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EFFECT OF PLANT LEAF RESIDUES ON WILT INCIDENCE ON GROWTH PARAMETERS OF GLADIOLUS CULTIVARS

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ABSTRACT

The pot culture experiment was conducted to investigate the potential of different plant materials to manage wilt disease of gladiolus caused by *Fusarium oxysporum* f. sp *gladioli.* In the experiment two main treatments i.e. cultivars (American Beauty, Psittacenus Hybrid) and five plant leaf residues i.e. *Lantana camera* (Ghaneri), *Ipomoea carnea* (Besharm), *Parthenium hysterophorus* (Parthenium), *Annona innoxia* (Sitaphal) and *Azadiracta indica* (Neem) were evaluated. The experiment was carried out at Plant Pathology Section, College of Agriculture, Nagpur during the year 2015-16. *In vitro* poison food technique plant leaf extracts were tested at 5% concentration. *Ipomoea carnea* was found significantly superior over the rest in arresting the growth of pathogen and exhibited 91.86 per cent inhibition. *In vivo* pot culture experiment, *Ipomoea carnea* was found significantly superior to minimize the wilt incidence (64.27%) and also increased spike length plant^{-1} (47.28 cm), number of leaves plant^{-1} (5.75), fresh weight of leaves plant^{-1} (9.62g), dry weight of leaves plant^{-1} (3.41g), number of corms plant^{-1} (3.35) and weight of corm (25.71g) over control. Cultivar American beauty showed maximum spike length plant^{-1} (47.08 cm), number of leaves plant^{-1} (5.88), fresh weight of leaves (9.68 plant^{-1}), dry weight of leaves (2.96 plant^{-1}), number of corms plant^{-1} (3.13) and weight of corm (20.54 plant^{-1}) than that of cultivar Psittacenous hybrid. Inferences from the above findings can be made that the incorporation of *Ipomea carnea* minimised wilt incidence and helped in increasing growth parameters of gladiolus crop.

INTRODUCTION

Bulbous flowering plants are one of the most wonderful creations of nature. Gladiolus easily tops the list and can rightly be called the "Queen of bulbous flower crops" grown in many parts of the world. Gladiolus symbolizing "strength and moral integrity". Gladiolus is a tender herbaceous perennial. This crop is severely affected by wilt disease caused by *Fusarium oxysporum* f .sp. *gladioli* (Massey) leading to the death of plant and rotting of corms. *Fusarium* disease of gladiolus is commonly known as yellows, wilt or corm rot. Aromatic and medicinal plants that secrete some substances that are used for the control of plant diseases and which are safe to human and environment. High level of active ingredients is being present in leaves, flowers, seeds and twigs of higher plants that are used for pathogen control.

MATERIALS AND METHODS

Field soil and the green plant leaf residues of *Lantana camera* (Ghaneri), *Ipomoea carnea* (Besharm), *Parthenium hysterophorus* (Parthenium), *Annona innoxia* (Sitaphal) and *Azadiracta indica* (Neem) used in experiment were collected from the experimental field, College of Agriculture, Nagpur. Corms with symptoms of wilt were collected from the field of Horticulture Section, College of Agriculture Nagpur.

Soil treatment with green plant residues

The plant leaves were washed with water and cut into small pieces (about 1cm^2) and this plant residues were incorporated in sterile soil. The plant leaves mix in the pot @ 4 g 100 g^{-1} of soil. Pots were filled as per treatment details and left for 15 days to allow the decomposition of the plants materials. Then corm was sown in the pot as per the treatments.

Preparation of plant extracts

The individual fresh leaves of the plant were weighed (50 g each), chopped into small bits separately and fine slurry of each leaves was prepared with known volume of water (50 ml) in a blender. The resultant slurry was strained through a double layer muslin cloth to remove uncrushed fibrous tissues of the plant leaves. The procedure was repeated twice and each time, the resultant slurry was filtered through two fold muslin cloth. 5% concentration of culture filtrate was used in experiment. Molten PDA medium (20 ml) was supplemented sceptically with different plant extracts to get desired concentration. Thus, Petri plates were centrally inoculated a mycelia disc (2 mm disc) taken from periphery of the seventh day old culture of *Fusarium oxysporum* f. sp. *gladioli* and inoculated at 28± 2^{0}C for 72

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hrs. A control was also maintained where no leaf extract was added to molten PDA medium. The radial mycelial growth of the pathogen was measured. Per cent growth inhibition was calculated. The pot culture experiment was carried out in Factorial Randomized Block design with four replications and six treatments. The plant extracts were evaluated by food poison technique in laboratory and per cent mycelia growth was calculated by formula,

$$I = \frac{(C - T)}{C} \times 100$$

Where,

I = Per cent inhibition of fungal growth

C = Growth of the fungus in control (mm)

T = Growth of the fungus in treatment (mm)

Wilting percentage

During study initial disease symptoms were recorded and final wilted plants were counted at 90 days. The per cent disease incidence was calculated by using formula (Jones and Jenkins, 1975).

$$\text{Percent disease incidence} \quad (I) = \frac{D}{T} \times 100$$

Where,

D = Number of wilted plants

T = Total number of plants.

The experiment was conducted in Factorial Randomized Block Design. Different plant extracts *viz*., *Lantena camera, Ipomea carnea, Parthenium hysterophorous, Annona innoxia Azadiracta indica* were used to determine their efficacy and relative toxicity on radial mycelial growth of *Fusarium oxysporum* f. sp. *gladioli* by using poison food technique. The observations on wilt incidence were recorded at 30, 60, 90, and 120 DAP. Growth parameters viz., spike length, number of leaves, fresh weight of leaves, number of corms, weight of corms pl^{-1} were recorded. Observation on effect of plant extracts on radial mycelial growth of *Fusarium oxysporum* f. sp. *gladioli in vitro* was also recorded and the data are presented in table 1.

RESULTS AND DISCUSSION

Data revealed significant reduction in average colony diameter by all treatments over uninoculated control((Table1). Minimum inhibition of *Fusarium oxysporum* f. sp. *gladioli* was recorded by *Ipomoea carnea* (5%) treatment with least radial mycelial growth (3.5 mm) and more inhibition of pathogen (91.86%), *Azadiracta indica* (5%) showed 5.5 mm redial mycelial growth and recorded 87.20% inhibition of pathogen, *Lantana camera* treatment (5%) showed radial mycelial growth of 6.5 mm with 82.55% (at 5% concentration) inhibition and *Parthenium hysterophorus* (5%) showed radial mycelial growth of 8.0 mm (81.39% inhibition) and *Annona innoxia* exihibited maximum radial mycelial growth of 11.0 mm (74.41% inhibition). Arora *et al.* (2012) reported the presence of phytochemical antimicrobial and antioxidant content in leaves and flower of *Ipomea cairica* which inhibited the growth of *A. niger* and *P. chrysogenum.* Similarly Kagale *et al.* (2011) also reported inhibition of radial mycelial growth of *Rhizoctonia solani* effectively by the application of leaf extract of *Zizubus jujube* and *Ipomea carnea.* These results are in conformity with Enespa and Dwivewdi (2014), who reported that 50% concentration of *A. indica* inhibited 100 per cent growth of *F. oxysporum* f.sp. *lycopersici in vitro*. It would be observed from the table 1 that *Azadiracta indica* arrested the mycelial growth up to 5.5 mm (87.20% inhibition) followed by *Lantena camera* 6.5 mm (82.55%). Inhibitory effect of plant extracts against *Fusarium* spp. have been reported by Tongbram and Chhetry (2012) and Hadian *et al.* (2012).

Interaction effect plant residues on wilt incidence

Effect of different cultivars and plant extracts were tested in pot containing sick soil and observations were recorded on number of wilted plants and per cent disease incidence and the results are presented in table 1.

Effect on cultivar

The effect due to cultivar on wilt incidence of gladiolus plant was found to be significant at 30, 60, 90 and 120 DAP. Minimum wilt incidence was noticed in cultivar Psittacenous hybrid (at 30, 60, 90 and 120 DAP) as compared to cultivar American beauty (33.42, 39.84, 59.02 and 69.09 after 30, 60, 90 and 120 DAP, respectively). Cultivar Psittacenous hybrid was found significantly superior over the cultivar American beauty at all the interval under study.

Effect of plant leaf residues

The data presented in table 3 revealed significant effects of plant leaf residues on wilt incidence of gladiolus cultivars. Among the incorporated plant leaf residues the treatment B_2 (*Ipomea carnea)* recorded minimum wilt incidence (32.28, 39.79, 58.73, 64.27 at 30, 60, 90 and 120 DAP, respectively) and the same treatment was found significantly superior over all other treatments. It was followed by B_5 treatment (*Azadiracta indica*) and recorded 35.49, 42.47, 59.70 and 68.43% wilt incidence at 30, 60, 90 and 120 DAP, respectively. Treatment B_1 (*Lantana camera*) recorded 36.70, 44.39, 64.50 and 70.42% wilt incidence at 30, 60, 90 and 120 DAP respectively. This was due to arriving of resistance in the cultivar. Reducing effect of wilt incidence due to plant leaf residues in gladiolus wilt caused by *Fusarium oxysporum* f. sp. *gladioli* have been reported by Riaz *et al.* (2007), Riaz *et al.* (2010) and Pontes *et al.* (2011). Antifungal effect of other plant residues has been reported by Njoroge *et al.* (2008), Khan *et al*. (2010), Singh *et al.* (2012) and Raj and Kumar (2010) in gladiolus.

Interaction effect on quality parameters

It was further revealed from the data furnished in table 3 that there were non significant differences at 30, 60, 90 and 120 DAP on spike length, number of leaves plant^{-1}, fresh weight of plant, and dry weight of plant due to cultivars and plant residues.

Spike length plant $^{-1}$

The data in respect of spike length plant^{-1} in gladiolus as influenced by the green plant leaf residues are presented in table 3.

Effect on cultivar

Significant differences were noticed on number of spikes length plant^{-1} due to various treatments on gladiolus (Table 3). Cultivar V_1 (47.08 cm pl^{-1}) found significantly superior over V_2 (Psittacenous hybrid) recording 44.63 cm pl^{-1} spike length.

Effect of plant leaf residues

The data (table 3) regarding the effect of green plant leaf residues on spike length plant^{-1} of gladiolus cultivar was found to be significant. Application of *Ipomea carnea* (47.28) significantly enhanced spike length plant^{-1} over control and rest of the treatments under study. Minimum number of spikes plant^{-1} was recorded in the treatment *Annona innoxia*(45.22) over control (44.81). Present results are in conformity with the reports of Chouhan *et al*. (2014), Shanmugam *et al*. (2011), Raj and Kumar (2009), Khan and Mustafa (2010), Mamatha and Ravishankar (2004), who evaluated fungicides and plant extracts of *Lantena camera* found effective in increasing spike length plant^{-1} and number of florets^{-1}.

Interaction effect

The interaction effect between cultivars x plant residues on spikes length plant^{-1} of gladiolus was found to be non-significant (Table3).

Total number of leaves plant^{-1}

The data in respect of total number of leaves plant^{-1} in gladiolus as influenced by plant leaf residues are presented in table 3.

Effect on cultivar

Total number of leaves plant^{-1} of gladiolus was found to be significant (table 3) influenced by different cultivars. Cultivar American beauty was found significantly superior over the cultivar Psittacenous hybrid. Maximum number of leaves plant^{-1} were recorded with American beauty (5.88 pl^{-1}) followed by Psittacenous hybrid (4.82 pl^{-1}) cultivars.

Effect of plant leaf residues

Application of different plant leaf residues on total number of leaves plant^{-1} of gladiolus cultivar was found to be significant (table3). Maximum number of leaves plant^{-1} was recorded with treatment of *Ipomoea carnea* (5.75 plant^{-1}) which was at par with all the treatments except B_2 treatment (4.60 plant^{-1}). Whereas, minimum number of leaves plant^{-1} were recorded with the treatment *Annona innoxia* (5.1 pl^{-1}).

Interaction effect

It would be observed from the data presented in table 3 that there were significant differences due to combination of cultivars and plant leaf residues in respect of number of leaves plant^{-1} . The treatment *Ipomoea carnea* recorded maximum number of leaves 6.27 in cultivar American Beauty and Psittancenus Hybrid (5.22 leaves plant^{-1}) also. This might be due to accumulation of more photosynthate during plant growth.

Fresh weight of leaves $^{-1}$

The data in respect of fresh weight of leaves plant^{-1} in gladiolus as influenced by the green plant leaf residues are presented in table 3.

Effect on cultivar

Fresh weight of leaves plant^{-1} of gladiolus was significantly influenced by different cultivars. Cultivar American Beauty was found significantly superior over the cultivar Psittancenus Hybrid.

Effect of plant leaf residues

The effect of different levels of plant leaf residues on fresh weight of leaves plant^{-1} of gladiolus cultivar was found to be significant (Table 3). The treatment *Ipomea carnea* produced maximum fresh weight of leaves plant^{-1} (9.62 g) and was significantly superior over all other treatments. Whereas, minimum fresh weight of leaves plant^{-1} were recorded with the treatment *Annona innoxia* (8.69 g). Similar findings were recorded by Muhammad *et al.* (2013) and Kareem *et al*. (2014). They used plant residues on *Dahlia dahliahortensis* and observed minimum wilt incidence and it also exhibited maximum plant fresh weight and maximum dry weight of plant.

Interaction effect

The data presented in table 3 revealed that, interaction effect on fresh weight of leaves plant^{-1} of gladiolus was found to be significant in all the treatments.

The data in respect of dry weight of leaves plant^{-1} in gladiolus as influenced by the plant leaf residues are presented in table 3.

Effect on cultivar

The data presented in table 3 exhibited that, dry weight of leaves plant^{-1} of gladiolus was significantly influenced by the different cultivars. Cultivar American Beauty was found significantly superior over the cultivar Psittacenus Hybrid. Maximum dry weight of leaves plant^{-1} were recorded in American Beauty (2.96 g pl^{-1}) followed by Psittacenus Hybrid (2.68 g pl^{-1}). This might be due to genetic character of plant species.

Effect of plant leaf residues

Application of different plant leaf residues on dry weight of leaves plant^{-1} of gladiolus cultivar was found to be significant (Table 3). The treatment *Ipomea canrea* produced the maximum dry weight of leaves plant^{-1} (3.41 g plant^{-1}) and was significantly superior over all other treatments. Whereas, minimum dry weight of leaves were

recorded with the treatment *Annona innoxia* (2.57 g plant^{-1}). These findings are in accordance with the reports of Kareem *et al*. (2014), who used the maize crop residues on *Dahlia dahliahortensis* in increasing fresh and dry weight of leaves. Singh *et al.* (2012) revealed that neem compost and biocontrol agent produced more fresh weight and dry weight in the incorporation of *Fusarium oxysporum* f. sp. *cumini* of cumin crop.

Interaction effect

Interaction effect due to the cultivar and treatments was found to be significant in respect of dry weight of leaves plant^{-1} of gladiolus (Table 3). Treatment *Ipomea carnea* significantly increased maximum dry weight of leaves in the cultivar American Beauty (3.79 g plant^{-1}) and Psittacenous hybrid (3.41 g plant^{-1}) followed by application of *Azadiracta indica*.

Number of corms plant^{-1}

The data in respect of number of corms plant^{-1} in gladiolus as influenced by the cultivars and plant residues are presented in table 3.

Effect on cultivar

It is evident from the table 3 that there were significant differences on number of corms plant^{-1}. Cultivar American Beauty was found significantly superior over the cultivar Psittacenus Hybrid

Effect of plant leaf residues

The data furnished in table 3 reveals that, there were significant differences on plant leaf residues on number of corms plant^{-1} of gladiolus cultivar. Maximum number of corms plant^{-1} (3.35 pl^{-1}) produced by the treatment *Ipomea carnea* and was significantly superior over all other treatments. These findings are in conformity with the reports Muhammad *et al.* (2014), who conducted studies on incorporation of *I. carnea* for control of *B. fabae* which inhibited mycelial growth and spore germination of the fungus.

Interaction effect

It would be observed from the table 3 that there were nonsignificant differences on interaction effect.

Weight of corm plant^{-1}

The data in respect of corm weight plant^{-1} in gladiolus as influenced by the green plant leaf residues are presented in table 3.

Effect on cultivar

It is observed from the table 3 that the weight of corms plant^{-1} of gladiolus cultivar was significantly enhanced by all the treatments. Cultivar American Beauty was found significantly superior over the cultivar Psittacenus Hybrid. Maximum corms weight plant^{-1} was recorded with the cultivar of American Beauty (20.54 g pl^{-1}) as compared to Psittacenus Hybrid (17.05 g pl^{-1}).

Effect of green plant leaf residues

The data presented in table 3 revealed that, the effect of incorporation of different green plant leaf residues on weight of corms plant^{-1} of gladiolus cultivar over unnoculated control was significant. Treatment *Ipomea carnea* produced maximum corm weight plant^{-1} (25.71 g pl^{-1}) and was found significantly superior over all other treatments. Whereas minimum corms weight plant^{-1} was recorded with the treatment *Annona innoxia* (17.00 g pl^{-1}). Raj and Kumar (2009) reported increase in corms weight by incorporation of plant extract on gladiolus.

Interaction effect

It is revealed from table 3 that, interaction effect on corm weight plant^{-1} of gladiolus was found to be significant on cultivars x over plant residues. Application of *Ipomea carnea* significantly increased corm weight in Psittacenus Hybrid (29.71 g pl $^{-1}$) and in the cultivar of American Beauty with the treatment of *Azadiracta indica* (21.71 g pl^{-1}). Inferences from the above findings can be made that the incorporation of *Ipomea carnea* minimised wilt incidence and helped in increasing growth parameters of gladiolus crop.

Table 1. Effect of plant leaf extract on radial mycelial growth of Fusarium oxysporum f. sp. gladioli in vitro

Treatments	Radial mycelial growth (mm)	Per cent inhibition over control (%)
B1 (*Lantena camera*)	6.50	82.55
B2 (*Ipomoea carnea*)	3.50	91.86
B3 (*Parthenium hysterophorous*)	8.00	81.39
B4 (*Annona innoxia*)	11.00	74.41
B5 (*Azadiracta indica*)	5.50	87.20
B6 (Control)	43.00	--
SE (m) ±	0.46	--
C D (P= 0.05)	1.88	--

Table 2. Interaction effect of cultivars and plant leaf residues on wilt incidence of gladiolus at various intervals

	Wilt incidence											
Cultivar / Treatment	30 DAP			60 DAP			90 DAP			120 DAP		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
B1	40.41	32.99	36.70	50.16	38.62	44.39	69.08	59.91	64.50	76.27	64.58	70.42
B2	37.41	27.16	32.28	47.49	32.08	39.79	66.44	51.03	58.73	72.00	56.54	64.27
B3	44.33	33.12	38.72	54.16	44.04	49.10	70.66	62.61	66.64	78.03	74.75	76.39
B4	46.79	36.83	41.81	55.41	42.70	49.06	72.63	64.58	68.60	81.38	79.16	80.27
B5	40.58	30.41	35.49	49.16	35.76	42.47	67.32	52.08	59.70	74.37	62.49	68.43
B6	54.83	40.03	47.43	60.41	45.85	53.13	75.24	64.99	70.12	68.21	77.02	81.61
Mean	44.05	33.42		52.79	39.84		70.22	59.20		78.04	69.09	
	V	B	V × B	V	B	V × B	V	B	V × B	V	B	V × B
SE ± (m)	0.84	1.58	2.24	1.25	2.34	3.31	0.90	1.68	2.38	1.49	2.79	3.94
CD (P=0.05)	2.42	4.53	-	3.57	6.68	-	2.57	4.82	-	4.26	7.98	-

Table 3. Effect of plant leaf residues on growth parameters and quality of gladiolus

Treatments	Spike length (cm pl^{-1})			No. of leaves (pl^{-1})			Fresh weight (g pl^{-1})			Dry weight of leaves (g pl^{-1})			No. of corms (pl^{-1})			Weight of corms (g pl^{-1})		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
B1	47	44.83	45.91	6.05	5.10	5.57	9.89	8.27	9.08	2.84	2.69	2.76	3.24	2.79	3.01	20.62	14.48	17.55
B2	49.08	45.49	47.28	6.27	5.22	5.75	10.32	8.93	9.62	3.79	3.03	3.41	3.66	3.04	3.35	21.71	29.71	25.71
B3	46.78	44.54	45.66	5.80	4.57	5.18	9.36	8.02	8.84	2.68	2.64	2.66	3.16	2.68	2.92	20.27	14.44	17.35
B4	46.13	44.32	45.22	5.70	4.50	5.10	9.57	8.11	8.69	2.57	2.56	2.57	2.74	2.51	2.63	19.68	14.32	17.00
B5	48.00	44.94	46.47	6.05	5.15	5.60	10.23	8.35	9.29	3.31	2.78	3.04	3.41	2.95	3.1	21.55	15.11	18.33
B6	46.05	43.57	44.81	5.52	4.40	4.96	8.74	7.99	8.36	2.60	2.55	2.58	2.57	2.49	2.53	19.43	14.29	16.86
Mean	47.08	44.63		5.88	4.82		9.68	8.27		2.96	2.68		3.13	2.74		20.54	17.05	
	V	B	V×B	V	B	V×B	V	B	V×B	V	B	V×B	V	B	V×B	V	B	V×B
SE ±(m)	0.35	0.67	0.94	0.07	0.13	0.19	0.06	0.12	0.94	0.03	0.05	0.07	0.04	0.08	0.12	0.13	0.25	0.38
C D (P=0.05)	2.03	3.79	-	0.21	0.39	0.56	0.18	0.34	2.88	0.08	0.16	0.22	0.013	0.25	-	0.21	0.72	1.03

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