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Vertical and Horizontal Resistance of Leading Egyptian Rice Cultivars and Lines to Rice Blast*

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Summary

The true resistance genes of the twenty Egyptian rice cultivars and lines to rice blast were presumed. Three cultivars and one line had the *Pi－a* resistant gene to rice blast. One cultivar was classified to be the *Pi－i* resistant genotype group. One cultivar and three lines were identified to be the *Pi－z*^{t} genotype group. One cultivar harbored *Pi－b* and other gene(s). The other ten cultivars and lines did not react to all isolates of rice blast fungi tested. Field resistance of three cultivars and one line in the *Pi－a* genotype group were estimated to be susceptible. Field resistance of one cultivar with *Pi－i* gene was estimated to be resistant. The spontaneous infection of one cultivar and three lines in the *Pi－z*^{t} genotype group were not recognized. Two cultivars and two lines in the group that they were resistant to the 13 races tested were infected spontaneously.

Introduction

Vertical and horizontal resistance of cultivars is very important to control rice blast disease. The Egyptian cultivars and lines of rice are classified into two groups : *Indica* and *Japonica*. They differ from each other on the resistance genes or the field resistance that they have. However, there is a little knowledge of the vertical and horizontal resistance of the Egyptian rice cultivars and lines.

In this experiment, the reactions of leading Egyptian rice cultivars and lines to some selected isolates of blast fungus were investigated by the artificial inoculation. After that, their resistance genes to rice blast fungi were presumed. Also, the degree of their horizontal resistance to rice blast was investigated at the upland nursery.

Materials and methods

Twenty leading Egyptian cultivars and lines (Table 1) were tested. The thirteen isolates of rice blast fungus, *Pyricularia oryzae* Cavara (*Magnaporthe grisea* (Hebert) Barr), Shin 85－86 (race 001), Ken 54－04 (003), Naga 69－150 (007), Ina 72 (031), TH68－126 (033), Yu－01 (033－b*), Ken 60－19 (037), TH77－1 (047), Ken 53－33 (137), Tus－01 (337), TH81－02－1 (337－b*), Ai 81－194 (407) and Ai 75－310 (437), were used.

To identify the vertical resistance gene, the seeds were sown in the seedling cases. The seedlings at 4～6 leaf age were inoculated with the spore suspension (4～5×10^5 conidia／ml) of blast fungus. The inoculated seedlings were incubated at 27℃ for 24 hr. The blast lesion types on the leaves of the cultivars and lines were explored 7～10 days after inoculation[3].

To evaluate the degree of the horizontal resistance of the cultivars and lines to rice blast, upland nursery test[2] was undergone. Egyptian cultivars, lines and Japanese differentials for the rice blast were used. The seeds were sown in the rows about 10 cm interval. Variety Norin 29 was used as a spreader. At 4～6 leaf age, the occurrence of blast disease spontaneously was observed and recorded four times every two day by Asaga's scale[1].

Results and discussion

The reactions of the twenty Egyptian rice cultivars and lines to the selected thirteen races of blast fungus were recorded, and their true resistance genes were presumed as shown in Table 1 . Ten of them were clarified on their true resistance gene.

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Egyptian cultivars Giza 171, Giza 172, Yabani 15 and line Giza 172 Mg 4－1－93 harbored *Pi－a* gene. Egyptian cultivar, Giza 2175, and lines, Giza 1368－5－4, Giza 2175－5－4 and Giza 2175－5－6 harbored *Pi－z'* gene. The reaction of IR 50 was susceptible to race 337－b*, but resistant to race 033－b*. As a result, IR 50 has *Pi－b* and other gene(s). The reactions of Giza 175 to race 047, 137, and 337 were moderate, but it was the same as cultivar with *Pi－i* gene to other races. For that reason, Giza 175 was assumed to have *Pi－i* gene. Since, cultivar Giza 181, Giza 1108, Giza 1368, Giza 1394, IR 28, IR 1626 and line IR 19743－46, IR 19743－46－3, IR 25571－31, IR 2588－32 showed resistance to all races used, their resistance genes could not be presumed.

Also, the scoring of blast occurrence of the cultivars and lines at the upland nursery was recorded as shown in Table 2 . Blast disease severity of Egyptian cultivars Giza 171, Giza 172, Yabani 15 and line Giza 172 Mg 4－1－93 was the same as Aichiasahi. Because Aichiasahi is estimated to be susceptible, their horizontal resistance may be susceptible. Disease incidence of Giza 175 was less than that of Ishikarishiroke. Ishikarishiroke is estimated to be moderate. Consequently, horizontal resistance of Giza 175 may be resistant. Giza 2175, Giza 1368－5－4, Giza 2175－5－4 and Giza 2175－5－6 were escaped by spontaneous infection. Therefore, their field

Table 1 . Reaction of Egyptian cultivars and lines to 13 selected races of rice blast fungus, *Pyricularia oryzae* Cavara, in Japan and presumed genotype for true resistance.

Cultivar／line ＼ Isolate (Race)	Shin85－86 (001)	Ken54－04 (003)	Naga69－150 (007)	Ina72 (031)	TH68－126 (033)	Yu－01 (033－b*)	Ken60－19 (037)	TH77－1 (047)	Ken53－33 (137)	Tus－01 (337)	TH81－02－1 (337－b*)	Ai81－194 (407)	Ai75－310 (437)	Presumed genotype
Giza 171	－	S	S	－	S	S	S	S	S	S	S	S	S	*Pi－a*
Giza 172	－	S	S	－	S	S	S	S	S	S	S	S	S	*Pi－a*
Giza 175	－	－	S	－	－	－	S	M	M	M	S	S	S	*Pi－i*
Giza 181	－	－	－	－	－	－	－	－	－	－	－	－	－	?
Giza 1108	－	－	－	－	－	－	－	－	－	－	－	－	－	?
Giza 1368	－	－	－	－	－	－	－	－	－	－	－	－	－	?
Giza 1394	－	－	－	－	－	－	－	－	－	－	－	－	－	?
Giza 2175	－	－	－	－	－	－	－	－	－	－	－	S	S	*Pi－z'*
Giza 172 Mg 4－1－93	－	S	S		S	S	S	S	S	S	S	S	S	*Pi－a*
Giza 1368－5－4	－	－	－	－	－	－	－	－	－	－	－	S	S	*Pi－z'*
Giza 2175－5－4	－	－	－	－	－	－	－	－	－	－	－	S	S	*Pi－z'*
Giza 2175－5－6	－	－	－	－	－	－	－	－	－	－	－	S	S	*Pi－z'*
IR 28	－	－	－	－	－	－	－	－	－	－	－	－	－	?
IR 50	－	－	－	－	－	－	－	－	－	－	S	－	－	*Pi－b**
IR 1626	－	－	－	－	－	－	－	－	－	－	－	－	－	?
IR 19743－46	－	－	－	－	－	－	－	－	－	－	－	－	－	?
IR 19743－46－3	－	－	－	－	－	－	－	－	－	－	－	－	－	?
IR 25571－31	－	－	－	－	－	－	－	－	－	－	－	－	－	?
IR 2588－32	－	－	－	－	－	－	－	－	－	－	－	－	－	?
Yabani 15	－	S	S	－	S	S	S	S	S	S	S	S	S	*Pi－a*

S : Susceptible reaction, － : Resistant reaction, M : Moderate reaction,
* This cultivar has other gene or genes

Table 2. Occurrence of blast disease at upland nursery test for Japanease differentials and Egyptian cultivars and lines subjected to spontaneous infection.

Cultivar or line	4 Aug.	6 Aug.	9 Aug.	11 Aug.
Shin 2	3.5*	4	7.5	7.5
Aichiasahi	3	3.5	8	8
Ishikarishiroke	3.5	5	7.5	7.5
Kanto 51	2.5	3.5	5.5	6
Tsuyuake	1.5	3	5.5	6.5
Fukunishiki	–	0.5	2	3.5
Yashiromochi	–	1.5	1.5	1.5
Pi No. 4	–	–	–	–
Toride 1	–	–	–	–
BL 1	–	–	–	–
Giza 171	2.5	5	7	7.5
Giza 172	3	4.5	7	7.5
Giza 175	1.5	1.5	4	4
Giza 181	–	–	–	–
Giza 1108	1	1.5	1.5	2
Giza 1368	–	–	–	–
Giza 1394	1	1	0.5	0.5
Giza 2175	–	–	–	–
Giza 172 Mg4−1−93	4.5	5.5	6	6
Giza 1368−5−4	–	–	–	–
Giza 2175−5−4	–	–	–	–
Giza 2175−5−6	–	–	–	–
IR 28	–	–	–	–
IR 50	–	–	–	–
IR 1626	–	–	–	–
IR 19743−46	0.5	0.5	2	2
IR 19743−46−3	–	0.5	0.5	1
IR 25571−31	–	–	–	–
IR 2588−32	–	–	–	–
Yabani 15	2	3	7	7.5

* The methods to be used in scoring are those of Asaga, where a scale of 0-10 is adopted for classification of blast reaction.

resistance could not be estimated. Giza 1108, Giza 1394, IR 19743 − 46 and IR 19743 − 46 − 3 were not infected to all the selected 13 races for the clarification of vertical resistance, but, they were infected spontaneously. It indicates that breakdown of their resistance will be happened, if the races were changed. Attention is needed to cultivate those cultivars in a field.

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和文摘要

Fathy EL-NEMER・進藤敬助・中島敏彦：エジプト品種・系統のいもち病真性抵抗性遺伝子推定および圃場抵抗性検定

エジプトで栽培されている20品種・系統のいもち病真性抵抗性遺伝子型を推定し，それらの圃場抵抗性の強弱を検定した。いもち病真性抵抗性遺伝子型 *Pi－a* と推定されたのは4品種・系統，*Pi－i* 型は1品種，*Pi－z'* 型は4品種・系統，*Pi－b* 型は1品種であった。*Pi－a* 型に属する4品種・系統の圃場抵抗性は全て弱，*Pi－i* 型の1品種の圃場抵抗性は強と判定された。*Pi－z'* 型の4品種・系統は，自然発生によるいもち病の発病が認められず，圃場抵抗性の強弱の判定はできなかった。いもち病真性抵抗性遺伝子型を推定する試験に用いた13菌株・レース全てに抵抗性反応を示し真性抵抗性遺伝子型不明であったグループの10品種・系統の内，2品種・2系統に自然発病によるいもち病の発生が認められた。