Disease Indexing of Rapeseed :Mustard Cultivars against Alternaria blight

Abstract

In the investigation, 120 rapeseed-mustard genotypes were screened under in vivo conditions for resistance against the foliar disease Alternaria blight. None of the genotypes were found to be immune to the disease. However, three genotypes—JT-1, RVM-3, and Pusa Jagannath—were identified as resistant (R), with disease severity ranging from 1% to 10%. Nine genotypes were classified as moderately resistant (MR), showing disease severity between 11% and 25%. A total of 67 genotypes were rated as moderately susceptible (MS), with disease severity ranging from 26% to 50%. Additionally, 41 genotypes were categorized as susceptible (S), where disease severity was between 51% and 75%. The highly susceptible none of genotypes were found.

Keywords: Resistance, Alternaria blight, disease indexing

Introduction

"Rapeseed-mustard group of crops are the major *rabi* oilseed crops of India. The group is mainly constituted by *Brassica juncea, B. napus B. rapa and B. carinata.* In India, rapeseed-mustard crops are cultivated on an area of 6.12 million ha and the production of 9.26 million tones" (Anon., 2020)."Among the Rapeseed-mustard group *B. juncea* (Indian mustard) is the major crops of the country, contributing more than 70% out of the total rapeseed- mustard area and production of the country. *B. juncea* is mainly cultivated in the Northern region of the state in Madhya Pradesh. Rapeseed-mustard crops are cultivated in an area of about 0.78 million ha and the production of 1.11 million tones and productivity 1422 kg/ha" (Anon., 2020). Major rapeseed- mustard growing districts of the state are Morena, Bhind, Gwalior and Sheopur as these four districts jointly contributing more than 75% share in area and production of this crops in the state, in which *B. juncea* is the dominant crop. Rapeseed-mustard is exposed to various types of foliar diseases including Alternaria blight (*Alternaria* spp.), downy mildew (*Peronosporaparasitica*), powdery mildew (*Erysiphecruciferarum*), sclerotinia stem rot (*Sclerotiniasclerotiorum*) and white rust (*Albugo candida*) etc.

"Out of these diseases, Alternaria blight of mustard caused by *Alternaria brassicae* (Berk.) Sacc. and*A. brassicicola*(Schw.), is a very important disease as it has been reported from all the continents of the world, causing severe economic 47% yield loss" (Meena*et al.*, 2010)."The disease appears regularly in moderate to severe form and its infection generally occurs on

leaves, stem and siliqua resulting in reduction of yield and poor seed quality brassica crops" (Saharan, 1992).

"The most common and damaging disease affecting rapeseed-mustard is the Alternaria blight, which causes major yield losses that may range from 15 to 71 per cent in productivity and 14 to 36 per cent in oil content" (Meena*et al*., 2010). "Besides losses in yield and oil content, it also has a negative impact on seed quality, reducing seed size and producing discoloration and staining" (Prasad and Lallu, 2006).

According to Changseri and Weber (1963), "the brown coloredconidiosphores and conidia of *Alternaria brassicae* (Berk.) Sacc. with long beaks can easily be identified and distinguished from *Alternaria brassicicola* which has conidia with very short or no beaks. Alternaria blight disease occurs on the stems and leaves of seedlings and mature plants, as well as in siliquae at the ripening stage. Both vegetable and oleaceous brassicas produce fewer high-quality seeds due to dark stains on the leaves and siliquae that inhibit photosynthetic ability and stimulate early ripening" (Kumar *et al.,* 2014).

Materials and Methods

The planting of 120 genotypes rapeseed- mustard were done under field conditions. In order to promote a severe natural epidemic of disease, the genotypes were sown in two rows each of three-meter length with spacing of 30x10 cm in randomized block design with two replications. To maintain the high humidity level in microclimate of the field, time to time irrigation was applied for favoring the development of the disease. Observations were recorded on randomly selected 10 plants from each genotype. Numerical rating grade was given on the basis of percentage of area covered by pathogen on the leaves. On the basis of disease intensity genotypes were classified into different groups viz., near immune/highly resistant, resistant, moderately resistant, moderately susceptible, susceptible, and highly susceptible.

DISEASE ASSESSMENT:

Table 1: Modified 0-5 scale for rating disease intensity of inrapeseed-mustardonleaf

RatingScale forleaf	Disease Intensity(%)	Reaction
0	0	NearImmune/ /highly resistant(I)
1	1-10	Resistant(R)
2	11-25	ModeratelyResistant(MR)
3	26-50	ModeratelySusceptible(MS)
4	51-75	Susceptible (S)
5	76-100	HighlySusceptible (HS)

The percent disease severity (%) of foliar diseases at each scoring was calculated by using following formula developed by (Sharma and Kolte, 1994):

Disease severity (%) =Sum of all numerical ratings × 100

Total no. of observation × maximum rating

RESULTS AND DISCUSSION

Screeningoftherapeseed-mustardgenotypes

Screening of rapeseed- mustard 120 genotypesgenotypes none of the entrieswerefreefromdisease andthreegenotypes,JT-1(8.7%),RVM-3(9.9%),PusaJagannath (10%), were resistant (R). These entries were significantly superiorover all the remaining 117 entries in respect of leaf infection. The 9 genotypeswere placed in the category of moderately resistant (MR) with PDI *viz.*, L-4(10.1%), L-6 (12.9%), RVT -1 (13.8%), RMT-10-5-18 (14.4%), RVT-2 (14.6%),RMT-0418-18(16.8%),RB-50(19.5%),YSH-401(21.5%),PusaJaiKisan,and (22.5%) and There are two 67genotypes were placed in the category ofmoderately susceptible (MS) remaining 41 genotypes were categorized assusceptible(S). Similarly, the finding of Anonymous (2011) "screened rapeseed-mustardcultivars for resistance to Alternaria blight diseases". None of the genotypeshowedresistantreactiontoAlternariablight.However,EC338997,EC339000,EC414293,NPJ154andRH345werefoundmoderatelyresistantto AlternariablightandMeena*etal*.(2011)alsoreportedthat"S.Alba,GSL1andT-27 were highly resistant against thirteen *Alternaria brassicae* isolates". "Earlysowing of well stored clean certified seeds, timely weeding, maintenance ofoptimum plant protection and avoidance of irrigation at flowering and podformationstagesmayhelptomanagethedisease"(Meena*etal*. 2012). Earlier, Khan (2010) "studied on the common Indian mustard cultivars,Mahyco Bold, Rohini, Alankar, Swarna, Varuna, Pusa Karishma, Pusa Bold,BS-2, Kalamoti and Kranti procured from authorized dealer in Aligarh werefound infected with *Alternaria brassicicola* and *A. brassicae*, former beinghighly dominant occurring singly and concomitantly while *A. brassicae* wasfound mostly in concomitant infestation. Development and progress of theblight was slower" in Alankar (15-23%) followed by Kalamoti (16-25%) andKranti(18-28%).

Similarly finding by Summuna*et al.* (2018)"studied thattwenty-sevendifferent genotypes screened for their reaction against Alternaria blight, twogenotypes*viz.*,RH-8113andPC-5showedmoderateresistance,fourgenotypes*viz.*,GM-3,RH-1359,RH-819andJM-1werefoundtobemoderately susceptible, eighteen genotypes *viz.*, Geeta, Pusa Bahar, Rohini,RH-30, Shivani, RH-781, RGN-13, GM-2, RRN-505, Krishna, GM-1, PusaJaganath,Vaibhav,RSPN-602,DGS-1,RSPN-25,RSPN-2andRSPR-69 recorded susceptible reaction. However, three genotypes *viz.*, Kranti, VarunaandCS-54werefoundtobehighlysusceptible".

Table 2: Disease reaction of different Rapeseed- mustard genotypes against Alternaria blight under field condition on pooled data basis (2020-21 & 2021-2022).

Rating Scale (0-5)	**Disease reaction**	**Number**	**Rapeseed-Mustard genotypes**
0	NearImmune/ Highly Resistant(HR)	Nil	Nil
1	Resistant (R)	3	JT-1,RVM3,PusaJagannath
2	Moderately Resistant (MR)	9	L-4, L-6, RVT -1, RMT-10-5-18, RVT-2, RMT-0418-18, RB-50, YSH-401, Pusa Jai Kisan

3	Moderately Susceptible (MS)	67	JMTA-06-1, TM-117, TM-53, RH-406, Kiran, PC-6, RVT- 3, JMM-927, RH-749, RSHE-19118, RVM-1, RSHE-1912, RMM-12-3-18, Pusa Vijay, RM 9906, RVM-2, TM-134, RSHM-1920, Vasundhara, RSHE-1900, RSHE-19107, RMX-9906, RSHM-1912, TPM-1, RSHM-1914, RSHE- 19095, GSL-1, PC-5, RSHE-19099, RSHE-19103, TM-108-1, RSHE-19110, JMM-991, TM-276, RGN-73, RMM-12-2-18, Swarn Jyoti, RSHE-19120, RS-6401, RSHE-19102, GSE-7, RH-725, PM-28, JM-2, PDZM-31, China Cabbage, PM-30, TM-273, TM-130, Bhawani, RMX-9903, TM-108, RSHE-1903, JM-3, RSHE-1902, RSHE-19111, JTC-1, Pusa Mahak, Bullet, Shraddha, Albely, Krishna, PM-27, Vardan, JM-1, TM-204, JMWR-908-1

4	Susceptible (S)	41	TM-179, TM-106, TM-218, TM-3, Rohini, Kranti, Varuna, JMWR-945-275, RSHE-1910, NRCDR-2, RM-1902, TM- 266-3, Karuna, NC-1, TJD-53, RMM-101-1, Pusha Bold, RSHE-19106, NRCHB-101, RSHE-19105, Giriraj, Sej-2, TM-172, PM-25, TJD-52, RP-9, TM-217, RMX-9303, RMM-12-1-18, TM-52, Bio-Y-SR, DMH-1, TM-277, RSHE- 19112, RSHE-19098, RS-6404, Anmol, TM-143, PM-26, NRCHB-506, TM-199
5	Highly Susceptible (HS)	0	Nil

Conclusion

It is concluded that the productivity may be due to several biotic and abiotic stresses. Alternaria blight caused by *Alternariabrasssicae* and *Alternariabrassicola* is one of the most severe yield destabilizing factors causing a reduction in yield.The ideal and most economical means of managing the Alternaria blight diseases is the use of resistant varieties. In present findings, out of 120 genotypes screened none of the genotypes were found diseases – free or highly resistant, only against Alternaria blight however threegenotypes *viz.*, JT-1 (PDI 8.7%), RVM-3 (PDI 9.9%), Pusa Jagannath (PDI10%), were resistant (R). These entries were significantly superior over all theremaining 117 entries in respect of leaf infection and 9, 67 and 41 genotypeswereplacedinthecategoryofmoderatelyresistant(MR),moderatelysusceptible(MS)andsusceptible(S)respectively.

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References

Anonymous,(2020).ProjectcoordinatorreportsICAR-DirectorateofRapeseed-Mustard,Bharatpur(Rajasthan).p2-5.

Changseri, W. and Weber, G.F. (1963). Three *Alternaria spp*. pathogenic on certaincultivatedcrucifers.*Phytopathology*.53:643.

Meena, P.D.; Awasthi, R.P.; Chattopadhyay, C.; Kolte, S.J. and Kumar, A. (2010).Alternaria blight: a chronic disease in rapeseed-mustard. *J. Oilseed Brassica*.1:1-11.

Prasad,R.andLallu.(2006).ManagementofAlternariablightofMustardwithcombination ofchemicalsandbotanicals.*Ann.Pl.Protec.Sci.*14(1)400-403.

Saharan,G.S.(1992).Diseaseresistance.In"BreedingOilseedBrassicas‖.labanaKS,Banga SS and Banga SK. (Eds.) Narosa Publishing House, New Delhi, India,p181-205.

Saharan,G.S.(1992).Diseaseresistance.In"BreedingOilseedBrassicas‖.labanaKS,Banga SS and Banga SK. (Eds.) Narosa Publishing House, New Delhi, India,p181-205.

Sharma S R and Kolte S J 1994. Effect of soil applied NPK fertilizers on severity of black spot disease (Alternaria brassicae) and yield of oilseed rape. Plant and Soil 167: 313-320z

Yadav MS, Dhillon SS, Kaur S, Brar KS, Singh K. Screening of Indian mustard germplasm for resistance to Alternaria blight and white rust. Plant Disease Researc 1999;14(1):70-72.

Yadav, R.B.; Kumar, A.; Kumar, A. and Verma, S.K. (2014). Screening of rapeseed - mustard cultivars/genotypes lines against Alternaria blight of mustard. *IndianJ.Sci.Res.*5(1):89-91.