Indian Phytopath. 59 (3) : 314-317 (2006)

Development of Alternaria blight in genotypes of Indian mustard (*Brassica juncea* (L.) Czern. & Coss.) under field conditions

BRAJESH KUMAR[1] and S.J. KOLTE
Department of Plant Pathology, Govind Ballav Pant University of Agriculture and Technology, Pantnagar 263145
[1]Department of Plant Pathology, S.D.J.P.G. College, Chandeshwar, Azamgarh 276128

ABSTRACT: Development of Alternaria blight in relation to disease resistance components was assessed in nine genotypes of Indian mustard (*Brassica juncea*) under natural field conditions. Two genotypes *viz*., PR 8988 and PR 9024 exhibited slow blighting and had lowest number of spots /10 cm² leaf area, reduced spot size, least number of conidia per spot and lowest disease index on leaf and pod. The maximum disease development was recorded during 62 to 72 DAS on leaves and from 100 to 110 DAS on pods.

Key words: *Alternaria brassicae, Brassica juncea,* resistance, disease development

Indian mustard (*Brassica juncea* (L.) Czern. & Coss.) is an important *rabi* oil seed crop which is widely grown in northern belt of country. There are various factors for low productivity of this crop and diseases are the major factors. Among the diseases, Alternaria blight caused by *Alternaria brassicae* (Berk.) Sacc. is the major constraint in production of this crop (Kolte, 1985). Alternaria blight appears every year (endemic) and causes more than 17-18% loss of yield in mustard (Saharan, 1984; 1992). In addition to direct losses, Alternaria blight also affects the quality of the seed by reducing size, causing seed discolouration and reduced oil content (Kaushik *et al*., 1984). Therefore, the present study was carried out to evaluate disease resistant genotypes and to determine the time at which disease severity is maximum so that effective disease management strategy can be developed.

MATERIALS AND METHODS

Nine genotypes of Indian mustard were grown in a randomized block design, the plot size being 4 x 3 m² using three replications. To check the inter-plot effect of inoculum coming from adjacent plots, each plot was surrounded by one row of *Brassica alba* which is resistant to all the fungal diseases (Rai *et al.,* 1976).

The number of spots were counted per 10 cm² leaf area on different tagged leaves with the help of a glass slide, on which 5x2 cm² area was marked. Observations were taken randomly at four places per leaf lamina on upper surface of leaf, starting from lower most leaf to the uppermost fully developed leaves. This method of counting of spots was followed in all the successive observations. Average number of spots was calculated. Alternaria blight spots were also counted on siliquae one week prior to maturity of the plant. A total of twenty five siliquae @ 5 siliquae per plant per genotype per replication were observed and average number of spots per siliqua was calculated.

Randomly five plants were selected in each genotype for measuring the spot size. From each plant five leaves were randomly selected on which diameter of randomly selected spots were measured in mm. Average size of leaf spot in each genotype was calculated. Five largest spot per infected siliqua of the selected plants were measured and

*Corresponding author: brajkumar222@yahoo.co.in

average was calculated on the basis of fifty spots/ genotype.

The spore production in different genotypes at different intervals on spots of Alternaria blight, the affected leaves were thoroughly washed in running tap water and the lesion of similar size were taken at different intervals, and separated by cork borer (8 mm). These lesions were surface sterilized with 0.1% mercuric chloride and further washed repeatdly in sterilized distilled water. Sporulation was observed by suspending sporulated lesions in vials containing a mixture of distilled water + lactophenol in the ratio of 9 : 1. These lesions were then shaken vigourously and scrapped with the help of an camel hair brush. The conidia were counted with the help of a haemocytometer.

The infected pods of above genotypes were collected from the field at different intervals and thoroughly washed in running tap water. The pods were cut in 6 mm pieces containing single spot. Fifteen such surface sterilized pieces were incubated in Petriplates in a moist chamber for 48 h at room temperature (23 ± 2^0 C) with alternating 12 h light and 12 h dark periods. Conidia were counted as per method described above.

Twenty five leaves @ five leaves per plant per genotype were evaluated individually giving 0-5 rating scale based on leaf and pod area covered by spots, considering necrotic as well as chlorotic area as per method given by Conn *et al.* (1990).

RESULTS AND DISCUSSION

Significant differences among genotypes and time intervals were observed for all the components of disease resistance *viz*., number of spots, size of spots, number of conidia per spot and disease index.

Least number of spots (4.03) were recorded on leaf of genotype PR 8988 which was at par with. Kranti and PR 9024 but it significantly differed from others (Table 1). Genotype PR 9301 showed maximum number of spots (6.04) per 10 cm^2. It was found that number of spots significantly increased with time. However, maximum number of spots was recorded in the period from 62 to 72 DAS. Similarly significant least number of spots on pods were found on PR 9024 (15.7) followed by PR 8988 (17.2). The maximum number of spots on pod were recorded on PR 9301 (34.70) which significantly differed from all others followed by PR 8943.

The genotypes PR 9301 resulted with maximum spot size (9.89 mm) which was significantly greater than other genotypes. PR 9650 was the next genotype that showed 8.97 mm spot size. This genotype significantly differed from all others except Varuna. Significantly smallest spot size was recorded in PR 8988, PR 9024 and PR 8943 (Table 1). Genotype Divya showed intermediate spot size on leaves. Maximum rate of increase in leaf spot size was recorded during 62 to 72 DAS. Similarly, smallest spot size on pod was recorded in PR 8988 (2.30 mm). It was at par with PR 9024. The genotype PR 9650 showed the largest spot size (3.92 mm) on pods which is significantly differed from others.

Number of conidia per spot on leaf was significantly lowest in the genotype PR 9024 (1.46) while it was the highest in PR 9301 (3.10). In general, number of conidia per leaf spot increased from 42 DAS to 72 DAS, beyond which it decreased. On pod spots conidia appeared was observed only after 120 DAS (0.37). It increased significnatly upto 130 DAS (0.51). Significantly highest number of conidia per spot was observed in PR 9301 (0.66). Where as PR 8988 produced significanatly lowest number of conidia per spot (0.30).

The genotypes differed significantly among themselves regarding disease index on leaf (Table 2). Significantly lowest disease index was recorded for PR 9024 (49.93%) and PR 8988 (52.00%). Significnatly highest disease indices were recorded for PR 9301 (64.80%) and PR 9650 (62.62%). Disease index increased significantly with time from 42 DAS to 82 DAS. There were significant differences among the genotypes regarding the disease index on pods (Table 2). Kranti (38.50%) and PR 9024 (39.2%) showed significantly lowest disease indices, whereas the highest disease index was observed for PR 9301 (57.30%). Disease index on pod was found to increase significantly from 90 (13.3%) to 130 DAS (87.5%).

In the present study nine genotypes were examined for blight resistance. Among them, PR 9888 and PR 9024 exhibited high level of resistance while Kranti and PR 8943 showed moderate level of

Table 1. Number and size of spots of Alternaria blight development on leaves and pods of Indian mustard under field conditions

Genotype	No. and size of spots on leaf (DAS)					Mean	No. and size of spots on pod (DAS)**					Mean
	42	52	62	72	82		90	100	110	120	130	
Kranti	2.06 (5.40)	2.36 (5.70)	3.80 (5.73)	5.23 (9.09)	7.10 (10.00)	4.11 (7.18)	5.00 (1.16)	9.50 (2.16)	25.30 (2.66)	31.30 (3.66)	34.60 (4.00)	20.20 (2.73)
Varuna	2.16 (6.40)	2.76 (7.70)	4.20 (8.16)	6.23 (10.60)	8.46 (11.90)	4.76 (8.85)	10.3 (1.66)	18.00 (2.16)	26.60 (3.00)	43.00 (4.16)	51.60 (4.40)	29.20 (3.08)
PR 9650	2.23 (6.16)	3.66 (7.00)	5.13 (8.83)	7.56 (10.66)	8.93 (12.20)	5.50 (8.97)	9.0 (2.00)	14.60 (2.66)	24.60 (3.33)	36.60 (4.23)	45.0 (4.76)	25.80 (3.92)
Krishna	2.16 (6.00)	2.66 (6.23)	3.93 (7.46)	6.13 (9.96)	8.03 (10.53)	4.58 (8.00)	6.0 (1.33)	11.70 (2.00)	21.60 (3.00)	34.00 (4.00)	42.60 (4.33)	22.90 (2.93)
PR 8988	1.63 (4.96)	2.43 (6.00)	3.93 (6.40)	5.83 (7.66)	6.33 (10.00)	4.03 (7.00)	5.60 (1.16)	8.30 (1.66)	19.30 (2.16)	25.30 (3.00)	27.30 (3.50)	17.20 (2.30)
PR 9301	2.56 (7.83)	3.80 (8.50)	5.53 (9.73)	8.80 (11.30)	9.53 (12.50)	6.04 (9.89)	9.60 (2.00)	19.00 (3.16)	34.00 (3.66)	44.00 (4.83)	67.00 (4.80)	34.70 (3.64)
PR 9024	1.53 (5.53)	2.50 (6.10)	3.80 (6.43)	6.06 (7.43)	6.46 (10.08)	4.07 (7.13)	6.00 (1.16)	8.30 (1.66)	16.60 (2.16)	22.00 (3.16)	25.60 (3.60)	15.70 (2.35)
PR 8943	1.43 (5.03)	2.53 (6.26)	3.90 (6.80)	6.23 (7.30)	7.83 (11.66)	4.39 (7.21)	6.00 (1.16)	10.30 (2.00)	18.60 (2.50)	32.00 (4.00)	37.00 (4.23)	20.80 (2.78)
*Divya	2.30 (5.96)	3.06 (6.10)	4.55 (6.46)	5.73 (9.36)	6.80 (10.30)	4.40 (7.66)	10.0 (1.50)	16.60 (2.33)	27.60 (3.16)	32.30 (4.00)	41.30 (4.46)	25.60 (1.17)
Mean	2.01 (5.92)	2.88 (6.57)	4.31 (7.29)	6.42 (9.28)	7.71 (10.70)	4.66 (7.90)	7.50 (1.46)	12.80 (2.20)	23.30 (2.85)	33.40 (3.95)	41.20 (4.23)	23.60 (2.94)
C.D. at 5%	Genotypes			0.250 (0.570)					1.580 (0.230)			
	Intervals			0.190 (0.420)					1.180 (0.170)			

* In the case of genotype Divya, observations on pods were taken at 70, 80, 90, 100 and 110 DAS

** DAS = Days After sowing

Values in the brackets are size of spots.

Table 2. Disease index (%) of Alternaria blight on leaves and pods of Indian mustard genotypes under field conditions

Genotype	Disease index (%) on leaves (DAS)					Mean	Disease index (%) on pods (DAS)**					Mean
	42	52	62	72	82		90	100	110	120	130	
Kranti	28.66	32.00	47.66	71.00	85.33	52.93	11.6	24.0	31.3	53.0	72.6	38.5
Varuna	32.00	36.00	58.33	82.33	93.66	60.46	11.6	26.0	62.3	72.3	94.0	54.2
PR 9650	33.00	37.00	61.33	85.66	95.66	62.62	16.3	24.6	64.3	71.3	98.3	55.0
Krishna	28.66	32.33	48.66	80.00	88.66	55.66	11.6	21.6	55.0	64.0	87.6	47.8
PR 8988	26.66	32.66	40.66	65.00	84.66	49.93	10.6	20.0	47.3	58.3	76.0	42.4
PR 9301	32.00	39.00	68.00	88.66	97.00	64.80	17.3	26.3	68.6	75.6	98.6	57.3
PR 9024	25.63	28.33	48.66	73.00	84.33	52.00	8.6	18.6	38.3	51.3	79.0	39.2
PR 8943	26.66	33.00	45.00	73.00	87.33	53.00	10.0	20.0	47.6	62.3	88.6	45.5
*Divya	27.73	29.66	49.00	76.00	88.00	54.00	17.6	23.0	49.3	68.7	93.3	50.3
Mean	29.03	33.37	51.92	77.22	89.25	56.16	13.3	22.7	51.5	64.7	87.5	47.8
C.D. at 5%	Genotypes			2.960				1.800				
	Intervals			2.200				1.340				

* In the case of genotype Divya, observations on pods were taken at 70, 80, 90, 100 and 110 DAS

**DAS = Days After Sowing

resistance. Rest of the genotypes were found susceptible. Various workers have evaluated slow blighting resistance using different assessement criteria. The reduced size of spot indicated the resistance reaction, while the increased spot size indicated susceptibility. Therefore, the size of spot can be used as a parameter of resistance. Similar results were reported by Kadian and Saharan (1983) and Bansal (1990).

Number of spots per unit area is an important parameter of disease development because greater number of spots cover more leaf area. Therefore this component could be used to assess the resistance. Similar observations were recorded by Saharan and Kadian (1983) and this parameter was considered as resistance component by Conn *et al*. (1990) and Awasthi *et al*. (1994). However, Ricker *et al*. (1985) were of the view that number of spots per unit area could not be used as a component of resistance. Although number of conidia per spot differed among genotypes they reduced at later periods of crop growth. Also, the number conidia per spot was not clearely related with the size of spot. Slow blighting is a form of incomplete or partial resistance controlled by a number of genes with small effects and it is more durable. Genotype PR 8988 and PR 9024 showed good level of partial resistance and therefore, these genotypes can be effectively used in breeding programme for development of disease resistant varieties and integrated disease management programme. In the present study, development of disease was found greater during 62 to 72 DAS on leaves and 100 to 110 DAS on pods. Therefore, this period of disease development should be considered better for spraying schedule for disease management strategy.

REFERENCES

Awasthi, R.P. and **Kolte, S.J.** (1994). Epidemiological factors in relation to development and prediction of *Alternaria blight* of rapeseed and mustard. *Indian Phytopath.* **47:** 322-326.

Bansal, V.K., Seguin-Swartz, Rakow, G.F.W. and **Petrie, G.A.** (1990). Reaction of *Brassica* species to infection by *Alternaria brassica*e. *Can. J. Plant Sci.* **70:** 1159-1162.

Conn, K.L., Tewari, J.P. and **Awasthi, R.P**. (1990). A disease assessment key for Alternaria black spot in rapeseed and mustard. *Can. Plant Dis. Surv.* **70:** 1.

Kadian, A.K. and **Saharan, G.S.** (1983). Symptomatology, host range and assessment of losses due to *Alternaria brassica*e infection in rapeseed and mustard. *Indian J. Mycol. Pl. Pathol.* **13:** 319-323.

Kaushik, C.D., Saharan, G.S. and **Kaushik, J.C.** (1984). Magnitude of losses in yield and management of Alternaria blight in rapeseed-mustard. *Indian Phytopath.* **37:** 398 (Abstr.).

Kolte, S.J. (1985). *Diseases of Annual Edible Oil Seed Crops*. Vol. II, CRC Press, Boca Raton Florida, USA, pp. 135.

Parlevliet, J.E. (1979). Components of resistance that reduced the rate of epidemic development. *Ann. Rev. Phytopath.* **17:** 203-222.

Rai, B., Kolte, S.J. and **Tiwari, A.N.** (1976). Evalution of olieferous Brassica germplasm for resistance to *Alternaria* leaf blight. *Indian J. Mycol. Pl. Pathol.* **6:** 76-77.

Richer, M.D., Beute, M.K. and **Campbell, C.I.** (1985). Components of resistance in peanut to *Cercospora arachidicola*. *Pl. Dis.* **69:** 1059-1064.

Saharan, G.S. and **Kadian, A.K.** (1983). Physiologic specialization in *Alternaria brassicae*. *Cruciferae Newsl.* **8:** 32-33.

Saharan, G.S. (1984). A review of research on rapeseed-mustard pathology in India. Paper presented in the Annual Rabi Oilseed Workshop held at Jaipur, 6-10 August, 1984.

Saharan , G.S. (1992). Management of rapeseed and mustard diseases. In: *Advances in Oilseed Research*. D. Kumar and M. Rai (eds). Science Publication, Jodhpur, India. Vol. I, Chapter **7:** 152-188.

Van der Plank, J.E. (1968). *Disease resistance in plants*. Academic Press, New York, pp. 194.

Received for publication February 23, 2005