Original Research Article

SCREENING OF POTATO VARIETIES/ENTRIES AGAINST COMMON SCAB (*STREPTOMYCES SCABIEI*) OF POTATO

Abstract

Common scab of potato, caused by *Streptomyces scabiei* (Thaxter) Waksman & Henriki, a significant and increasingly prevalent disease in North Gujarat, isa major threat to potato cultivation in the region. The field experiment was carried out at the Potato Research Station, S. D. Agricultural University, Deesa, Gujarat in two successive cropping seasons (2021-22 and 222-23) to screen the potato varieties/entries against common scab (*Streptomyces scabiei*) of potato.Out of 30 varieties/entries screened against common scab, nonwas found free from disease but two varieties namely, Kufri Sindhuri and Kufri Gaurav were found moderately resistant, four varieties/entries (K. Chipsona-3, AICRP-PH-3, K. Sukhyati and K. Lalit) were found as moderately susceptible and twenty-one varieties/entries were found as susceptible while three varieties/entries were found as highly susceptible.

Key word: Common scab, potato, screening, varieties, entries, *Streptomyces*

Introduction

The potato (*Solanum tuberosum*L.) is one of the most widely cultivated and economically significant crops globally. It serves as a staple food in many countries and contributes to food security, providing essential nutrients and a substantial caloric source. Potatoes are processed into a variety of products, including potato flour, chips, French fries, frozen potatoes, potato starch, and potato-based tapioca. 100-gram of fresh potato provides 1.6 grams of protein, 22.6 grams of carbohydrates, 0.6 grams of minerals, 0.4 grams of dietary fiber, 0.1 grams of fat, and 25 milligrams of vitamin C (Saini & Umrav, 2008). However, like other crops, potatoes are susceptible to various diseases, with common scab (*Streptomyces scabiei*) being one of the most pervasive and significant. Common scab is a soil-borne disease that affects potato tubers, leading to the development of lesions that diminish the aesthetic quality and marketability of the crop(Loria *et al.,* 1997). While the disease does not directly affect yield, it significantly reduces the visual appeal of tubers, which in turn decreases their market value, posing a major challenge for producers and impacting the potato industry(Arora, 2012).

Effective management of common scab requires an integrated approach, with cultivar selection being one of the most crucial strategies for controlling the disease. Identifying and developing potato varieties that exhibit resistance to *S. scabiei* can significantly mitigate the impact of the disease, thereby improving the overall quality of the harvest and ensuring better market acceptance. However, the resistance of potato varieties to common scab varies widely, and factors influencing this resistance are not fully understood. Therefore, screening potato varieties for resistance to *S. scabiei* is essential for identifying cultivars that can withstand the disease.

Materials and methods

Field experiment was carried out at Potato Research Station, S. D. Agricultural University, Deesa (Gujarat). To evaluate thirty varieties/entries of potato for their reaction to common scab disease of potato caused by *S. scabiei*for two consecutive years *Rabi*of2021-22 and 2022-23. The experiment was laid out in a randomized block design with three replications. Planting was done at row spacing of 50 cm and plant to plant spacing of 20 cm. Recommended dosage of fertilizers 206 kg N, 110 kg P and 275 kg K per hectare was applied. Observations on disease reaction were recorded at the time of harvesting and per cent disease incidence was recorded according to the below mentioned formula given by Singh and Tyagi (1996).

$$\text{Disease Incidence (\%)} = \frac{\text{Number of Infected tubers}}{\text{Total number of tubers examined}} \times 100$$

Ten tubers per variety/entrywere visually observed for per cent disease intensity. Per cent disease intensitywascalculated by using the mentioned below formula given by Jeswani and Sharma (1990).

$$\text{PDI} = \frac{\sum \text{All numerical ratings}}{\text{Total number of tubers examined X Maximum disease rating (5)}} \times 100$$

On the basis of per cent disease intensity the varieties and entries were categorized according to the pathological reactions as described by Patel (1991).

Table:1 Disease intensity rating scale and reaction

Rating	Description	Reaction
0	Healthy tuber	Resistant (R)
1	1-10 per cent tuber surface affected	Moderately Resistant (MR)
2	11-25 per cent tuber surface affected	Moderately Susceptible (MS)
3	26-50 per cent tuber surface affected	Susceptible (S)
4	Above 50 per cent tuber surface	Highly susceptible (HS)

Results and Discussion

Out of 30 varieties/entries screened, significantly least per cent disease incidence was recorded in K. Sindhuri (14.44 %) which was found at par with K. Lalit (21.11 %), K. Gaurav (22.22 %), K. Mohan (23.33 %), K. Sangam (24.44 %) and K. Sukhyati (25.56 %) in the season2021-22. The next best variety in list of merit were AICRP-PH-3 (26.67%) and AICRP-P-57 (30%). The rest of varieties/entries recorded more than 30 per cent disease incidence of

common scab. The significantly highest per cent disease incidence of common scab of potato was recorded in variety K. Pukhraj (57.78 %) in season 2021-22 (Table,2).

In season 2022-23, the significantly least per cent disease incidence was recorded in K. Sindhuri (15.56 %) which was found at par with K. Lalit (17.78 %), K. Gaurav (20.00 %), K. Sangam (23.33 %) and K. Lima (26.67 %) in season 2022-23. The next best variety in list of merit were K. Laukar and AICRP-PH-3 both the varieties/entries recorded 30.00 per cent disease incidence. The rest of varieties/entries recorded more than 30.00 per cent disease incidence of common scab. The significantly highest per cent disease incidence of common scab of potato was recorded in AICRP-P-70 (56.67 %) variety in 2022-23 (Table,2).

Table 2: Disease incidence of potato varieties/entries against common scab

Sr. No.	Name of varieties/entries	Disease incidence (%)		
		2021-22	2022-23	Pooled
1	K. Sindhuri	*22.54^{i} (14.44)	23.59^{h} (15.56)	23.07^{l} (15.00)
2	AICRP-P-70	39.46^{bcd} (40.00)	49.17^{a} (56.67)	44.31^{ab} (48.33)
3	AICRP-P-68	40.71^{bc} (42.22)	45.91^{ab} (51.11)	43.31^{abc} (46.67)
4	K. Mohan	29.06^{fghi} (23.33)	39.46^{bcd} (40.00)	34.26^{fghi} (31.67)
5	AICRP-P-32	39.49^{bcd} (40.00)	40.78^{abcd} (42.22)	40.14^{bcdef} (41.11)
6	K. Khyati	43.99^{ab} (47.78)	41.42^{abc} (43.33)	42.71^{abcd} (45.56)
7	AICRP-P-75	36.13^{bcdefgh} (34.44)	38.73^{bcde} (38.89)	37.43^{cdefgh} (36.67)
8	K. Chipsona-3	30.61^{defghi} (25.56)	34.07^{cdefg} (31.11)	32.34^{hij} (28.33)
9	K. Pukhraj	49.81^{a} (57.78)	45.26^{ab} (50.00)	47.53^{a} (53.89)
10	AICRP-P-24	36.83^{bcdefg} (35.56)	42.71^{abc} (45.56)	39.77^{bcdef} (40.56)
11	K. Ganga	39.46^{bcd} (40.00)	36.15^{bcdef} (34.44)	37.81^{bcdefgh} (37.22)
12	AICRP-PH-3	31.29^{defgh} (26.67)	33.37^{cdefg} (30.00)	32.33^{hij} (28.33)
13	K. Frysona	38.82^{bcd} (38.89)	37.41^{bcde} (36.67)	38.11^{bcdefgh} (37.78)
14	K. Jyoti	33.31^{cdefgh} (30.00)	34.83^{cdef} (32.22)	34.07^{fghi} (31.11)
15	K. Nilkanth	41.42^{bc} (43.33)	36.77^{bcde} (35.56)	39.09^{bcdefg} (39.44)
16	K. Sukhyati	30.61^{defghi} (25.56)	34.17^{cdef} (31.11)	32.39^{ghij} (28.33)

17	K. Gaurav	28.18^{ghi} (22.22)	26.86^{fgh} (20.00)	27.52^{jkl} (21.11)
18	K. Lima	34.02^{cdefgh} (31.11)	31.31^{defgh} (26.67)	32.66^{ghij} (28.89)
19	K. Lalit	27.48^{hi} (21.11)	25.00^{gh} (17.78)	25.24^{kl} (19.44)
20	AICRP-P-42	34.81^{cdefgh} (32.22)	38.85^{bcde} (38.89)	36.83^{cdefgh} (35.56)
21	LR	36.79^{bcdefg} (35.56)	36.77^{bcde} (35.56)	36.78^{cdefgh} (35.56)
22	AICRP-P-57	33.37^{cdefgh} (30.00)	38.79^{bcde} (38.89)	36.08^{defgh} (34.44)
23	K. Pushkar	38.14^{bcde} (37.78)	34.15^{cdefg} (31.11)	36.15^{defgh} (34.44)
24	K. Sangam	29.59^{efghi} (24.44)	29.17^{efgh} (23.33)	29.38^{ijk} (23.89)
25	K. Garima	38.14^{bcde} (37.78)	40.12^{abcd} (41.11)	39.13^{bcdefg} (39.44)
26	K. Laukar	34.10^{cdefgh} (31.11)	33.42^{cdefg} (30.00)	33.76^{fghij} (30.56)
27	K. Badshah	41.42^{bc} (43.33)	40.78^{abcd} (42.22)	41.10^{bcde} (42.78)
28	K. Chipsona-4	34.83^{cdefgh} (32.22)	38.34^{bcde} (38.89)	36.58^{defgh} (35.56)
29	K. Bahar	37.44^{bcdef} (36.67)	34.10^{cdefg} (31.11)	35.77^{efghi} (33.89)
30	K. Surya	37.47^{bcdef} (36.67)	36.86^{bcde} (35.56)	37.16^{cdefgh} (36.11)
S.Em. ± (T)		2.63	2.89	1.96
CD at 5% (T)		7.48	8.17	5.50
S.Em. ± (Y X T)		-	-	2.76
CD at 5% (Y X T)		-	-	NS
CV (%)		12.80	13.66	13.25

*Figures are arc sine transformed values and figures in the parenthesis are original values.

Treatment mean with common letter/letters are not significant by Duncan's New Multiple Range Test at 5% level of significance

The pooled data revealed that the significantly least per cent disease incidence was recorded in K. Sindhuri (15.00 %) which was found at par with K. Lalit (19.44 %) and K. Gaurav (21.11 %). Variety K. Pukhraj recorded significantly highest per cent disease incidence (53.89 %) than the rest variety/entries (Table: 2).

The data of season2021-22 (Table: 3) revealed that the minimum per cent disease intensity was recorded in varietyK. Gaurav (7.33 %) which was found at par with K. Sindhuri (10.00 %). The next best variety in list of merit were K. Sukhyati (19.33 %), K. Chipsona-3 (20.67 %) and AICRP-PH-3 (23.33 %). The rest of varieties/entries recorded more than 25 per cent disease intensity of common scab in season 2021.22 (Table,3).

In season 2022-23, the minimum per cent disease intensity was recorded in K. Sindhuri (8.67 %) and which was found at par with K. Gaurav (11.33 %). Both varieties *i.e.* K. Gaurav and K. Sinduri also recorded minimum disease intensity in pooled data while K. Pukhraj variety recorded the significantly highest per cent disease intensity (60.00 & 59.33%, respectively) than the rest of varieties/entries (Table,3).

Table 3: Disease intensity of potato varieties/entries against common scab

Sr. No.	Name of varieties/entries	Disease intensity (%)		
		2021-22	2022-23	Pooled
1	K. Sindhuri	*18.85^{n} (10.00)	17.47^{i} (8.67)	18.15^{m} (9.33)
2	AICRP-P-70	46.80^{abc} (52.67)	46.05^{abc} (51.33)	46.43^{ab} (52.00)
3	AICRP-P-68	36.70^{efghi} (35.33)	39.88^{cdef} (40.67)	38.29^{defgh} (38.00)
4	K. Mohan	32.64^{hijkl}m (28.67)	38.27^{defg} (38.00)	35.45^{ghij} (33.33)
5	AICRP-P-32	42.20^{cdef} (44.67)	37.48^{defg} (36.67)	39.84^{cdefg} (40.67)
6	K. Khyati	49.12^{ab} (56.67)	47.96^{ab} (54.67)	48.54^{a} (55.67)
7	AICRP-P-75	37.92^{defgh} (37.33)	39.09^{cdef} (39.33)	38.50^{defgh} (38.33)
8	K. Chipsona-3	27.28^{lm} (20.67)	28.53^{h} (22.67)	27.91^{l} (21.67)
9	K. Pukhraj	50.28^{a} (58.67)	51.11^{a} (60.00)	50.69^{a} (59.33)
10	AICRP-P-24	38.31^{defgh} (38.00)	35.11^{efgh} (32.67)	36.71^{efghi} (35.33)
11	K. Ganga	33.89^{hijk} (30.67)	30.90^{gh} (26.00)	32.39^{ijkl} (28.33)
12	AICRP-PH-3	29.12^{klm} (23.33)	29.38^{h} (24.00)	29.25^{kl} (23.67)
13	K. Frysona	33.02^{hijkl} (29.33)	35.53^{efgh} (33.33)	34.27^{hij} (31.33)
14	K. Jyoti	33.83^{hijk} (30.67)	37.92^{defg} (37.33)	35.87^{ghij} (34.00)
15	K. Nilkanth	43.35^{bcd} (46.67)	39.11^{cdef} (39.33)	41.23^{cdef} (43.00)
16	K. Sukhyati	26.36^{m} (19.33)	29.16^{h} (23.33)	27.76^{l} (21.33)
17	K. Gaurav	16.03^{n} (7.33)	19.52^{i} (11.33)	17.78^{m} (9.33)
18	K. Lima	30.46^{ijklm} (25.33)	35.50^{efgh} (33.33)	32.98^{ijk} (29.33)
19	K. Lalit	29.57^{jklm}	29.21^{h}	29.39^{kl}

		(24.00)	(23.33)	(23.67)
20	AICRP-P-42	35.91^{fghij} (34.00)	37.09^{defg} (36.00)	36.50^{fghi} (35.00)
21	LR	43.35^{bcd} (46.67)	41.38^{bcde} (43.33)	42.36^{bcd} (45.00)
22	AICRP-P-57	35.50^{ghijk} (33.33)	42.97^{bcde} (46.00)	39.24^{cdefgh} (39.67)
23	K. Pushkar	42.97^{bcde} (46.00)	36.26^{defgh} (34.67)	39.62^{cdefg} (40.33)
24	K. Sangam	29.54^{jklm} (24.00)	33.34^{fgh} (30.00)	31.44^{jkl} (27.00)
25	K. Garima	41.40^{cdefg} (43.33)	41.82^{bcde} (44.00)	41.61^{cde} (43.67)
26	K. Laukar	38.72^{defgh} (38.67)	37.91^{defg} (37.33)	38.31^{defgh} (38.00)
27	K. Badshah	44.12^{bcd} (48.00)	43.74^{bcd} (47.33)	43.93^{bc} (47.67)
28	K. Chipsona-4	34.22^{hijk} (31.33)	35.48^{efgh} (33.33)	34.85^{ghij} (32.33)
29	K. Bahar	35.91^{fghij} (34.00)	37.53^{defg} (36.67)	36.72^{efghi} (35.33)
30	K. Surya	35.91^{fghij} (34.00)	37.51^{defg} (36.67)	36.71^{efghi} (35.33)
S.Em. ± (T)		1.96	2.31	1.52
CD at 5% (T)		5.55	6.54	4.26
S.Em. ± (Y X T)		-	-	2.13
CD at 5% (Y X T)		-	-	NS
CV (%)		9.58	11.09	10.22

*Figures are arc sine transformed values and figures in the parenthesis are original values.

Treatment mean with common letter/letters are not significant by Duncan's New Multiple Range Test at 5% level of significance

It is evident from the results presented in Table, 4 that out of 30 varieties/entries tested against common scab, no variety/entry was entirely free from disease but two varieties *viz.*, K. Sindhuri and K. Gaurav were found moderately resistant, four varieties/entries*viz.*, K. Chipsona-3, AICRP-PH-3, K. Sukhyati and K. Lalit was moderately susceptible and twenty one variety/entries *viz.*, AICRP-P-68, K. Mohan, AICRP-P-32, AICRP-P-75, AICRP-P-24, K. Ganga, K. Frysona, K. Jyoti, K. Nilkanth, K. Lima, AICRP-P-42, LR, AICRP-P-57, K. Pushkar, K. Sangam, K. Garima, K. Laukar, K. Badshah, K. Chipsona-4, K. Bahar and K. Surya were found as susceptible while three varieties/entries *viz.*, AICRP-P-70, K. Khyati and K. Pukhraj were found to be highly susceptible.

Table 4: Reaction of potato varieties/entries against common scab disease

Category	Disease index	Varieties/entries

	(Rating)	
Resistant	0 (Healthy tuber)	-
Moderately resistant (2)	1 (1-10 per cent tuber surface affected)	K. Sindhuri and K. Gaurav
Moderately susceptible (4)	2 (11-25 per cent tuber surface affected)	K. Chipsona-3, AICRP-PH-3, K. Sukhyati and K. Lalit
Susceptible (21)	3 (26-50 per cent tuber surface affected)	AICRP-P-68, K. Mohan, AICRP-P-32, AICRP-P-75, AICRP-P-24, K. Ganga, K. Frysona, K. Jyoti, K. Nilkanth, K. Lima, AICRP-P-42, LR, AICRP-P-57, K. Pushkar, K. Sangam, K. Garima, K. Laukar, K. Badshah, K. Chipsona-4, K. Bahar and K. Surya
Highly susceptible (3)	4 (Above 50 per cent tuber surface)	AICRP-P-70, K. Khyati and K. Pukhraj

Discussion:

The present findings are supported by the work of Vashisth *et al.* (1982) who found that Kufri Sindhuri, a red variety showed comparatively lower common scab disease index than Kufri Chandramukhi. Mishra and Srivastava (1999) reported that none of the varieties were resistant except Kufri Sindhuri and Kufri Lalima which had moderate resistance against common scab of potato. Chaudhary (2005) screened ninety-five potato varieties/entries against common scab of potato and reported that the none was found resistant but twenty-three varieties/ entries recorded moderately resistant reaction in which the varieties *viz.*, Kufri Alankar, Atlantic, Kufri Jawahar, Kufri Sindhuri and Kufri Sutlej were taken place. Twenty-four varieties/ entries found moderately susceptible. He also reported the K. Pukhraj variety as highly susceptible.

Basu *et al*. (2005) screened twelve potato cultivars in naturally infested field against common scab of potato and reported that out of twelve cultivars, three cultivars (Kufri Lalima, Kufri Sindhuri and Kufri Anand) were least susceptible, three cultivars (Kufri Kanchan, Kufri Badshah and Kufri Giriraj) were medium susceptible, three cultivars (Kufri Pukhraj, Kufri Sutlej and Kufri Jawhar) were highly susceptible and rest three cultivars (Kufri Jyoti, Kufri Chandramukhi and Kufri Ashoka) were very highly susceptible. In

general, the red skinned cultivars were least susceptible to the scab pathogen. Besides, *cv.* Kufri Anand being a white skinned cultivar, was also among the least susceptible.

Conclusion:

Out of 30 varieties/entries tested against common scab, none was entirely free from disease but two varieties namely, K. Sindhuri and K. Gaurav were found to be moderately resistant, four varieties/entries namely, K. Chipsona-3, AICRP-PH-3, K. Sukhyati and K. Lalit were moderately susceptible, twenty-one variety/entries were found as susceptible while three varieties/entries namely, AICRP-P-70, K. Khyati and K. Pukhraj were found to be highly susceptible.

Ethics declarations: This article does not contain any studies with human participants or animals performed by any of the authors

Disclaimer (Artificial intelligence)

I here by declare that no generative AI technologies used in manuscript.

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