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DEPLOYMENT OF RESISTANCE IN SOYBEAN FOR ROOT ROT AND YMV THROUGH RECOMBINATION BREEDING

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ABSTRACT

Crossing programme was carried out in few promising lines of soybean in cage house at Regional Research Centre, Amravati and among these the cross of TAMS 38 and RKS 24 were produced some unique F0 seeds. Subsequently seven generations of this cross were subjected to field conditions and characteristically fixed genotype named AMS 38 - 24 was tested in pathological trial conducted for three years during *kharif* 2012 to 2015 to ascertain the reaction against root rot and YMV. The entries *viz.*, AMS 1001, AMS 1004, AMS 1002, AMS 131-1, AMS 100-39-1, AMS 595 and AMS 38-24 were found absolute resistance reaction against root rot under natural and sick plot nursery condition. These genotypes also showed absolute resistance and null incidence against YMV in natural condition. Among these genotype AMS 38-24 found very unique type as shown differential morphological attributes viz., white flowered, moderately matured, grey colour pubescence present on stem, petioles, leaves and pods, few leaves of the plant possessed tetra and penta foliate, black variegated strips on brown seed coat, medium bold seeds. Most unique characteristics i. e. tetra and penta foliate leaves, grey pubescence on ventral surface of leaves and variegated black srips on brown seed coat are the morphological markers which are useful for identification in seed production programme

(Key words: Soybean, genotype, resistance, root rot, YMV, foliate, pubescence)

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] (2n = 40) is one of most important crops that have the potential to provide the world's increasing demand for food, feed and fuel. The spread of soybean from its native land of origin has mainly due to its adaptability and predominant use as a food crop for human nutrition, as a protein source for animals, as a medical plant and lately as industrial crop (Alghamdi, 2004).

This crop is prone to attack by different pathogens, including fungi, bacteria, nematode and virus. Among all these pathogens the most destructive pathogen for this crop is fungus and virus. These cause heavy yield losses of this crop every year. It has been seen that soybean crop always severely infested by root rot and yellow mosaic disease. Root rot of soybean caused by *Rhizoctonia bataticola* (pycnidial stage *Macrophomina phaseolina*) is severe disease in Maharashtra and other states of India resulting in huge losses on account of pre and post emergence damping off and root rot in well grown plants which cause substantial loss to yield. Root rot causes up to 76% yield loss under congenial conditions (Gupta and Chavan, 2005). Among yellow mosaic disease, Yellow Mosaic Virus (YMV) incited by *Mungbean Yellow Mosaic Virus* (MYMV) and *Mungbean Yellow Mosaic India Virus* (MYMIV) also spoil soybean production. The magnitude of yield loss due to YMV in soybean has been reported to be as high as 80 per cent (Nene, 1972). Therefore, there is imperative need to tackle the disease before it causes stern damage to the soybean industry.

At present situation, cultivated soybean varieties by the farmers are susceptible to the diseases. The use of resistant cultivars of crop plays an important role in controlling the losses caused by the disease. A genotype with root rot and YMV disease resistance and high yield potential offered scope in breeding programme to evolve multiple tolerance genotypes combined with good yield. Therefore, deployment of root rot and YMV resistance in soybean is prime need for best survival of this crop.

MATERIALS AND METHODS

Crossing programme was carried out in few promising lines of soybean in cage house at Regional Research Centre, Amravati. Among these the cross of TAMS 38 and RKS 24 was produced some unique F_0 seeds having blackish variegated strips around brown seed coat which designated as AMS 38-24. All these F_0 seeds were sown in *kharif* 2009 and all F_1 were observed characteristically similar to the mother parent except flower colour and pubescence. These two characters were used as a morphological marker to identify hybrid plants. By using these morphological marker F_1 plants were selected, F_1 seeds were bulk together and sown in late r*abi* 2009 in sick plot nursery of root rot. F_2

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plants were selected on the basis of certain morphological characteristics viz., pubescence on ventral surface of leaves, white flower colour, determinate, dwarf, early matured and showing healthy performance against root rot in sick plot nursery. Seeds of selected F_2 bulked together and F_3 population was raised in summer 2010 for selection of healthy plants against YMV. Subsequent F_4, F_5, F_6 and F_7 generations were grown alternate in sick plot nursery of root rot in *kharif* and YMV in *summer* in the year 2010 – 2011 and 2011 – 2012. The line showing absolute resistance against YMV and Root Rot was selected from F_7 population and evaluated in pathological trials along with the 12 other lines developed by mutagenesis and 4 checks with two rows of three meter length. Recommended agronomical practices were followed similar to all tested entries. The evaluation trials were conducted in the year 2012 – 2013, 2013 – 2014 and 2014 – 2015 under natural and sick plot condition. Observations of incidence of diseases were recorded as per procedure devised by Anonymous (2006). The observations regarding infection of plant were recorded by 0-9 rating scale and on the basis of per cent disease incidence genotypes classified as follows (Anonymous, 2006).

Rating	Reaction	Infection presence
0	Absolutely Resistant	0 %
1	Highly Resistant	0.01-11.11 %
3	Moderately Resistant	12.22-33.33 %
5	Moderately Susceptible	34.44-55.55 %
7	Susceptible	56.66-77.77 %
9	Highly Susceptible	78.88-100.0 %

RESULTS AND DISCUSSION

Data recorded on per cent disease incidence of root rot in natural and sick plot conditions are present in table 1. Per cent disease incidence of root rot registered in the range of 0.0-100% in respective genotypes/checks. The 10 soybean genotypes AMS 1001, AMS 1004, AMS 1002, AMS 100-1, AMS 131-1, AMS 100-39-1, AMS 595, AMS 38-24, AMS-MB-5-19 and AMS-MB-5-18 were showed mean null (0.0) incidence and absolute resistance (AR) reaction against root rot over three years performance under both the conditions. However, checks JS 335, MAUS 71, TAMS 38, AMS 99-33 and JS 93-05 were found mild to high invasion of root rot. Check variety JS 335 exhibited moderately susceptible (avg. 43.50%) reaction in natural field conditions however, under sick plot conditions it showed susceptible (avg. 63.57%) reaction. Maximum disease incidence (93.0 and 100%) noticed in check variety TAMS 38 under natural and sick plot conditions respectively.

Data recorded on per cent disease incidence of YMV during *kharif* season of 2012 - 13 to 2014 – 15 are presented in table 2. Results revealed that total 10 genotypes AMS 475, AMS 1001, AMS 1004, AMS 1002, AMS 1003, AMS 99-33, AMS 131-1, AMS 100-39-1, AMS 595 and AMS 38-24 showed zero mean incidence and absolute resistance reaction against YMV over three years of observations under natural condition, whereas check variety JS 93-05 was shown moderately susceptible (avg. 50.0%) reaction and checks *viz.,* MAUS 71, JS 335, TAMS 38 exhibited highly resistance reaction. Ingle *et al.* (2014) also conducted similar preliminary studies on screening of advance soybean entries against root rot and YMV and observed disease incidence of varying degrees with root rot/YMV resistant source. They also determine the resistance of different soybean genotypes against Rhizoctonia root rot and reported that AMS 1001, AMS 1006, AMS 38-24, AMS 1014 and AMS 359 were found absolute resistant reaction.

In present investigation, entries like AMS 1001, AMS 1004, AMS 1002, AMS 131-1, AMS 100-39-1, AMS 595 and AMS 38-24 maintained their absolute resistance (AR) status against root rot in both natural and sick plot condition and these genotypes also revealed AR reaction against YMV. Mahesha *et al.* (2009) screened 204 soybean genotypes both under natural and laboratory conditions against many diseases and reported that several genotypes had multiple disease resistant. Similarly Patil *et al.* (2011) and Shriro *et al.* (2009) also reported disease resistance in several genotypes of soyabean. Mishra and Verma (2003) screened several genotypes of rice for bacterial bright and reported disease resistance in rice disease.

Moreover, amongst these genotypes AMS 38-24 having very distinctive character as shown brown colour of seed with black variegated strips on grains. Genotype AMS 38-24 was also found unique in certain morphological characters (Table 3), leaf shape (ovate), flower colour (white), pubescence (grey pubescence on entire plant along with ventral surface of leaves, maturity (medium), pod (2 and 3 seeded flattened in shape), seed size (medium bold), pod colour at harvest (blackish grey), seed shape (spherical), seed coat (variegated black strips on brown seed coat), growth habit (determinate) and higher oil content (21.56%).Most unique characteristics i. e. tetra and penta foliate leaves, grey pubescence on entire plant alongwith ventral surface of leaves and variegated black srips on brown seed coat are the morphological markers which are

Table 1. Per cent disease incidence of root rot of soybean under natural field and sick plot conditions

Entries	Root rot incidence (%) and reaction of disease									
	Under natural field			Avg. Mean	Reaction	Under sick plot			Avg. Mean	Reaction
	2012-13	2013-14	2014-15			2012-13	2013-14	2014-15		
AMS 475	0.0	0.0	0.0	0.0	AR	12.1	14.0	16.0	14.03	MR
AMS 1001	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 1004	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
MAUS 71 ©	5.5	10.4	70.2	28.7	MR	18.4	30.2	85.8	44.80	MS
JS 335 ©	0.0	60.4	70.1	43.5	MS	34.5	76.2	80.0	63.57	S
AMS 1002	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 1003	4.5	7.8	10.0	7.43	HR	10.8	12.1	15.0	12.63	MR
TAMS 38©	100	98.4	80.6	93.0	HS	100	100	100	100.0	HS
AMS 99-33	34.6	35.5	40.1	36.73	MS	40.1	40.1	60.4	46.87	MS
AMS 100-1	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 131-1	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 100-39-1	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 595	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS 38-24	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS-MB-5-19	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
AMS-MB-5-18	0.0	0.0	0.0	0.0	**AR**	0.0	0.0	0.0	0.0	**AR**
JS 93-05 ©	0.0	0.0	0.0	0.0	AR	0.0	0.0	10.0	3.33	HR

© Check

Table 2. Per cent disease incidence of YMV on soybean under natural field condition

Entries	% Incidence of YMV under natural field condition			Avg. mean of YMV incidence over three years	Reaction over three years
	2012-13	2013-14	2014-15		
AMS 475	0.0	0.0	0.0	0.00	AR
AMS 1001	0.0	0.0	0.0	0.00	AR
AMS 1004	0.0	0.0	0.0	0.00	AR
MAUS 71 ©	6.4	0.0	12.56	6.32	HR
JS 335 ©	12.2	0.0	8.10	6.77	HR
AMS 1002	0.0	0.0	0.0	0.00	AR
AMS 1003	0.0	0.0	0.0	0.00	AR
TAMS 38 ©	0.0	0.0	10.20	3.40	HR
AMS 99-33	0.0	0.0	0.0	0.00	AR
AMS 100-1	20.1	0.0	0.0	6.70	HR
AMS 131-1	0.0	0.0	0.0	0.00	AR
AMS 100-39-1	0.0	0.0	0.0	0.00	AR
AMS 595	0.0	0.0	0.0	0.00	AR
AMS 38-24	0.0	0.0	0.0	0.00	AR
AMS-MB-5-19	12.6	11.11	0.0	7.90	HR
AMS-MB-5-18	36.4	32.10	0.0	22.83	MR
JS 93-05 ©	-	77.90	78.10	52.0	MS

Table 3. Ancillary characters of respective entries

Entries	Days to 50% flowering	Flower colour	Days to maturity	Leaves	Pubescence	Seed coat	100 seed wt. (g)
AMS 475	49	Violet	98	Trifoliate	Absent	Yellow	11.0
AMS 1001	48	Violet	98	Trifoliate	Absent	Yellow	10.0
AMS 1004	48	Violet	97	Trifoliate	Absent	Yellow	9.50
MAUS 71 ©	49	Violet	99	Trifoliate	Absent	Yellow	9.25
JS 335 ©	48	Violet	100	Trifoliate	Absent	Yellow	9.0
AMS 1002	48	Violet	99	Trifoliate	Absent	Yellow	10.0
AMS 1003	49	Violet	98	Trifoliate	Absent	Yellow	10.5
TAMS 38 ©	46	White	98	Trifoliate	Grey	Yellow	12.0
AMS 99-33	48	Violet	99	Trifoliate	Absent	Yellow	10.0
AMS 100-1	46	White	99	Trifoliate	Tawny	Yellow	11.50
AMS 131-1	49	White	99	Trifoliate	Tawny	Yellow	10.5
AMS 100-39-1	50	Violet	100	Trifoliate	Absent	Yellow	11.0
AMS 595	50	Violet	101	Trifoliate	Absent	Yellow	8.0
AMS 38-24	46	White	98	Tetra\ Penta foliate	Grey	Black strips on brown seed coat	12.0
AMS-MB-5-19	50	White	100	Trifoliate	Tawny	Yellow	10.0
AMS-MB-5-18	49	White	100	Trifoliate	Tawny	Yellow	9.50
JS 93-05 ©	48	Violet	99	Trifoliate	Absent	Yellow	11.75

useful for identification in seed production programme

Soybean entries viz., AMS 1001, AMS 1004, AMS 1002, AMS 131-1, AMS 100-39-1, AMS 595 and AMS 38-24 have novel source of resistance to disease, which may include in breeding programme for development of resistant cultivars. However, there is need of continuous screening for confirmation.

REFERENCES

Anonymous, 2006. Proceeding and Technical Porgramme of Annual meeting of AICRP on Soybean, DSR, Indore (MP).

Gupta, G. K. and G. S. Chauhan, 2005. Symptoms, Identification and Management of Soybean Diseases. DSR, Indore, Technical Bulletin No.10. pp. 1-92.

Ingle, Y. V., P. V. Patil and C. U. Patil, 2014. Evaluation of breeding material of soybean against Rhizoctonia root rot. Proceeding of 1st international conference on soybean (SOYCON). pp. 101.

Mishra, Laxmikant and Ravindra Varma, 2003. Screening of rice genotypes for bacterial leaf blight resistance. J. Soils and Crops. **13**(2):200-203.

Mahesha, B., P.V. Patil and B. Nandini, 2009. Identification of multiple disease resistance sources in soybean. Crop Research. **37**: 213-216.

Nene, Y. L. 1972. A survey of the viral diseases of pulse crops in India. G. B. Pant Univ. of Agril. Tech., Pantnagar, India. **4**:191.

Patil, C. U., V. M Mohade, V. R. Wankhade and S. P. Patil, 2011. Reaction of soybean cultivars against major fungal diseases. J. Pl. Dis. Sci. **6**(2):195-197.

Shrirao, A. V., D. B. Gawande, R. A. Shrirao, S. P. Patil and A. C. Khote, 2009. Evaluation of soybean genotypes against the major diseases. J. Pl. Dis. Sci. **4**(1): 92-94.

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