

**พันธุ์ต้านทานข้าวที่มีต่อเพลี้ยกระโดดหลังขาว**  
**Varietal Resistance of Rice to Whitebacked Planthopper,**  
**Sogetella furcifera (Horvath)**

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ABSTRACT

Varietal resistance of rice to whitebacked planthopper, *Sogetella furcifera* (Horvath) was evaluated and carried out for its resistance mechanism. From screening test of 244 rice varieties and lines by host preference, antibiosis and tolerance test methods were used. It was found that among test varieties and lines, only ARC5752 /WC1240, Ptb33, Chempan, Sonpatter 45 and ADR 52 were indicated resistant to whitebacked planthopper. Resistance of all resistant rice varieties and lines were evaluated as both non-preference and antibiosis together but not tolerant one, Non-preference feeding for nymphs was found affected for egg oviposition in resistant varieties and lines of rice.

บทคัดย่อ

ได้ทำการประเมินพันธุ์ต้านทานของข้าวที่มีต่อเพลี้ยกระโดดหลังขาว เพื่อหากลไกของความต้านทานจากการคัดเลือกพันธุ์ข้าว 244 สายพันธุ์ โดยวิธีการทดสอบการชอบพืชอาหาร การมีผลชงักงันต่อการเจริญเติบโต และความสมบูรณ์ และการทนทานต่อการทำลายของแมลง พบว่าในจำนวนพันธุ์และสายพันธุ์ข้าวที่ทดสอบมีเพียง ARCS152, WS1240, Ptb33, Chempan, Sonpattar 45 และ ADR52 เท่านั้นที่พบว่ามีความต้านทานต่อเพลี้ยกระโดดหลังขาว กลไกของพันธุ์และสายพันธุ์ข้าวทั้งหมดที่พบว่าต้านทานมีลักษณะความต้านทานแบบการไม่ชอบพืชอาหารและการมีผลชงักงันต่อการเจริญเติบโตและความสมบูรณ์ของแมลงควบคู่กันทั้งสองอย่าง แต่ไม่ใช่ลักษณะความทนทานต่อการทำลายของแมลงลักษณะ

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ของการไม่ชอบดูดกินพืชอาหารของตัวอ่อน พบว่า มีผลต่อการไม่ชอบวางไข่ของตัวโตเต็มวัยบนพันธุ์และสายพันธุ์ข้าวที่ต้านทานด้วย

### Introduction

The whitebacked planthopper, *Sogatella furcifera* (Horvath) is considered as a common rice insect pest in Thailand and others Asian Countries (Mochida, 1982). The tremendous increases in population of this insect were due to the use of brown planthopper resistant rice variety (Ruay Aree, 1984), also including the application of the synthetic insecticides in the paddy field which causes harmful affected the key natural enemies of planthoppers. Future control strategies will be depended on appropriate combinations of varietal resistance, cultural control, conservation of important natural enemies, and judicious use of insecticides (Way, 1976). However, the progress of studies on the resistance of crop varieties to planthoppers has resulted in serious problems involved in screening. To reduce times, labor and space, the techniques for screening have to be developed and used as a standard procedure.

### Objective

The objectives of this proposed study were included :

1. To screening the varietal resistance of rice for the whitebacked planthoppers.
2. To determine the mechanism of resistance for whitebacked planthopper.

### Materials and Methods

The whitebacked planthoppers were mass reared and multiplied under the greenhouse condition at Pathum Thani Rice Research Center. The field collected insects were examined for their viruliferous by employed the seedling method (Nasu, 1961; Ling, 1968). The only free virus insects were confined and reared on 60 days old Taichung Native 1 which grown in 12cm diameter clay plots. Four of the potted plants were placed inside a wooden rearing cage (45 x 45 x 135 cm) with a glass plate at the front side but on the top and other three sides were made with a fine mesh nylon cloth and mesh wire.

#### Screening for Varietal Resistance

The total of 244 rice varieties were used as the material in this experimental screening test. These rice (*Oryza sativa* L.) varieties and lines seed were obtained from the World Germplasm Bank which maintained at the International Rice Research Institute (IRRI), Germplasm Bank of Rice at Pathum Thani Rice Research Center and

lowland rice at Pathum Thani Rice Research Center, Thanyaburi, Thailand. The mass screening techniques and the plant damage evaluation were done on the basis of Standard Evaluation System (SES) for rice by using whiteback planthopper index (IRRI, 1980). This mass screening test for varietal resistance of *S.furcifera* was conducted under the greenhouse condition at Pathum Thani Rice Research Center.

#### Retesting of Selected Varieties

The rice varieties which showing resistance in the preliminary screening test were reevaluated following as the same technique of screening as described above. The mass screening was done to reject the bulk of susceptible lines, each selected varieties were replicated three times. Aside from the grade to be noted, the number of an insect present on each tested variety at 24 hours or more after infestation were recorded, and the damage which they caused at 5 days intervals were also recorded.

#### Mechanism of Resistance

Mechanism of resistance which included non-preference, antibiosis and tolerance of selected rice varieties and line from the mass screening were conducted for *S.furcifera* under the greenhouse and the field condition. The resistance's level were compared and analyzed based on the criteria of IRRI (1978, 1980, 1981).

## Results and Discussion

### Host Preference

From the results of experiment (Table 1) it was shown that at six hours after infestation, the number of whitebacked planthopper (WBPH) nymphs feeding on resistant varieties and susceptible check were nonsignificantly different, except the number of nymphs on ARC 5752 and chempan which significantly less than susceptible check (TNI). One and three days after infestation, there were more nymph on TNI, the susceptible check than on the resistant varieties. At five days after infestation, the susceptible TNI was found to wilt and nymphs moved to varieties that they preferred. Seven days after infestation the number of WBPH nymph on susceptible check TNI were significantly less than resistant varieties and lines, since the susceptible check variety had found severely damaged. The resistant varieties were only shown slightly damaged even when more insects moved to them from the susceptible variety that has been killed. The white backed planthopper nymphs were preferred susceptible more than resistant. It was also indicated that after four days infestation of WBPH adults, the

number of eggs on the resistant varieties were found significantly less than susceptible check TNI (Table 2).

#### Antibiosis

The percent survival of first instar nymphs and nymphal development of whitebacked planthopper were indicated that from five to eleven days after infestation the percent insect survival on resistant entries were decreased when the day's number increased and significantly less than susceptible TNI. On the resistant varieties, the developing time from nymph to adult was also significantly longer than on the susceptible TNI (Table 3). Amount of honeydew excretion by the whitebacked planthopper after feeding on resistant and susceptible rice varieties were detected. After feeding of female adults, on the resistant rice varieties there were honeydew excretion area more significantly less than on susceptible TNI, especially the less area on the resistant variety WC 1240 only 0.044 mm<sup>2</sup> (Table 4).

#### Tolerance

The tolerance of the tested rice varieties and lines to white backed planthopper was observed, the experimental results were obtained (Table 7). From the obtained results, it was indicated that either the number of insect fed per rice hill, rice hopper burn percent or rice yield in term of harvestable seed yield (kg/rai) were shown significantly different among tested rice varieties and lines. The tolerance mechanism was not able to detected, since the number of infested insect on resistant rice varieties and lines were drastically decreased in number as compared to the susceptible check Taichung Native 1 rice variety. The lowest rice hopper burn percentage were observed on Suduru Samba (0.00 %), Chempan (5.00 %), ARC 5752 (5.17 %) and WC 1240 (9.33 %) in Compared with susceptible Taichung Native 1 (100 %).

### Conclusion

From the experiment results, it is concluded that the adults and nymphs of whitebacked planthopper did not like to feed on resistant varieties and adults did not also like to lay eggs. Among the tested rice varieties and lines, varieties that non-preference for an insects were indicated as ARC 5752, WC 1240, Pht 33, Chempan, Sanpattar 45 and ADR 52. These six resistant varieties were indicated their resistance mechanism as antibiosis together with non-preference mechanism resistant one.

Table 1. Feeding preference of *Sogatella furcifera* (Horvath) nymph on different tested rice varieties and lines and their resistant level.

Varieties and lines	No. of WBPH nymphs (nymphs/20 seedlings)						Rice resistant level
	6 hrs.	1 day	3 days	5 days	7 days		
ARC5752	241 a	253 ab	237.14 b	206 bcd	162 bcd	1.00 a <sup>1</sup>	
WC1240	287 abc	262 ab	254.58 bcd	214 ab	178 cd	1.00 a	
Ptb33	294 abc	274 abc	268.53 bcd	233 bce	184 de	1.50 ab	
BKNLR78007-R-R-PSL-3-4	311 bc	325 e	320.63 f	295 f	261 g	3.50 c	
Chempan	253 ab	249 ab	242.66 bc	218 abc	154 bc	1.00 a	
BKNLR78007-R-R-PSL-3-8	297 abc	318 de	295.80 ef	290 f	248 fg	3.50 c	
Sonpattar 45	324 c	304 cde	292.42 ef	265 e	232 f	3.00 b	
ADR52	308 bc	282 bcd	274.16 de	241 cde	207 e	2.00 b	
Suduru Samba (resistant check)	276 abc	237 a	211.35 a	197 a	142 b	1.00 a	
TNI (susceptible check)	331 c	458 f	425.60 g	252 ce	56 a	9.00 d	
C.V.(%)	12.9	9.0	1.3	6.8	9.1	17.6	

1/ In a column, means followed by a common letter are not significantly different at the 5% level by DMRT

Table 2 Average number of adults *Sogatella furcifera* (Horvath) and number of eggs found on tested rice varieties and lines on 4 days after Infestation.

Varieties or lines -----	No. of WBPH adults, days after infestation				Number of WBPH adults		Number of WBPH eggs
	1 hour	1 day	2 days	3 days	4 days	average 4 day (insects/plant)	4 day after infestation
ARC5752	19 ab	8 a	4.94 a	7.50 a	2.75 a	5.8	532 ab <sup>1/</sup>
WC1240	17 a	11 a	7.99 ab	8.00 a	6.75 abc	8.4	580 ab
Ptb33	22 ab	14 a	9.01 a	7.50 a	5.50 ab	9.0	691 ab
BKNLR78007-R-R-PSL-3-4	23 ab	37 b	18.56 bc	30.00 b	27.25 de	28.2	1656 d
Chempan	11 a	8 a	4.01 a	3.50 a	5.25 ab	5.2	403 a
BKNLR78007-R-R-PSL-3-8	21 ab	31 b	21.94 bc	24.50 b	19.25 cde	24.2	1031 bc
Sonpattar 45	18 a	12 a	12.35 abc	13.75 a	16.00 bcd	13.5	861 ab
ADR52	21 ab	13 a	11.11 ab	11.75 a	19.50 cde	13.8	740 ab
Suduru Samba (resistant check)	21 ab	10 a	4.45 a	6.25 a	2.75 a	5.9	678 ab
TNI (susceptible check)	32 b	53 e	32.17 e	30.75 b	30.75 e	36.7	1387 ce
C.V.(%)	41.6	31.8	27.5	48.3	59.9		37.4

<sup>1/</sup> In a column, means followed by a common letter are not significantly different at the 5% level by DMRT.

Table 3. Percentage of nymph survival and developmental period (days) from the first instar nymphs to adults of whitebacked planthopper *Sogatella furcifera* (Horvath) on the rice varieties and lines.

Varietits and lines	Survival (%) (days after infestation)						Precent survival of insects	Nymphal stage (days)
	1 day	3 days	5 days	7 days	9 days	11 days		
ARC5752	97.50 a	85.00 ab	72.50 abc	66.25 abc	57.50 ab	51.25 abc	46.25 abc	18.00 b <sup>1/</sup>
WC1240	100.00 a	88.75 abc	75.00 bc	68.75 bc	60.00 abc	53.75 abc	51.25 bcd	12.63 a
Ptb33	98.75 a	90.00 abcd	78.75 bc	72.50 bc	63.75 bcd	55.00 abcd	52.50 bcd	15.88 b
BKNLR78007-R-R-PSL-3-4	98.75 a	95.00 cd	83.75 bcd	78.50 cd	72.50 cd	66.25 de	45.00 ab	10.00 a
Chempan	100.00 a	87.50 abc	71.25 ab	62.50 ab	56.25 ab	48.75 ab	41.25 a	18.38 b
BKNLR78007-R-R-PSL-3-8	98.75 a	96.25 cd	86.25 cd	81.25 cd	75.00 d	68.75 e	60.00 d	10.38 a
Sonpattar 45	98.75 a	93.75 bcd	81.25 bcd	76.25 bc	68.75 bcd			
ADR52	97.52 a	91.25 abcd	82.50 bcd	70.00 bc	66.25 bcd	58.75 bcde	56.25 d	18.00 b
Suduru Samba (resistant check)	96.25 a	82.50 a	60.00 a	52.50 a	48.75 a	45.00 a	41.25 a	18.50 b
TNI (susceptible check)	100 a	98.75 d	95 d	93.75 d	90.00 e	87.50 f	83.75 e	10.00 a
C.V.(%)	2.7	6.5	11	13.3	12.9	12.8		11.9

<sup>1/</sup> In a column, means followed by a common letter are not significantly different at the 5% level by DMRT

Table 4 Honeydew excretion by three-day adult whitebacked planthopper  
*Sogatella furcifera* (Horvath) eighteen hours after infestation on the  
rice plants.

Varieties and lines	Honeydew excretion (millimetre) <sup>2</sup>
ARC5752	2.31 a <sup>1/</sup>
WC1240	0.04 a
Ptb33	1.89 a
BKNLR78007-R-R-PSL-3-4	13.34 ab
Chempan	4.13 a
BKNLR78007-R-R-PSL-3-8	18.34 bc
Sonpattar 45	4.63 a
ADR52	0.65 a
Suduru Samba (resistant check)	0.47 a
TNI (susceptible check)	30.38 c
C.V. (%)	115.90

<sup>1/</sup> In a column, means followed by a common letter are not significantly different at the 5% level by DMRT



Table 5 Number of insects, rice hopperburn percentage and yield of rice plants after infestation by whitebacked planthopper *Sogatella furcifera* (Horvath).

Varieties and lines	No of insects after infestation 35 pairs of adults whitebacked planthopper/25 rice hills		Rice hopperburn	Rice Yield
	20 days	40 days	(%)	(kg/rai)
ARC5752	10.78 ab	10.55 ab	5.17 b	615.83 ab <sup>1/</sup>
WC1240	20.37 abc	17.89 bc	9.33 c	534.42 bcd
Ptb33	16.30 abc	17.37 bc	13.33 d	502.83 cd
BKNLR78007-R-R-PSL-3-4	31.15 c	131.11 e	66.00 g	443.02 d
Chempan	5.30 a	9.56 ab	5.00 b	644.27 a
BKNLR78007-R-R-PSL-3-8	23.67 bc	126.22 e	62.67 g	440.29 d
Sonpattar 45	19.29 abc	83.48 d	44.33 f	458.68 d
ADR52	9.70 ab	21.48 c	35.00 e	481.40 cd
Suduru Samba (resistant check)	6.19 a	7.15 a	0.00 a	584.10 abc
TNI (susceptible check)	31.11 c	380.30 f	100.00 b	58.73 e
C.V. (%)	48.5	6.8	5.8	11.9

<sup>1/</sup> In a column, means followed by a common letter are not significantly different at the 5% level by DMRT

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