EVALUATION OF GLYCINE MAX GENOTYPES AGAINST FUSARIUM SOLANI CAUSING WILT UNDER NATURAL SICK FIELD

ABSTRACT

Soybean wilt (SDS) has very emerging disease in Chhattisgarh and increased losses in soybean production in recent years hence the study was done to identify potential sources of resistance to wilt disease.Hence the research was conducted at College of Agriculture, IGKV, Raipur, Chhattisgarh under natural sick field condition during to determine 325 genotypes of soybean [*Glycine max* (L.) Merr.]were screened against *Fusariumsolani*f.sp. *glycine*causing wilt.In screening of soybean genotypes, whereas 84 genotypes were highly resistant, 135 were identified as resistant, 35 were recorded moderately resistant, 33 were susceptible and 38 were highly susceptible to the disease. In this experiment the 13 genotypes (viz. VLS 88, DS 3101, MACS 1454, VLS 89, PK-317, NRC-2007-1-3, NRC-2011-A-3-22, NRC-2011-A-3-6, NRC-2011-A-3-10, AMS-148, Cat-2502, Cat-2722 and EC-685256.) were showed totally highly susceptible as 100 % mortality.

Key words: Soybean, Screening,Resistant, Wiltand*Fusariumsolani*

INTRODUCTION

Soybean (*Glycine max* (L.) Merr.)is a legume of the family Fabaceae, subfamily Faboideae. Soybean has become a miracle crop of the twentieth century. It is a triple beneficiary crop, a unique food, a valuable feed and an industrial raw material with considerable potential (Chavan*et al.*, 2014) which made it as a "wonder crop". Its seed contains 40% protein, 20% oil, 30% carbohydrates, excellent amounts of dietary fibre, vitamins, minerals and high level of amino acids such as lysine, leucine, lecithin and large amount of phosphorus. Soybean plants build up the soil fertility by fixing large amounts of atmospheric nitrogen through root nodules. In India it's occupies an area (*kharif*) of 114.50 lakh ha. with a production of 124.11 mt and productivity of 114.5 kg/ha (Anonymous, 2022). Sustainable soybean production is continuously challenged by diseases that cause quantitative and qualitative losses in yield. It's suffered from a number of diseases such as many fungal, bacterial and viral diseases which are responsible for low producing. Among the fungal pathogens, Fusarium wilt is very common and important disease of soybean. These pathogens cause significant loss in yield and primarily responsible for wide gap in the yield levels in farmers field (Zape*et al.*, 2014). In India root rot of soybean caused by *F. solani* was first reported by Agarwal and Sarbhoy (1975). Foliar symptoms of SDS appear before flowering of late maturing varieties or after flowering in cultivars of early maturing group (Verma*et al*., 2009).The symptoms of wilt of soybean caused by *Fusariumsolani*f. sp. *glycine* were observed and infected plants showed wilting at all stages of their growth. At seedling stage, leaves and stems became chlorotic. Further they became necrotic and drooped leading to sudden death of the plant. Early symptoms of SDS, were seen in the uppermost parts, these uppermost leaves became chlorotic that enlarged as the disease became more severe. These patches on the leaves then progressed into necrotic patches. Following necrosis of the leaflets in the top of the canopy, defoliation of the soybean plants slowly progressed downwards into the canopy. Furthermore a large reduction in root volume was also observed. The decreased root volume reduces the roots capacity to take up the essential nutrients and water necessary for maximum yield. Plants that exhibited foliar symptoms of SDS also showed greyish to

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reddish brown internal and external discoloration on the taproot which started near the pith and later moved upwards in the vascular system. (Naviand Yang 2008). Previously scattered and circular to irregular chlorotic spots on leaves, interveinal necrotic, necrosis of taproot and lateral roots leading to reduction in root mass, flower and pod abortion and total defoliation of the plant in severe cases have been found associated with SDS in soybean caused by *F. solani*f.sp. *glycine* (Roy et al., 1997; Rupe and Hartman, 1999; Scherm et al., 1998).

The pathogen is primarily a soil inhabitant; hence controlling the disease is very difficult as no effective chemicals are available at present. The development of resistant varieties is considered as more practicable. Therefore to identify resistant genotypes to manage the disease some soybean genotypes were evaluated against the wilt caused by the *Fusariumsolani*.

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MATERIALS AND METHODS

To find out the source of resistance an experiment was conducted during *kharif* season under wilt sick field conditions in the field of IGKV, Raipur.The experiment was conducted with randomized block design with three replications.In this trial 325 varieties were grown with recommended agronomic package of practices. In this experiment every one variety is sown randomly in 2 rows and 3 m length along with three replication. The observations were recorded for per cent mortality during pod development stage and the per cent of mortality was calculated by using the following formula after that the per cent mortality was grouped in 1 to 9 scales as under:

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$$\text{Mortality \%} = \frac{\text{Wilted plants}}{\text{Total plants}} \times 100$$

Table 1. Mortality percentage and reaction.

Disease Scale	Mortality percent	Reaction
1	<1	Highly Resistant
3	1.1-10	Resistant
5	10.1-20	Moderately Resistant
7	20.1-50	Susceptible
9	>50	Highly Susceptible

RESULT AND DISCUSSION

In the present study, 325 soybean genotypes were screened against *Fusarium* wilt under natural sick field conditions and results are present in **Table 2**. The mortality per cent of *Fusarium*wilt ranged from 0 per cent to 100 per cent. Only 84 genotypeswere found highly resistant for *Fusarium* wilt (*F. solani*f.sp. *glycine*) disease, whereas 135 genotypeswere identified as resistant, 35 genotypes were recorded moderately resistant/tolerant, 33 genotypeswere susceptible and 38 were highly susceptible to the disease. In this experiment

the 13 genotypes were showed totally 100% wilted viz. VLS 88, DS 3101, MACS 1454, VLS 89, PK-317, NRC-2007-1-3, NRC-2011-A-3-22, NRC-2011-A-3-6, NRC-2011-A-3-10,

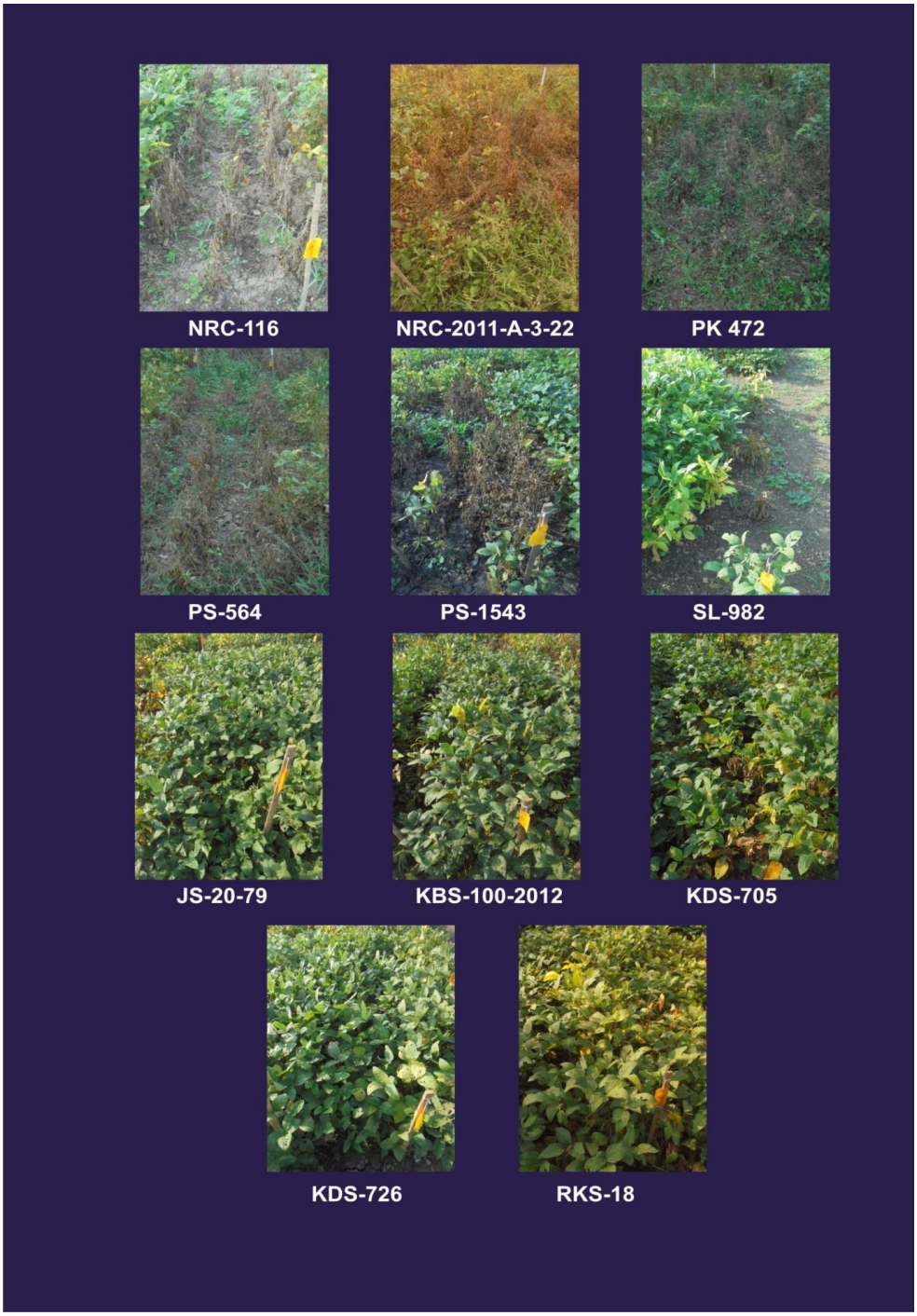

Fig 1. The genotypic variation of the trees.

AMS-148, Cat-2502, Cat-2722 and EC-685256. Muller *et al*. (2003) were screened 2000 different cultivars against sudden death syndrome in soybean and found less than 2 % of those cultivars were moderately resistant, when compared to moderately resistant cultivar PI 520733. Klingelfuss*et al*. (2002) observed the reaction of 8 soybean cultivars against sudden death syndrome (SDS). They found in genotypes PI 567734, PI 520733 MGBR 46 were the most resistant to SDS with AP% of 30.79, 31.30 and 35.34 per cent respectively. Muller *et al* (2002) identified 57 PIs as being moderately resistant to SDS and appropriate to use as source of resistant to increase the level of resistant of cultivars in the United states.Patel *et al*. (1988) reported out of sixty one promising lines tested for two years, genotypes GAUT-82- 9 and GAUT-82-74 were free from *F. oxysporum*f. sp. *udum*infection. While GAUT-82-23 were completely free from *F. oxysporum*f. sp. *udum*infection.Ahmad *et al*. (2010) reportedconsiderable variation among the 321 chickpea genotypes against *F. oxysporum.*

Table2: Level of resistance/susceptibility of soybean germplasm/genotypes against *Fusarium* wilt

Disease Reaction	No. of Entries	Name of entries
Highly Resistant	84	NRC 99, RSC 10-15, JS 20-96, JS 93-05, RVS 2007-6, JS 20-98, RSC 10-46, RVS2008-24, MAUS 706, MACS 1460, KDS 753, JS 20-87, JS-20 -53, RVS-2002-19, JS-20-89, KBS-100-2012, BAUS-96, MACS-1370, 9752, BRAGG, SL-599, JS-97, JS/SH/96-31, B-458, EC-389392, JS-82-180, MAUS-144, MAUS-754, MAUS-145, RAUS-5, H6P20, NRC-95-02-03, NRC-96-03-02, NRC-2006-4-13, NRC-2006-I-1, NRC-2007-L-1-5, GP 101, GP 103, GP 107, NRC-2OO8-D-5-3, NRC-2OO8-B-3-21-1, NRC-2OO8-G-1-8-2, NRC-2OO8-B-2-6-2, NRC-2007-A-2-3, NRC-2OO8-G-2-6 ,NRC-2OO8-J-8-1-1, NRC-2011-F-1-23, NRC-2011-F-1-15, NRC-2011-A-3-8, NRC-2012-B-6-3-1-4-3, NRC-2012-M-127-2-3, NRC-2012-I-1-6, NRC-2012-12-1-9, VS-2004-114, VS-2004-18, VS-2004-13, VLS-2, VS-2005-12, VS-2005-23, H4P13, H5P4, H5P3, NRC-95-06-03, NRC-95-03-02, NRC-95-08-01, H3P8, H3P23, Delhi-19, Delhi-20, Delhi-21, Cat-3299, EC-34078, JS-20-35, JS-20-42, JS-20-47,JS-20-55, JS-20-59, JS-20-72, JS-20-78, JS-20-81,MAUS-14-2, MAUS-703, PI-283327, PRAB-1
		KBS 23-2014, JS 97-52, MACS 1442, PS 1550, KDS 869, NRC 116, KDS-726, SL-955, JS-20-79, RVS-2002-4, RKS-18, BIRSA SOYA-1, PK-10-24, JS-415, JS-15-14, PB-1, EC-38971, EC-391167, TS-99-76, PS-564, PS10-92, Seelajit , PK-416, PK-12-41, PK-515, HIMSO-15-36, KB-165, TS-128-5, TS-148, MACS-756, DS-98-14, PK-13-14, MACS-798, DS-228, MACS-693, PK-12-25, PK-327, PK-262, JS-16-40, MMSS-36, EC-34117, JS-90-41, SL-517,B-S-97-12, JS-18-13, HIMSO-15-21, MAUS-71, MAUS-61-2, JS-93-05, JS-97-52, H5P8, NRC-95-05-03, NRC-2006-4-1-2, NRC-

Resistant	135	2006-C-7, NRC-2006-F-2-2, NRC-2007-J-3, NRC-2007-A-3-1, NRC-2006-M-6, NRC-2007-B-1-19, NRC-2007-B-2-4, NRC-2007-4-1-36, NRC-2007-C-1-5, NRC-2007-12-7-2, GP102, GP 104, GP 105, GP 106, GP 108, GP 109, GP 110, GP111, GP 112, GP113, GP 114, NRC- 2OO8-G-1-12 NRC-2OO8-B-3-17, NRC-2OO8-F-1, NRC-2OO8-B-1-9-1, NRC-2OO8-B-2-2-2, NRC-2011-C-5-5, NRC-2011-B-1-8-1-43, NRC-2011-H-4-10, NRC-2011-G-3-13, NRC-2011-E-2-1-9-1, JSM-117-4, NRC-2011-C-4-12, NRC-2012-M-127-1, NRC-2012-F-1-18-3, NRC-20-G-1-2-2-5, NRC-2012-J-2-2-1, NRC-2011-A-3-7, NRC-2011-C-N-11, VS-2002-9, VS-2004-9, VS-2173, VS-2005-19, VS-2005-21, VS-2005-22, VS-2005-28, VS-2005-37, NRC-95-03-03,NRC-95-12-01, NRC-96-02-02, NRC-95-03-01, NRC-96-05-03, NRC-95-10-03, H6P21, Delhi-3, Delhi-8, Delhi-9, Delhi-14, Delhi-17, Delhi-22, Delhi-23, Delhi-25, Delhi-26, AMS-39-2-1, AMS-50-B, Cat-1368, Cat-2388, EC-2581, EC-15966, EC-39491,EC-107416, EC-118443, EC-457161, EC-685255, GP-393, GP-448, Himso-175, JS-20-74, JS-20-76, JS-20-83, JSM-224, JSM-227
Moderately resistant	35	PK-1024, NRC-56, SL-518, NRC-57, JS-98-21, EC-391181, NRC-37, H3P12, NRC-2007-G-1-15, NRC-2011-E-4-11-1-1, NRC-2011-E-2-5-12-1, NRC-2012-M-127-3, VS-2157, Delhi-1, Delhi-2, Delhi-4, Delhi-7, Delhi-15, Delhi-24, MS-115, AMS-MB-5-18, Cat-1113, EC-232019, EC-389148, EC-391336, EC-685250, JSM-258,
Susceptible	33	DSB 24 ,RVS 2008-8 PS 1552, AMS 1003, AMS 1004, PS 1556, DSB-25, KDS-743, JS-335, DS-2705, MACS-1407, NRC-93,RKS-113,KDS-705, JS-20-69, JS-20-71, NRC-94, MAUS-612, MACS-58, NRC-2, JS-79-263, NRC-2006-A-4-12, NRC-2006-J-7, NRC-2006-A-23, NRC-2OO8-F-6, NRC-2011-E-2-1-7, VS-495, Delhi-11, Delhi-12, Delhi-13, Delhi-16, Delhi-18, EC-685243
Highly susceptible	38	SL 1028, VLS 88, DS 3101, MACS 1454, NRC 100, DSb 28-3 DS 3102, VLS 89, MACS-1410, PS-1543, HIMSO-1685, DSB-23-2, SL-982, KBS-22-2009, MACS-1416, IS-9, PK-472, JS-80-54, JS-92-14, PK-317, MACS-694, MACS-124, JS/SH/94-21, NRC-2007-1-3, NRC-2011-A-3-22, NRC-2011-A-3-6, NRC-2011-A-3-10, VS-2004-19, VLS-47, Delhi-5, Delhi-6, Delhi-10, AMS-148, Cat-2502, Cat-2722, EC-100027, EC-685256, MAUS-41,
Total		**325**
LSI		**3.81**

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