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Field evaluation of Soybean varieties for resistance to Yellow mosaic virus (YMV) in the lower gangetic plains of West Bengal, India

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The study was conducted with the objective to assess the resistance source against Yellow Mosaic Virus (YMV) in soybean at Regional Research Station (RRS), Gayespur, Bidhan Chandra Krishi Viswavidyalaya, (BCKV), West Bengal, India during *kharif*, 2016 and *kharif*, 2017. Yellow mosaic virus (YMV) is a major viral disease of soybean, which can cause up to 80% yield loss in severe cases. Twenty six varieties including one susceptible check were screened against YMV under natural condition. Percent Disease Index was worked out and it varied from 0.00 % to 33.33 %. Only three varieties *viz.* PS 19, JS 9752 and PK 564 were found immune (Disease severity 0%). Thirteen varieties *i.e.*, RKS 18, Kalitur, RAUS 5, PK 1042, Shilajeet, PS 1241, MAUS 71, PK 1024, PK 416, Alankar, Bragg, Ankur and PK 262 were observed to be resistant (Disease severity 1% to 10%). Seven varieties (NRC 37, PK 472, PK 1092, Indira Soya 9, PS 1029, NRC 37, and PS 1347) were categorized as moderately resistant (Disease severity 10% to 20%) and two varieties (PK 327 and JS 20-29) were showed under moderately susceptible (Disease severity 20% to 30%). Only one variety *i.e.* JS 335 was found susceptible (Disease severity 30% to 50%). None of the varieties was observed highly susceptible (Disease severity above 50.1%). These Immune and resistant varieties can be used as good donor for evolving resistant varieties against Yellow Mosaic Virus in soybean.

Key words: Soybean, yellow mosaic virus, field evaluation, resistance

INTRODUCTION

Soybean (*Glycine max* L.) is the unique grain legume globally known for its dual purpose use as pulse and oilseed containing 38-44% protein and 18-22% oil. Soybean also finds place as the key component in a diverse range of industrial products like solvents, adhesives, inks, lubricants and insulating foams etc. In a large section of vegetarian people in country like India, soybean plays an important role as a rich source of protein. Occupying an area of 12.03 mha with total production of 12.98 mt and productivity 1079 kg/ha soybean finds an important place in the Indian agriculture (Anonymous, 2013). India is the third largest importer of

soya oil in the world and is one of the major exporters of soya meal to the other Asian countries (Anonymous, 2013). The south and central India particularly the state of Madhya Pradesh and Maharashtra are the hubs of soybean production in India, where soybean has already been established as an important industrial crop. Among other factors, pest and diseases are the most important ones for such low productivity. The yellow mosaic virus (YMV) disease caused by Gemini virus and transmitted by white fly (*Bemisia tabacci*) is the most important disease of soybean. Besides India, it is prevalent in Sri Lanka, Bangladesh, Pakistan and Thailand. Yellow mosaic virus (YMV) is a major disease of soybean, which can cause up to 80% yield loss in severe cases (Kumar *et al.* 2014). Since it is a viral disease, its control through chemi-

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cal or cultural practices is not effective, nor is it environment friendly. Deployment of genetic resistance is the best approach for management of YMV. For such approach to be effective, it is important to understand the genetic control of the disease. The resistance of genotypes may vary from region to region depending upon the strain of virus prevalent in the area. Usharani *et al.* (2004) indicated that the species of YMV prevalent in Northern India are different from that prevalent in South India. The present study was therefore, designed to evaluate a large number of soybean varieties in Gayespur Farm, BCKV to identify useful sources of resistance to YMV disease.

MATERIALS AND METHODS

Field screening for Yellow Mosaic Virus (YMV) disease resistance in soybean varieties were carried out at the RRS Farm, Gayespur, Bidhan Chandra Krishi Viswavidyalaya, during the *kharif* season in the year 2015 and 2016. Twenty six different varieties of soybean were screened in the field under natural condition to find the resistance potentials of the genotypes. Each entry is sown in single row of three meter length with the spacing of 30 cm x 10 cm in two replications. Seeds were sown on 24th June, 2015 and 29th June, 2016. All the recommended agronomic practices were followed. No insecticidal spray was given in order to allow the whitefly population to spread the disease. Disease incidence was recorded periodically and Percentage Disease Index was worked out using the formula $PDI = [\text{Sum of numerical rating}/\text{total number of observations taken} \times \text{maximum disease score}] \times 100$. The genotypes were categorized using (0-5) arbitrary scale as Immune (I), Resistant (R), Moderately Resistant (MR), Moderately Susceptible

(MS), Susceptible (S) and Highly Susceptible (HS) based on disease severity (Table 1).

RESULTS AND DISCUSSION

Evaluation of resistant varieties is considered to be the most feasible and durable solution of controlling YMV disease of soybean. Screening soybean varieties against YMV disease under natural condition is the first step in identifying the resistant donors for development soybean varieties with YMV resistance. Per cent disease severity was worked out and it varied from 0.00 to 33.33 per cent. The study revealed that maximum number of entries was grouped under resistant to moderately resistant categories. Among twenty seven varieties, only three varieties *viz.* PS 19, JS 9752 and PK 564 were found immune (Disease severity 0%).. Thirteen varieties *i.e.*, RKS 18, Kalitur, RAUS 5, PK 1042, Shilajeet, PS 1241, MAUS 71, PK 1024, PK 416, Alankar, Bragg, Ankur and PK 262 were observed to be resistant (Disease severity 1% to 10%). Seven varieties (NRC 37, PK 472, PK 1092,

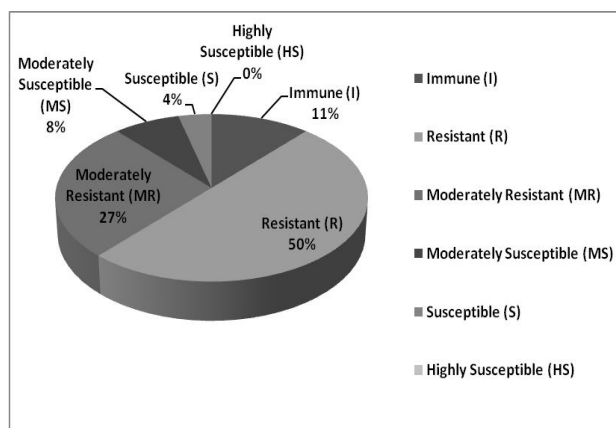


Fig. 1 : Percentage of screened varieties on the basis of reactions to YMV (*kharif*, 2015 and 2016)

Table 1: Disease scale and grouping of Soybean varieties against YMV on the basis of Disease severity scale at R.R.S Farm, Gayespur, B. C. K. V., West Bengal

| Scale | Disease Severity percent | Disease Reaction | Number | Name of varieties |
|-------|--------------------------|-----------------------------|--------|---|
| 0 | 0.0 | Immune (I) | 03 | PS 19, JS 9752, PK 564 |
| 1 | 0.1-10.0 | Resistant (R) | 13 | RKS 18, Kalitur, RAUS 5, PK 1042, Shilajeet, PS 1241, MAUS 71, PK 1024, PK 416, Alankar, Bragg, Ankur, PK 262 |
| 2 | 10.1-20.0 | Moderately Resistant (MR) | 07 | NRC 37, PK 472, PK 1092, Indira Soya 9, PS 1029, NRC 37, PS 1347 |
| 3 | 20.1-30.0 | Moderately Susceptible (MS) | 02 | PK 327, JS 20-29 |
| 4 | 30.1-50.0 | Susceptible (S) | 01 | JS 335 |
| 5 | Above 50.1 | Highly Susceptible (HS) | 00 | -- |

Table 2: Percent disease index (PDI) and disease reaction of YMV in soybean varieties under natural condition during *kharif*, 2015 and 2016

| Variety | Percent Disease Index (2015) | | Percent Disease Index (2016) | | Percent Disease Index (Pooled) | | Disease Reaction |
|---------------|------------------------------|---------|------------------------------|--------|--------------------------------|---------|------------------|
| RKS 18 | 8.0 | (16.4)* | 9.0 | (17.5) | 8.50 | (17.0)* | R |
| NRC 37 | 14.0 | (22.0) | 11.0 | (19.4) | 12.50 | (20.7) | MR |
| PS 19 | 0.0 | (0.0) | 0.0 | (0.0) | 0.00 | (0.0) | I |
| PK 327 | 23.0 | (28.7) | 20.0 | (26.6) | 21.50 | (27.6) | MS |
| Kalitur | 4.0 | (11.5) | 5.0 | (12.9) | 4.50 | (12.2) | R |
| RAUS 5 | 8.0 | (16.4) | 9.0 | (17.5) | 8.50 | (17.0) | R |
| PK 1042 | 6.0 | (14.2) | 5.0 | (12.9) | 5.50 | (13.6) | R |
| JS 9752 | 0.0 | (0.0) | 0.0 | (0.0) | 0.00 | (0.0) | I |
| Shilajeet | 4.0 | (11.5) | 5.0 | (12.9) | 4.50 | (12.2) | R |
| PK 564 | 0.0 | (0.0) | 0.0 | (0.0) | 0.00 | (0.0) | I |
| PS 1241 | 0.0 | (0.0) | 1.0 | (5.7) | 0.50 | (4.1) | R |
| PK 1092 | 15.0 | (22.8) | 13.0 | (21.1) | 14.00 | (22.0) | MR |
| Indira Soya 9 | 20.3 | (26.8) | 15.2 | (22.9) | 17.75 | (24.9) | MR |
| PS 1029 | 18.0 | (25.1) | 11.0 | (19.4) | 14.50 | (22.4) | MR |
| NRC 37 | 15.0 | (22.8) | 10.0 | (18.4) | 12.50 | (20.7) | MR |
| PS 1347 | 14.0 | (22.0) | 14.7 | (22.5) | 14.33 | (22.2) | MR |
| JS 20-29 | 26.0 | (30.7) | 20.0 | (26.6) | 23.00 | (28.7) | MS |
| MAUS 71 | 0.0 | (0.0) | 2.0 | (8.1) | 1.00 | (5.7) | R |
| PK 1024 | 0.0 | (0.0) | 2.0 | (8.1) | 1.00 | (5.7) | R |
| PK 472 | 12.0 | (20.3) | 10.0 | (18.4) | 11.00 | (19.4) | MR |
| PK 416 | 5.0 | (12.9) | 3.0 | (10.0) | 4.00 | (11.5) | R |
| Alankar | 8.0 | (16.4) | 3.0 | (10.0) | 5.50 | (13.6) | R |
| Bragg | 2.0 | (8.1) | 1.0 | (5.7) | 1.50 | (7.0) | R |
| Ankur | 5.0 | (12.9) | 6.0 | (14.2) | 5.50 | (13.6) | R |
| PK 262 | 2.0 | (8.1) | 3.0 | (10.0) | 2.50 | (9.1) | R |
| JS 335 (SC) | 32.7 | (34.9) | 34.0 | (35.7) | 33.33 | (35.3) | S |
| SEm(±) | 7.322 | | 4.869 | | | | |
| CD (0.05) | 21.33 | | 14.183 | | | | |

*Figures in parentheses are angular transformed values

Indira Soya 9, PS 1029, NRC 37 and PS 1347) were categorized as moderately resistant (Disease severity 10% to 20%) and two varieties (PK 327 and JS 20-29) were showed under moderately susceptible (Disease severity 20% to 30%). Only one variety i. e. JS 335 was found susceptible (Disease severity 30% to 50%). None of the varieties was observed highly susceptible (Disease sever-

ity above 50.1%) (Table 2). It could be noticed that the resistant level was relatively quite high as compared to susceptible status (Fig. 1). Among the screened varieties only 11% was found immune, 50% resistant, 27% moderately resistant, 8% moderately susceptible and 4% susceptible against YMV disease (Fig. 1). The results of present screening were in accordance with several other

findings. Talukdar *et al.* (2013) screened 100 germplasms of soybean and 29 genotypes, mostly improved varieties of Northern India were identified with higher level of resistance consistently over the years. Baruah *et al.* (2014) found that screening for Yellow Mosaic Virus resistance revealed one highly susceptible variety *viz.* JS 335 and two highly resistant varieties *viz.* DS 9712 and DS9814. These Immune and resistant varieties can be used as good donor for evolving resistant varieties against Yellow Mosaic Virus in soybean.

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