

Original Research Article

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Study on Fungal Leaf Spot Diseases of Gladiolus (*Gladiolus grandiflorus*) in Prayagraj City

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ABSTRACT

Keywords

Alternaria alternata, Chi square test, *Curvularia trifolii* f. sp. *gladioli*, *Gladiolus*, Per cent disease incidence, Survey

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Study on fungal leaf spot diseases of gladiolus (*Gladiolus grandiflorus*) in Prayagraj city was assessed in the year 2019 and 2020. A survey was conducted in Prayagraj city among different varieties during their active growth period of gladiolus which revealed the incidence of *Curvularia* leaf spot and *Alternaria* leaf spot to be the predominant diseases of the crop. The per cent disease incidence recorded, among the varieties surveyed for *Curvularia* leaf spot are Flevo spirit (53.84%), Petar pears (76.92%), Extasy (38.46%), Charisma (61.53%), Performer (54.54%), Ocilla (71.42%), White prosperity (30.00%) and the per cent disease incidence for *Alternaria* leaf spot are as follows Flevo spirit (73.34%), Petar pears (53.33%), Extasy (46.67%), Charisma (66.66%), Performer (40.00%), Ocilla (58.34%), White prosperity (69.23%). The mean per cent disease incidence for *Curvularia* leaf spot is 55.24% and where as for *Alternaria* leaf spot it is 58.22% respectively during 2019 and 2020. The varieties exhibited different incidence where the highest disease incidence recorded for *Curvularia* leaf spot is Petar pears and for *Alternaria* leaf spot the highest disease incidence was from the variety Flevo spirit respectively. The disease samples surveyed were collected for the isolation and identification of the disease. The pathogens *Curvularia trifolii* f. sp. *gladioli* and *Alternaria alternata* was isolated in potato dextrose agar medium and identified their morphological structures using a microscope. The chi square is performed for *Curvularia trifolii* f. sp. *gladioli* and *Alternaria alternata* to analyze statistical data. These diseases need special attention in devising protection strategies of the crop.

Introduction

World would not have been as beautiful, charming and cherishing as it is today, without flowers. Among the various bulbous flowering plants which provide glamour, perfection and color, gladiolus (*Gladiolus grandiflorus* L.) easily tops the list and can rightly be called the “Queen of bulbous

flower crops” is grown in many parts of the world (Kaikal and Nauriyal, 1964). The word gladiolus was originally coined by Pling the Elderr (AD 23-79) from the Latin word “Gladius” meaning “Sword”. So, it is also known as “sword lily” on account of the shape of its leaves (Randhawa and Mukhopadhyay, 1986). Gladiolus belongs to the family Iridaceae, together with *Iris* and

Crocus (Meerow, 2012), subfamily Ixioidae and order Iridales. Gladiolus is grown on an area of about 85,000 ha throughout the world. The major gladiolus producing countries are the United States, Holland, France, Poland, Italy, Bulgaria, Australia, Israel and India. In the international flower trade gladiolus occupies fourth place (Bose and Yadav, 1989). It is intended that 60% of gladiolus corms in Brazil are intended for the production of cut flowers for the domestic market and the remaining 40% are exported, especially to Holland (Tombolato *et al.*, 2010). In India, about 3500 ha area is occupied by bulbous plants with maximum area under gladiolus estimated around 1270 ha of land is under cultivation of this flower (Anonymous, 2008). The major areas being Kalimpong, New Delhi, Srinagar, Nainital, Pune, Bangalore, Hyderabad and its cultivation is rapidly expanding in the states like Andhra Pradesh, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Uttar Pradesh, Uttaranchal, Tamil Nadu and West Bengal (Naveen and Raju, 2007). According to the advance estimates on area and production of horticulture crops for 2018-19 issued by the National Horticulture Board, 33,900 hectares under flower cultivation would have clocked a produce of 28,580 metric tonnes. The Agricultural and Processed Food Products Export Development Authority (APEDA), the body responsible for export, promotion and development of floriculture in India, puts the value of exports by the country at Rs 571.38 crores/81.94 USD millions in 2018-19.

Prayagraj comes under agro climatic zone V dry sub humid to semi arid central plains of Uttar Pradesh. Soil is alluvium calcareous sandy loam with 62% land cultivated and 56% irrigated area. Climatic conditions are suitable for gladiolus cultivation and gladioli grow best in sandy loam soil. However, Gladiolus are adversely affected by wide range of pathogens *viz.*, Curvularia leaf spot,

Fusarium wilt, Fusarium corm rot or Yellows, Septoria leaf spot, Corm rot or Hard rot, Sclerotinia dry rot, Botrytis leaf spot, Stemphyllium leaf spot, Dry rot, Scab, Bacterial blight (Pataky, 1983). Among these, curvularia leaf spot due to *Curvularia trifolii* f. sp. *gladioli* causes economic losses. The early sown gladioli sell at a premium price in the market but have been found to suffer from very high incidence of curvularia leaf spot in the North Indian plains due to high temperature and humidity prevailing at that time. The disease was first recorded in India in 1967 from the National Botanical Garden, Lucknow, Uttar Pradesh (Singh, 1968). The disease curvularia leaf spot causes severe spotting of the stems, leaves, spikes, flowers and even the corms. The characteristic spots are circular and elongated on the leaves, irregular on the spikes. The color of the spot is tan, surrounded by a darker reddish brown ring and surrounded by a outer yellow halo (Torres *et al.*, 2013), (Riaz *et al.*, 2010). Black spore masses are often seen on the central spot of the spot. The brown or dead area is sunken. Gladiolus found affected by alternaria leaf spot (*Alternaria alternata*). The initial symptoms were in the form of small brownish circular spots with yellowish margin on the ventral surface of leaves. Spot at advance stage formed large brownish circular lesion. Spots were coalescing together and covered large area on leaf (Bhagat *et al.*, 2018). Although, the fungal diseases had become very severe nowadays not much work is carried out on fungal diseases of gladiolus. In this view survey was conducted on foliar fungal diseases of gladiolus that help us to know their characteristic symptoms.

Materials and Methods

A survey of commercially cultivated gladiolus fields in the various survey locations of Prayagraj was conducted during October 2019 to March 2020 for occurrence and distribution

of foliar fungal diseases of gladiolus. The leaves showing typical disease symptoms were collected in separate bag and were brought to the laboratory. Collected samples were subjected to isolation. Isolation of the fungal pathogens was done on potato dextrose agar (PDA) medium in a sterile Petri dish and kept for incubation at room temperature ($28 \pm 1^\circ\text{C}$). All the operations were carried out in aseptic condition. Growth of organism was observed regularly. Slides were prepared and examined under research microscope for identification. Fungal culture was purified by hyphal tip method and transferred on PDA slants for further use. Observations of per cent disease incidence were recorded weekly. Incidence was calculated from number of infected and total number of healthy plants.

The percent disease incidence was calculated by following formula (Mayee and Datar, 1986).

$$\text{Per cent disease incidence} = \frac{\text{No. of plants showing symptoms}}{\text{Total no. of plants examined}} \times 100$$

Results and Discussion

The results from the present study, disease incidence of the fungal foliar pathogen curvularia leaf spot *Curvularia trifolii* f. sp. *gladioli* with respect to the all the varieties Flevo spirit, Petar Pears, Performer, Extasy, Ocilla, Charisma and White Prosperity surveyed was observed in the month of October 2019 to March 2020 (Table: 1) with highest leaf spot disease incidence i.e. 76.92 per cent was recorded from the variety Petar Pears surveyed from the Horticulture Field, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj and lowest leaf spot disease incidence with 30.00 per cent from the variety White Prosperity surveyed from Naini, Prayagraj. And the mean per cent disease incidence is 55.24% (Fig. 1–4).

Table.1 Incidence of Curvularia leaf spot of gladiolus in different varieties collected in Prayagraj during 2019-2020

Sr.no .	Survey location	Varieties	Pathogen (leaf spot)	Number of plants tagged	Number of diseased plants surveyed	Per cent disease incidence (%)
1.	Horticulture Field, SHUATS	Flevo Spirit	<i>Curvularia trifolii</i> f.sp. <i>gladioli</i> (Curvularia Leaf spot)	13	07	53.84
2.	Horticulture Field, SHUATS	Petar Pears		13	10	76.92
3.	Horticulture Field, SHUATS	Performer		13	05	38.46
4.	Horticulture Field, SHUATS	Extasy		13	08	61.53
5.	Civil Lines	Ocilla		11	06	54.54
6.	Civil Lines	Charisma		14	10	71.42
7.	Naini	White Prosperity		10	03	30.00
Mean PDI						55.24

Table.2 Incidence of *Alternaria* leaf spot of gladiolus in different varieties collected in Prayagraj during 2019-2020

Sr.n o.	Survey location	Varieties	Pathogen (leaf spot)	Number of plants tagged	Number of diseased plants Surveyed	Per cent disease incidence (%)
1.	Horticulture Field, SHUATS	Flevo Spirit	<i>Alternaria alternata</i> (Alternaria Leaf spot)	15	11	73.34
2.	Horticulture Field, SHUATS	Petar Pears		15	08	53.33
3.	Horticulture Field, SHUATS	Performer		15	07	46.67
4.	Horticulture Field, SHUATS	Extasy		15	10	66.66
5.	Civil Lines	Ocilla		10	04	40.00
6.	Civil Lines	Charisma		12	07	58.34
7.	Naini	White Prosperity		13	09	69.23
		Mean PDI				58.22

Fig.1 Disease incidence of curvularia leaf spot of gladiolus in different varieties collected in Prayagraj during 2019-2020

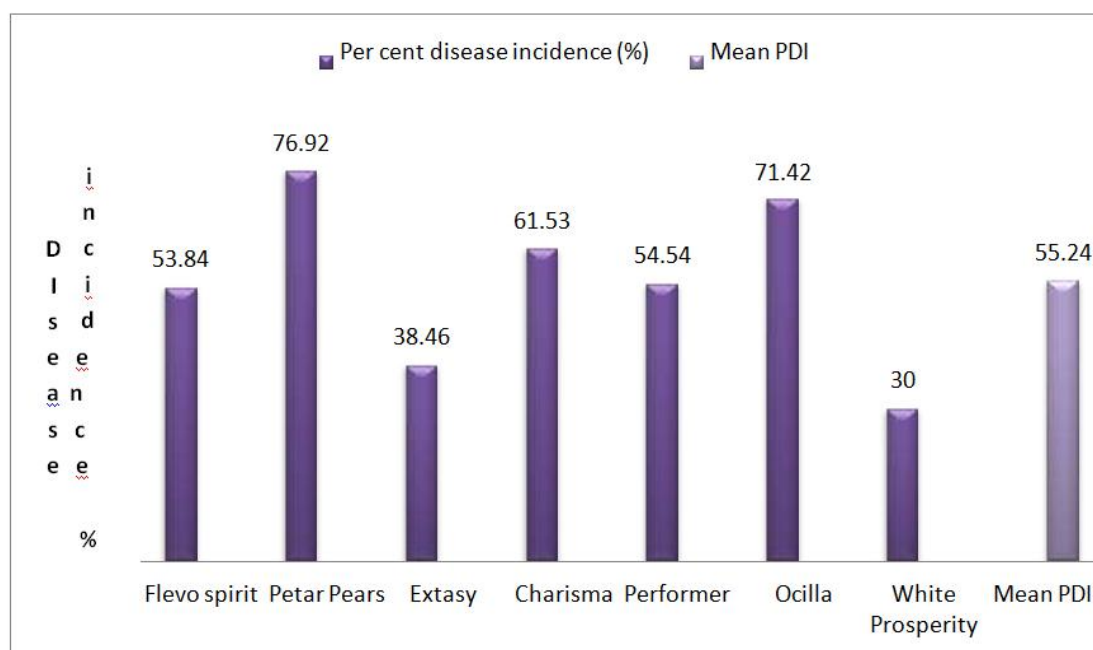


Fig.2 Diseased leaves of gladiolus with curvularia symptom



Fig.3 Disease incidence of Alternaria leaf spot of gladiolus in different varieties collected in Prayagraj during 2019-2020

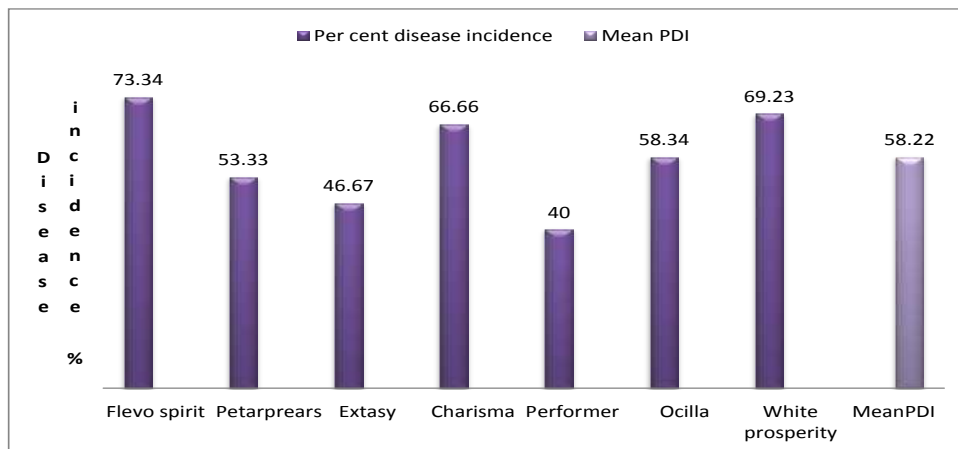


Fig.4 Diseased leaves of gladiolus affected by alternaria symptom (early stage and later stage of the symptom)



The varieties surveyed for the fungal foliar pathogen *Alternaria* (Table 2) from the Horticulture Field, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj are Flevo spirit, Petar Pears, Performer, Extasy with total number of plants tagged for the survey and to record the incidence is 15 plants each variety and the diseased plants and its disease incidence are Flevo spirit with 11 diseased plants and an incidence of 73.34%, Petar Pears with 8 diseased plants and an incidence of 53.33%, Performer with 7 diseased plants and an incidence of 46.67%, Extasy with 10 diseased plants and an incidence of 66.66% from the Horticulture Field. And the varieties surveyed from the Civil lines Ocilla had a total number of 10 tagged plants with 4 diseased plants and an incidence of 40.00% and Charisma had a total number of 12 tagged plants with 7 diseased plants and an incidence of 58.34% and the variety White Prosperity surveyed from Naini had a total number of 13 tagged plants with 9 diseased plants and an incidence of 69.23%.

To examine statistically, chi-square test was performed for *Curvularia* and *Alternaria* leaf spots for the following surveyed varieties. A chi-square test is a test of statistical significance and the formula for the chi-square test is as follows:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

After carrying out the survey for disease incidence and after performing chi-square test in gladiolus it is found to be disease stressed. The data analyzed according to (Rao and Scott, 1987) in each of the *Curvularia trifolii* f. sp. *gladioli* and *Alternaria alternata* disease samples in the period of 2019-2020 were compared using chi-square test, where degree of freedom is 6 and the test statistic values are 4.69 and 6.26, the probability being 0.05, the

tabular value is 12.59. The chi-square test statistic values are lesser than the tabular value and it's non-significant, as all the varieties have been infected by the pathogens according to the survey recorded. After carrying out the survey for disease incidence and after performing chi-square test in gladiolus it is found to be disease stressed.

In conclusion the survey conducted in Prayagraj city in gladiolus crop was found to be infected with fungal foliar diseases viz., *Curvularia* and *Alternaria* leaf spot. Among the varieties surveyed in Prayagraj city, the variety Petar pears has been more prone to *Curvularia* and the variety White prosperity is less prone to *Curvularia* than the other varieties and also among the varieties surveyed Flevo spirit showed more disease incidence to *Alternaria* and the variety Ocilla showed less disease incidence to *Alternaria*. The findings of the present investigation are limited to one crop season (October 2019 to March 2020) under Prayagraj city agro-climatic conditions as such to validate the present finding, more such trials should be carried out in future.

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