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Rapeseed-Mustard Germplasm Evaluation and Management Against Black Rot (*Xanthomonas Campestris* PV. *Campestris*)-A Potential Threat

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ABSTRACT

Field experiments were conducted during 2010-11 to 2011-12 crop seasons to identify resistant genotypes for the management of bacterial blight/black rot caused by *Xanthomonas campestris* pv. *campestris* (Pammel) Dawson. Symptoms of disease were recorded 40-45 days after sowing in different localities of Faizabad district of U.P. Disease was characterized by the initial symptoms appeared as dark color streaks on the stem from ground level, which girdle the stem making very soft and hollow followed by rotting. Lower leaves showed midrib cracking 'V' shaped yellowing on the leaf margin, browning of veins and weathering. Profuse exudation of yellowish fluid from the affected stem and leaves may also occur. Out of 110 genotypes screened, ten entries namely T-27, GSL-1, PHR-2, DRMR-243, PBC-9221, JMTA-9, EC-399299, EC-38899, HNS-9605 and HNS-004 were recorded resistant and forty four were moderately resistant. Rest of the genotypes proved moderately susceptible from *X. campestris* pv. *campestris*. In absence of resistant genotypes, manage the disease through combination of bio-agents, fungicide and antibiotic such as seed treatment with *Pseudomonas fluorescens* @ 5g/kg seed + spraying with Streptocycline (100ppm) thrice at 15 days interval followed by Seed treatment with Streptocycline (100ppm) + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval) , respectively.

Keywords: Rapeseed–mustard, Symptoms, Entries, *Management, Xanthomonas campestris* pv. *Campestris.*

INTRODUCTION

The oilseed crops, especially *Brassica* spp. play a vital role in the agricultural economy of India. Rapeseed-mustard, among these are important *rabi* crops of mid-eastern India. The crop suffers with number of devastating diseases caused by fungi, bacteria and viruses. Bacterial blight caused by *Xanthomonas campestris* pv. *campestris* (Pammel) Dawson is becoming a threat to rapeseed-mustard growing farmers in eastern Uttar Pradesh (Singh *et al.*, 2008). Symptoms appeared as irregularly shaped, dull yellow areas along leaf margins which expand to leaf midrib and create a characteristic 'V' shaped lesion; lesions may coalesce along the leaf margin to give plant a scorched appearance.

Bacterial blight or black rot disease of crucifers is highly destructive, which causes considerable economic damage, 0.03 % infection can lead to epidemics. Infection on crops like crucifers may result in the loss of crop qualitatively and quantitatively. With the progression of disease, infected tissues become black which render normal flow of water and nutrients (Wangeningen and Jan 2005 and Lgnatov *et al.*, 2007). Strong winds, warm and humid climate also play an important role in the wide spread of the disease (Roberts *et al.*, 1999; Mugiira *et al.*, 2011). The initial infections may enter from debris of crucifer plants (Mustard, Cabbage and cauliflower etc.), weeds and irrigation water (Roberts, *et al.*, 1999). The objective of the present study was under taken characterization of symptoms, varietal screening of rapeseed and mustard genotypes and management against phytopathogenic bacteria *Xanthomonas campestris* pv. *campestris*.

MATERIALS AND METHODS

Field experiments were conducted at the University Experiment Station at Kumarganj (26°47'N, 82°12'E, 113 msl), Faizabad, Uttar Pradesh during 2007-08 to 2009-10 cropping seasons following recommended agronomic practices (120Kg N, 60Kg P, 60Kg/ha). One hundred ten promising genotypes/cultivars supplied by Directorate of rapeseed-mustard research, Sewar, Bharatpur, Rajasthan were sown in the last week of October during 2010-11 and 2011-12 *rabi* season. All the entries were planted in paired rows and replicated twice. Plant to plant and row to row spacing was maintained as 30x10cm. Crop was fertilized with NPK in ratio of 120:60:60 kg/ha to obtained a good crop. The genotypes were evaluated for black rot under natural condition. The symptoms of the disease were also studied in susceptible genotypes. For screening, data on disease index scale and disease reactions were obtained by following a standard evaluation system (IRRI, 1996), where the index values were: 0 to 1= HR (highly resistant), 2= R (resistant), 3= MR (moderately resistant), 4 to 6 MS (moderately susceptible), 7= S (susceptible) and 8 to 9 HS (highly susceptible). The tested mustard genotypes were classified into different groups on the basis of their response and reaction to the pathogen.

Management trials were also carried out during *rabi* season of 2010-11 and 2011-12 with mustard variety 'varuna' for the management of black rot disease. The experiment had nine treatments with three replications each in a randomized block design with each plot measuring 3.0 m x 4.0 m. The treatments included, **i)** seed treatment with streptocycline @ 100ppm, **ii)**

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seed treatment with *Pseudomonas fluorescens* @ 5g/kg of seed, **iii)** T_1 + spraying with Streptocycline (100ppm) twice at 15 days interval, **iv)** T_1 + spraying with Streptocycline (100ppm) thrice at 15 days interval, **v)** T_1+ two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval, **vi)** T_2 + spraying with Streptocycline (100ppm) twice at 15 days interval**, vii)** T_2 + spraying with Streptocycline (100ppm) thrice at 15 days interval**, viii)** T2 + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval, **ix)** untreated control (Table 1). The treatments were imposed at the time of seed sowing in the field following recommended agronomic practices including nutrient management *i.e.* 120Kg N, 60Kg P, 60Kg/ha. Observations were made on the incidence of black rot on leaves at weekly intervals by using disease index standards on a following 0 to 5 scale.

RESULTS AND DISCUSSION

For the first time it was recorded during 2004-05 crop season in the experimental plots and nearby farmers fields and adjoining districts of Faizabad. Appearance of disease was recorded 40-45 days after sowing in about all the localities. The early symptoms on young plant occur as necrotic lesions on cotyledons or lower leaves. The lower leaves fall off prematurely and the pathogen continues to develop systemically. Symptoms begin appear when the pathogen invades the vascular system. Incidence of disease was very less and severity was also mild. Disease was characterized by the initial symptoms appeared as dark color streaks on the stem from ground level, which girdle the stem making very soft and hollow followed by rotting. Lower leaves showed midrib cracking 'V' shaped yellowing on the leaf margin, browning of veins and weathering. Profuse exudation of yellowish fluid from the affected stem and leaves may also occur. The affected area later turns brown and dirty. Similar observations were made by Singh *et al.* (2008).

To find out the resistant source, 110 genotypes were evaluated against this disease under field condition. Out of which ten genotypes namely T-27, GSL-1, PHR-2, DRMR-243, PBC-9221, JMTA-9, EC-399299, EC-38899, HNS-9605 and HNS-004, were recorded resistant. Forty four genotypes were moderately resistant (RH-555, BIO-45R, RGN-236, NRCHJ-1103, PHR-2, Parasmani-02-01, RH-116, ELM-108, ROHINI, RGN-229, RH-408, RH-305, 45S45, LET-14-1, HYT-33, LET-17, NPJ-24, EJ-20, NPJ-113, PCJ-04-405, RTM-1212, RH-0304, DLSC-1 NRCDR-805, JMT-08-13, JMT-04-3, PAB-2005-16, NRCIJ-38, PAB-2005-19, EC-399299, EC-414293, NPJ-143, NRCM-807, EC-399296, PAB-2020, EC339000, EC399312, PQR-2001, PT-303, PQR-9701-46,LET-36, LET-17, LET-18, LET-40). Fifty six, moderately susceptible (PBR-357, RRN-631, RK-08-2, SKM-0526, RGN-241, NDRE-07, NRCM-802, HUJM-05-3, PR-2006-1, Divya-22, PRKS-28, JMWR-08-3, ELM-134, NRCM-812, RH216, SKM-0301, ELM-123, BAUM-2007, NDRS-2016-1, JM-1, NPJ-125, LET-36, RH-216, NPJ-140, PBR-300, NPJ-121, RH-7846, RH-306, NRCIJ-06-44, JGM-901, NPJ-127, RH-0616, PBR-91, JMT-08-11,EC-414322, JMM-07-1, EC-414299, RB-55JMM-07-2, JMM-08-1, JMM-927, PAM-2004-4, NRCM-806, RH-345, NPJ-144, NPJ-143, RH-427, EC-399301, PAB-2002, LES-41, LET-14-1). Sources of resistant to *X. campestris* pv. *campestris* in brassica genomes have been examined by Hunter *et al.* (1987) and Lema *et al.* (2011). The resistant lines may be utilized in development of resistant variety (Guo *et al.*, 1991**).**

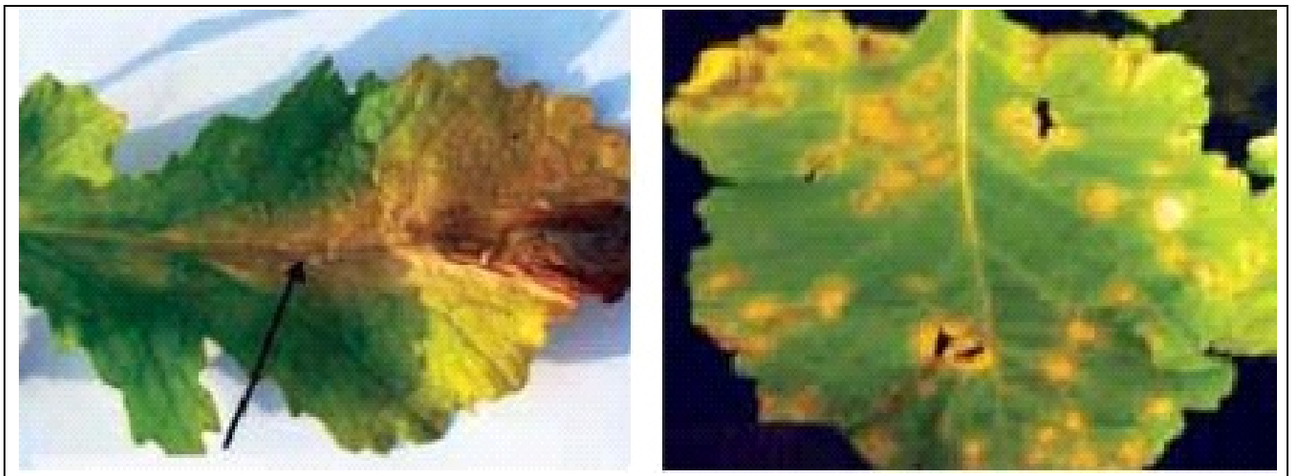

Fig. 1: Black rot *(Xanthomonas campestris* pv. *campestris)* affected mustard leaves at fully grown stage

The results of the trials showed that all the treatments were effective in reducing the black rot incidence as compared to untreated control (Table1 and Fig.1). The black rot incidence was significantly reduced to a mean PDI of 30.65 a decrease of 48.44 per cent over control in treatment-T_7 (T_7= T_2 + spraying with Streptocycline (100ppm) thrice at 15 days interval) followed by T_5 (T_1 + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval) and T_4 (T_1 + spraying with Streptocycline (100ppm) thrice at 15 days interval), respectively. Our results are in agreement with Gopalakrishnan and Artal (2013) who reported that Streptocycline is more effective in comparison to other treatment. Mishra and Arora (2010) found that seed and seedling treatment with *P. fluorescens* gave significant control over black rot in cauliflower.

Table 1: Effect of various treatments on black rot incidence (%) in mustard variety 'Varuna'

Treatments	Mean PDI		Pooled Mean	Disease reduction over control (%)
	2010-11	2011-12		
T1= Seed treatment with Streptocycline (100ppm)	48.26	50.33	49.29	17.08
T2= Seed treatment with *Pseudomonas fluorescens* @ 5g/kg seed	54.56	57.24	55.90	5.97
T3= T1+ spraying with Streptocycline (100ppm) twice at 15 days interval	38.58	42.74	40.66	31.60
T4= T1+ spraying with Streptocycline (100ppm) thrice at 15 days interval	32.35	36.75	34.55	41.88
T5= T 1 + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval	30.56	33.98	32.27	45.71
T6= T2+ spraying with Streptocycline (100ppm) twice at 15 days interval	32.60	38.40	35.50	40.28
T7= T 2 + spraying with Streptocycline (100ppm) thrice at 15 days interval	28.84	32.46	30.65	48.44
T8= T2 + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval	35.28	38.22	36.75	38.18
T9= Untreated Control	57.45	61.47	59.45	-
SEm ±	0.78	1.01	0.89	
CD (P=0.05)	2.31	3.01	2.66	

CONCLUSION

Ten genotypes of rapeseed-mustard, T-27, GSL-1, PHR-2, DRMR-243, PBC-9221, JMTA-9, EC-399299, EC-38899, HNS-9605 and HNS-004, which were observed as resistant against bacterial blight/black rot may be used as donor for transferring resistant genes to susceptible varieties otherwise good agronomic base through back cross method of crop breeding. In absence of resistant genotypes manage the disease effectively through combination of bio-agents, fungicide and antibiotic such as seed treatment with *Pseudomonas fluorescens* @ 5g/kg seed + spraying with Streptocycline (100ppm) thrice at 15 days interval) followed by Seed treatment with Streptocycline (100ppm) + two sprays with Streptocycline (100ppm) + Copper oxychloride (0.3%) at 15 days interval) , respectively.

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