Omonrice 9: 128-132 (2001)

*SHORT COMMUNICATION*

# Evaluation of the regional rice mutants in the mekong delta (2000-2001)

**Nguyen Trong Luong, Vuong Dinh Tuan and Pham Van Ro**


## ABSTRACT

*Thirty five mutants and their respective parents originated from 11 Asian countries were used in this test at both dry season (DS) and wet season (WS). Growth duration and plant height of all mutants were shorter than that of their respective parents. The number of panicle/$m^2$ ranged from 195 - 303 (in WS), and 271 - 372 (in DS), the largest number of panicle belong to PRN 519 (WS and DS) and THDB (DS). Mutants produced higher yield than their parents and the control in the wet season such as Shwewartun, THDB, PRN 381, Y 1281 and TNDB - 100. In 2000 - 2001 dry season, the mutant which overyielded than its parents, check variety was noticed as THDB (7.13 ton/ha).*


## INTRODUCTION

Rice is one of the most important cereal crops in Vietnam. Efforts have been made to increase rice productivity and improve grain quality to meet the demands of an increasing population annually. Beside the conventional breeding programs are routinely used, new technologies such as: anther culture, soma clonal variation and tissue culture combined with mutagenesis are also exploited in the Cuu Long Rice Research Institute (CLRRI). Mutation breeding for crop improvement, infact, has been started from 1960s in Vietnam. Consequently, two rice varieties DT10 and DT11 were generated from this approach. In 1992, rice landraces induced mutation by radiation to create high yielding genotypes without photoperiod sensitivity have been implemented at CLRRI. Two promising mutants namely TNDB - 100 and THDB were selected in 1994. TNDB was released in 1997 as national variety developingn several hundred thousands ha in the Mekong Delta (MD). Then, in 1999, THDB was also admitted as a national rice variety disseminating in coastal areas influenced by salt instrusion and acid sulfate. Recognition of the effective activities of CLRRI and its significant contribution to rice improvement in the Mekong Delta, CLRRI has been nominated as a representative of Vietnam in the "Mutational Enhancement of Genetic Diversity in Rice" (RAS/5/037) program of IAEA. The main objective of this program is to evaluate the induced mutants from different member countries for further utilization in breeding programs.

## MATERIALS AND METHODS.

Thirty five mutants and their respective parents originated from 11 Asian countries were evaluated (table 1) with IR64 as control. The experiment was laid out in a randomized block design with three replications. Eighteen-day old seedlings were transplanted into a 10 $m^2$ plot with 33 hills per sqm (one seedling/hill). Fertilizer ratio was 100- 40- 30 kg NPK / ha.

Observation was taken to record all performance and yield of tested varieties. In the wet season (2000), three Korea varieties did not germinate including: Hwacheonbyeo; Hwancheong du-1 and Hwancheong du-2. Two photosensitive ones from Vietnam Tainguyen duc and Tep hanh have not flowered yet till date. Therefore, data of these varieties were not available. One variety from Philippines (IR22- M1), two photosensitive varieties from Vietnam did not obtain grain yield due to flood. Therefore, six entries were not available for yield trial in 2000-2001 dry season.

Table 1: List of induced mutant and their respective parents tested in 2000 wet season

| No. | Varieties | Origin | Type of variety |
|---|---|---|---|
| 1 | Cisadane | Indonesia | Parent |
| 2 | Atomita 4 | " | Mutant |
| 3 | Cilosari | " | Mutant |
| 4 | IR 5 | GRC/IRRI | Parent |
| 5 | Shwewartun | Myanmar | Mutant |
| 6 | Q 31 Acc.9338 | Malaysia | Parent |
| 7 | Y 1281 (Q31-60-2) | " | Mutant |
| 8 | Hwacheon-byeo | Korea | Parent |
| 9 | Hwacheong du-1 | " | Mutant |
| 10 | Hwacheong du-2 | " | Mutant |
| 11 | Tainan 3 | GRC/IRRI | Parent |
| 12 | PNR381 | India | Mutant |
| 13 | PNR519 | " | Mutant |
| 14 | IR8 | " | Parent |
| 15 | PNR166 | " | Mutant |
| 16 | Tai nguyen | Vietnam | Parent |
| 17 | TNDB-100 | " | Mutant |
| 18 | Tep hanh | " | Parent |
| 19 | THDB | " | Mutant |
| 20 | RD25 | Thailand | Parent |
| 21 | IR25'86 GICs-PTT-9-1-1-2-2 | " | Mutant |
| 22 | Sigadis Milagrosa | Philippines | Parent |
| 23 | PR26305-M32 | " | Mutant |
| 24 | IR22 M-1 | " | Parent |
| 25 | PR26768-PJ(T)4 | " | Mutant |
| 26 | BR4 | Bangladesh | Parent |
| 27 | Binadhan 4 | " | Mutant |
| 28 | IRATOM 24 | " | Parent |
| 29 | Binadhan 6 | " | Mutant |
| 30 | Basmati 370 | Pakistan | Parent |
| 31 | Kashmir Basmati | " | Mutant |
| 32 | DM25 | " | Mutant |
| 33 | 3027 | China | Parent |
| 34 | R3027 | " | Mutant |
| 35 | IR64 | PBGB | Parent |

Table 2: Some agronomical characters, yield and yield components of tested varieties in MD (2000 wet season)

| No | Varieties | Duration (days) | Plant height (cm) | No. of panicle/$m^2$ | Filled grains/ Pan. | Unfilled grain (%) | 1000-grain wgt (g) | Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| 1 | Cisadane | 140 | 138 | 205 | 77.3 | 29.4 | 26.8 | 3.19 |
| **2** | **Atomita 4** | **135** | **136** | **208** | **61.2** | **33.6** | **28.7** | **2.66** |
| **3** | **Cilosari** | **135** | **130** | **211** | **55.3** | **28.3** | **26.7** | **2.18** |
| 4 | IR 5 | 150 | 150 | 297 | 65.4 | 36.0 | 22.9 | 3.20 |
| **5** | **Shwewartun** | **155** | **176** | **258** | **68.5** | **25.7** | **25.6** | **4.12** |
| 6 | Q 31 Acc.9338 | 138 | 135 | 237 | 58.0 | 25.1 | 18.8 | 2.51 |
| **7** | **Y 1281 (Q31-60-2)** | **120** | **102** | **259** | **63.2** | **26.2** | **24.0** | **3.78** |
| 8 | Tainan 3 | 120 | 110 | 208 | 63.0 | 20.3 | 21.5 | 2.12 |
| **9** | **PNR381** | **110** | **109** | **276** | **64.5** | **29.1** | **22.6** | **3.84** |
| **10** | **PNR519** | **110** | **102** | **303** | **56.6** | **22.4** | **19.9** | **2.63** |
| 11 | IR8 | 115 | 108 | 250 | 46.3 | 31.3 | 24.6 | 2.70 |
| **12** | **PNR166** | **108** | **107** | **274** | **56.4** | **40.2** | **20.8** | **3.00** |
| **13** | **TNDB-100** | **115** | **110** | **266** | **64.2** | **23.5** | **22.4** | **3.76** |
| **14** | **THDB** | **135** | **115** | **267** | **58.6** | **21.5** | **27.5** | **3.90** |
| 15 | RD25 | 130 | 131 | 288 | 60.0 | 25.2 | 24.8 | 2.79 |
| **16** | **IR25'86 GICs-PTT-9-1-1-2-2** | **105** | **97** | **204** | **54.4** | **30.3** | **25.6** | **2.43** |
| 17 | Sigadis Milagrosa | 130 | 134 | 228 | 23.6 | 55.2 | 20.5 | 0.92 |
| **18** | **PR26305-M32** | **115** | **110** | **223** | **48.5** | **27.4** | **22.5** | **2.22** |
| 19 | IR22 M-1 | 120 | 112 | 250 | 0 | 100 | 0 | 0.00 |
| **20** | **PR26768-PJ(T)4** | **120** | **119** | **284** | **51.4** | **28.2** | **21.2** | **2.47** |
| 21 | BR4 | 145 | 139 | 195 | 63.0 | 25.3 | 20.4 | 3.33 |
| **22** | **Binadhan 4** | **120** | **130** | **231** | **58.6** | **27.7** | **19.9** | **2.21** |
| 23 | IRATOM 24 | 120 | 97 | 237 | 58.2 | 31.2 | 23.4 | 3.32 |
| **24** | **Binadhan 6** | **120** | **122** | **236** | **65.1** | **23.6** | **24.2** | **3.32** |
| 25 | Basmati 370 | 130 | 158 | 290 | 68.7 | 29.4 | 15.4 | 2.85 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **26** | **Kashmir Basmati** | **105** | **131** | **261** | **35.2** | **45.4** | **19.4** | **1.70** |
| **27** | **DM25** | **110** | **133** | **257** | **55.6** | **27.3** | **16.2** | **2.58** |
| 28 | 3027 | 105 | 107 | 236 | 66.5 | 22.5 | 21.4 | 3.36 |
| **29** | **R3027** | **105** | **102** | **263** | **58.0** | **25.3** | **22.7** | **3.18** |
| 30 | IR64 (control) | 120 | 104 | 265 | 64.5 | 24.2 | 24.1 | 3.51 |
| | **CV (%)** | | | **9.2** | **9.6** | **10.1** | **2.0** | **13.6** |
| | **LSD 0.05** | | | **5.11** | **8.37** | **4.87** | **0.77** | **0.57** |

Table 3: Some agronomical characters, yield and yield components of tested varieties in MD (2000 - 2001 dry season)

| No | Varieties | Duration (days) | Plant height (cm) | No. of panicle/$m^2$ | Filled grains/ panicle | Unfilled grain (%) | 1000-grain wgt (g) | Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| 1 | Cisadane | 116 | 118 | 295 | 100.6 | 18.2 | 27.1 | 6.60 |
| **2** | **Atomita 4** | **109** | **119** | **308** | **94.1** | **5.4** | **29.9** | **6.65** |
| **3** | **Cilosari** | **111** | **109** | **273** | **97.6** | **4.6** | **27.0** | **5.77** |
| 4 | IR 5 | 125 | 121 | 323 | 83.0 | 9.6 | 23.0 | 5.75 |
| **5** | **Shwewartun** | **123** | **141** | **282** | **75.0** | **7.1** | **25.7** | **5.13** |
| 6 | Q 31 Acc.9338 | 119 | 133 | 287 | 88.8 | 22.3 | 20.3 | 4.83 |
| **7** | **Y 1281 (Q31-60-2)** | **109** | **98** | **286** | **98.7** | **20.6** | **24.9** | **6.07** |
| 8 | Tainan 3 | 115 | 128 | 332 | 93.9 | 21.3 | 22.6 | 6.22 |
| **9** | **PNR381** | **104** | **100** | **293** | **94.8** | **11.6** | **23.6** | **6.42** |
| **10** | **PNR519** | **95** | **94** | **372** | **84.0** | **5.9** | **21.5** | **6.23** |
| 11 | IR8 | 119 | 94 | 306 | 90.0 | 20.0 | 25.6 | 5.57 |
| **12** | **PNR166** | **95** | **96** | **339** | **84.7** | **5.4** | **21.7** | **6.18** |
| **13** | **TNDB-100** | **107** | **101** | **334** | **85.1** | **11.9** | **23.0** | **6.35** |
| **14** | **THDB** | **115** | **115** | **372** | **106.0** | **6.9** | **26.6** | **7.13** |
| 15 | RD25 | 113 | 128 | 292 | 103.7 | 4.6 | 25.8 | 6.93 |
| **16** | **IR25'86 GICs-PTT-9-1-1-2-2** | **99** | **99** | **271** | **101.3** | **2.7** | **26.6** | **5.93** |
| 17 | Sigadis Milagrosa | 116 | 102 | 295 | 84.1 | 5.2 | 21.3 | 5.15 |
| **18** | **PR26305-M32** | **111** | **101** | **297** | **88.1** | **3.3** | **23.2** | **5.87** |
| **19** | **PR26768-PJ(T)4** | **117** | **110** | **352** | **96.4** | **4.8** | **22.8** | **6.06** |
| 20 | BR4 | 124 | 126 | 306 | 90.0 | 5.3 | 21.8 | 5.52 |
| **21** | **Binadhan 4** | **114** | **130** | **306** | **114.1** | **20.1** | **21.0** | **6.4** |
| 22 | IRATOM 24 | 100 | 93 | 266 | 85.5 | 17.7 | 24.3 | 5.3 |
| **23** | **Binadhan 6** | **119** | **125** | **293** | **98.7** | **4.3** | **24.9** | **6.23** |
| 24 | Basmati 370 | 104 | 100 | 370 | 89.6 | 32.8 | 22.1 | 5.23 |
| **25** | **Kashmir Basmati** | **110** | **140** | **304** | **78.2** | **7.1** | **22.5** | **4.8** |
| **26** | **DM25** | **116** | **146** | **354** | **74.7** | **28.6** | **22.9** | **4.93** |
| 27 | 3027 | 103 | 125 | 365 | 58.5 | 10.7 | 23.0 | 5.48 |
| **28** | **R3027** | **107** | **102** | **299** | **100.9** | **3.8** | **23.9** | **6.47** |
| 29 | IR64 (control) | 109 | 104 | 315 | 105.6 | 4.4 | 25.5 | 6.47 |
| | **CV(%)** | | | **8.8** | **6.49** | **11.3** | **1.13** | **8.1** |
| | **LSD 0.05** | | | **13.7** | **10.35** | **4.87** | **0.44** | **0.79** |

Table 4: Growth duration and Yield in 2000 wet season and 2000-2001 dry season, in the MD of Vietnam

| No. | Varieties | Duration (days) | | Yields (t/ha) | |
|---|---|---|---|---|---|
| | | Wet season | Dry season | Wet season | Dry season |
| 1 | Cisadane | 140 | 116 | 3.19 | 6.60 |
| **2** | **Atomita 4** | **135** | **109** | **2.66** | **6.65** |
| **3** | **Cilosari** | **135** | **111** | **2.18** | **5.77** |
| 4 | IR 5 | 150 | 125 | 3.20 | 5.75 |
| **5** | **Shwewartun** | **155** | **123** | **4.12** | **5.13** |
| 6 | Q 31 Acc.9338 | 138 | 119 | 2.51 | 4.83 |
| **7** | **Y 1281 (Q31-60-2)** | **120** | **109** | **3.78** | **6.07** |
| 8 | Tainan 3 | 120 | 115 | 2.12 | 6.22 |
| **9** | **PNR381** | **110** | **104** | **3.84** | **6.42** |
| **10** | **PNR519** | **110** | **95** | **2.63** | **6.23** |
| 11 | IR8 | 115 | 119 | 2.70 | 5.57 |
| **12** | **PNR166** | **108** | **95** | **3.00** | **6.18** |
| **13** | **TNDB-100** | **115** | **107** | **3.76** | **6.35** |
| **14** | **THDB** | **135** | **115** | **3.90** | **7.13** |
| 15 | RD25 | 130 | 113 | 2.79 | 6.93 |
| **16** | **IR25'86 GICs-PTT-9-1-1-2-2** | **105** | 99 | **2.43** | 5.93 |
| 17 | Sigadis Milagrosa | 130 | 116 | 0.92 | 5.15 |
| **18** | **PR26305-M32** | **115** | **111** | **2.22** | **5.87** |
| **19** | **PR26768-PJ(T)4** | **120** | **117** | **2.47** | **6.06** |

| | | | | | |
|---|---|---|---|---|---|
| 20 | BR4 | 145 | 124 | 3.33 | 5.52 |
| **21** | **Binadhan 4** | **120** | **114** | **2.21** | **6.40** |
| 22 | IRATOM 24 | 120 | 100 | 3.32 | 5.30 |
| **23** | **Binadhan 6** | **120** | **119** | **3.32** | **6.23** |
| 24 | Basmati 370 | 130 | 104 | 2.85 | 5.23 |
| **25** | **Kashmir Basmati** | **105** | **110** | **1.70** | **4.80** |
| **26** | **DM25** | **110** | **116** | **2.58** | **4.93** |
| 27 | 3027 | 105 | 103 | 3.36 | 5.48 |
| **28** | **R3027** | **105** | **107** | **3.18** | **6.47** |
| 29 | IR64 (control) | 120 | 109 | 3.51 | 6.47 |

*The bold letters in the tables indicate mutant varieties.*

## RESULTS AND DISCUSSION

Data from table 2 and 3 showed that growth duration of all mutants were shorter than that of their respective parents. Similarly, plant height of all mutants were also shorter than that of their parents. In 2000 - 2001 dry season, however, growth duration of some mutants were longer than that of their parents such as Binadhan 6, Kashmir Basmati, R 3027. The effectiveness of induced mutation approach have clearly induced shorter height of plant and shorter growth duration. These good traits were widely preferred by not only breeders but also farmers. Apparently, the plant height and growth duration were readily reduced on mutagenesis. These two characters are easily recognised among the induced mutants. Development of varieties that possess very early and early maturity makes a significal contribution to escape flood in rainy season or salinity intrusion in dry season in the MD. As a result rice productivity of the region is increased.

Other yield components varied among varieties and depended to season. The number of panicle/$m^2$ ranged from 195 - 303 (in WS), and 271 - 372 9 (in DS), the largest number of panicle belong to PRN 519 (WS and DS) and THDB (DS). In general, some yield components such as the number of panicle/$m^2$, filled grains / panicle and 1000-grain weight in DS were higher than in the WS. Though the environmental conditions greatly affect yield components, the percentage of unfilled grains was varied depending on varieties and crop also. In the wet season, the lowest ratio was observed in the mutant THDB (21.5%) from Vietnam, while the highest ratio belongs to Sigadis Milagrosa (55.2%). That was why it yielded lowest. In dry season, the unfilled grain ratio of varieties was much lower than that in the wet season which varied from 3.8 - 32.8% (table 3).

There were some mutants produced higher yield than their parents and the control in the wet season such as Shwewartun, THDB, PRN 381, Y1281 and TNDB-100. Regarding to incidence of blast disease on Shwewartun in dry season could be explained by its leaf bushy, unerect morphology.

In 2000 - 2001 dry season, grain yield of mutants was higher than that of their parents, among them, the highest yield was observed in THDB (7.13 t/ha), higher than that of control variety IR 64 (6.47 t/ha) but not significally different at the level 0.05.

Growth duration of all varieties in dry season was shorter than that in the wet season. There were some varieties, however, exhibited longer growth duration than that in the west season such as Kashmir Basmati, DM 25 and R 3027.

## CONCLUSION

Based on the data from the tables and our observations in the field in both seasons, there were eight varieties exhibited good performance, high yield and high adaptability to MD of Vietnam namely: THDB, TNDB-100, RD25, PRN 381, Cisadane, Binadhan 6, R3027. On the other hand, Y1281 possess slight aroma, long grain but ununiform growth, this variety could be used as materials for good grain quality breeding

The data obtained from the tables partly showed the effectiveness of induced mutation approaches in rice improvement, especially to reduce plant height and growth duration which meet the demand of rice production in the Mekong Delta.

Table 5: General performance of tested varieties

| No. | Varieties | Wet season | Dry season |
|---|---|---|---|
| 1 | Cisadane | Ununiform heading time, | Strong culm, good tillering |
| 2 | Atomita 4 | strong culm, good tillering | and good resistance to |
| 3 | Cilosari | and good resistance to | insect and pest diseases |
| 4 | IR 5 | insect and pest diseases | Sensitive to BL |
| 5 | Shwewartun | | |
| 6 | Q 31 Acc.9338 | Ununiform growth, long grain | Ununiform growth, long grain |
| 7 | Y 1281 (Q31-60-2) | Uniform heading time, good growth and poor tillering | Uniform, good growth, erect flag leafs |
| 8 | Tainan 3 | Uniform growth, poor tillering | Slightly brown spots |
| 9 | PNR381 | And sensitive to rice blast | Ununiiform flowering, weak culm |
| 10 | PNR519 | | Poor growth, ununiform flowering |
| 11 | IR8 | Uniform growth, poor tillering and sensitive to BPH | Short plant, slight brown spots |
| 12 | PNR166 | | Blight blast at ripe time |
| 13 | TNDB-100 | Uniform heading time, good | Uniform heading time, good |
| 14 | THDB | Growth, strong culm and | Growth, strong culm and |
| 15 | RD25 | resistance to insects, diseases | resistance to insects, diseases |
| 16 | IR25'86 GICs-PTT-9-1-1-2-2 | Poor growth, poor tillering | Poor tillering, slight brown spots |
| 17 | Sigadis Milagrosa | High ratio of unfilled grains | Good tillering, short plant |
| 18 | PR26305-M32 | | Brush leaf, slight BS |
| 19 | PR26768-PJ(T)4 | | Good growth |
| 20 | BR4 | Ununiform heading time | Uniform growth, slight BS |
| 21 | Binadhan 4 | | Slight BS |
| 22 | IRATOM 24 | | Infected BL slightly |
| 23 | Binadhan 6 | | Good growth |
| 24 | Basmati 370 | Tall and weak culm | Weak culm, lodging |
| 25 | Kashmir Basmati | | Weak culm, grain bearing awns, lodging |
| 26 | DM25 | | Weak culm, lodging |
| 27 | 3027 | | Slight BS |
| 28 | R3027 | | Slight blast |
| 29 | IR64 (control) | | |

***SUMMARY IN VIETNAMESE***

*Ba mươi lăm dòng đột biến và giống gốc của 11 nước thuộc Chấu Á đã được khảo nghiệm trong hai vụ đông xuân và hè thu tại Việt Nam. Thời gian sinh trưởng và chiều cao cây đột biến có xu hướng ngắn hơn giống gốc của chúng. Số bông / $m^2$ biến động từ 195 - 303 (trong vụ hè thu), và 271 - 372 (trong vụ đông xuân), Số bông trên / $m^2$ lớn nhất được ghi nhận trên giống PRN 519 (đông xuân và hè thu), Tép Hành Đột Biến (đông xuân). Các dòng đột biến đều đạt năng suất cao hơn giống gốc, giống đối chứng trong vụ hè thu là Shwewartun, THĐB, PRN 381, Y 1281 and Tài Nguyên ĐB-100. Trong vụ đông xuân 2000 - 2001, dòng đột biến có năng suất cao hơn giống gốc và giống đối chứng là THĐB (7.13 ton/ha).*