Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 516-518
Received: 05-11-2018
Accepted: 08-12-2018

Jay Kumar Yadav
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

HK Singh
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

SK Singh
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Sandeep Kumar
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Divya Singh
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Ravindra Kumar Pandey
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Correspondence
Jay Kumar Yadav
Department of Plant Pathology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Effect of sowing dates on development of downey mildew disease in Indian mustard (*Brassica juncea* L.)

Jay Kumar Yadav, HK Singh, SK Singh, Sandeep Kumar and Divya Singh

Abstract
Downy mildew caused by *Peronospora brassicae* (Pers. ex Fr.) Fr. is one of the most common and destructive disease of Indian mustard [*Brassica juncea* (L.) Czern & Coss.] The experiments were conducted under field condition to develop effective management strategies for this disease through evaluation of date of sowing. Therefore, series of experiments were conducted during 2015-2016 at Genetics and Plant Breeding Farm, N. D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) to find out the appropriate sowing time to minimize the Downey mildew disease severity and maximum yield. The sowing dates w***as*** 01 October (D1), 10 October (D2), 20 October (D3), 30 October (D4), 10 November (D5), 20 November (D6), 30 November (D7) and 10 December (D8), 2015 after 10 days intervals. Over all on the basis of pooled data of different time intervals the maximum incidence (20.92%) was also recorded in the plots sown on 10th November, 2015. In contrastingly, it was minimum (0.73) in plots sown on 1st October, 2015 and highest AUDPC was recorded in 10th November, 2015 sown crops and minimum is recorded as a 1st October, 2015 (15)**.** On the basis of experimentation it was concluded that early sown crops (Ist Fortnight of October) escaped the disease as compared to its delayed sowings (2nd Fortnight of October, 1st and 2nd Fortnight of November). Management of the Downey mildew disease through manipulation of date of sowing is a cheapest and best method of disease control.

Keywords: Date of sowing, downey mildew, development

Introduction
Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is a winter *Rabi* season crop requires 18 ^{0}C to 25 ^{0}C temperature, low humidity, without any role of rains during flowering. Rainfall, high humidity and cloudy weather are not good for the crop during winter as it invites disease and the crop gets spoiled completely. However, under rain fed conditions, 1 or 2 pre-flowering rains help in boosting the seed yield. Excessive cold and frost are harmful to the crop. *Toria* is more liable to suffer from frost and cold and is, therefore, usually sown earlier and harvested before the onest of frost. The crops are long day in periodic response and are not drought tolerant. They require an annual precipitation of 35-45 cm and do not tolerate water logging.

The world leader in rapeseed and mustard growing countries of the world are India, Canada, China, Pakistan, Bangladesh, Germany, France, Sweden and Poland. In India, it had the area of 6.5 mha with production of 7.8 mt and productivity of 1208 kg/ha. India contributes 28.3% and 19.8% in world acreage and production, respectively and had ranks second after China in the world in respect of acreage and third in production after China and Canada. In India its cultivation is mainly confined to U.P., M.P., Rajasthan, Haryana, Assam, Gujarat, and West Bengal. Among the entire oilseed crops producing states, in U.P. it was grown on 6.39 lakh ha with production of 7.9 lakh metric tonnes and productivity of 1236 Kg/ha and had ranks third in area after M.P. and Rajasthan and second in production after Rajasthan. (Anonymous, 2013) [1].

Among the various abiotic and biotic factors behind lower productivity and oil content, the fungal foliar diseases like Alternaria blight caused by *Alternaria brassicae* (Berk) Sacc. and *Alternaria brassicicola* (Schwein) Wiltshire, white rust caused by *Albugo candida* (Pers. ex Lev.) Kuntze, downy mildew caused by *Peronospora brassicae* (Pers. ex Fr.) Fr. and powdery mildew caused by *Erysiphe cruciferarum* Opiz ex. Junell are widely prevalent under Eastern U.P. conditions**.**

Among the diseases, downy mildew disease may appear simultaneously with white rust and is now reported to occur in all the important rapeseed-mustard growing states of the country such as Uttar Pradesh, Bihar, Punjab, Haryana, Rajasthan, West Bengal etc.

Bains and Jhooty (1979) have reported that due to white rust in association with downy mildew a reduction of 37-41 percent in siliquae and 17-32 percent in seed yield may occur. Substantial work has been done on different aspects of these diseases in case of Indian mustard. Keeping in view the importance of disease, it was necessary to investigate further, to find out the effectiveness of sowing dates on severity of the this diseases.

Materials method

The experiment was conducted Genetics and Plant Breeding Farm at N. D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during the *rabi* season 2015-2016 with eight different sowing dates. The experiment was conducted in randomized block desighn having 4m x3m plot size with 30cm x 10cm plant spacing plant to plant and row to row in three replications Indian mustard susceptible variety ' Varuna' was sown as per treatment. Fertilizer was applied in the ratio of 120:60:60 kg of NPK in the form of urea, single super phasphate and murate of potash, respectively. Half dose of nitrogenous and full dose of potash and phasphorus were applied in furrows as basal dose at the time of sowing, remaining half dose of nitrogenous fertilizer was given as top dressing after first irrigation. The sowing dates w***as*** 01 October (D1), 10 October (D2), 20 October (D3), 30 October (D4), 10 November (D5), 20 November (D6), 30 November (D7) and 10 December (D8), 2015 after 10 days intervals, respectively.

After germination, the crop was regularly watched for appearance of the disease and severity was recorded on blighted proportion of whole plant basis visually on 5 randomly selected plants per row leaving the border row plants by using 0-9 point scale for disease rating as suggested in the proceeding of All India Co-ordinate Research Project on Rapeseed and Mustard Pathology, Planning and Review Session 2013-14. The observation was recorded as a date of appearance of disease in each treatment, Maximum disease severity (%) and seed yield per plot (q/h). The percent disease intensity (PDI) was calculated by following formula.

$$\text{PDI (\%)} = \frac{\text{Sum of all the disease rating}}{\text{Number of plant observed} \times \text{Maximum disease grading}} \times 100$$

The area under the disease progress curve (AUDPC) is commonly used to quantify disease intensity over time. It is useful in part because it integrates the amount of disease over time, rather than at a particular time point. The AUDPC is calculated in order to compare cultivars or treatments. It is most frequently calculated using the midpoint rule method (Campbell and Madden, 1990) [3]. The details of the formula are as follows

$$\text{AUDPC} = \sum_{i=1}^{n} [(Y_i + {}_1 + Y_1) \times 0.5] [T_i + {}_1 - T_1$$

Where,

y = Percentage of affected foliage at each reading.

t = Time in days of each reading.

n = Total number of readings.

Result and Discussion

The downy mildew disease incidence was recorded for the first time on 18.11.2015, in the plots sown on November 10th, 2015. Likewise, in the plots sown on 20th November, the downy mildew appeared on dated 28.11.2015 after 10 days of sowing. It is evident that the disease appeared at the crop age of 8 days means just after emergence, irrespective of the weather parameters. Downy mildew disease severity was also found significantly at par in the plots sown on 10th as well as 20th November, 2015.

The maximum disease severity (4.50%) after 10 days of sowing was recorded in 20th November, 2015 sown plots. Likewise, after 17th days of sowing, the maximum disease severity (17.66%) persisted in the same plots indicating the similar pattern. The 1st October, 2015 sown crops were found again free after 17th days of sowing. Likewise, after 24th days of sowing, the maximum disease severity (40.75%) persisted in the same plots indicating the similar pattern. The minimum severity (2.17) after 24th days of sowing was recorded in the plots sown on dated 1st October 2015.The disease severity in both 30th October, 2015 and 10th November, 2015 sown crops were significantly at par with 24 days sowing which was maximum at the stage (Table -1).

Over all on the basis of pooled data of different time intervals the maximum incidence (20.92%) was also recorded in the plots sown on 10th November, 2015. In contrastingly, it was minimum (0.73) in plots sown on 1st October, 2015. Accordingly it may be concluded that the early sown crop escaped from the disease (Table-1). The AUDPC of downy mildew ranged from 15 to 424 in different dates of sowing. The 10th November, 2015 sown crops was recorded highest AUDPC (424) followed by 20 November, 2015 (366), 30 October, 2015 (356), 30 November, 2015 (271), 20 October, 2015 (179), 10 December, 2015(134), 10 October, 2015(38), and 1st October, 2015 (15) (Table -1). The maximum disease severity (4.50%) after 10 days of sowing was recorded in 20th November, 2015 sown plots. Likewise, after 17th days of sowing, the maximum disease severity (17.66%) persisted in the same plots indicating the similar pattern. The 1st October, 2015 sown crops were found again free from disease after 17th days of sowing. Likewise, after 24th days of sowing, the maximum disease severity (40.75%) persisted in the 10th November, 2015 sown plots indicating the similar pattern with present findings. Different workers have also reported that infection of downy mildew on cotyledons started by the end of October and progress upto November and crop planted after mid-November escaped downy mildew infection (Kolte *et al.*, 1986, Mehta, 1993, Saharan *et al.*, 1997 and Singh and Singh 2005) [4, 5, 9, 8].

The incidence of downy mildew was again noted when the individual plants were observed critically in combination of white rust. White rust incidence was noted singly but at flowering and later stage, the incidence of downy mildew could not be visualized singly. These observations confirm the findings of Mehta and Saharan (1998) [6] in India who obtained infection of mustard foliage starts by the end of October (cotyledon stage) and progressed up to November. The crop planted after mid November may not contract downy mildew. However, downy mildew growth as a mixed infection with white rust on floral parts can be seen up to March (Mehta and Saharan, 1998) [6]. Bains and Jhooty (1978) [2] reported that downy mildew pathogen produced heavy infection and sporulation in plants of *B. juncea.*

Mehta (2014) [7] also reported the downy mildew alone or in combination with white rust is responsible for causing severe losses in yield of several temperate and tropical brassicaceous crops particularly rapeseed-mustard. Yield losses due to downy mildew infection alone are very difficult to estimate, since in most cases, it is always associated with white rust.

On the basis of experimentation it was concluded that early sown crops (I[st] Fortnight of October) escaped the disease as compared to its delayed sowings (2[nd] fortnight of October, 1[st] and 2[nd] fortnight of November) also recomended for early sown crop management of this devastating disease.

Table 1: Effect of date of sowing on Downy mildew severity on cotyledons

S. No.	Date of sowing	Appearance of Disease	Percent Disease Severity			Mean	AUPADC	Yield (q/h)
			Days after sowing (DAS)					
		DAS/ Date	10	17	24			
1	1 Oct. 2015	24 24-10-2015	0.00 (0.00)	0.00 (0.00)	2.17 (8.47)	0.73	15	20.41
2	10 Oct. 2015	20 30-10-2015	0.00 (0.00)	0.00 (00.00)	5.47 (13.53)	1.82	38	19.99
3	20 Oct. 2015	16 06-11-2015	0.00 (0.00)	6.25 (14.48)	19.35 (26.10)	8.53	179	19.16
4	30 Oct. 2015	18 18-11-2015	0.00 (0.00)	12.36 (20.58)	38.47 (38.33)	16.94	356	16.66
5	10 Nov. 2015	8 18-11-2015	4.35 (12.04)	17.66 (24.85)	40.75 (39.67)	20.92	424	14.99
6	20 Nov. 2015	8 28-11-2015	4.50 (12.25)	16.46 (23.94)	33.51 (35.37)	18.15	366	10.83
7	30 Nov. 2015	7 07-12-2015	2.65 (9.37)	9.45 (17.90)	27.87 (31.87)	13.32	271	6.24
8	10 Dec. 2015	11 23-12-2015-	0.00 (0.00)	5.76 (13.89)	13.33 (21.41)	6.36	134	4.16
		Mean	1.43	8.49	22.61			
		C.D.	1.362	1.761	1.786			
		SEm±	0.445	0.575	0.583			

References

1. Anonymous. Agriculture Outlook and Situation Analysis Reports. Under the Project Commission by the National Food Security Mission. Ministry of Agriculture (NCAER), 2013, 24.
2. Bains SS, Jhooty JS. Increased susceptibility of virus infected *Brassica juncea* to *Pernospora parasitica*. Pl. Dis. Reptr. 1978; 62:1043-46.
3. Campbell CL, Madden LV. Introduction to plant disease epidemiology. John Wiley & Sons, New York City, 1990.
4. Kolte SJ, Awasthi RP, Vishwanath. Effect of planting dates and associated weather factors on staghead phase of white rust and downy mildew of rapeseed and mustard. Indian J Mycol. Pl. Pathol. 1986; 16:94-102.
5. Mehta N. Epidemiology of white rust and downy mildew disease complex in mustard and residual toxicity of fungi toxicant. Ph.D. Thesis, C.C.S. Haryana Agriculture conversely, Hisar, Haryana; India, 1993, 154p.
6. Mehta N, Saharan GS. Effect of planting dates on infection and development of white rust and downy mildew disease complex in mustard. J Mycol Pl. Path. 1998; 28:259-265.
7. Mehta N. Epidemiology and forecasting for the management of rapeseed- mustard disease. J Mycol. Plant Pathol. 2014; 44(2):131-147.
8. Singh RB, Singh RN. Status and management of foliar diseases of timely sown mustard in mid eastern India. Pl. Dis. Res. 2005; 20(1):18-24.
9. Saharan GS, Verma PR, Nashaat NI. Monograph on Downy mildew of crucifers. Saskatoon Research Centre Technical Bulletin 1997-01, Research Branch Agricultural and Agri-Food Canada, 1997, 76-88.