ASSESSMENT OF LOSSES EPIDEMIOLOGY AND MANAGEMENT OF BLACK SPOT DISEASE OF RAPESEED-MUSTARD

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INTRODUCTION

Black spot or Alternaria blight caused by Alternaria brassicae (Berk.) Sacc. is the most serious and widespread disease of rapeseed-mustard. Amongst the oil yielding Brassica crops, yield losses are heavier in Brassica campestris var. yellow sarson followed by B. campestris brown sarson and B. juncea (Kadian and Saharan 1983). Environmental optima for A. brassicae conidial germination and host infection has been worked out (Kadian and Saharan 1984). The role of prevailing environmental conditions under field on the progression of disease has been studied (Saharan and Kadian 1984). The disease has been managed through different chemicals (Kolte and Tewari 1978; Tripathi et al. (1987). Present paper deals with critical analysis of factors affecting assessment of yield losses, disease development in relation to prevailing environmental conditions and management of disease.

MATERIALS AND METHODS

To assess the losses caused by black spot, rapeseed-mustard crops were sown in 3x3.5 m size plots. Different intensities of the disease were created in the field on foliage and/or pods by spraying difolatan and pathogen inoculum. The disease severity on foliage and/or pods was computed on 0-5 rating scale after 90 days of sowing. The effect of each category of infection on foliage and/or pods on yield components viz., pod length, number of seeds per pod, number of infected seeds per pod, 1000 seed weight, per cent seed germination and oil content was estimated.

The disease progression under field conditions was measured on 25 marked leaves of susceptible mustard cv. Prakash. The observations on increase in number and size of lesions were recorded at an interval of 7 days till the senescence of the leaf. The effect of host resistance on progression of disease was measured on cvs RC 781, Tower and Prakash in terms of number of infected leaves, number and size of lesions per infected leaf at an interval of seven days. The different weather variables viz., maximum temperature (MXT), minimum temperature (MNT), mean temperature (MT), mean relative humidity (MRH), rainfall (mm), and wind velocity (km/hr) prevailing during the period of study were analysed for their effect on development of disease under field conditions. The effect of temperature, relative humidity and period of leaf wetness was studied on conidial germination and host infection. The host resistance was measured through number of lesions, size of lesions, latent period, sporulation capability and infection rate of A. brassicae on cvs RC 781, Tower and Prakash.

For fungicidal control of the disease B. juncea (cv RH 30), B. campestris var. brown sarson (cv BSH-1) and B. campestris var. yellow sarson (cv YSPB-24) were sown on 3.0x4.5 m size plots in three replications. Captafol, mancozeb, zineb and blitox-50 (0.2 per cent w/v) were sprayed four times at an interval of 15 days. First spray was given after 30 days of sowing. Suitable control was maintained. Disease intensity and yield was recorded.

To find out the optimum growth stage of B. juncea for fungicidal

control of black spot the crop (cv RH 30) was sown on 2.7 x 3.5 m size plots in four replicates. Captafol (0.2 per cent w/v) was sprayed after 30, 45, 60, 75 and 90 days of sowing at an intervalof 15 days. The data on disease intensity and yield was taken.

RESULTS

Assessment of losses

The effect of black spot infection on yield and yield components was more pronounced due to pod infection than foliage. However, severe infection on foliage caused considerable yield losses in rapeseed-mustard crops. The maximum loss in yield up to 35 per cent was revealed in B. campestris var. yellow sarson followed by 33.5 per cent in B. campestris var. brown sarson and 32 per cent in B. juncea. It was observed that with the each ten per cent increase in disease intensity there was reduction in one Q/hac of yield. When disease intensity on foliage was more than 65 per cent than subsequent increase in disease caused 20 to 35 per cent reduction in yield. The superficial lesion formation on pods had little effect on yield and yield components of rapeseed-mustard but deep lesions on pods reduced the yield significantly. It was observed that with the increase in disease intensity on pods there was reduction in pod length, number of seeds per pod, 1000 seed weight, per cent seed germination, per cent oil content and increase in number of infected seeds per pod as compared to healthy pods. It is evident from the data (Table 1) that the increase in number of deep lesions on pods caused steep rise in number of infected seeds per pod and sharp decline in per cent seed germination and per cent oil content of rapeseed-mustard crops.

Epidemiology

A leaf wetness period of 16-24 h, temperature of 25°C and relative humidity around 90% was found most congenial for A. brassicae conidial germination and host infection. The temperature regimes higher and lower than 20-25°C caused reduction in infection frequencies coupled with reduction in number and size of lesion formation. The periodical and cumulative increase in number and size of lesion per leaf of susceptible cv. Prakash was highest and lowest in Tower a resistant one. On tower infection was delayed up to 25 days with very few lesions (0.95) of restricted size. The per cent infected leaves per plant were only 15.6% in cv Tower as compared to 36.5% in cv Prakash. Maximum disease development was observed during the period when there was MXT from 10.5-22.5°C, MNT from7.5-10.5°C, MT from 14.5-15.5°C, MRH from 65.5-80.5%, wind velocity from 4.5-8.0 km/ha and rainfall from 0.5-2.5 mm. Abrupt temperature fluctuation arrested disease progression. In susceptible cv Prakash closer plant spacing (30x15 cm), high doses of nitrogen (> 80 kg N/hac.) and intermittent winter rains favoured faster disease development.

In resistant cvs viz., Tower and RC 781 higher latent period of 16 and 12 days respectively was noticed compared to 3 days in cv Prakash. In cvs Tower and RC 781, 82 and 90 conidia per lesion were produced whereas in cv Prakash more than 265 conidia per lesion were recorded. The apparent infection rate (r) of A. brassicae in cvs Tower, RC 781 and Prakash was 0.05, 0.09 and 0.46 respectively.

Disease management

All the four fungicides used reduced black spot severity on rapeseed-mustard crops (Table 2). Captafol when applied @ 0.2 per cent

Table 1. Effect of black spot on number of infected seeds per pod (a) per cent seed germination (b) and per cent oil content of rapeseed-mustard

Infection category	*B. juncea*			*B. campestris* var. brown sarson			*B. campestris* var. yellow sarson		
	a	b	c	a	b	c	a	b	c
0	0	95.5	40.5	0	96.5	43.5	0	95.0	45.7
1	0	95.0	40.0	0.54	96.0	43.2	0.85	94.0	45.0
2	0.85	91.5	37.8	2.76	82.5	42.5	2.56	90.5	44.0
3	2.40	83.0	37.0	3.90	80.0	40.3	2.96	79.5	43.2
4.	3.62	71.5	36.5	4.95	69.5	36.9	3.69	65.0	39.0
5	6.56	50.5	32.0	5.50	42.0	34.9	4.50	41.5	34.5
	-	-0.97	-0.89	-	-0.92	-0.87	-	-0.86	-0.90

0 = healthy pods, 1 = minute superficial lesions on pods, 2 = one to two deep lesions on pods, 3 = three to five deep lesions on pods, 4 = five to eight deep lesions on pods and 5 = more than nine deep lesions on pods.

Table 2. Efficacy of fungicides in reducing black spot severity on rapeseed-mustard

Fungicides	*B. juncea*		*B. campestris* var. yellow sarson		*B. campestris* var. brown sarson	
	Disease intensity (%)	Yield (Q/ha)	Disease intensity (%)	Yield (Q/ha)	Disease intensity (%)	Yield (Q/ha)
Captafol	15.6 (25.46)	22.26	20.5 (25.43)	12.5	19.6 (23.67)	13.4
Mancozeb	20.5 (26.67)	21.89	24.6 (30.34)	12.3	22.4 (29.67)	12.7
Zineb	30.3 (34.46)	20.40	35.7 (42.82)	10.4	33.6 (44.61)	11.2
Blitox-50	42.5 (41.64)	20.56	48.5 (52.48)	9.2	47.4 (51.52)	9.5
Control	69.8 (67.35)	18.46	79.6 (74.34)	6.5	74.6 (69.23)	7.2
C.D. at 5%	3.24		3.46		3.86	

Figures in parentheses are angular transformed values.

Table 3. Optimum growth stage of *B. juncea* for reducing black spot through fungicidal sprays

Fungicidal[1] spray after days of sowing	Disease intensity (%)	Yield (Q/ha)
30	15.5	21.5
45	19.0	21.3
60	40.6	18.2
75	49.5	17.0
90	65.5	15.0
Control	75.5	12.0
C.D. at 5%	3.53	

1. Captafol (0.2%) was sprayed.

w/v four times at an interval of 15 days reduced disease intensity from 69.8% in control to 15.6% in B. juncea, from 79.6% to 20.5% in B. campestris var. yellow sarson and from 74.6% to 19.6% in B. campestris var. brown sarson alongwith higher yields. Mancozeb closely followed the captafol in its efficacy in reducing the disease and increasing the yield in these crops. However, performance of zineb and blitox 50 was not up to the mark.

The optimum time for application of fungicides on B. juncea crop was found to be 30 to 45 days after sowing. When captafol was sprayed after 30-45 days of sowing, it reduced disease intensity from 75.5% in control to 15.5% with 21.5 Q/hac of yield. Fungicidal sprays after 60 days of sowing could not arrest the disease and there was significant decrease in yield (Table 3). Three to four fungicidal sprays applied at proper growth stage of the crop managed the black spot disease with more than 9 Q/hac increase in yield as compared to unsprayed plots.

DISCUSSION

Serious quantitative and qualitative losses due to black spot infection in Brassica crops have been reported (Degenhardt et al. 1974; Chahal and Kang 1978; Kadian and Saharan 1983; Tripathi et al. 1987). Present study reports the correlation of disease intensity on foliage and/or pods in yield losses by affecting yield contributing components. It was found that in each crop deep lesion formation on pods caused heavy yield losses and each ten per cent increase in disease on foliage reduced yield significantly. A 0-5 rating scale for assessing pod infection has been suggested.

On susceptible and resistant cvs A. brassicae infection and progression was measured. For conidial germination and host infection, 16-24 h leaf wetness, 20-25°C temperature and 90% relative humidity was found most congenial. Under field conditions on rapeseed-mustard disease developed very fast on plants with closer spacing (30x15 cm) receiving high doses of nitrogen (>80 kg N/ha) when there was 12-25°C temperature, >70% relative humidity, 2-5 km/h wind velocity and intermittent winter rains. It is in accordance with the earlier reports (Kadian and Saharan 1984; Saharan and Kadian 1984). As reported earlier (Saharan and Kadian 1983) infection rate of A. brassicae was observed to be high in susceptible cv Prakash (0.46) as compared to in resistant cvs Tower (0.05) and RC 781 (0.09).

Three to four fungicidal sprays of captafol (0.2%) or mancozeb (0.2%) starting after 30-45 days of sowing reduced black spot infection on rapeseed-mustard with higher yields. Delay in fungicidal sprays after 60 days of sowing could not arrest the disease and there was significant adverse effect on yield. The use of captafol and mancozeb have been advocated earlier also (Kolte and Tewari 1978; Tripathi et al. 1987).

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