

Extensive Varietal Screening to Find New Sources of Gladiolus Wilt Resistance

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Abstract

In a field experiment conducted during 2022-2023 at AICRP on Floriculture, ZARS Ganeshkhind, Pune, twenty-nine gladiolus varieties and eighteen hybrids were screened for resistance against wilt disease of gladiolus. The wilt incidence ranged from 3.44% to 26.31%, with no variety or hybrid found to be disease-free. Out of the 29 varieties, 16 were resistant, and 9 were moderately resistant. Three varieties (Pusa Manmohak, Seln white, A.C.-1) were moderately susceptible, and one variety (Sancerre) was susceptible to wilt disease. Among the 18 hybrids, none were disease-free, with 14 being resistant and 4 (GKGL-07-13, GKGL-07-16, GKGL-07-19, GKGL-07-26) moderately resistant to wilt disease.

Key words : Gladiolus, *In-vivo* assay, inoculum load, *Fusarium* wilt, resistance sources.

Gladiolus (*Gladiolus hortensis* L.), the queen of the bulbous flowers, is one of the most well-known ornamental bulbous plants produced for its commercial use interesting flowers in various areas across the globe. It is a member of the family Iridaceae and subfamily Crocoideae. This genus has 300 species, which are extensively dispersed over Southern Africa, the Mediterranean region, and Eurasia (Cantor and Tolety, 2011). The second most significant cut flower from a bulb, gladiolus is cultivated all across the world (Cohat, 1993). As cut flowers, fragrances, and other things, it has enormous commercial worth. The top gladiolus producing nations are the United States, Holland, France, Poland, Italy, Bulgaria, Brazil, Australia, Israel and India. It is one among the most sought-after commercial cut flowers on the domestic and international markets. India has recently produced close to 260 tonnes of gladiolus on 11660 acres of land. Chhattisgarh, West Bengal, Uttar Pradesh, Assam, Karnataka, Madhya Pradesh and Orissa are the primary gladiolus-producing states in India. According to APEDA statistics for 2021-2022, Chhattisgarh

has the largest production among these states (115 tonnes), followed by West Bengal (55 tonnes), and Uttar Pradesh (46 tonnes) (Anonymous, 2021). In Maharashtra, the districts of Pune, Nashik, Ahmednagar, Satara, Sangali, Kolhapur, Nagpur and Thane are mostly where floriculture is cantered. Additionally, maintaining the ecological balance and lowering environmental pollution depend on growing beautiful plants and flowers. Since the dawn of civilization, flowers have in some manner captivated the attention of man. For their gorgeous design in bouquets, gardens and landscapes flowers are grown. Flowers are necessary for all events, including weddings, parties, religious occasions and social gatherings. Gladiolus production ranks sixth for loose flowers and third for cut flowers in India, according to Nath et al. (2020). Many maladies that are brought on by fungus, bacteria, nematodes and viruses damage in gladiolus. Among the most significant fungal diseases induced by *F. oxysporum* f. sp. *gladioli* are corm rot and wilt of gladiolus (Mirza and Shakir, 1991). The most serious biotic stress to gladiolus

is wilt, which is caused by *Fusarium oxysporum* f. sp. *gladioli* and can result in up to 60–80% crop failure (Munde *et al.*, 2019). The current study was therefore conducted in order to identify effective steps for improved disease control through varietal screening against wilt of gladiolus cause by *Fusarium oxysporum* f. sp. *gladioli*.

Material and Methodology

Varietal Screening for Disease

Resistance : The wilt disease was studied in field under natural conditions. The source of resistance in gladiolus varieties and hybrids of gladiolus was done. Twenty-nine varieties and eighteen hybrids of gladiolus were screened for wilt resistance. Gladiolus varieties/hybrids were observed critically for wilt symptoms and the per cent disease incidence was calculated.

Disease Reaction : Virulence of pathogen and disease reaction against twenty-nine varieties and eighteen hybrid lines of gladiolus were recorded by following the below mention scale and categorized as mentioned below (Mayee and Datar, 1986).

Reactions	Category	% Wilt Incidence
Immune	(I)	00.00
Resistant	(R)	0.1- 5.0%
Moderately resistant	(MR)	5.1- 10.0%
Moderately susceptible	(MS)	10.1- 20.0 %
Susceptible	(S)	20.1- 50.0%
Highly susceptible	(HS)	50.1% and above

Varieties of Gladiolus : Twenty-nine varieties (Table 1) of gladiolus and eighteen hybrids (Table 3) were selected for screening against *F. oxysporum* f. sp. *gladioli*. Gladiolus corms of varieties and hybrids were stored in refrigerator for one month. After this, corms were surface sterilized with 0.1 per cent mercuric chloride. Then corms were washed with sterile distilled water and dried at room

temperature before sowing. In the sick soil, corms of gladiolus varieties and hybrid lines were sown. Observation on wilt per cent incidence was recorded after 15 days. Per cent wilt incidence was calculated by using following formulae. % Incidence = Number of wilted plants upon total number of sown corms x 100

Results and Discussion

Varietal Screening : The management of

Table 1. Reaction of different varieties against wilt of gladiolus caused by *Fusarium oxysporum* f. sp. *gladioli*

Name of varieties	Per cent disease incidence	Reaction
Arka supreme	4.54	R
Tambri	3.44	R
Summer sunshine	4.34	R
DHN 86-1	3.57	R
Arka	3.84	R
Jaggi-07	7.14	MR
A.C.-1	13.04	MS
Sancerre	26.31	S
Arka Pratham	4.17	R
Pusa Sindhuri	4.00	R
Pricila	7.69	MR
Punjab lemon delight	4.16	R
Pusa Kiran	4.76	R
Punjab Pink	4.54	R
Psitacinus hybrid	9.52	MR
White Shipen	8.33	MR
Punjab Glad-1	4.17	R
Aarati	3.84	R
Surya Kiran	4.00	R
Punjab Galnce	9.09	MR
Arka Keshar	8.33	MR
Seln white	16.66	MS
Pusa Urmila	3.84	R
Pusa Suhagan	3.44	R
Pusa Manmohak	17.39	MS
Arka Ranjini	8.33	MR
Punjab Glad - 2	7.40	MR
Pratap Glad-1	4.16	R
Phule Neelrekha	7.69	MR

Table 2. Reaction for disease resistance of gladiolus varieties against wilt disease

Disease rating	Reaction	No. of varieties	Name of varieties
00 %	Immune	00	-
0.1 -5.0%	Resistant	16	Arka supreme, Tambri, DHN 86-1, Arka Pratham, Pusa sindhuri, Punjab lemon delight, Pusa kiran, Arka, Punjab Pink, Punjab Glad-1, Aarati, Surya Kiran, Pusa Urmila, Pusa suhagan and Pratap glad-1
5.1.1-10 %	Moderately resistant	9	Jaggi-07, Pricila, Psitacinus hybrid, White Shipen, Punjab Galnce , Arka Keshar , Arka Ranjini , Punjab glad – 2 and Phule Neelrekha
10.1- 20 %	Moderately susceptible	03	A.C.-1, Pusa Manmohak, Seln white
20.1- 50 %	Susceptible	01	Sancerre
Above 50%	Highly susceptible	00	-

diseases through host plant resistance has been an adaptable choice in all the crop improvement programmes. Utilization of resistant varieties/hybrids in farming is the most simple, effective and economical method in the management of diseases. Besides these, the resistant cultivars conserve natural resources and reduce the cost, time and energy when compared to the other methods of disease management. In the present study available twenty-nine varieties and eighteen hybrids were screened under natural field conditions for their resistance to *F. oxysporum* f. sp. *gladioli* at Zonal Agricultural Research Station, Ganeshkhind, Pune during 2022-23. The results presented in Table 1 and Table 3 indicated that the gladiolus varieties and hybrids have variable degrees of disease resistance against wilt disease caused by *F. oxysporum* f. sp. *gladioli*. Within first fifteen to twenty days wilting plant appears and after some days of observations majority of genotypes exhibited wilting symptoms. The reaction of genotypes was worked out as per the scale given by Mayee and Datar (1986) on per cent wilt incidence.

Screening of gladiolus varieties against wilt disease : Twenty-Nine varieties of gladiolus were screened under natural condition for their resistance against wilt pathogen. Out of Twenty Nine gladiolus varieties, none of the

variety was found free from wilt disease, Sixteen varieties showed less than 5.00 per cent wilt disease incidence and categorized as resistant type (*viz.*, Arka supreme, Tambri, summer sunshine, DHN 86-1, Arka Pratham, Pusa sindhuri, Arka, Punjab lemon delight, Pusa kiran, Punjab Pink, Punjab Glad-1, Aarati, Surya Kiran, Pusa Urmila, Pusa suhagan, Pratap glad-

Table 3. Reaction of different hybrids against wilt of gladiolus caused by *Fusarium oxysporum* f. sp. *gladioli*

Name of hybrid lines	Per cent disease incidence	Reaction
GKGL-94-2	3.84	R
GKGL-94-58	4.76	R
GKGL-07-1	4.16	R
GKGL-07-2	4.00	R
GKGL-07-4	4.54	R
GKGL-07-5	4.54	R
GKGL-07-7	4.34	R
GKGL-07-8	3.70	R
GKGL-07-9	4.16	R
GKGL-07-10	4.76	R
GKGL-07-11	4.16	R
GKGL-07-13	8.69	MR
GKGL-07-14	3.84	R
GKGL-07-16	9.52	MR
GKGL-07-18	4.76	R
GKGL-07-19	9.09	MR
GKGL-07-22	3.70	R
GKGL-07-26	8.69	MR

1), nine varieties showed 5.1 to 10.0 per cent disease incidence and categorized as moderately resistant type (*viz.*, Jaggi-07, Pricila, Psitacinus hybrid, White Shipen, Punjab Galnce, Arka Keshar, Arka Ranjini, Punjab glad - 2 and Phule Neelrekha) while three varieties showed 10.1 to 20.0 per cent disease incidence and categorized as moderately susceptible (*viz.*, A.C.-1, Pusa Manmohak and Seln white). However, only one variety Sancerre showed more than 20% disease incidence (26.31%) and categorized as susceptible one. (Table 2)

Screening of gladiolus hybrid lines against wilt disease : The results presented (Table 4) reported that, out of eighteen gladiolus hybrid lines, none of the hybrid was found free from wilt disease. Fourteen hybrid lines *viz.*, GKGL-94-2, GKGL-94-58, GKGL-07-1, GKGL-07-2, GKGL-07-4, GKGL-07-5, GKGL-07-7, GKGL-07-8, GKGL-07-9, GKGL-07-10, GKGL-07-11, GKGL-07-14, GKGL-07-14, GKGL-07-18 and GKGL-07-22 showed less than 5.00 per cent disease incidence and were found resistant to wilt. While, four hybrid lines was moderately resistant *viz.*, GKGL-07-13, GKGL-07-16, GKGL-07-19 and GKGL-07-26 showed 5.1 to 10.0 per cent disease incidence.

The present findings are exactly matching with Borakhade *et al.* (2021) who reported that out of forty-six gladiolus varieties, none of the variety was found free from wilt disease. The PDI on different varieties ranged from 1.72 to 22.80, minimum being on Arka Tilak (1.72)

while maximum on Sancerre (22.80). Sixteen varieties showed 1.1 to 5.0 per cent disease incidence, twenty-five varieties showed 5.1 to 10.0 per cent disease incidence and four varieties showed 10.1 to 20.0 per cent disease incidence, while only one variety *viz.*, Sancerre showed more than 20 per cent disease incidence. Similarly, Vavre *et al.* (2021) conducted field experiments on varietal screening in sick soil for corm rot of gladiolus during 2019-2020. The results indicated that none of the variety was noticed free from disease. Nine varieties *viz.*, IIHR-59-32, Punjab glance, Arti, Pusa Kiran, Punjab glad-1, Surayakiran, Subhagini, Arkaragini and Phule Tejas found resistant to wilt. While twenty-two varieties were found moderately resistant, three varieties *viz.*, summer sunshine, Suchitra and Psitacinus hybrid showed moderately susceptible reaction, while one variety Sancerre showed susceptible reaction. Out of twenty gladiolus hybrid lines, only one hybrid line 07-9 was found free from wilt disease. Eight hybrid lines *viz.*, 07-1, 07-2, 07-8, 07-13, 07-14, 07-15, 07-19 and 94-02 showed less than 5.0 per cent disease incidence and were found resistant to wilt. While ten hybrid lines showed 5.1 to 10.0 per cent disease incidence. Only one hybrid line 07-6 was found susceptible to wilt and completely in agreement with present investigation.

The results of present investigation were partially similar to the work done by Kumari *et al.* (2017) who evaluated thirty gladiolus genotypes for agronomic traits and natural

Table 4. Reaction for disease resistance of gladiolus hybrids against wilt disease

Disease rating	Reaction	No. of hybrids	Name of hybrids
00 %	Immune	00	-
0.1 to 5.0%	Resistant	14	GKGL-94-2, GKGL-94-58, GKGL-07-1, GKGL-07-2, GKGL-07-4, GKGL-07-5, GKGL-07-7, GKGL-07-8, GKGL-07-9, GKGL-07-10, GKGL-07-11, GKGL-07-14, GKGL-07-14, GKGL-07-18 and GKGL-07-22
1.1- 10%	Moderately resistant	04	GKGL-07-13, GKGL-07-19, GKGL-07-26, GKGL-07-16
10.1- 20 %	Moderately susceptible	00	-

screening to Fusarium wilt during 2015 and 2016. Among the genotypes 45 days of planting, different genotypes showed varied disease incidence (3.47– 45.13%) and plant mortality index (0–35.47%). Genotypes, Swarnima, Pusa Unnati and Suryakiran were found more resistant to fusarium wilt, while Urmi and White Friendship were found highly susceptible.

Conclusion

The present study concluded that, the gladiolus varieties were screened under natural field condition. The wilt incidence ranged from 3.44 to 26.31%. None of the variety was found disease-free. Out of 29 varieties 16 varieties found resistant, 9 varieties found moderately resistant. The 3 varieties *viz.*, Pusa Manmohak, Seln white and A.C.-1 were found moderately susceptible and one variety *viz.*, Sancerre was found susceptible against wilt disease. The wilt incidence ranged from 3.70 to 9.52 % in the screening of gladiolus hybrids. None of the hybrid was found disease-free. Out of 18 hybrids screened, 14 hybrids were found resistant and 4 hybrids *viz.*, GKGL-07-13, GKGL-07-16, GKGL-07-19 and GKGL-07-26 were found moderately resistant against wilt disease.

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