	1—3
	3	do	1.10 $\pm$ 0.30	1—2

isolate from flax root collected in Hokkaido showed the highest mean value. As stated by Hashioka *et al.*⁴⁾ and Ui *et al.*⁶⁾, this fungus contains 5~9 nuclei per cell (Fig. 2).

C. *Rhizoctonia oryzae*: Similar to the results of Hashioka *et al.*⁴⁾, all the isolates of rice sheath spot fungus collected in Thailand showed the mean value 5.83 nuclei ranging from 5 to 7

(Fig. 3).

D. *Sclerotium oryzae-sativae*: Eleven isolates from Thailand, Laos, Kagoshima and Hokkaido were proved commonly to be binucleate (Fig. 4), irrespective of difference in locality.

E. *Sclerotium hydrophilum*: In each of isolates from rice plants, more than 90% of 300 hyphal cells showed to be binucleate (Fig. 5).

F. *Sclerotium fumigatum*: Irrespective of difference in the source of isolation, *i.e.* rice, day-flower and barnyard grass, the mode in number of nuclei was found to be 2, though the range extends from 1 to 4 (Fig. 8).

G. *Sclerotium orizicola*: Only one isolate from a sheath of rice plant was examined. This fungus showed wide variation in number of nuclei, indicating the mean value of 5.87 (Fig. 6).

H. *Magnaporthe salvinii*: Observation was made with the conidial state, *i.e.* *Helminthosporium sigmoideum* Cav. Mononucleate character was perceived (Fig. 9), though hyphae of this fungus are very fine and the septa are indistinct under microscope.

I. *Curvularia irregularis*: Although the microscopical observation was similar to the above mentioned fungus, the hyphal cell of this fungus seemed to be uninucleate (Fig. 7).

From present observations, number of nuclei in hyphal cell of *Rhizoctonia* group was proved to be multinucleate, namely, hyphal cells of *Pellicularia sasakii* were found to contain 7.3 nuclei in average, *Pellicularia filamentosa* has 6.6 and *Rhizoctonia oryzae* has 5.8 nuclei. Those of the different species of *Sclerotium* were binucleate, except *Sclerotium orizicola* containing 5.9 nuclei in average, and *Magnaporthe salvinii* and *Curvularia irregularis* causing culm rot were mononucleate.

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Explanation of Plate

Nuclei in hyphal cell of the different fungi causing rice sclerotiosis.

Fig. 1. *Pellicularia sasakii* No. 42 isolated from rice leaf sheath in Thailand.

Fig. 2. *Pellicularia filamentosa* I-115 from *Robinia pseudoacacia* in Ibaraki, East Japan.

Fig. 3. *Rhizoctonia oryzae* No. 13 from rice leaf sheath in Thailand.

Fig. 4. *Sclerotium oryzae-sativae* A-2 from rice leaf sheath in Kagoshima, Southern Japan.

Fig. 5. *Sclerotium hydrophilum* No. 3 from rice in India.

Fig. 6. *Sclerotium orizicola* from rice in Hokkaido, Northern Japan.

Fig. 7. *Curvularia irregularis* No. 1 from rice in Shizuoka, Middle Japan.

Fig. 8. *Sclerotium fumigatum* No. 4 from barnyard grass in Aichi, Middle Japan.

Fig. 9. Conidial state (*Helminthosporium sigmoideum* Cav.) of *Magnaporthe salvinii* No. 2 from rice in Shizuoka, Middle Japan.