Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7043

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **7 (1):** 327-332 (2019)

Research Article

International Journal of Pure & Applied Bioscience

Screening of *Brassica juncea* (L.) Against Downy Mildew and White Rust in *Tarai* Region of Uttarakhand

S. Ravi[1*] and R. P. Awasthi[2]

[1]Department of Plant Pathology,College of Agriculture, G.B.P.U.A. &T. Pantnagar-263145, Uttarakhand, India

[2]Department of Plant Pathology,College of Horticulture, VCSG UUHF Bharsar, Pauri Garhwal -246123, Uttarakhand, India

*Corresponding Author E-mail: sraviachieve@gmail.com

Received: 3.11.2018 | Revised: 7.12.2018 | Accepted: 16.12.2018

ABSTRACT

Brassica juncea (L.) Czern. & Coss., The yield potential of these crops are affected by a number of diseases. Among them, white rust (Albugo candida) and downy mildew (Hyaloperonospora brassicae) are the important one. Yield losses with mixture of WR and DM 17 to 60%.The field investigations were carried out both of the year on the basis of resistance and susceptible entries.Use of resistant varieties are considered as effective and environment friendly. Screened out eight accessions of B. juncea against white rust and downy mildew under unprotected field conditions. DM (at 15 days)- Per cent disease index (PDI) ; Genotypes were found as most resistant against downy mildew, EC-399296, EC-399301 and EC-399313, other EC-399299 found resistant reaction and EC-399302 have been observed moderately resistant, Varuna and Kranti came out as susceptible entries. Divya was found most susceptible genotype. WR (at 60, 75 and 90 days)-(PDI); Genotypes EC-399301 and EC-399296 were found as most resistant, EC-399313, EC-399299 resistant, another one EC- 399302 showed moderately resistant reaction, Varuna and Divya came out as susceptible. Kranti was most susceptible genotype, (PDI) was maximum. If it has taken long period of time somewhere it was decreased the (PDI). Staghead incidence (1WBH): EC-399301 and EC-399296 were found as most resistant, EC-399313, EC-399299, and EC- 399302 showed moderately resistant reaction. Varuna and Divya observed as susceptible genotypes. Kranti was most susceptible to staghead incidence. Staghead Severity (1WBH): EC-399301 and EC-399313 were found most resistant to staghead severity. EC-399299, EC-399296 found as resistant and EC- 399302 showed moderately and Kranti, Varuna and Divya were susceptible.

Key words: *Brassica juncea, Downy mildew, White rust, PDI, Staghead incidence, Staghead severity, Screening, Tarai.*

INTRODUCTION

Rapeseed–mustard most important edible oilseed crop in India. (*Brassica juncea* [L.] Czern. & Coss.) Commonly called rai (raya or laha). The yield potential of these crops are affected by a number of diseases. Among them, white rust (WR) *Albugo candida* and downy mildew (DM) *Hyaloperonospora brassicae* are the important one.

Cite this article Ravi, S. and Awasthi, R.P., Screening of *Brassica juncea* (L.) Against Downy Mildew and White Rust in *Tarai* Region of Uttarakhand, *Int. J. Pure App. Biosci.* **7 (1):** 327-332 (2019). doi: http://dx.doi.org/10.18782/2320-7051.7043

The characteristic symptoms as white to cream yellow raised pustules by white rust and downy growth with necrotic lesions by downy mildew on the abaxial surface of leaf. These two diseases associated for causing severe infection on rapeseed-mustard. Severe infection at flowering stage, often in association with *A. candida* and *H. brassicae* causes extensive distortion, hypertrophy, hyperplasia and sterility resulting inflorescence malformation called "staghead"[2]. In toria loss due to white rust is more if associated with downy mildew[10]. Yield losses caused by white rust or a mixture of white rust and downy mildew, range between 17 to 60%, [9, 11]. Depending on the severity of both foliar and staghead phase of the disease, the per cent yield losses ranging from 23-89.8 % in Indian mustard [*B. juncea* (L.) Czern and Coss] in India[3, 12]; Bisht *et al*.[5] observed losses 20-60% and Gupta *et al.*[8] found that 17-34 %. Keeping the above facts in view, the present investigation was carried out different genotypes of *Brassica juncea* (L.) infected with white rust (*Albugo candida*) and downy mildew *(Hyaloperonospora brassicae).*

MATERIAL AND METHODS

The field experiments were conducted at NEB-Crop Research Centre, GBPUA&T, Pantnagar. Situated at 29^0N latitude and 79.5^0E longitude at an altitude of 243.84 meters above the mean sea level (msl), Pantnagar lies in the foot hills of Himalayas (Shivalik range) and falls in the *Tarai* region of Uttarakhand, India. The Climate is subtropical with hot and humid summer and cold winters, during the *rabi* crop season in the year 2011-12 and 2012-13. Eight genotypes of *Brassica juncea* namely EC-399313, EC -399299, EC- 399296 , EC - 399301 , EC- 399302, Kranti, Varuna, and Divya were used for the present investigation. The data obtained *in vivo* conditions were analysed using simple randomized block design (RBD) with three replications.

Per cent disease index (PDI) at cotyledonary stage of downy mildew, ten cotyledonary leaves was taken at 15 days after sowing. Ten cotyledonary leaves from each replication of an accession were taken and evaluated individually giving (0-9) disease rating scale[14]. The disease index was calculated by using the following formula:

$$\text{Disease index} = \frac{\text{Sum of all numerical rating}}{\text{Number of leaves examined} \times \text{Maximum grade (9)}} \times 100$$

Per cent disease index (PDI) at true leaf stage of white rust, average disease index on true leaves due to white rust were taken at 60, 75 and 90 days after sowing in each replication by using 0-9 disease rating scale[14]. Ten leaves were randomly collected from each accession and scored as per the above rating scale and disease index was calculated separately for each accession by using the same formula mentioned as above in.

Staghead incidence, total number of plants and plants showing staghead were counted separately in each accession one week before harvest (WBH). The staghead incidence was calculated with the help of following formula:

$$\text{Staghead incidence (\%)} = \frac{\text{Number of plants showing staghead}}{\text{Total number of plants}} \times 100$$

Staghead severity, total racemes of ten plants and number of racemes showing staghead were counted on per plant basis and observed one (WBH) in each plot. Staghead severity was calculated as per formula given below:

$$\text{Staghead severity (\%)} = \frac{\text{Number of racemes showing staghead/plant}}{\text{Total number of racemes/plant}} \times 100$$

RESULTS AND DISCUSSION

In present investigations were observed eight accessions of *Brassica juncea* namely EC-399313, EC-399299, EC-399296 EC399301, EC399302, Kranti, Varuna, and Divya were screened out during (2011-12 and 2012-13) under different parameters. The response of various accessions that were screened out against white rust and downy mildew of *B. juncea* in (Table 1-4).

Per cent disease index (PDI)of downy mildew (at 15 days): Genotypes were found most resistant against downy mildew EC-399296, EC-399301; EC-399313, and EC-399299 found resistant reaction and EC-399302 was found moderately resistant; Varuna and Kranti came out as susceptible entries. Divya was found as most susceptible genotype both of the year, comparison to other genotypes.

Per cent disease index (PDI) of white rust (at 60, 75 and 90 days): Genotypes EC-399301 and EC-399296 were found as most resistant; EC-399313 and EC-399299 resistant; EC- 399302 was showed moderately resistant reaction, Varuna and Divya came out as susceptible. Kranti was observed as most susceptible genotype and per cent disease index (PDI) was much in comparison to other genotypes, both of the years. If it has taken long period of time somewhere it was decreased the value of (PDI).

Staghead incidence (1WBH): EC-399301 and EC-399296 were found as most resistant, EC-399313, EC-399299; EC- 399302 showed moderately resistant reaction. Varuna and Divya showed as susceptible genotypes, Kranti was most susceptible to staghead incidence genotypes, both of the years.

Staghead severity (1WBH): EC-399301 and EC-399313 were found as most resistant to staghead severity. EC-399299 and EC-399296 found as resistant; EC- 399302 showed moderately resistant. Kranti, Varuna and Divya were found susceptible to staghead severity both of the year.

Similar work has been reported by Yadav *et al.*[18] and Adhikari *et al.*[1]. Yadav and Sharma[19] also found that genotypes EC-399301 and EC-399299 were resistant to white rust under field conditions. Mukherjee *et al.*[13] have reported that most commercial Indian mustard (*B. juncea*) varieties are highly susceptible to white rust. Sources of resistance to downy mildew have been identfied at the cotyledonary stage in several Brassica crops by Nashaat and Rawlinson[15]; Nashaat and Awasthi[14] and Silue *et al.*[16, 17]. Bhatt[4] observed some similar result in the field condition evaluated disease index, staghead incidence and staghead severity against resistance and susceptible genotypes of *Brassica* species. Bisht *et al.*[6] screened out of Brassica germplasm against white rust on *Brassica* species. Gangapur *et al.*[7] analysed correlation and path analysis in Indian mustard *B. juncea* (L.) both genotypic and phenotypic levels in protected and unprotected conditions of eleven yield contributing characters.

Table 1: Screening of *B. juncea* genotypes against white rust and downy mildew under field in (2011-12)

Genotypes	Per cent Disease Index(PDI)				
	Downy mildew	White rust			Mean
	Cotyledon	Leaves			
	*15 days	*60days	*75 days	*90 days	
EC-399313	13.70 (21.72)	12.96 (21.10)	22.96 (28.63)	24.81 (29.88)	18.61 (25.33)
EC-399299	14.44 (22.33)	16.67 (24.10)	23.33 (28.88)	25.93 (30.61)	20.09 (26.48)
EC-399296	12.22 (20.45)	12.59 (20.78)	20.74 (27.09)	19.63 (26.30)	16.30 (23.65)
EC-399301	11.11 (19.47)	13.33 (21.40)	18.89 (25.76)	18.15 (25.21)	15.37 (22.96)
EC-399302	19.63 (26.30)	18.89 (25.76)	25.19 (30.12)	27.78 (31.81)	22.87 (28.50)
Kranti	35.93 (36.83)	43.33 (41.17)	58.15 (49.69)	56.67 (48.83)	48.52 (44.13)
Varuna	39.63 (39.01)	40.37 (39.45)	50.37 (45.21)	52.96 (46.70)	45.83 (42.59)
Divya	46.67 (43.09)	34.07 (35.71)	41.85 (40.31)	42.22 (40.52)	41.20 (39.91)
CD at 5 %	1.09 (0.79)	1.36 (1.02)	1.76 (1.04)	0.86 (0.58)	-

***** Mean of three replications

( ) Values in parentheses are angular transformed

Table 2: Screening of *B. juncea* genotypes against white rust and downy mildew under field in (2012-13)

Genotypes	Per cent Disease Index (PDI)				Mean
	Downy mildew	White rust			
	Cotyledon	Leaves			
	*15days	*60 days	*75 days	*90 days	
EC-399313	14.44 (22.33)	15.56 (23.23)	23.33 (28.88)	25.93 (30.61)	19.82 (26.26)
EC-399299	15.19 (22.93)	17.78 (24.94)	24.81 (29.88)	26.67 (31.09)	21.11 (27.21)
EC-399296	12.59 (20.78)	15.93 (23.52)	22.96 (28.63)	23.33 (28.88)	18.70 (25.45)
EC-399301	12.96 (21.10)	13.70 (21.72)	21.11 (27.35)	22.22 (28.12)	17.50 (24.57)
EC-399302	21.85 (27.87)	20.74 (27.09)	27.41 (31.57)	28.89 (32.51)	24.72 (29.76)
Kranti	36.67 (37.27)	45.56 (42.45)	60.00 (50.77)	57.78 (49.48)	50.00 (44.99)
Varuna	42.22 (40.52)	43.70 (41.38)	54.07 (47.34)	50.74 (45.42)	47.68 (43.67)
Divya	51.11 (45.64)	36.30 (37.05)	44.44 (41.81)	43.70 (41.38)	43.89 (41.47)
CD at 5 %	1.38 (0.86)	0.89 (0.62)	1.43 (0.91)	1.02 (0.60)	-

***** Mean of three replications

( ) Values in parentheses are angular transformed

Table 3: Screening of *B. juncea;* Staghead incidence and Staghead severity under field in (2011-12)

Genotypes	1 week before harvest (WBH)	
	*Staghead incidence	*Staghead severity
EC-399313	1.82 (7.75)	0.79 (4.16)
EC-399299	2.44 (8.96)	1.59 (7.24)
EC-399296	1.21 (6.23)	1.67 (7.43)
EC-399301	0.91 (5.47)	0.67 (2.71)
EC-399302	2.18 (8.45)	2.22 (8.45)
Kranti	5.13 (13.08)	4.92 (12.78)
Varuna	4.49 (12.22)	3.89 (11.32)
Divya	3.81 (11.20)	3.28 (10.40)
CD at 5 %	0.98 (1.71)	1.22 (3.77)

***** Mean of three replications

( ) Values in parentheses are angular transformed

Table 4: Screening of *B. juncea;* Staghead incidence and Staghead severity under field in (2012-13)

Genotypes	1 week before harvest (WBH)	
	*Staghead incidence	*Staghead severity
EC-399313	2.12 (8.34)	0.74 (4.03)
EC-399299	2.73 (9.51)	1.67 (7.43)
EC-399296	1.52 (6.99)	1.59 (7.24)
EC-399301	1.21 (6.23)	0.56 (2.48)
EC-399302	2.47 (9.00)	2.15 (8.33)
Kranti	5.71 (13.82)	5.47 (13.50)
Varuna	4.76 (12.60)	3.81 (11.21)
Divya	4.13 (11.70)	3.67 (11.04)
CD at 5 %	0.74 (1.51)	1.16 (3.59)

***** Mean of three replications

( ) Values in parentheses are angular transformed

CONCLUSION

Evaluated eight genotypes of *Brassica juncea* in *Tarai* region of Uttarakhand. DM - (PDI) ; Genotypes were found most resistant against downy mildew EC-399296, EC-399301, EC-399313; Divya was found most susceptible genotype. WR -(PDI) ;Genotypes EC-399301 and EC-399296 were found as most resistant, Varuna and Divya came out as susceptible, Kranti was most susceptible. Staghead incidence: EC-399301 and EC-399296 were found as most resistant, Varuna and Divya showed as susceptible, Kranti was most susceptible to staghead incidence. Staghead Severity: EC-399301 and EC-399313 were found most resistant; Kranti, Varuna and Divya observed as a susceptible to staghead severity. Yield was found maximum in most of resistant genotypes and lower in susceptible.

Acknowledgement

Our special thanks to the Oilseed lab- Plant Pathology and Genetics & Plant Breeding Department, College of Agriculture, Officer In charge-Crop Research Centre at G.B.P.U.A. &T. Pantnagar, U.S. Nagar, Uttarakhand.

REFERENCES

1. Adhikari, M., Patni, C. S. and Awasthi, R. P., Evaluation of *Brassica juncea* genotypes against downy mildew and white rust under artificial inoculation conditions, *Adv. Pl. Sci.* **19(2):** 397-400 (2006).
2. Awasthi, R. P., Nashaat, N. I., Heran, A., Kolte, S. J. and Singh, U. S., The effect of *Albugo candida* on the resistance to *Peronospora parasitica* and *vice-versa* in rapeseed mustard. In abstract. Proceedings of the *Indian Phytopathological Society* Golden Jubilee, Int. Conf. on Integrated Pl. Dis. Management for sustainable agriculture, New Delhi, 10-15 November, 105 (1997b).
3. Bains, S. S. and Jhooty, J. S., Mixed infections by *Albugo candida* and *Peronospora parasitica* on *Brassica juncea* inflorescence and their control, *Ind. Phytopathol*. **32(2):** 268-271(1979).
4. Bhatt, R., Studies on pathological and biochemical aspects and management of white rust and downy mildew in rapeseed-mustard. Ph.D. thesis, Department of Plant Pathology, GBPUA&T, Pantnagar.(2012).
5. Bisht, I.S., Agrawal, R.C. and Singh, R., White rust (*Albugo candida*) severity in mustard (*B. juncea*) varie-ties and its effects on seed yield, *Pant Variety and Seed.* **7:** 85-89 (1994).
6. Bisht, K.S., Tewari, A.K. and Upadhyay, P., Screening of Brassica germplasm against *Albugo candida* (White rust disease) on *Brassica* species(Rapeseed-mustard), *Journal of Applied and Natural Science.* **8(2):** 658-662 (2016).
7. Gangapur, D. R.; Prakash, B. G.; Salimath , P. M.; Ravikumar, R. L. and Rao, M. S. L., Correlation and path analysis in Indian mustard (*Brassica juncea* L.Czern and Coss), *Karnataka J. Agric. Sci.* **22 (5):** 971-977(2009).
8. Gupta, K., Prem, D. and Agnihotri, A., Role of bio-technology for incorporating white rust resistance in *Brassica* species, *Plant Biotechnology and Molecular Markers*. Anamaya Publisher, New Delhi, India (2004).
9. Harper, R. R. and Pittman, U. J., Yield loss in *B. campestris* and *B. napus* from systemic stem infection by *A. cruciferarum*, *Phytopathology*. **64:** 406 (1974).
10. Kolte, S. J., Disease management strategies for rapeseed-mustard crops in India, *Agriculture Review*. **6:** 81-88 (1985a).
11. Kolte, S. J., Sharma, K. D. and Awasthi, R. P., Yield losses and control of Downy mildew and White rust of rapeseed and mustard, Abst. Third Int. Symp. *Pl. Patho.*, IARI, New-Delhi, 14-18 Dec., 1981p. 70-71(1981).
12. Lakra, B.S. and Saharan, G.S., Correlation of leaf and staghead infection intensities of white rust with yield and yield components of mustard, *Indian J. Mycol. Plant Pathol*. **19:** 279-281(1989a).

13. Mukherjee, A. K., Mohapatra, T., Varshney, A., Sharma, R. and Sharma, R. P., Molecular mapping of a locus controlling resistance to *Albugo candida* in Indian mustard, *Pl. Breeding.* **120:** 483–487 (2001).
14. Nashaat, N. I. and Awasthi, R. P., Evidence for differential resistance to *Peronospora parasitica* (downy mildew) in accessions of *Brassica juncea* (mustard) at the cotyledon stage, *J. Phytopathol.* **143:**157-159(1995).
15. Nashaat, N. I. and Rawlinson, C. J., The response of oilseed rape (*Brassica napus* ssp *oleifera*) accessions with different glucosinolate and erucic acid contents to four isolates of *Peronospora parasitica* (downy mildew) and the identification of new sources of resistance, *Pl. Pathol.***43:** 278-285(1994).
16. Silue, D., Laviec, C. and Tirilly, Y., New sources of resistance in *Brassica oleracea* var *botrytis* to downy mildew caused by *Peronospora parasitica, J. Phytopathol*. **143:** 659-661 (1995).
17. Silue, D., Nashaat, N. I. and Tirilly, Y., Differential responses of *Brassica oleracea* and *B. rapa* accessions to seven isolates of *Peronospora parasitica* at the cotyledon stage, *Pl. Dis.* **80 (2):**142-144 (1996).
18. Yadav, M. S., Dhillon, S. S., Singh, K. and Brar, K. S., Screening of Indian mustard germplasm for resistance to Alternaria blight and white rust, *Plant Dis. Res.* **14(1):** 70-72 (1999).
19. Yadav, R. and Sharma, P., Genetic diversity for white rust (*Albugo candida*) resistance in rapeseed mustard, *Indian J. Agric. Sci.* **74(5):** 281-283(2004).