Evaluation of Resistance to Bacterial Wilt and *Verticillium* Wilt in Eggplants (*Solanum melongena* L.) Collected in Malaysia

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Summary

Sixty accessions of eggplants collected in Malaysia were evaluated for their resistance to bacterial wilt, *Verticillium* wilt and *Fusarium* wilt, caused by *Pseudomonas solanacearum*, *Verticillium dahliae* and *Fusarium oxysporum*, respectively. In the evaluation of the field infected with *P. solanacearum*, more than 60 % of the accessions were resistant. Based on the evaluation at the seedling stage of the resistant accessions, LS1934 was judged to be the most resistant accession to bacterial wilt, but most of the same accessions were not resistant to *Verticillium* wilt. LS2436 was the only accession with a relatively high resistance to *Verticillium* wilt. LS1934 and LS2436 were also resistant to *Fusarium* wilt.

Introduction

Bacterial wilt caused by *Pseudomonas solanacearum* E. F. Smith is an economically important disease of eggplant (*Solanum melongena* L.) worldwide (Kelman, 1953). The bacteria can survive in soils in areas with temperate and warm climates (Kelman, 1953) and they can be the limiting factor for cultivation of this vegetable.

Verticillium wilt caused by *Verticillium dahliae* Kleb. is also an important disease of eggplant (Goth and Webb, 1981). The fungus can survive in soils for more than 14 years (Schnathorst, 1981) and can also be a limiting factor for cultivation of this vegetable in temperate areas (Snyder and Smith, 1981).

In areas infected with these organisms, the use of resistant varieties may achieve stable production. However, there are no resistant varieties of high quality. In Japan, grafting of eggplants onto resistant rootstocks such as 'Torvum vigor' (*S. torvum* Swartz) is widely practiced to avoid the damage caused by bacterial wilt and/or *Verticillium*

wilt. However, the grafting procedure requires a certain expertise, and is time-consuming. Furthermore, the grafted seedlings must be grown at optimum temperature and humidity for the graft union to knit. Automatic grafting machines are being developed, but are not yet available. Therefore, breeding of resistant eggplant varieties is essential.

The authors have attempted to breed bacterial wilt-resistant eggplants based on Japanese standards (black fruit skin, black calyx, medium to small fruit size, weight about 100 g) by using resistant gene(s) derived from 'Dingaras Multiple Purple' (Nath, 1975) and 'Nantou Qie' (Chinese variety). To obtain sources with higher resistance for further breeding, we screened our collection of eggplants as well as wild relatives for resistance to bacterial and *Verticillium* wilt. Several wild relatives were found to show a relatively high resistance to these diseases (unpublished data), but most of them exhibit a low or no compatibility with eggplant.

We report here the resistance of eggplant accessions to bacterial and *Verticillium* wilt, which were collected in Malaysia from 1985 to 1986 in cooperation with the Malaysian Agricultural Research and Development Institute (MARDI). In addition, these accessions were evaluated for

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Fusarium wilt resistance.

Materials and Methods

1. Bacterial wilt

1) Evaluation in infected field

In the summer of 1987, 59 accessions of eggplants collected from Malaysia including some prickly wild type accessions, 3 susceptible cultivars, i.e. 'Italian Happy Globe' (Takii & Co., Ltd. (*S. aethiopicum* L. (synonym *S. integrifolium* Poir.)), 'F₁ Caravan' ('Taibyō VF' in Japanese; Takii & Co., Ltd.), and 'Money Maker No. 2' ('Senryō 2 gou' in Japanese; Takii & Co., Ltd.), and 3 resistant cultivars, i.e. 'Assist', 'F₁ Meet' (Takii & Co., Ltd.), and 'Dingaras Multiple Purple', were evaluated in our experimental field heavily infected with *P. solanacearum*. 'Italian Happy Globe', 'F₁ Caravan', 'F₁ Meet', and 'Assist' were used as control rootstocks. 'F₁ Caravan', 'F₁ Meet', and 'Assist' are interspecific hybrids between *S. melongena* and *S. aethiopicum*. In most of the accessions, collected seeds were used directly. But some accessions with little amount of the collected seeds were used after propagation. Seeds were sown on 22 April 1987 in a greenhouse, and 10 seedlings of each accession were transplanted to the infected field on 12 June (7 weeks after sowing). Artificial inoculation was not attempted because the susceptible check 'Money Maker No. 2' was severely damaged in mid-July.

Each plant was scored on 22 August (10 weeks after transplanting to the infected field) for foliar symptoms on a 0 to 4 scale as follows: 0 = no symptoms; 1 = a few leaves wilted; 2 = half of the leaves wilted; 3 = almost all the leaves wilted; and 4 = all the leaves wilted or the plant died.

2) Evaluation by artificial inoculation

In the summer of 1989, 16 accessions which were highly resistant to bacterial wilt in the field evaluation (1987) were reevaluated at the seedling stage by artificial inoculation. Seeds of 16 accessions estimated as resistant and 5 checks listed in Table 3 were sown on 8 June 1989 and the seedlings were grown in a greenhouse.

Seedlings were inoculated on 18 July (6 weeks after sowing) with cultures of EBw89 strain (isolated from infected eggplant) and E8570 strain (provided by Dr. Ozaki, Morioka Branch, NIVOT, Japan). The cultures were grown at 30 °C in

Wakimoto medium (Wakimoto, 1962). Two-day-old cultures were used directly as inocula after adjusting the bacterial concentration by the addition of tap water. The concentrations of the inocula in each strain were 1.5×10^{10} cells $\cdot$ ml⁻¹ and 3.0×10^{10} cells $\cdot$ ml⁻¹, respectively. Twelve seedlings of each accession were carefully removed from the nursery and washed with tap water. The root-tip of each plant was cut to two-thirds its length, and the roots were dip-inoculated with the inoculum. The inoculated seedlings were planted in a flat filled with sterilized soil and kept at a relatively high temperature (24 ~ 35 °C) in a plastic-tunnel in a greenhouse. Foliar symptoms of each plant were scored into 5 grades as above evaluation on 30 Sept. (11 weeks after inoculation).

2. Verticillium wilt

Fifty-six accessions of eggplant collected from Malaysia, 5 susceptible cultivars, 'Italian Happy Globe', 'Assist', 'Dingaras Multiple Purple', 'Money Maker No. 2', and 'Nakate Shinkuro' and 2 resistant cultivars, 'F₁ Meet' and 'F₁ Caravan', were evaluated at the seedling stage for their resistance to *Verticillium* wilt. Five tests were performed at the seedling stage because of the differences in the collection time, poor quality, and small quantity of seeds. The accessions that were once estimated as resistant, based on the relatively low value of average disease indices, were tested at least twice to confirm their resistance. A schedule of the tests is listed in Table 1.

Inoculum for this evaluation was prepared by culturing No. 5 strain (isolated from strawberry) at 25 °C in potato glucose medium supplemented with 0.1 % dibasic potassium phosphate and 0.3 %

Table 1. Schedule of tests for the evaluation of *Verticillium* wilt resistance.

Test No.	Sowing	Inoculation	Evaluation
I	'85 19 Dec.	'86 30 Jan.	'86 24 Feb.
II	'85 19 Dec.	'86 14 Feb.	'86 11 Mar.
III	'86 29 Oct.	'86 28 Nov.	'87 10 Jan.
IV and VI ^z	'87 12 Mar.	'87 09 Apr.	'87 20 May
V and IX ^z	'92 27 Jan.	'92 18 Mar.	'92 12 May
VII	'89 24 Jan.	'89 07 Apr.	'89 09 May
VIII	'89 24 Jan.	'89 02 May	'89 02 June
X	'94 25 Feb.	'94 07 Apr.	'94 09 May

^z The tests were carried out simultaneously.

yeast extract. Ten-day-old culture was used as inoculum after adjusting the spore concentration to $1.0 \sim 2.0 \times 10^7$ spores $\cdot$ ml $^{-1}$. Seedlings were carefully removed from the nursery and washed with tap water. The root-tip of each plant was cut to two-thirds its length, and the roots were dip-inoculated with the inoculum. The inoculated seedlings were planted in a flat filled with sterilized soil, drenched with 10 ml of inoculum to each plant, and grown in a greenhouse.

About one month after the inoculation, foliar symptoms of each plant were scored on a scale of 0 to 4 as follows : 0=no symptoms; 1=slight wilt and yellowing of the lowest leaves; 2=half of the leaves wilted or showed yellowing; 3=almost all the leaves wilted or showed yellowing; and 4=all the leaves wilted, showed yellowing or plant died.

3. *Fusarium* wilt

Two accessions of LS1934 and LS2436, which were highly resistant to bacterial and *Verticillium* wilt in this study, as well as a susceptible cultivar 'Nantou Qie (LS 96)', were evaluated at the seedling stage for their resistance to *Fusarium* wilt. Seeds were sown on 16 Sept. 1992, and the seedlings were grown in a greenhouse.

Seedlings were inoculated on 28 Oct (6 weeks after sowing) with strain SUF126 (provided by Dr. Umekawa, Kyushu Natl Agric. Exp. Stn, Japan) cultured at 25 °C in potato sucrose medium. Ten-day-old culture was used as inoculum after adjusting the spore concentration to 1.2×10^7 spores $\cdot$ ml $^{-1}$. Fifteen to thirty seedlings of each accession were carefully removed from the nursery, washed with tap water, and dip-inoculated as above. The inoculated seedlings were planted in a flat filled with sterilized soil, drenched with 5 ml of inoculum to each plant, and grown in a greenhouse.

Foliar symptoms of each plant were scored on 25 Nov. (4 weeks after inoculation) on a 0 to 4 as follows : 0=no symptoms; 1=slight wilt and yellowing of the lowest leaves; 2=half of the leaves wilted or showed yellowing; 3=almost all the leaves wilted or showed yellowing; and 4=all the leaves wilted, showed yellowing or plant died.

Results and Discussion

1. Bacterial wilt

1) Evaluation in infected field

Six weeks after transplanting to the infected field, the susceptible 'Italian Happy Globe', 'F₁ Caravan', and 'Money Maker No. 2' were severely damaged by bacterial wilt (data not shown). In the final observation, 10 weeks after transplanting, they were completely destroyed by the pathogen. After six weeks, the disease indices of the resistant cultivars 'Assist', 'F₁ Meet', and 'Dingaras Multiple Purple' were 0.80, 0.60, and 0.00, respectively; in the final observation, the values were 3.60, 3.90, and 0.00. 'Assist' and 'F₁ Meet' that were resistant to bacterial wilt were not fully resistant in the heavily infected field. Only 'Dingaras Multiple Purple' seemed to be highly resistant in the evaluation (Table 2).

Twenty-seven accessions which did not show any symptoms even in the final observation were considered to be highly resistant. Nine accessions with a disease index of less than 1.00 also appeared to be resistant. In total, 36 accessions or more than 60 % of the tested accessions were deemed resistant.

2) Evaluation by artificial inoculation

To select accessions with a higher resistance among the resistant accessions detected in the evaluation in the infected field, seedlings were inoculated with bacterial suspensions with more than 10^{10} cells $\cdot$ ml $^{-1}$ (Table 3). The inoculation conditions were so drastic that even the resistant check 'Dingaras Multiple Purple' was damaged. Under these conditions, seedlings of LS1860, LS1903, LS1911, and LS1934 with average indices below 2.5 were judged to be highly resistant to the two strains of inocula. The index of LS1934 was 1.63, a value lower than that of 'Dingaras Multiple Purple' (2.17). Thus, the former should be more resistant to bacterial wilt than the latter. In other evaluations at the infected field or by the artificial inoculation, LS1934 always showed resistance to bacterial wilt (data not shown). LS1934 plants were resistant to *Fusarium* wilt as well as to bacterial wilt (Table 4).

In the field evaluation, more than 60 % of the accessions were resistant to bacterial wilt; some displayed a higher resistance in the artificial inoculation when the selection pressure was more severe. The presence of a high level of bacterial wilt resistance among the Malaysian accessions may be ascribed to the occurrence of the pathogen of bacterial wilt under the climatic conditions pre-

Table 2. Evaluation of resistance to bacterial wilt in eggplant accessions collected in Malaysia, indexed 10 weeks after transplanting to an infected field.

Accession	Disease Index ^z						Accession	Disease Index ^z					
	0	1	2	3	4	Ave. ^y		0	1	2	3	4	Ave. ^y
LS 1859	8	1			1	0.50	LS 2249					10	4.00
LS 1860	10					0.00	LS 2252	1					0.00
LS 1883		1	1		8	3.50	LS 2254	10					0.00
LS 1884		1	2	1	6	3.20	LS 2255	7		1		2	1.00
LS 1891	7			1	2	1.10	LS 2262			1	2	7	3.60
LS 1896	5					0.00	LS 2263	4	2		1	3	1.70
LS 1902	1		1	1	7	3.30	LS 2264	1	1	1		7	3.20
LS 1903	10					0.00	LS 2271	10					0.00
LS 1907					10	4.00	LS 2280					10	4.00
LS 1910		1			9	3.70	LS 2281					2	4.00
LS 1911	10					0.00	LS 2282					10	4.00
LS 1913	10					0.00	LS 2283	9					0.00
LS 1931	9				1	0.40	LS 2284			2		8	3.60
LS 1934	10					0.00	LS 2287		1			9	3.70
LS 1949	9					0.00	LS 2288					10	4.00
LS 1951	10					0.00	LS 2382	5	4	1			0.60
LS 1998	3		2		5	2.40	LS 2397	10					0.00
LS 1999	2	1	3	1	2	1.80	LS 2413	2				8	3.20
LS 2014			1		1	3.00	LS 2414					10	4.00
LS 2208	9	1				0.10	LS 2429	6	1	1		2	1.10
LS 2209	10					0.00	LS 2433	1					0.00
LS 2217	3	1	2		4	2.10	LS 2434	7				2	0.89
LS 2219	10					0.00	LS 2435	10					0.00
LS 2223	1	1	2	1	5	2.80	LS 2436	9				1	0.40
LS 2227	4	2	1		2	1.30	LS 2439	10					0.00
LS 2228	7		1	1	1	0.90	LS 2440	9				1	0.40
LS 2234	2	1	1		6	2.70	Asist ^x			2		7	3.60
LS 2235					10	4.00	F ₁ Meet ^x				1	9	3.90
LS 2237	7	2	1			0.40	F ₁ Caravan ^x					10	4.00
LS 2240					10	4.00	I. H. G. ^w					10	4.00
LS 2242					10	4.00	D. M. P. ^v	10					0.00
LS 2245		1			9	3.90	Money Maker No.2					10	4.00
LS 2247	6				4	1.60							

^z Foliar symptom scale, higher numbers indicate severer disease.^y Average value of disease indices of each accession.^x F₁ between *S. aethiopicum* (syn. *S. integrifolium*) and *S. melongena*.^w Italian Happy Globe (*S. aethiopicum*).^v Dingaras Multiple Purple.

vailing in tropical areas, such as Southeast Asia.

2. *Verticillium wilt*

Disease indices of the susceptible check 'Money Maker No. 2' were 3.63 (test No. IV) and 3.58 (test No. V), indicating a lack of resistance to *Verticillium* wilt. The rootstocks 'Italian Happy Globe' and 'Assist', which were considered to be susceptible, showed a relatively high level of resistance equal to that of the resistant 'F₁ Meet' and 'F₁

Caravan'. Our results indicate that the inoculations were performed adequately. It was suggested that the *Verticillium* wilt resistance of the rootstocks was derived from *S. aethiopicum*. Because all the accessions were either *S. aethiopicum* varieties or hybrids between *S. aethiopicum* and *S. melongena* (Table 5).

None of the eggplant accessions collected in Malaysia showed immunity or complete resistance to *Verticillium* wilt. Disease indices of 45 acces-

Table 3. Evaluation of resistance to bacterial wilt in greenhouse-grown eggplant accessions collected in Malaysia. Indexed 11 weeks after t inoculation.

Accession	Bacterial strain EBw89						Bacterial strain E8750						Average value of disease index
	Disease Index ^z						Disease Index ^z						
	0	1	2	3	4	Ave. ^y	0	1	2	3	4	Ave. ^y	
LS 1860	3				9	3.00	7				5	1.67	2.34
LS 1896					2	4.00					2	4.00	4.00
LS 1903	7				5	1.67	3				9	3.00	2.34
LS 1911	9				3	1.00	4				8	2.67	1.87
LS 1913	2				10	3.33	1				11	3.67	3.50
LS 1934	6		1		5	1.92	8				4	1.33	1.63
LS 2208	5				7	2.33	4				8	2.67	2.50
LS 2209	3				9	3.00	2			1	9	3.25	3.13
LS 2219	1				11	3.67	6				6	2.00	2.84
LS 2252	3			1	8	2.92	3				9	3.00	2.96
LS 2254	1				11	3.67					12	4.00	3.84
LS 2271	2				10	3.33	5				7	2.33	2.83
LS 2283	3				9	3.00	4			1	7	2.58	2.79
LS 2397	1				11	3.67	1				11	3.67	3.67
LS 2435	1				11	3.67	1			1	10	3.58	3.63
LS 2439					12	4.00					12	4.00	4.00
Asist ^x	4			1	7	2.58	3				9	3.00	2.79
F ₁ Meet ^x					12	4.00	2				8	3.20	3.60
D. M. P. ^w	6				6	2.00	5				7	2.33	2.17
Money Maker No.2	1		1		10	3.50	1				11	3.67	3.59
Nakate Shinkuro					12	4.00	2				10	3.33	3.67

^z Foliar symptom scale, higher numbers indicate severer disease.^y Average value of disease indices of each accession.^x F₁ between *S. aethiopicum* (syn. *S. integrifolium*) and *S. melongena*.^w Dingaras Multiple Purple.**Table 4.** Indices of resistance to *Fusarium* wilt, evaluated 4 weeks after inoculation.

Accession	Disease Index ^z					
	0	1	2	3	4	Ave. ^y
LS 1934	29				1	0.13
LS 2436	25				0	0.00
'Nantou Qie' (LS 96)	0				15	4.00

^z Foliar symptom scale, higher numbers indicate severer disease.^y Average value of disease indices of each accession.

sions of the Malaysian accessions exceeded 3.00, which indicated that they were not resistant to *Verticillium* wilt. However, the 10 accessions, LS1910, LS2014, LS2263, LS2382, LS2429, LS2433, LS2434, LS2436, LS2439, and LS2440, showed a partial resistance in the first test (Table

6).

To confirm the resistance to *Verticillium* wilt, several tests were performed in the resistant accessions (Table 6) which revealed that LS2436 possessed relatively high resistance; it was also resistant to bacterial wilt (Table 2) and to *Fusarium* wilt (Table 4).

In the evaluation of *Verticillium* wilt, more than 80 % (45 out of 56 accessions) of the Malaysian accessions were not resistant, presumably because *Verticillium* wilt does not occur in Malaysia.

In this study, we were able to identify two new resistant accessions LS1934 (bacterial wilt and *Fusarium* wilt resistant) and LS2436 (*Verticillium* wilt, bacterial wilt and *Fusarium* wilt resistant). Fruit of LS1934 are reddish-purple when immature and globular (8 cm in width×9 cm in length); fruit of LS2436 are green and, likewise, globular (6 cm in width×6 cm in length). Although the

Table 5. Evaluation of resistance to *Verticillium* wilt in eggplant accessions collected in Malaysia.

Test No. ^z	Accession	Disease Index ^y						
		0	1	2	3	4	Ave. ^x	
I	LS 1859				2	8	3.80	
	LS 1860				2	4	3.20	
	LS 1883			1	3	6	3.50	
	LS 1891				2	8	3.80	
	LS 1902			1	1	8	3.70	
	LS 1903			2	3	5	3.30	
	LS 1907			1	5	4	3.30	
	LS 1910 ^w		2	3	2	3	2.60	
	LS 1911			1	4	5	3.40	
	LS 1913				5	5	3.50	
	LS 1931		1	1	1	7	3.40	
	LS 1934				3	6	3.67	
	LS 1949			1	4	3	3.25	
	LS 1951			2	3	5	3.30	
	LS 1998				1	9	3.90	
LS 1999		1		2	5	3.38		
II	LS 1884			2	4	1	2.86	
	LS 1896				2	2	3.50	
	LS 2014		2		1	2	1.59	
III	LS 2206					5	4.00	
	LS 2208					6	4.00	
	LS 2209					6	4.00	
	LS 2217					6	4.00	
	LS 2219			1	2	3	3.33	
	LS 2223				3	3	3.50	
	LS 2227				2	4	4.00	
	LS 2228				6	4	4.00	
	LS 2234				6	4	4.00	
	LS 2235				6	4	4.00	
	LS 2237				6	4	4.00	
	LS 2240		1		1	3	3.20	
	LS 2242			1	3	3	3.50	
	LS 2254				2	3	3.60	
	III	LS 2255					5	4.00
		LS 2262		1			5	3.33
		LS 2263			1	1	2	2.60
		LS 2264					1	2
LS 2271						6	4.00	
LS 2280						6	4.00	
LS 2281						6	4.00	
LS 2282						5	4.00	
LS 2283						1	4	3.80
LS 2284					1	1	3	3.40
LS 2287					1	1	4	3.50
LS 2288					4	4.00		
IV	LS 2382				3	2	1	2.67
	LS 2397					1	9	3.90
	LS 2413		1		1		8	3.40
	LS 2414				2	1	6	3.44
	LS 2429		2	4	2			1.90
	LS 2434		2	3	1	1	6	2.46
	LS 2435				2	6	2	3.00
	LS 2436			2	5	2	1	2.20
	LS 2439		1		2	1		1.75
	LS 2440		1		2	4	2	2.67
	Asist ^v		1	5	3			1.22
	F ₁ Meet ^v		2	4	2			1.00
	F ₁ Caravan ^v				6	2		1.25
	I. H. G. ^u				5	3		1.38
B. B. ^t		1	2	2	1	2	2.13	
M. M. ^s				1	1	6	3.63	
V	LS 2433		1	2				0.67
	F ₁ Meet				4	5	3	2.92
	F ₁ Caravan			1	6	2	3	2.58
	M. M.			1	1		10	3.58

^z Schedule of tests are given in Table 1.^y Foliar symptom scale, higher numbers indicate severer disease.^x Average value of disease indices of each accession.^w The accessions underlined are estimated to be resistant based on their average disease indices.^v F₁ between *S. aethiopicum* (syn. *S. integrifolium*) and *S. melongena*.^u Italian Happy Globe (*S. aethiopicum*).^t Black Beauty.^s Money Maker No.2.

growth of both accessions is relatively slow and the yield is relatively low (authors' observation), they could serve as breeding materials for resistance to *Verticillium* wilt, *Fusarium* wilt and bacterial wilt. We are now planning to release a rootstock variety 'Daitaro'. It is a F₁ hybrid between LS1934 and 'WGCR 112-8' (Indian variety with

bacterial wilt resistance) which shows a high resistance to bacterial wilt and to *Fusarium* wilt. Furthermore, its performance as a rootstock (yield and fruit quality of grafted plants) is superior to that of other rootstock varieties. Analysis of the inheritance of the resistance should be carried out for further breeding programmes.

Table 6. Evaluation of resistance to *Verticillium* wilt in accessions estimated to be resistant.

Test No. ^z	Ref. No. ^y	Accession	Number of Tests	Disease Index ^x					
				0	1	2	3	4	Ave. ^w
VI	IV	<u>LS 1910</u> ^v	2		1	3	4	2	2.70
		<u>LS 2014</u>	2	2				4	2.67
		<u>LS 2263</u>	2			5	4	1	2.60
		Asist ^u		1	5	3			1.22
		F ₁ Meet ^u		2	4	2			1.00
		F ₁ Caravan ^u			6	2			1.25
		I. H. G. ^t			5	3			1.38
		B. B. ^s		1	2	2	1	2	2.13
VII		M. M. ^r				1	1	6	3.63
		LS 2014	3		1	4	7	6	3.00
		LS 2263	3			2	7	7	3.31
		<u>LS 2436</u>	2		7	5	3	3	2.11
		F ₁ Meet			12	6	1	1	1.55
		F ₁ Caravan			4	8	2	1	1.00
		I. H. G.			1	9	7		2.35
		M. M.				2	7	8	3.35
VIII		N. S. ^q					5	11	3.69
		LS 1910	3			4	5	9	3.28
		LS 2382	2			1	2	17	3.80
		LS 2429	2			2	2	8	3.50
		LS 2439	2			1	1	4	3.50
		LS 2440	2			1	5	4	3.30
		F ₁ Caravan				6	3		2.33
		I. H. G.				1	1	3	3.40
IX	V	M. M.					6	14	3.70
		<u>LS 2436</u>	3		9	2		1	1.42
		F ₁ Meet				4	5	3	2.92
		F ₁ Caravan			1	6	2	3	2.58
X		M. M.			1	1		10	3.58
		LS 2433	2		1	4	4	11	3.25
		<u>LS 2436</u>	4		13	3	2	2	1.65
		I. H. G.		2	1	7	9	1	2.35
		N. S.						20	4.00

^z Schedule of tests are given in Table 1.^y The tests were carried out simultaneously with the reference number test indicated in Table 5.^x Foliar symptom scale, higher numbers indicate severer disease.^w Average value of disease indices of each accession.^v The underlined accessions are estimated to be resistant based on their average disease indices. Accessions with thick line (____) or with double line (====) indicate that the accessions are resistant based on two or more evaluations.^u F₁ between *S. aethiopicum* (syn. *S. integrifolium*) and *S. melongena*.^t Italian Happy globe (*S. aethiopicum*).^s Black Beauty.^r Money Maker No.2.^q Nakata Shinkuro.

Note : A seed sample for research purposes is available on NIVOT (Dr. Shinji MONMA).

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マレーシアで収集したナス (*Solanum melongena* L.) の青枯病抵抗性および半身萎ちょう病抵抗性

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摘 要

著者らは、マレーシア農業開発研究所 (MARDI) の協力によってマレーシアより収集した 60 系統のナス (*Solanum melongena*) について、青枯病および半身萎ちょう病に対する抵抗性素材を見出すため、両病害に対する抵抗性検定を実施した。また有望系統に関しては半枯病抵抗性検定を実施した。

1) 青枯病汚染圃場を用いた検定の結果、供試したナス系統の約 60% が抵抗性を示した。さらに、これらの抵抗性系統の中でより高度な抵抗性を有する系統を選抜するため、強度の接種条件 (菌濃度 $1.5 \sim 3.0 \times 10^{10}$ cell・ml⁻¹) で幼植物検定を行ったところ、LS 1934 は最も高度な抵抗性を示した。

2) 半身萎ちょう病の幼植物接種検定の結果、供試

した約 80% の系統が病性であり、免疫あるいは完全な抵抗性を示した系統は見い出せなかった。部分的な抵抗性を示した系統の抵抗性程度には差異が認められ、複数回の再検定により、LS 2436 は相対的に高い抵抗性を示すことが確認された。なお、LS 2436 は青枯病汚染圃場検定で青枯病にも抵抗性であった。

3) LS 1934 および LS 2436 の半枯病抵抗性を調べるために、幼植物接種検定を行ったところ、両系統ともに抵抗性であることが判明した。

以上、青枯病および半枯病に抵抗性を示す LS 1934、半身萎ちょう病、青枯病及び半枯病に抵抗性を示す LS 2436 の 2 系統の有望な育種素材を、マレーシアで収集したナスの中から見い出すことができた。

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