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二化螟虫 (*Chilo suppressalis* W.)에 對한 벼品種 抵抗性에 關한 硏究

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Studies on Varietal Resistance of Rice to Striped Rice Borer, *Chilo suppressalis* Walker.

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Abstract

Several selected rice varieties Tong-il (Suweon #213-1), Jinheung, IR747, Suweon #229 and so forth were evaluated for their resistance to the striped rice borer, *Chilo suppressalis* Walker. The resistance appears to be non-preference and antibiosis in nature.

Under laboratory and greenhouse conditions, resistance to striped rice borer was manifested by the low larval weight, percentage of pupation and number of eggs recorded. In the cage test, varieties Suweon #240 and Shenshuraku appeared to be non-preferred by the borer moths for oviposition. Under field condition, variety Tetep received the lowest percentage of infested tillers.

Introduction

Crop yield losses are often attributed to insect damage. One hundred different insect species have been reported to feed and infest rice plant; however, 20 species are considered as important pests (IRRI 1965, Paik, 1967; Pathak et. al, 1971). Of these, stem borers cause great crop damage. In Korea and other parts of Asia, stem borers occur regularly and infest plants from late seedling stage to maturity (Vega and Andres, 1972; Israel, 1967; Shim, 1965).

The use of insecticides in controlling insect pests has been proven to be the fastest way of conrolling insects; however, using insecticides as the main control measure offer a lot of disadvantages. Insecticides are hazardous to man and to other non-target organisms (Pathak, 1967). It causes environmental pollution and when applied continuously, insects develop resistance to insecticides; in addition, insecticides are expensive. Planting resistant varieties has long been considered as an ideal method in suppressing insect pest population (Beck, 1965). The use of resistant varieties does not mean additional cost to the farmers and it is compatible with other control measures (Painter, 1968; Pathak, 1973). Screening for varieties resistant to stem borers and to different insect pests of rice occupied a major part in the research programs.

Distinct differences in the reaction of rice varieties to stem borers have been recorded. Tsutsui (1951) and Matsuo (1952) observed more larvae from stems of susceptible varieties than from resistant varieties. Douglas and Ingram (1942), and Van and Guan(1959) reported that there is a significant correlation between stalk size and the extent of infestation. Taller varieties are more susceptible to stem borer attack (Ghosh, 1959, 1960; Pathak, 1969). The length and

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width of the leaves were positively correlated with the number of egg masses received per plant (Patanakamjorn, 1965). Pathak (1969, 1971) reported that borer larvae established more easily on loose-sheathed varieties than on those with tight leaf sheaths.

Matsuo (1952) reported a high correlation between infested stems and numbers of egg masses laid by first generation striped borer in Japan. Repeated field experiments showed that ovipositing striped borer moths distinctly preferred some varieties to others (Pathak et. al, 1971). The borer larvae found difficulty in boring through heavily sclerotized stem tissues (Van and Guan, 1959).

A significant negative correlation was recorded between silica content of the stem and susceptibility to the rice borer (Djamin and Pathak, 1967; Pathak et. al, 1971). Nakano et. al. (1961) reported that the silicon absorbed by the rice plants appears to give the host an ability to resist borer attack.

This study aims to screen selected varieties for their resistance to striped rice borer, *Chilo suppressalis* Walker.

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Materials and Method

A. Laboratory experiment

Seven-day old seedlings of recommended varieties Tong-il (Suweon ≠ 213-1) and Jinheung, resistant varieties Suweon ≠229 and IR747, and the susceptible check variety Juckna were infested with 20 first-instar borer larvae. The test varieties were grown in glass jars (10×13cm) and kept inside the incubating room with a temperature maintained at 26°C and 12-hour light period per day. The test plants were changed every 5 days. Data on the weight per larva, length of larval period and the number of larvae that pupated were recorded.

B. Greenhouse experiment

A similar test was one in the greenhouse using 60-day old plants. Six potted plants from each test variety were infested with 10 first-instar larvae. The plants were dissected to determine the larval weight and the rate of pupation. Emerging adults were allowed to lay eggs on the corresponding test variety from which the larvae were reared. Also, the number of eggs laid on each plant was counted.

A test for ovipositional preference on 57 selected varieties was done in the cage house. Six 40-day old plants of the each test variety, grown in plastic pots (10×15cm) were arranged randomly inside the screen cage. About 800 pairs of the borer moths collected from the field were released on the plants. The number of egg masses laid on each variety was taken.

C. Field experiment

The varieties tested for ovipositional preference were also grown in the field to determine the degree of striped borer infestation under natural condition. Each test variety was replicated 3 times and transplanted in 3-row-15-hill plots randomly arranged. Transplanting date was so timed such that the peak of occurrence would coincide with the susceptible stage of the plants. Data on the number of infested tillers were recorded from each replication 35 days after the peak of occurrence of the first generation of the borer moths.

Results and Discussion

Not much difference in the duration of the larval period was observed between test varieties when caged on 7-day old seedlings or on 60-day old plants (Table 1). However, the larval period was longer on older plants than on seedlings. In this case, the effect of varietal resistance is more expressed on older plants. Pathak (1967) reported that some varieties were highly resistant at one stage become susceptible at another, while several others maintain their resistance or susceptibility throughout plant growth. Significant differences were recorded on the larval weight caged on 60-days old plants. The larvae weighed less on Suweon ≠229 and IR747. On susceptible varieties, the larvae weighed almost twice as much as those on resistant varieties; and, the pupae on susceptible varieties were almost twice as large as those on

resistant varieties (IRRI 1965). Ishii et. al, (1962) found that rice plant contains certain factors which inhibits the growth and development of the larvae.

The percentage of pupation differed significantly. As shown in Table 1, the rate of pupation on the susceptible check variety and Tong-il (Suweon #213 -1) was almost twice as much as that on IR747. The larvae pupated earlier and in greater numbers on susceptible varieties (Pathak, 1969). Low number of eggs was recorded on IR747 as compared to other test varieties (Table 1).

In the test for ovipositional preference, Suweon # 240 and Shenshuraku received the lowest number of egg masses (Table 2). Sixteen other varieties were not preferred much by the borer moths. Tong-il and Jinheung, the two recommended varieties, were among those that had 10 egg masses per plant. Pathak (1964, 1969) reported that even under heavy infestations, only a few egg masses were found on resistant varieties. Certain varieties were significantly more preferred for oviposition than others (IRRI, 1967).

Table 3 shows that a low percentage of infested tiller was recorded even on the susceptible varieties. This indicates that there was a low borer infestation in the field during the conduct of the experiment.

Tetep had the lowest percentage of infested tillers although it attracted borer moths for oviposition (Table 2). The insect preference for one variety over the other could be due to differences in the morphological or chemical character of the plant (IRRI, 1968). Das (1969) reported that the stem borer infestation in a variety could be influence by the attraction of the plants to the ovipositing moths and the resistance of the plants to larval feeding and growth. In some varieties, the resistance to borers changes with stage of plant growth (IRRI, 1970). Thus, resistance in a variety may result from a complex of factors which may be physical or chemical in nature.

Table 1. Striped rice borer, *Chilo suppressalis* Walker, development on 7-day old seedlings and 60-day old plants of selected test varieties. IAS, 1973.

Variety[a]	Larval period (day)		Weight/larva (mg)		Rate of pupation (%)	
	I[b]	II[c]	I[b]	II[c]	I[b]	II[c]
Tong-il (Suweon #213-1)	39.6	50.2	46.0	34.2a	69a	69.7a
Jinheung	41.2	51.5	46.0	22.2ab	42b	42.2b
Suweon # 229	41.5	55.8	43.3	18.1b	49ab	48.6ab
IR747	44.1	53.3	39.8	18.0b	38b	34.8b
Juckna (check)	42.0	47.5	43.5	34.4a	53a	65.3a

a Replicated 6 times with 20 first-instar larvae per replication.
b Seven-day old seedligns
c Sixty-day old plants

Table 2. Number of egg masses of striped rice borer, *Chilo suppressalis* Walker, on selected test varieties. IAS, 1973.

Number of egg masses/ plant[a]				
0-1	2-3	4-6	7-9	10
Suweon #240	Mangetsu mochi	Kanto #79	Tetep	TNI
Shenshuraku	TKM-6	Suweon #223	Norin Mochi #1	Fukunohana
	Pungkwang	〃 235	Akibare	Suweon #213-1(Tong-il)
	Suweon #82	〃 241	Shirogane	〃 236
	〃 197	〃 242	Kimaze	〃 238
	〃 214	Susukaze	Hokwang	Jinheung
	〃 228	Sadominori	Shin #2	Paltal
	〃 234	Milseung	Norin #29	Chukoku #41
	〃 239	Jaekun	Suweon #225	Tokai #25
	Matsumae	Norin #6	〃 226	Chukei #314
	Palkum	Nongkwang	〃 230	

Palkweng	IR781-194-13-1-1-2-1	〃	232
Mankyeng	KC45-26-3-8-5	〃	237
IR1317-70-1		Kwanok	
IR781-137-1-2-3		Nongbaek	
IR1325-B1-11-B-48-2-B-2-3		Kusabue	

a Each variety was replicated 6 times. About 800 pairs of borer moths were released to test their ovipositional preference.

Table 3. Percentage of infested tiller of striped rice borer, *Chilo suppressalis* Walker, on selected test varieties. IAS, 1973.

Variety[a]	Infested Tiller(%)	Variety[a]	Infested Tiller(%)
Tetep	1.02	Kanto ＃79	6.38
Mangetsu mochi	2.18	Pungkwang	6.42
IR 747	2.19	Suweon ＃234	6.44
Chukoku ＃41	2.24	Tokai ＃25	6.52
Norin mochi ＃1	2.72	Shirogane	6.63
Susukaze	3.53	Suweon ＃242	6.81
IR781-137-1-2-3	3.59	IR1325-B1-11-B-48-2-B-2-3	6.89
IR1317-316-3-1-1-2-1-1-2-9	3.72	Suweon ＃230	7.74
Shenshuraku	3.86	Palkweng	7.76
TKM-6	3.86	IR781-194-13-1-1-2-1	7.87
Suweon ＃232	3.95	Suweon ＃240	7.88
Suweon ＃239	4.02	Suweon ＃225	8.51
Suweon ＃241	4.13	Kimaze	8.67
Suweon ＃214	4.24	Hokwang	9.15
Palkum	4.29	Suweon ＃82	9.29
SR600-1-37-2-1	4.67	Milseung	9.41
Suweon ＃238	4.92	Suweon ＃223	9.75
Suweon ＃197	4.95	Norin ＃29	9.77
Akibare	5.01	Fukunohana	10.04
Paltal	5.29	Kusabue	10.04
Matsumae	5.59	Norin ＃6	10.70
Suweon ＃213-1(Tongil)	5.61	Nongback	10.83
Sadominori	5.67	Chukei ＃314	10.99
Suweon ＃236	5.71	Jaekun	11.10
Shin ＃2	5.81	Suweon ＃226	11.33
Suweon ＃235	5.85	Kwanok	11.74
Suweon ＃237	6.30	TNI	14.98
IR800-14-3-2-2	6.34	Jinheung	15.83
Mankyeng	6.35	KC45-26-3-8-5	16.50

a Each variety was replicated 3 times and transplanted in 3-row-15-hill plots.

Summary

Selected varieties were tested for their resistance to *Chilo suppressalis* Walker under laboratory, greenhouse and field conditions.

1. Laboratory experiment-an antibiosis type of plant resistance was manifested by the low larval weight and percentage of pupation. There was no distinct difference between the larval period on both the 7-day old seedlings and 60-day old plant.

a. The larval weight did not differ much on 7-day

old seedlings which ranged from 39.8 to 46mg per larva. On 60-day old plants, a marked difference was observed ranging from 18.0 to 34.4mg per larva.

b. The rate of pupation on 7-day old seedlings and 60-day old plant varied from 38% on resistant variety IR747 to 69% on Tong-il (Suweon 213-1), a recommended variety, and 34.8 to 69.7%, respectively.

2. Greenhouse experiment -among the 57 selected varieties tested for ovipisition, only Suweon 240 and Shenshuraku received the smallest number of egg masses per plant.

3. In field experiment-58 varieties were exposed to natural borer infestation. Varieties Tetep, Managetsu mochi and IR747 had 1.02, 2.18 and 2.19% infested tillers, respectively.

抄 錄

二化螟虫(*Chilo suppressalis* Walker)에 對한 벼 品種別 抵抗性을 알기 위하여 統一(水原 213-1), 振興, IR747, 水原 229號 等 58個 品種을 供試하여 試驗을 하였다.

室內試驗에서 幼虫期間은 品種間 大差없었다. 幼虫體重은 感受性 品種에서는 34.4mg이었으나 抵抗性 品種은 18.0mg이었으며 蛹化率도 抵抗性 品種에서 높았다. 産卵選好性 試驗에서는 水原 240號 천추락 等이 낮은 選好性을 보였고 圃場調査에서는 Tetep, 망게스 찰 IR747 等이 낮은 被害莖率을 나타내었다.

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