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SURVEY ON PEARL MILLET BLAST INCIDENCE AND SEVERITY IN MAJOR PEARL MILLET GROWING DISTRICTS OF HARYANA

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SUMMERY

The incidence of pearl millet blast has increased tremendously and being noticed over the varieties and commercially grown hybrids in the pearl millet growing regions of the country. Pearl millet blast has emerged as a very serious threat to the production of pearl millet fodder and grain in the changing climate resulting economic losses to the growers. To know the incidence and severity of the disease a survey was carried out during *kharif* season 2020-21 and 2021-22 in major pearl millet growing districts of Haryana *viz.,* Bhiwani, Mahendragarh, Rewari, Hisar, Charkhi Dadri, Gurugram, Jhajjar and Nuh. The results of survey reveals that the maximum mean disease incidence was recorded in Bhiwani district (71.92 %) followed by Mahendragarh (67.1 %), Hisar (57.88 %), Charkhi Dadri (53.92 %), Rewari (53.35 %) and Jhajjar (50.35 %) while the minimum disease incidence (38.74%) was recorded in Nuh district. The disease severity was ranged from 30.04 % to 56.36 % in year 2020-21 whereas, it was ranged 34.93 % to 60.01 % in 2021-22 this might be due to the more favourable environmental conditions as there were more rainfall and humidity in year 2021-22.

Key words : Pearl millet, blast, fodder, grain, disease incidence, severity

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] belongs to family *poaceae* is an important cereal food grain and fodder crop which is profusely adapted to cultivation over a range of tropical and subtropical climates in Asia and Africa with very low inputs (Arya *et al*., 2014). Pearl millet was domesticated as a fodder and cereal crop in Africa more than 3000 years ago and subsequently introduced into India. It is grown as a nutrient-rich food source for humans and a highly palatable and nutritious forage crop for livestock. Besides, food for human consumption, the grain is also used for poultry feed, swine and catfish diets (Andrews and Kumar, 1992) and some industrial uses. Bajra grains contain about 11.6 per cent protein, 5 per cent fat, 67.5 per cent carbohydrates and about 2.3 per cent mineral (Yadav *et al.,* 2016). It is cultivated over an area of 7.65 million hectares with a production of 10.86 million tones and productivity of 1420 kg/ha in India. In India, about 90 per cent of its cultivation and production is primarily contributed by five states *viz.,* Rajasthan, Gujarat, Uttar Pradesh, Haryana and Maharashtra. In Haryana, it is grown in a 5.69 lakh hectares area with 13.50 lakh metric tonnes of production with productivity 2372 kg/ha (Anonymous, 2020).

The pearl millet cultivation for subsistence food, feed and fodder has been expanding into non-traditional regions of the world (Yadav *et al*., 2013). Pyricularia leaf spot or pearl millet blast caused by *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*) has emerged as a very serious threat to the production of pearl millet fodder and grain in the changing climate (Chandra *et al.,* 2017). The disease has been found to have significant adverse effects on green forage yield and digestible dry matter (Wilson and Gates, 1993; Raj *et al*., 2014). Pearl millet blast disease prevalence has increased at a terrifying rate on dual purpose (fodder and grain) pearl millet commercial hybrids (Lukose *et al.,* 2007; Thakur *et al.,* 2009). Lubadde *et al*. (2014) observed that among the pearl millet diseases leaf blast had the highest disease severity range (43.61 to 67.67%) and had a non-significant negative correlation with grain and forage yield. The range of pearl millet blast incidence was recorded from 1.0 to 60.0 per cent in Rajasthan, Madhya Pradesh, Maharashtra Tamil Nadu Gujarat and Karnataka in field surveys during 2014-2015 (Chandra *et al.,* 2017). Therefore, a survey attempt was made to know the occurrence and severity of pearl millet blast during 2020-21 and 2021-22 in major pearl millet growing districts of Haryana.

MATERIALS AND METHODS

The intensive survey was carried out during *kharif* season 2020-21 and 2021-22 in major pearl millet growing districts of Haryana *viz.,* Bhiwani, Mahendragarh, Rewari, Hisar, Charkhi Dadri, Gurugram, Jhajjar and Nuh to record the incidence and severity of blast disease on pearl millet. The survey was conducted in five villages selected randomly from each district. In the selected villages five fields were selected and from every field an area of 1 m^2 was marked at five randomly selected spots. The number of blast infected plants were recorded in each 1 m^2 quadrats marked in each field. The data on blast severity and incidence was recorded at grain development stage. Blast severity was recorded using 0-9 scale as given by Chandra *et al.* (2017) with slight modification to Sharma *et al.,* 2013 as detailed below :

The disease incidence was calculated by following formula:

$$\text{Disease incidence} = \frac{\text{No. of infected plants}}{\text{Total no. of plants assessed}} \times 100$$

The percentage disease index (PDI) was calculated by the formula given by McKinney, 1923:

$$\text{Per cent disease index} = \frac{\text{Sum of all numerical ratings}}{\text{No. of plants examined} \times \text{maximum disease rating}} \times 100$$

The mean disease incidence and severity of all the selected field of a village represents the level of disease of that individual village and the mean of five villages represents the disease incidence and severity of blast disease in selected districts of Haryana.

RESULTS AND DISCUSSION

The pearl millet blast incidence and severity during *kharif* 2020-21 ranged from 34.46 to 71.01 and 22.55 to 60.14 per cent respectively and none of the surveyed fields were found free from the disease (Table 1). Among pearl millet growing districts of Haryana Mahendragarh District had maximum area and production and placed second after Bhiwani pertaining to of disease incidence and severity. Amongst the surveyed villages in Mahendragarh district Malra village had maximum disease incidence (68.00 %) and disease severity (58.44 %) followed by Pali (67.97 % and 54.56 %) and Bhungarka (64.88 % and 50.66 %) while least disease incidence (62.10 %) and severity (48.88 %) were recorded in village Dohar Kalan located in Narnaul Tehsil. Bhiwani district was recorded to exhibit maximum maximum disease incidence (70.29 %) and disease severity (56.36 %) among all surveyed districts in Haryana. The surveyed villages in Bhiwani district were Devsar, Chang, Singhani, Kairu and Isharwal and amongst these Chang village exhibited maximum disease incidence (71.39 %) and disease severity (60.14 %) and the minimum 68.31 per cent disease incidence was in Devsar village and lowest disease severity (51.23 %) recorded in village Singhani. In Nuh district, the maximum disease incidence was recorded in Firozpur Jhirka (40.72 %) while the minimum was recorded in Ujina (34.46 %). In the case of disease severity, the highest blast severity was observed in Firozpur Jhirka (40.72 %) and the lowest

Disease severity rating scale

Rating Scale	Symptoms and lesions	Disease reaction
0	No lesion	Highly Resistant
1	No lesion to small brown specks of pin head size without sporulating center	
2	Large brown specks	
3	Small, roundish to slightly elongated, necrotic gray spot, about 1-2 mm in diameter with a brown margin	Resistant
4	Elliptical lesions, 1-2 cm long, frequentally confined to the area between main veins, covering <2% of leaf area	Moderately Resistant
5	Typical blast lesions covering <10% of the leaf area	
6	Typical blast lesions covering 10 – 25% of the leaf area	Susceptible
7	Typical blast lesions covering 26-50% of the leaf area	
8	Typical blast lesions covering 51-75% of the leaf area and many leaves dead	Highly Susceptible
9	>75% leaf area covered with lesions and most leaves dead	

TABLE 1
Pearl millet blast disease incidence and severity at different locations of Haryana during 2020-21 and 2021-22

District	Village	Latitude	Longitude	Disease incidence (%)		Pooled mean	Disease severity (%)		Pooled mean
				2020	2021		2020	2021	
Mahendragarh	Malra	28.351132	76.172979	68.00	72.07	70.04	58.44	64.78	61.61
	Pali	28.335322	76.133683	67.97	72.01	69.99	54.56	63.88	59.22
	Kothal kalan	28.191081	76.165015	62.84	66.51	64.68	52.66	49.56	51.11
	Bhungarka	27.933670	76.156072	64.88	68.78	66.83	50.66	57.77	54.22
	Dohar kalan	28.117457	76.018561	62.10	65.82	63.96	48.88	55.77	52.33
	Mean			65.16	69.04	67.10	53.04	58.35	55.70
Bhiwani	Devsar	28.758741	76.087773	68.31	72.37	70.34	54.44	55.56	55.00
	Chang	28.880431	76.241468	71.39	75.68	73.54	60.14	54.44	57.29
	Singhani	28.526725	75.796100	70.74	75.00	72.87	51.23	66.89	59.06
	Kairu	28.705474	75.875297	70.61	74.83	72.72	58.67	58.88	58.78
	Isharwal	28.764853	75.702559	70.41	69.85	70.13	57.33	64.30	60.82
	Mean			70.29	73.55	71.92	56.36	60.01	58.19
Charkhi Dadri	Jhojhu kalan	28.521055	76.152084	57.89	61.30	59.60	42.00	52.22	47.11
	Berla	28.511261	76.016364	44.87	47.46	46.17	41.11	42.26	41.69
	Charkhi	28.614332	76.217241	49.22	52.15	50.69	37.66	44.44	41.05
	Jharli	28.499537	76.375652	56.20	59.54	57.87	47.62	46.88	47.25
	Badhra	28.511149	75.946834	53.67	56.89	55.28	45.44	45.77	45.61
	Mean			52.37	55.47	53.92	42.77	46.31	44.54
Hisar	Balsamand	29.072193	75.482113	54.93	58.24	56.59	39.44	50.88	45.16
	Hisar	29.157617	75.696286	57.22	60.59	58.91	47.33	42.22	44.78
	Muklan	29.06759	75.658837	50.80	53.76	52.28	42.90	47.50	45.20
	Saharwa	28.923892	75.740183	54.15	57.45	55.80	48.00	52.33	50.17
	Adampur	29.281613	75.473374	63.92	67.72	65.82	50.55	52.88	51.72
	Mean			56.21	59.55	57.88	45.64	49.16	47.10
Rewari	Tint	28.178865	76.489023	55.50	63.53	59.52	42.70	51.11	46.91
	Bawal	28.057048	76.601099	53.39	56.63	55.01	45.13	43.55	44.34
	Masani	28.203756	76.730987	50.14	53.16	51.65	42.44	45.44	43.94
	Bhurthala	28.370817	76.476668	49.94	52.92	51.43	33.79	25.44	29.62
	Gudiani	28.358771	76.536263	47.72	50.57	49.15	34.67	44.75	39.71
	Mean			51.33	55.36	53.35	39.74	42.06	40.90
Nuh	Firozpur Jhirka	27.789911	76.948358	40.72	38.83	39.78	33.46	36.00	34.73
	Imam Nagar	27.925082	77.033157	39.35	42.46	40.91	32.88	39.44	36.16
	Meoli	28.042525	76.972962	38.10	38.87	38.49	22.55	26.88	24.72
	Adbar	28.083091	77.033895	35.46	38.66	37.06	31.77	38.22	35.00
	Ujina	28.044509	77.848555	34.46	40.52	37.49	29.55	34.11	31.83
	Mean			37.62	39.87	38,75	30.04	34.53	32.49
Gurugram	Balewa	28.287040	76.695781	46.66	45.06	45.86	32.68	34.66	33.67
	Sohna	28.253077	77.061288	42.88	48.60	45.74	37.89	41.90	39.90
	Pataudi	28.331822	76.782981	39.67	44.07	41.87	37.33	40.66	39.00
	Jamalpur	28.373540	76.836199	43.41	45.36	44.39	31.49	41.22	36.36
	Bilaspur	28.281442	76.855726	43.76	46.34	45.05	33.78	31.33	32.56
	Mean			43.27	45.89	44.38	34.63	37.95	36.29
Jhajjar	Mundsa	28.546555	76.475365	44.38	49.93	47.16	35.11	32.88	34.00
	Salhawas	28.455792	76.470856	49.05	49.11	49.08	34.66	30.66	32.66
	Dighal	28.766731	76.630772	48.27	53.87	51.07	33.89	43.77	38.83
	Beri	28.702693	76.579899	51.65	53.84	52.75	39.77	41.77	40.77
	Khajpur	28.580647	76.633956	50.50	51.87	51.19	36.00	44.60	40.30
	Mean			48.77	51.72	50.25	35.89	39.54	37.72

was in Meoli village (22.55 %). Among all the surveyed districts of Haryana the maximum disease incidence was recorded in Bhiwani (70.29 %) followed by Mahendragarh (65.16 %), Hisar (56.21 %), Charkhi Dadri (52.37 %), Rewari (51.33 %) and Jhajjar (48.77 %). While the minimum disease incidence was recorded in Nuh (37.62 %) followed by Gurugram (43.27 %) during *kharif* 2020-21.

During *kharif* 2021-22 the blast incidence was recorded at maximum (75.68 %) in Chang village followed by villages Singhani (75.00 %), Kairu (74.83 %), Devsar (72.37 %) of Bhiwani district and Malra (72.07 %) and Pali (72.01 %) of Mahendragarh district while the minimum (38.66%) was recorded in Adbar village of Nuh district followed by Firozpur Jhirka (38.83 %) and Meoli (38.87 %) (Table 1). In case of disease severity, the maximum 66.89 per cent was recorded in Singhani village of Bhiwani district followed by Malra (64. 78 %) Village of Mahendragarh district. The maximum disease severity among all the surveyed districts in Haryana was recorded in Bhiwani (60.01 %) followed by Mahendragarh (58.35 %), Hisar (49.16 %) and Charkhi Dadri (46.31 %) while the minimum was recorded in Nuh (34.93 %) followed by Gurugram (37.95 %). Meena *et al.* (2019) recorded the blast severity ranged from 8.55 percent in Bhopatpur village in Joura block to 16.50 percent in Mebra village in Vijaypur block in the surveyed villages.

The mean disease incidence (fig.1) was recorded maximum in Bhiwani district (71.92 %) followed by Mahendragarh (67.1 %), Hisar (57.88 %), Charkhi Dadri (53.92 %), Rewari (53.35 %) and Jhajjar (50.35 %) while the minimum disease incidence (38.74%) was recorded in Nuh district. In Karnataka, Adhikari *et al*. (2020) recorded maximum disease severity score (7.9) in Vijayapur district followed by Bagalkot district (6.7). The severity score of blast disease was relatively fair to good which recorded between 1.6 to 7.9 disease severity scale. Recently, Parihar *et al.* (2021) reported that the blast severity is higher in Bhind (33.75%) and Morena (33.23%) districts as compared to Gwalior (23.68%) and Sheopur (22.70%) district and it is serious problem in bajra cultivation in northern Madhya Pradesh. In Uganda, Lubadde *et al*. (2014) studied the occurrence and severity of major diseases of pearl millet and their effect on grain yield during 2012. In terms of severity, leaf blast (*Pyricularia grisea*) (62.20%) was the most frequent disease followed by ergot (*Claviceps fusiformis*) (43.33%) and rust (*Puccinia substriata*) (29.46%). Bhojyanaik (2013) reported the severity of

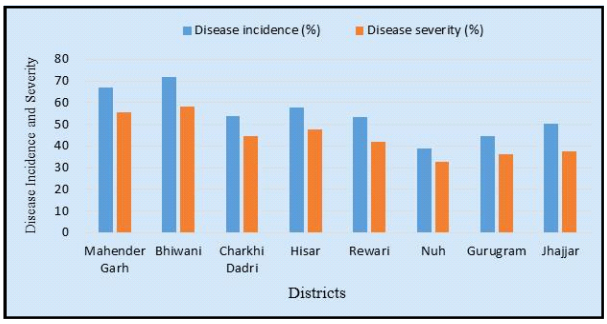

Fig. 1. Mean disease incidence and severity among surveyed districts of Haryana.

disease ranged between 30-78 %. The highest disease severity was recorded in Koppal district (76.1%) followed by Bagalkot (37.3%) and Bijapur (31.1%) district and Koppal district marked as the "hotspot' for the pearl millet blast disease among the surveyed districts. Infections caused by blasts are most likely to occur during rainy seasons, when relative humidity is high, and when the daily mean temperature is low.

CONCLUSION

The results of the survey concluded that the maximum pearl millet blast incidence and severity was in Bhiwani district followed by Mahendragarh district during both the years might be due to some factors, such as the contiguous area under monoculture, host susceptibility, virulent strain of the pathogen and favorable weather conditions. Bhiwani district had the maximum disease incidence (71.92 %) followed by Mahendragarh (67.1 %), Hisar (57.88 %), Charkhi Dadri (53.92 %), Rewari (53.35 %) and Jhajjar (50.35 %) while minimum disease incidence 38.74 per cent was recorded in Nuh district. In case of disease severity which was also recorded maximum in Bhiwani district (58.19 %) followed by Mahendragarh (55.70 %), Hisar (47.40 %) and Charkhi Dadri (44.54 %) whereas minimum was recorded in Nuh district (32.29 %).

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