

**Assessment of improved rice varieties against the infestation of brown planthopper  
(*Nilaparvata Lugens* Stal) (Hemiptera: Delphacidae)**

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**Abstract**

Brown planthopper, (*Nilaparvata lugens* Stal) is the devastating pest of rice and distributed throughout the rice growing areas in worldwide. Though the resistant rice varieties have frequently been released globally, the seriousness of *N.lugens* is innumerable due to the coevolution strategy of *N.lugens*. It is also common to the Batticaloa district of Sri Lanka where the problem of *N.lugens* is recorded repeatedly. Thus the regular reevaluation of improved rice varieties is mandate for the proper management of *N.lugens*. Screening of sixty rice varieties including the varieties highly growing in the Batticaloa district was carried out at Rice Research and Development Institute, Batalagoda, Sri Lanka during yala 2017. The BPH resistance of different 60 rice varieties was assessed using conventional seed box test along with the resistant (Ptb 33) and susceptible check (Bg 380). The results showed that the rice varieties viz., Bg 94-1, Bg 366, Bg 357, Bg 374 and Bg 300 were mainly cultivated by the farmers at the Batticaloa district whereas almost all the varieties lost the unique characteristics in resisting the *N.lugens*. However Bg 357 and Bg 366 can fairly be recommended for the Batticaloa district as showed Moderately Resistant. Among the tested 60 rice varieties, 21 varieties viz., Bg 379/2, Bg 407H, Bg 359, Bg 304, Bg 305, Ld 371, At 306, At 405, Bg 403, Bg 310, At 354, At 309, At 311, Bg 745, Bg 38, H-4, H-10, Bg 369, H-7, Bw 453 and Bw 267-3 exhibited Moderately Resistant to BPH attack. These varieties can also be recommended to the Batticaloa district once after conducting a similar study at the Batticaloa district of Sri Lanka.

**Keywords:** Moderately resistant, *Nilaparvata lugens*, resistant, rice varieties, screening

**Introduction**

Rice is the primary staple food of more than two billion people of Asia and for about hundreds of millions of people of Africa and Latin America (Heong and Hardy, 2009). It is noted from the report that 34% of the total agriculture area of Sri Lanka is occupied by rice cultivation (Anon, 2017).

It is projected that the demand for rice will increase by 1.1% per year and to meet this demand, the rice production should grow at the rate of 2.9% per year. In order to meet the increasing demand for rice it is recommended to use high yielding varieties and increase cropping intensity (Anon, 2017). These practices can't be long lasting

in increasing the rice production as they promote the development of phytophagous pests.

At present rice growing farmers at Sri Lanka face a dilemma in getting income, as the outbreaks of pests in rice cultivation are serious. One of the most devastating pests that threatened the rice cultivation is the brown planthopper (BPH). In 1977, the International Rice Research Institute (IRRI) convened the first brown planthopper conference to outline management strategies that included rice varieties resistant to pests, cultural practices, and integrated pest management (IPM)

measures. It was clearly reported by the IRRI's research in the 1990s that brown planthoppers were secondary pests, brought about by insecticide misuse (Heong and Hardy, 2009).

In Sri Lanka, it was recorded around 50-75% of yield loss by the attack of BPH in various districts including Batticaloa. The yield loss even went to 100% in certain areas of Batticaloa district especially in yala season though the improved rice varieties, which were released by Rice Research and Development Institute as resistant or moderately resistant to BPH occurrence viz., Bg 94-1, Bg 300, Bg 352, Bg 357, Bg 366 and Bg 374 are cultivated by Batticaloa farmers. Jena and Kim, (2010) reported that the effectiveness of resistant variety could be lost in some time due to the development of biotypes in BPH by coevolution process. Thus the reevaluation of resistant varieties at frequent interval is recommended by IRRI to rice varieties. With this background the present study carried out to reevaluate the resistant rice varieties highly cultivated by farmers at the Batticaloa district.

## **Materials and Methods**

### **Questionnaire survey**

A questionnaire survey was conducted in three selected areas (Mandur, Kokkadichchola and Kaluthavalai) of Batticaloa district where the severe damage of BPH has been recorded in past. Ten rice-growing farmers from each selected area were randomly selected to know the mainly cultivating rice varieties in the Batticaloa district.

### **Screening of rice varieties against BPH attack**

#### **a. Location**

The experiment was conducted under the planthouse conditions during yala 2017 at Rice Research and Development Institute, Batalagoda, Sri Lanka located in the Intermediate zone.

#### **b. Selected rice varieties for screening**

Sixty rice varieties including the varieties mainly cultivating in the Batticaloa district viz., Bg 379/2, H-4, H-7, H-10, Bg 745, Bg 38, Bg 407H, Bg 403, Bg 369, Bg 366, Bg 359, Bg 357, Bg 310, Bg 305, Bg304, Bg300, Ld371, At306, At 309, At 311, At 354, At 405, Bw 267-3, Bw 453, Bg 251, Bg 250, Bg 358, At 303, At 362, At 401, Bw 364, Bg 3-5, Bg 90-2, Bg 94-1, Bg 252, Bg 352, Bg 370, Bg 374, Bg 406, Bg 407, Bg 450, Bg 454, Bw 266-7, Bw 302, Bw 361, Bw 367, Bw 372, Bw 452, Ld 66, Ld 253, Ld 355, Ld 356, Ld 368, Ld 408, At 308, Bg 360, Bw 272-6B, Bw 363, Ld 365 and At 373 were selected to do screening along with the resistant (Ptb 33) and susceptible check (Bg 380).

#### **c. Screening at seedling stage**

The BPH resistance of different rice varieties was assessed using conventional seed box test described by Heinrichs *et al.* (1985). The seed box was filled with sterilized soil for about one inch thickness. After the leveling of soil, holes were prepared in equal distance to sow the seeds. Sixty-two rice varieties were sown in a box and covered with a thin layer of fine soil. All agronomic practices were carried out properly to maintain the seedlings of rice varieties. After 14 days of sowing nymphs BPH were introduced to seed box at the rate of 10 nymphs per seedling. The experiment was replicated five times. The seedlings were observed daily to learn the 'hopper burn' symptoms and the damage were graded by using Standard Evaluation System (SES) released by International Rice Research Institute (IRRI, 1980).

## **Results and Discussion**

### **Rice varieties cultivating in the Batticaloa district**

The questionnaire survey showed that the rice varieties viz., Bg 94-1, Bg 366, Bg 357, Bg 374 and Bg 300 were mainly cultivated by the farmers at the Batticaloa district.

**Table 1. Present status of rice varieties**

| <b>Types of Resistance</b>                     | <b>Rice Varieties</b>   |
|--|---|
| Resistant to Moderately resistant              | Bg 379/2  |
| Moderately resistant                           | H-4, H-7, H-10, Bg 745, Bg 38, Bg 407H, Bg 403, Bg 369, Bg 366, Bg 359, Bg 357, Bg 310, Bg 305, Bg 304, Bg 300, Ld 371, At 306, At 309, At 311, At 354, At 405, Bw 267-3, Bw 453                  |
| Moderately resistant to Moderately susceptible | Bg 251, Bg 250, Bg 358, At 303, At 362, At 401, Bw 364  |
| Moderately susceptible                         | Bg 3-5, Bg 90-2, Bg 94-1, Bg 252, Bg 352, Bg 370, Bg 374, Bg 406, Bg 407, Bg 450, Bg 454, Bw 266-7, Bw 302, Bw 361, Bw 367, Bw 372, Bw 452, Ld 66, Ld 253, Ld 355, Ld 356, Ld 368, Ld 408, At 308 |
| Susceptible                                    | Bg 360, Bw 272-6B, Bw 363, Ld 365, At 373   |

**Screening at seedling stage**

Table 1 shows the present status of rice varieties in respect to resistant or

susceptibility whereas Table 2 stated the comparison of rice varieties with respect to the previous status.

**Table 2. Comparison of present and previous status of rice varieties in relation to resistance**

| <b>Rice Varieties</b>  | <b>Previous status</b> | <b>Present status</b> |
|--|------------------------|-----------------------|
| Bg 379/2   | R                      | R / MR                |
| Bg 407H, Bg 357, Bg 359, Bg 304, Bg 305, Ld 371, At 306, At 40                                   | R                      | MR                    |
| Bg 300, Bg 352, Bg 406, Ld 408   | R                      | MS                    |
| Bg 358, At 362, Bw 364   | R                      | MR / MS               |
| Bg 360   | R                      | S                     |
| Bg 403, Bg 310, At 354   | R / MR                 | MR                    |
| Bg 94-1, Ld 253, Ld 356, At 308  | R / MR                 | MS                    |
| Bg 250   | R / MR                 | MR / MS               |
| Bg 366   | MR                     | MR                    |
| BG 251, At 303   | MR                     | MR / MS               |
| Bg 454, Bg 252, Bg 374, Bw 361, Ld 368   | MR                     | MS                    |
| Bw 363, Ld 365, At 373   | MR                     | S                     |
| At 309, At 311   | MR / MS                | MR                    |
| Bw 272-6B  | MR / MS                | S                     |
| Bg 745, Bg 38, H-4, H-10, Bg 369, H-7, Bw 453, Bw 267-3  | -                      | MR                    |
| At 401   | -                      | MR / MS               |
| Bg 450, Bg 370, Bg 3-5, Bg 407, Bg 90-2, Ld 355, Ld 66, Bw 367, Bw 372, Bw 452, Bw 302, Bw 266-7 | -                      | MS                    |

It was clearly noted from the Table 2 that the level of resistance found in a crop could be

reduced or even vanished after some time (Bhogadhi *et al.*, 2015; Jena and Kim, 2010).

The variety Bg 379/2 previously showed its nature as resistant however presently the ability of resistant slightly changed and categorized as Resistant or Moderately Resistant whereas the resistant characteristics exclusively disappeared in Bg 360, which was recorded as resistant variety in early, though susceptible presently. The varieties *viz.*, Bg 407H, Bg 357, Bg 359, Bg 304, Bg 305, Ld 371, At 306 and At 405 belonged to the category Moderately Resistant.

Likewise, among the rice varieties mainly cultivating in the Batticaloa district, Bg 357 and Bg 300 were released previously as resistant whereas at present the nature of these varieties has been changed to moderately resistant and susceptible respectively. Likewise Bg 94-1 has been released formerly as resistant or moderately resistant but now it was changed to moderately susceptible. The variety Bg 374 was recorded as moderately resistant in early however now it showed moderately susceptible. Simultaneously Bg 366 stands still as moderately resistant.

A study conducted by Madurangi *et al.*, (2010) stated that Bg 379/2 was resistant to moderately resistant and Bg 300 moderately resistant to BPH attack, which is par with present findings.

Further it was noted from the study that the location of present screening study was RRDI, which belongs to the intermediate zone. In order to recommend the rice varieties from the tested varieties to the Batticaloa district the similar screening study should be repeated at the Batticaloa district as it belongs to dry zone. Different findings stated that there might be a chance to drift off the performance of rice varieties, like nutrient contents, vigorous of plants, etc. while they were growing under different climatic conditions (Wade *et al.*, 1999; Jing *et al.*, 2010).

## Conclusions

The study showed that almost all the rice varieties mainly cultivating in the Batticaloa district lost their resisting ability against BPH attack. However comparatively Bg 357 and Bg 366 can be recommended for the Batticaloa district in order to minimize the infestation of BPH.

Among the tested rice varieties, the varieties *viz.*, Bg 379/2, Bg 407H, Bg 359, Bg 304, Bg 305, Ld 371, At 306, At 405, Bg 403, Bg 310, At 354, At 309, At 311, Bg 745, Bg 38, H-4, H-10, Bg 369, H-7, Bw 453 and Bw 267-3 showed Moderately Resistant to BPH attack. Thus these varieties can also be recommended to the Batticaloa district once the similar study will be repeated at the Batticaloa district to check the consumer preference, yielding ability and vigorousness of the variety.

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