International Journal of Microbiology Research
ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 9, Issue 1, 2017, pp.-847-849.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000234

Research Article

EVALUATION OF INDIGENOUS AND EXOTIC RAPESEED-MUSTARD GENOTYPES FOR RESISTANCE TO SCLEROTINIA ROT CAUSED BY *Sclerotinia sclerotiorum*

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Received: January 09, 2017; Revised: January 17, 2017; Accepted: January 18, 2017; Published: January 28, 2017

Abstract- Sclerotinia rot incited by *Sclerotinia sclerotiorum* is very serious disease of rapeseed- mustard throughout world. For over two decades, research on the management of this disease has been directed at various approaches, and yet currently available methods have not provided effective control. Therefore, different rapeseed-mustard genotypes of diverse origin (indigenous and exotic origin) were screened for their relative resistance/tolerance to Sclerotinia rot disease under permanent sick plot conditions in field at Research Area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar during *rabi* 2012-13 and 2013-2014. Out of sixty nine genotypes, none of the genotypes was found resistant (<10% D.I.), however, nine genotypes *viz.,* Varuna albino, Montara, Ringot 1, Brassica I, Brassica II, EC 126745, EC 322090, EC 322091, Kiran showed moderately resistant reaction (10-20 % D.I.) against Sclerotinia rot disease. These sources of moderate resistant genotypes need to be tested for their resistance with other inoculation techniques and after that may be utilized in resistance breeding programme for at least development of tolerant variety of rapeseed-mustard.

Keywords- Genotypes, Rapeseed-mustard, Resistance, *Sclerotinia sclerotiorum.*

Citation: Rakesh, et al., (2017) Evaluation of Indigenous and Exotic Rapeseed-Mustard Genotypes for Resistance to Sclerotinia Rot Caused by *Sclerotinia sclerotiorum.* International Journal of Microbiology Research, ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 9, Issue 1, pp.-847-849.

Introduction

Rapeseed-mustard is the third most important oilseed commodity in the world after soybean (*Glycine max*) and palm (*Elaeis guineensis Jacq*) in world agriculture and India is the third largest producer with global contribution of 28.3 per cent acreage and 19.8 per cent production [1,2]. Rapeseed-mustard is exposed to various pathogens, which infect and disturb the normal physiological functions during growth and development. Among the diseases that hampered the productivity of rapeseed-mustard, Sclerotinia rot caused by *Sclerotinia sclerotiorum* (Lib.) de Bary is most recognized disease worldwide. In India, the Sclerotinia stem rot was considered as minor importance few decades ago but recently this disease is a serious handicap in successful cultivation of rapeseed-mustard [3]. Yield losses of 72.0 per cent from Uttar Pradesh and 50.9 per cent from Rajasthan in Indian mustard due to this disease were reported [4,5]. Host resistance offers the only economic and sustainable method for effective management of this disease [6]. Complete resistance to *S. sclerotiorum* is lacking in all cultivated rapeseed-mustard crops, however, partial resistance was identified in some of the *Brassica napus* and to a lesser extent in *B. juncea* genotypes from China, Australia [7] and India [8,9]. *B. napus* and *B. juncea* cv. *rugosa* genotypes have been reported to possess resistance against Sclerotinia rot in the field as well as in green house conditions [10]. Four genotypes *viz.,* PCR-10, RW-8410, RW-9401 and RGN-8006 consistently proved promising against Sclerotinia stem rot of mustard [11]. Three genotypes of *B. juncea* of Chinese origin were tolerant, whereas none of the Indian lines was tolerant while, among *B. napus* two genotypes of Australian origin were observed tolerant [12]. Lack of effective resistance to Sclerotinia stem rot in cultivated species has stimulated the interest of researchers towards finding at least few source lines, so that these could be used in resistance breeding programmes. Growing resistant/ moderately resistant variety is economical, viable, safest and eco-friendly approach. Present study was, therefore, undertaken to find out the sources of resistance/ moderately resistance in rapeseed-mustard genotypes against Sclerotinia stem rot disease under sick plot conditions.

Materials and Methods

Sixty nine (indigenous and exotic origin) rapeseed-mustard genotypes were screened for their relative resistance/ tolerance to Sclerotinia stem rot disease under permanent sick plot conditions in field at Research Area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar during *rabi* 2012-13 and 2013-2014. Genotypes were sown in the first week of November in paired rows of 3m length. Three replicates of each genotype were sown in randomized block design. Infector row of highly susceptible variety BSH-1 was repeated after every two test entries. Observation on per cent disease incidence was recorded before 15 days of harvest. Disease incidence was calculated by the following formula.

$$\text{Disease incidence (\%)} = \frac{\text{Number of diseased plant}}{\text{Total number of plant}} \times 100$$

After recording the disease incidence, the genotypes were grouped under following reaction categories:

Disease Reaction	Disease incidence (%)
Resistant	< 10
Moderately Resistant	10 to 20
Moderately Susceptible	20 to 40
Susceptible	40 to 60
Highly Susceptible	> 60

Results and Discussion

During the present study among sixty nine rapeseed-mustard genotypes including indigenous and exotic origin screened for their relative resistance against Sclerotinia rot disease under permanent sick plot conditions, none of the genotypes was found resistant (<10% D.I.). However, nine genotypes *viz.,* Varuna albino, Montara, Ringot 1, Brassica I, Brassica II, EC 126745, EC 322090, EC 322091, Kiran showed moderately resistant reaction (10-20 % D.I.) against stem rot disease. Forty two genotypes showed moderately susceptible reaction (20-40% D.I.), while twelve genotypes *viz.,* HNS 9605, Domo 4, RH 0345, UDN 69, Parkash, AMORA, JM 6004, JM 6010, JM 6026, Shiva, Savita and Pusa Bold remained susceptible (40-60% D.I.) and six genotypes *viz.,* BSH 1, RC 41455, RC 199, YSPB 24, Varuna, Kranti showed highly susceptible reaction (>60% D.I), respectively [Table-1 and 2] and[Fig-1].

Results obtained are in agreement with [10, 9] and [13] for genotypes Brassica 1 and Brassica 2 as moderately resistant, for genotypes Haoyou, Jinshanhung, JM 6009, JM 6011, JM 6012, and JM 6018 as moderately susceptible reaction and for genotypes AMORA, JM 6026 and JM 6014 as susceptible reaction. However, in the present study, *B. juncea* genotypes Ringot 1 and Montara showed moderately resistant reaction, while RL (EC 597334) and JM 6014 showed moderately susceptible reaction and JM 6010 showed susceptible reaction. Sharma *et al.* (2009) also indicated that *B. juncea* genotype Montara was high tolerant to *S. sclerotiorum* under field conditions as also reported in the present study.

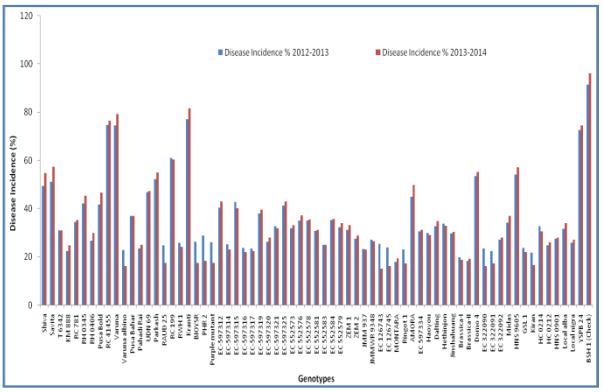

Fig-1 Per cent disease incidence of rapeseed- mustard genotypes screened under Sclerotinia rot sick plot conditions during rabi 2012-13 and 2013-14.

Table-1 *Disease reaction of rapeseed- mustard genotypes screened under Sclerotinia rot sick plot conditions during rabi 2012-13 and 2013-14.*

Disease Reaction	Disease incidence (%)	Germplasm lines
Resistant	<10	Nil
Moderately resistant	10-20	Varuna albino, Montara, Ringot 1, Brassica I, Brassica II, EC 126745, EC 322090, EC 322091, Kiran
Moderately susceptible	20-40	T 6342, KM 888, RC 781, RH 0406, Pusa Bahar, Pahadi Rai, RWH 1, JM 6009, JM 6011, JM 6012, JM 6014, JM 6015, JM 6018, JN 004, JN 031, JN 033, JM 018, JR 042, JR 049, JM 016, ZEM 1, ZEM 2, JMM 937, JMMWR 9348, RL, Haoyou, Dalting, Jinshanhuang, Hethinjon, EC 126743, EC 322092, Midas, GSL 1, HC 0212, HC 0214, HNS 0901, *B. alba* (Local), *B. nigra* (Local), RAUD 25, BIOYSR, Purple mutant, PHR 2
Susceptible	40-60	HNS 9605, Domo 4, JM 6004, JM 6010, JM 6026, RH 0345, UDN 69, Parkash, AMORA, Shiva, Savita, Pusa Bold
Highly susceptible	>60	BSH 1, RC 41455, RC 199, YSPB 24, Varuna, Kranti

Table-2 *Evaluation of rapeseed-mustard germplasm lines for resistance against stem rot under sick plot conditions during rabi 2012-13 and 2013-14.*

Sr. No.	Genotype	Species	Origin	*Disease incidence (%) (2012-13)	*Disease incidence (%) (2013-14)	*Disease incidence Mean
1	Shiva	*B. juncea*	India	49.3 (44.5)	54.8 (47.7)	52.1
2	Savita	*B. juncea*	India	51.0 (45.6)	57.3 (49.1)	54.2
3	T 6342	*B. juncea*	India	30.9 (33.6)	31.0 (33.6)	31.0
4	KM 888	*B. juncea*	India	22.3 (28.0)	24.6 (29.6)	23.4
5	RC 781	*B. juncea*	India	34.3 (35.8)	35.3 (36.3)	34.8
6	RH 0345	*B. juncea*	India	42.1 (40.4)	45.2 (42.2)	43.7
7	RH 0406	*B. juncea*	India	26.6 (31.0)	29.8 (33.0)	28.2
8	Pusa Bold	*B. juncea*	India	41.7 (40.1)	46.5 (42.9)	44.1
9	RC 41455	*B. juncea*	India	74.7 (59.9)	76.5 (61.1)	75.6
10	Varuna	*B. juncea*	India	74.4 (59.6)	79.3 (62.9)	76.8
11	Varuna albino	*B. juncea*	India	22.8 (28.4)	16.2 (23.7)	19.5
12	Pusa Bahar	*B. juncea*	India	37.0 (37.4)	37.0 (37.4)	37.0
13	Pahadi Rai	*B. juncea*	India	23.3 (28.9)	25.0 (29.9)	24.1
14	UDN 69	*B. juncea*	India	46.9 (43.1)	47.2 (43.3)	47.0
15	Parkash	*B. juncea*	India	52.2 (46.2)	54.9 (47.8)	53.6
16	RAUD 25	*B. juncea*	India	24.7 (29.8)	17.4 (24.6)	21.0
17	RC 199	*B. juncea*	India	61.0 (51.3)	60.4 (51.0)	60.7
18	RWH 1	*B. juncea*	India	25.7 (30.3)	24.0 (29.3)	24.9
19	Kranti	*B. juncea*	India	77.0 (61.4)	81.6 (64.6)	79.3
20	BIOYSR	*B. juncea*	India	26.2 (30.7)	17.3 (24.5)	21.8
21	PHR 2	*B. juncea*	India	28.8 (32.4)	18.2 (25.2)	23.5
22	Purple mutant	*B. juncea*	India	25.9 (30.5)	17.4 (24.6)	21.7
23	EC-597312 (JM 6004)	*B. juncea*	Australia	40.4 (39.4)	42.9 (40.8)	41.7
24	EC-597314 (JM 6009)	*B. juncea*	Australia	25.2 (30.0)	23.0 (28.6)	24.1
25	EC-597315 (JM 6010)	*B. juncea*	Australia	42.7 (40.8)	40.2 (39.3)	41.4
26	EC-597316 (JM 6011)	*B. juncea*	Australia	23.6 (28.9)	22.0 (27.9)	22.8
27	EC-597317 (JM 6012)	*B. juncea*	Australia	23.3 (28.7)	22.3 (28.1)	22.8
28	EC-597319 (JM 6014)	*B. juncea*	Australia	38.1 (38.1)	39.4 (38.8)	38.8
29	EC-597320 (JM 6015)	*B. juncea*	Australia	26.1 (30.6)	28.0 (31.9)	27.0
30	EC-597321 (JM 6018)	*B. juncea*	Australia	32.7 (34.9)	31.8 (34.2)	32.3
31	EC-597325 (JM 6026)	*B. juncea*	Australia	41.2 (39.9)	43.0 (40.9)	42.1
32	EC 552573 (JN 004)	*B. juncea*	Australia	31.7 (34.2)	33.0 (34.9)	32.4
33	EC 552576 (JN 031)	*B. juncea*	Australia	34.9 (36.1)	37.2 (37.5)	36.1
34	EC 552578 (JN 033)	*B. juncea*	Australia	35.0 (36.2)	35.5 (36.5)	35.2
35	EC 552581 (JM 018)	*B. juncea*	Australia	30.8 (33.7)	31.2 (33.9)	31.0
36	EC 552583 (JR 042)	*B. juncea*	Australia	24.8 (29.8)	25.0 (29.9)	24.9
37	EC 552584 (JR 049)	*B. juncea*	Australia	35.1 (36.3)	35.7 (36.6)	35.4

38	EC 552579 (JM 016)	*B. juncea*	Australia	32.3 (34.6)	34.0 (35.4)	33.2
39	ZEM 1 (EC 223759)	*B. juncea*	Australia	31.2 (33.9)	33.1 (35.0)	32.2
40	ZEM 2 (EC 223760)	*B. juncea*	Australia	27.4 (31.4)	28.8 (32.2)	28.1
41	JMM 937	*B. juncea*	Australia	23.2 (28.7)	23.0 (28.5)	23.1
42	JMMWR 9348	*B. juncea*	Australia	27.1 (31.2)	26.5 (30.8)	26.8
43	EC 126743	*B. juncea*	Australia	25.3 (30.1)	15.0 (22.7)	20.2
44	EC 126745	*B. juncea*	Australia	23.8 (29.1)	16.0 (23.5)	19.9
45	EC 597328 (MONTARA)	*B. juncea*	China	17.9 (25.0)	19.4 (26.1)	18.7
46	EC 597331 (Ringot 1)	*B. juncea*	China	22.9 (28.5)	17.2 (24.5)	20.0
47	EC 597333 (AMORA)	*B. juncea*	China	44.9 (42.0)	49.9 (44.9)	47.4
48	EC 597334 (RL)	*B. juncea*	China	30.4 (33.4)	31.1 (33.8)	30.7
49	EC 597335 (Haoyou)	*B. juncea*	China	29.9 (33.1)	28.9 (32.4)	29.4
50	EC 597336 (Dalting)	*B. juncea*	China	32.7 (34.7)	34.8 (36.1)	33.7
51	EC 597340 (Hethinjon)	*B. juncea*	China	33.6 (35.4)	32.9 (34.9)	33.3
52	EC 597341 (Jinshahuang)	*B. juncea*	China	29.6 (32.9)	30.3 (33.3)	29.9
53	EC 597343 (Brassica-I)	*B. juncea*	China	19.8 (26.3)	18.7 (25.5)	19.3
54	EC 597344 (Brassica-II)	*B. juncea*	China	18.2 (25.2)	19.2 (25.9)	18.7
55	Domo 4	*B. juncea*	Canada	53.4 946.9)	55.2 (48.0)	54.3
56	EC 322090	*B. juncea*	China	23.5 (28.9)	16.2 (23.6)	19.9
57	EC 322091	*B. juncea*	China	22.4 (28.2)	17.1 (24.4)	19.8
58	EC 322092	*B. juncea*	China	27.0 (31.2)	27.8 (31.7)	27.4
59	Midas	*B. napus*	Canada	34.1 (35.7)	37.0 (37.1)	35.6
60	HNS 9605	*B. napus*	India	54.1 (47.3)	57.0 (49.0)	55.6
61	GSL 1	*B. napus*	India	23.7 (29.1)	21.9 (27.8)	22.8
62	Kiran	*B. carinata*	India	21.7 (27.6)	16.5 (23.9)	19.1
63	HC 0214	*B. carinata*	India	32.7 (34.8)	30.4 (33.4)	31.6
64	HC 0212	*B. carinata*	India	24.6 (29.7)	26.0 (30.6)	25.3
65	HNS 0901	*B. napus*	India	27.5 (31.5)	28.0 (31.7)	27.7
66	Local alba	*B. alba*	India	31.5 (34.0)	34.0 (35.5)	32.7
67	Local nigra	*B. nigra*	India	25.7 (30.4)	27.1 (31.1)	26.4
68	YSPB 24	B. rapa var. yellow sarson	India	72.5 (58.4)	74.4 (59.5)	73.5
69	BSH 1 (Check)	*B. rapa* var. *Brown sarson*	India	91.4 (73.2)	96.2 (78.7)	93.8
	C.D. (p=0.05)			4.0	5.0	
	C.V. (%)			6.9	8.7	

*Mean of three replications, The values in parentheses are angular transformation

Conclusion

Nine genotypes (Varuna albino, Montara, Ringot 1, Brassica I, Brassica II, EC 126745, EC 322090, EC 322091, Kiran) sources of moderate resistance found in the present study, need to be tested for their authenticity with other inoculation techniques and after that can be utilized in resistance breeding programme for at least development of tolerant variety of Indian mustard

Acknowledgement

The authors are grateful to the Head of Department Dr. S.S. Karwasra for providing facilities timely during the study of investigation

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