International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1801-1806

Received: 25-05-2019
Accepted: 27-06-2019

SV Pawar
Ph.D. Research Scholar,
Department of Plant Pathology,
Post Graduate Institute,
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Akola,
Maharashtra, India

RW Ingle
Associate Professor,
Department of Plant Pathology,
Post Graduate Institute,
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Akola,
Maharashtra, India

RS Lad
Ph.D. Research Scholar,
Department of Plant Pathology,
Post Graduate Institute,
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Akola,
Maharashtra, India

Correspondence
SV Pawar
Ph.D. Research Scholar,
Department of Plant Pathology,
Post Graduate Institute,
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Akola,
Maharashtra, India

Management of leaf spot disease of safed musli (*Chlorophytum borivilianum*) incited by *Phoma* spp. under field condition

SV Pawar, RW Ingle and RS Lad

Abstract
The leaf spot disease of Safed musli caused by *Phoma* spp. is the major threats in the Vidarbha region of Maharashtra. The present investigation was carried out during the year 2016-2017 and 2017-2018 in an *in vivo* condition at Nagarjun Medicinal and Aromatic Plant Garden, Dr. P.D.K.V., Akola for management of leaf spot disease of Safed musli by biological and cultural methods. The lowest per cent disease incidence (21.03% and 21.62%) and intensity (2.07% and 2.36%) of leaf spot were recorded in treatment T3 (Safed musli + *Trichoderma viride* + Pigeon pea 3:1) after 77 DAS for both the year of experiments. It was concluded from present studies, the traditional method of farming (Biological and Cultural methods) for the management of leaf spot disease of Safed musli was best and also reduced incidence and intensity of same disease for longer period.

Keywords: Safed musli, management, Leaf spot and *Phoma* spp

Introduction
Plants have been the prime source of drugs since the creation of human civilization. The Indian flora is well known to have medicinal value (Around 2000 plant species) and their uses vary from folklore to manufacture of drugs and are also used in allopathic system of medicine. The wonder herb Safed musli (*Chlorophytum borivilianum* Sanpatau and Fernandez) commonly known as dholi musli belonging to class Monocotyledons, Family Anthericaceae (Liliaceae) is a promising medicinal herb with great economic potential. Under social validation, Safed musli is a powerful herb, the root tubers of which have been in use for aphrodisiac and health promotion purpose since 11th Century A.D. (Sarangadhar Samhita) in India. Safed musli is a rare divine-graced herb to offer all the effects required for achievement for health par superiority or for attaining the ultimate positive health (Charak Samhita 2nd Century B.C.). Roots of Safed musli are used as a herbal Viagra in Ayurvedic formulations and commonly used to cure general weakness, revitalize diabetes, arthritis, curative for natal and postnatal problems, diarrhea and gonorrhea as stimulant of brain development in childern and for increasing general body immunity. It is supplementary therapy for blood purification, nervous disorder and some gynecological problems (Oudhia, 2001) [3].
There is some bottlenecks which are hampering the successful cultivation of safed musli and the fluctuation in the production is largely on account of disease. There are reports of some diseases which cause considerable damage to safed musli crops *viz.,* Finger/root rot caused by *Rhizoctonia solani*, tuber rot by *Fusarium solani*, collar rot by *Corticium rolfsii* (Singh *et.al.,* 2001) [6], leaf blight by *Colletrotrichum capsici* (Sattar *et.al.,* 2006) [5], leaf spot by *Curvularia* spp. And *Macrophomina phaseolina* (Kunal *et. al.,* 2004) and anthracnose by *Colletrotrichum dematium* (Rao and Narendra, 1974) [4] and rust *Aecidium hartwegiae* Theum. During the storage fleshy roots become hallow and may get infected with *Aspergillus* and *Fusarium* spp. One of the major bottlenecks in commercial cultivation of safed musli is root rot caused by *Rhizoctonia solani* which is widely prevalent in all safed musli growing regions and occurs in varying severity. Since no systemic investigation has been undertaken in past to find out the occurrence and severity as well as effect of date of sowing on disease development and losses caused by root rot at farmer fields of safed musli growing areas of India. There is an urgent need to address these problems on war footing for formerly ignored but important disease of safed musli.

Safed musli is widely cultivated in Akola and Buldana districts of Vidarbha region; in year 2013-14 cultivated area of these two districts was 62.5 ha with production of 1.33 MT obtained (Anonymous, 2013-14) [1].

Leaf spot is an important disease and are prevalent in most Safed musli growing fields at Vidarbha region of Maharashtra. These diseases ultimately results in severe early blighting of leaves, which is a direct loss of its medicinal value. Present investigation was undertaken to manage leaf spot disease by biological and cultural methods with different combinations treatment.

Material and Methods

Rhizomes/ tubers of safed musli and seeds of intercropping crops

The tubers of safed musli were obtained from Nagarjun Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola and the seeds of pigeon pea and maize were collected from Pulse Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The seeds of sorghum was obtained from Sorghum Research Station, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

Bio-control agents

The fresh cultures of fungal bio-agent *viz.*, *Trichoderma viride*, and bacterial bio-agents *Pseudomonas fluorescens* and *Bacillus subtilis* were obtained from Department of Plant Pathology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

Recording the leaf spot incidence and intensity under natural field condition

The initiation and development of leaf spot disease of safed musli was recorded at weekly interval and per cent the incidence / occurrence of the diseases was on calculated. The disease occurrence was recorded by selecting 25 plants for leaf spot disease of Safed musli crop.

Observations

Observations on per cent disease incidence and intensity were recorded periodically. Incidence was calculated from number of infected and healthy plants. The per cent disease incidence of leaf spot of safed musli was calculated by following formula.

$$\text{Per cent Disease Incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

The average intensity was worked out by using the following formula.

$$\text{Per cent Disease Intensity} = \frac{\text{Summation of all numerical ratings}}{\text{Total number of leaves examined X maximum ratings}} \times 100$$

Numerical rating scale for foliar disease intensity (Ingle *et. al* 2014) [2]

Scale	Remark
0	No lesions
1	Pinhead size spots on leaves
3	Small Spots of 1-2 mm on 10% leaf area
5	Spots of 1-2 cm length on 25% leaf area
7	Spots on 26-50% leaf area
9	Spots on more than 50% leaf area

Methods of application of bio-agents

Rhizome/Tuber dipped in all three bio-agents suspension (Commercial product of *Trichoderma viride* 25 gm/l, Culture of *Pseudomonas fluorescens* 10 ml/l and Culture of *Bacillus subtilis* 10 ml/l) for 10 to 15 minutes.

Experimental layout

The experiment was carried out at Nagarjun Medicinal and Aromatic Plant Garden, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola in Factorial Randomized Block Design with three replications and thirteen treatments.

1. Location: Nagarjun Medicinal and Aromatic Plants Garden, Dr. P.D.K.V., Akola
2. Soil type: Inceptisol.
3. Design: Randomized Block Design (RBD)
4. No. of replications: 3
5. No of treatments: 13
6. Total No. of plots: 39
7. Plot size: Gross 3.5 x 1.8 m^2
8. Crop and variety: Safed musli- Local
   Sorghum- SPH-1635
   Maize- Monsanto 900M
   Pigeon pea- AKT-8811
9. Season: 2016-2017 and 2017-2018 *(Kharif)*
10. Spacing: Safed musli 30 x 10 cm (High density)
    Sorghum 45 x 45 cm
    Maize 60 x 30 cm
    Pigeon pea 45 x 30 cm
11. Seed rate

Crop	Seed rate/ha	Seed rate for intercropping
Safed musli	3.33 lakh sprout	2.50 lakh sprout
Sorghum	8-10 Kg	4 Kg
Maize	20 Kg	10 Kg
Pigeon pea	20 Kg	10 Kg

12. Method of sowing: Safed musli: Planting
    : Sorghum: Dibbling
    : Maize: Dibbling
    : Pigeon pea: Dibbling
13. Date of sowing: 01/07/2016 and 27/06/2017
14. Date of Harvesting: 07/02/2017 and 02/02/2018

Treatment details

Sr. No.	Treatment Number	Treatment details
1.	T_1	Safed musli + Sorghum + *Trichoderma viride* + *Azotobacter* + FYM (3:1)
2.	T_2	Safed musli + Maize + *T. viride* + *Azotobacter* + FYM (3:1)
3.	T_3	Safed musli + Pigeon pea + *T. viride* + *Azotobacter* + FYM (3:1)
4.	T_4	Safed musli + Sorghum + *T. viride* + *Pseudomonas flourescens* + *Azotobacter* + FYM (3:1)
5.	T_5	Safed musli + Maize + *T. viride* + *P. flourescens* + *Azotobacter* + FYM (3:1)
6.	T_6	Safed musli + Pigeon pea + *T. viride* + *P. flourescens* + *Azotobacter* + FYM (3:1)
7.	T_7	Safed musli + Sorghum + *T. viride* + *Bacillus subtillis* + *Azotobacter* + FYM (3:1)

8.	T_8	Safed musli + Maize + *T. viride* + *B. subtillis* + *Azotobacter* + FYM (3:1)
9.	T_9	Safed musli + Pigeon pea + *T. viride* + *B. subtillis* + *Azotobacter* + FYM (3:1)
10.	T_{10}	Safed musli + Sorghum + *T. viride* (spraying) + *P. flourescens* + *B. subtillis* + *Azotobacter* + FYM (3:1)
11.	T_{11}	Safed musli + Maize + *T. viride* (spraying) + *P. flourescens* + *B. subtillis* + *Azotobacter* + FYM (3:1)
12.	T_{12}	Safed musli + Pigeon pea + *T. viride* (spraying) + *P. flourescens* + *B. subtillis* + *Azotobacter* + FYM (3:1)
13	T_{13}	Sole safed musli (Control)

Results and Discussion

Initiation of leaf spot disease

The leaf spot disease of safed musli was observed in the field of Nagarjun Medicinal and Aromatic Plant Garden, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the 1st week of August to 4th week of September in the year 2016. Same disease was observed during the year 2017 on 5th week of July to 4th week of September. It was noticed that the disease occurred when the prevailing temperature was within range of 24 to 29 ºC, relative humidity about 81 to 88 per cent and the average rainfall around 10.80 mm per day. In case of the safed musli crop infected by *Phoma* spp. pathogen, initially the disease appeared in the form of small pin head like dark reddish to brownish coloured spot observed on leaves. The lesion enlarged to form irregular light brown-grey patches on leaves. On close examination of infected leaves white to grey translucent leaf epidermis remaining and surrounded by dark brownish hallow. Further black colored asexual fruiting bodies of this pathogen (Pycnidia) was observed on remaining translucent epidermis in scattered form which serve as secondary infection of that pathogen.

Effect of bioagents and intercropping on leaf spot disease incidence and intensity of safed musli (2016-2017)

The disease was first appeared on upper portion of young leaves on 4th August 2016 (35 DAS). It was noticed that the leaf spot disease caused by *Phoma* spp. occurred when the prevailing temperature was within range of 23 to 31 ºC, relative humidity about 86 to 88 per cent and the average rainfall around 9.32 mm per day. The result presented in Table 1 and 2, revealed that at all days of observations the different factors of bioagents and intercropping system were statistically significant over disease incidence and intensity caused by *Phoma* spp.

The minute pin head like spot was first observed in safed musli leaves at 35 DAS. Disease incidence and intensity was evaluated on 25 plants by counting the number of affected leaves. The data on diseases incidence and intensity of *Phoma* spp. was statistically significant. The lowest disease incidence (1.92%) and intensity (0.15%) caused by *Phoma* spp. on safed musli was observed in T_3 (safed musli + *T. viride* + pigeon pea) at 35 DAS and it was followed by T_1 (safed musli + *T. viride* + sorghum) which showed 2.07 per cent disease incidence and 0.73 per cent disease intensity. Whereas the highest disease incidence (6.37%) and intensity (1.32%) was recorded in sole safed musli crop. The data on per cent disease incidence and intensity of leaf spot 42 DAS, the results were statistically significant. The least disease incidence (4.74%) and intensity (0.44%) was observed in T_3 of 3:1 ratio of intercropping (safed musli + *T. viride* + pigeon pea). The maximum incidence (10.51%) and intensity (2.22%) was recorded in untreated plot. The treatment combination safed musli + *T. viride* + pigeon pea was statistically superior to all over treatments. The maximum disease incidence (13.77%) and intensity (2.37%) at 49 DAS was observed in sole safed musli plots. Whereas the minimum disease incidence (8.59%) and intensity (0.88%) was recorded in treatment combination of safed musli + *T. viride* + pigeon pea (T_3) and it was followed by T_9 (safed musli + *T. viride* + *B. subtilis* + pigeon pea) which showed 9.33, 1.18 per cent disease incidence and intensity respectively.

When normally dry to humid climate was occured during the 18th to 25th August in 2016 (56 DAS) it favors to increase diseases incidence up to 3.50 to 6.00 per cent, caused by *Phoma* spp. At that climatic condition the greatest leaf spot disease incidence (17.77%) and intensity (2.66%) was recorded in control treatment plots. In case of favorable climatic conditions to disease development, the lowest incidence (12.14%) and intensity (1.18%) was observed in T_3 treatment as compared to all treatments and also showed superior treatment combination to manage disease. Incidence of leaf spot of safed musli at 63 DAS, the results were statistically significant. The least disease incidence (13.18%) and intensity (1.33%) was observed in T_3 of 3:1 ratio of intercropping (safed musli + *T. viride* + pigeon pea). The maximum disease incidence was recorded in T_{13} (20.00%) and intensity (2.96%). The maximum disease incidence (23.11%) and intensity (3.25%) at 70 DAS was observed in sole safed musli plots. Whereas the minimum disease incidence (16.14%) and intensity (1.62%) was recorded in treatment combination of safed musli + *T. viride* + pigeon pea (T_3) and it was followed by T_6 (safed musli + *T. viride* + *P. fluorescens* + pigeon pea) which showed 19.55 per cent disease incidence and intensity 2.37 per cent. The data on diseases incidence of *Phoma* spp. was statistically significant at 77 DAS. The lowest disease incidence (21.03%) and intensity (2.07%) caused by *Phoma* spp. on safed musli was observed in T_3 (safed musli + *T. viride* + pigeon pea) at 77 DAS and it was followed by T_6 (safed musli + *T. viride* + *P. fluorescens* + pigeon pea) which showed 22.37 per cent disease incidence and 2.51 per cent disease intensity. The treatment number T_3 was significantly superior as compared to all the treatments.

Table 1: Effect of different treatments on incidence of leaf spot of safed musli caused by *Phoma* spp. (2016-2017)

Treatments	Percent incidence at**						
	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS
T1	2.07 (1.44)*	6.52 (2.55)	10.22 (3.20)	14.37 (3.79)	16.73 (4.09)	20.59 (4.54)	24.44 (4.94)
T2	4.29 (2.06)	7.55 (2.74)	10.22 (3.19)	13.77 (3.71)	17.18 (4.41)	20.14 (4.49)	24.15 (4.91)
T3	1.92 (1.38)	4.74 (2.17)	8.59 (2.93)	12.14 (3.48)	13.18 (3.63)	16.14 (4.02)	21.03 (4.59)
T4	3.85 (1.96)	7.11 (2.66)	10.07 (3.17)	14.07 (3.75)	17.18 (4.14)	20.88 (4.57)	24.88 (4.99)

T5	4.89 (2.20)	8.00 (2.83)	10.96 (3.31)	14.81 (3.85)	17.33 (4.16)	20.74 (4.55)	24.73 (4.97)
T6	2.96 (1.68)	6.96 (2.64)	9.92 (3.15)	12.74 (3.57)	17.18 (4.14)	19.55 (4.42)	22.37 (4.73)
T7	3.10 (1.72)	6.96 (2.64)	10.37 (3.22)	14.07 (3.75)	17.03 (4.13)	20.59 (4.54)	24.74 (4.97)
T8	3.70 (1.91)	7.11 (2.66)	10.81 (3.29)	14.22 (3.77)	17.03 (4.13)	20.44 (4.52)	24.44 (4.94)
T9	2.96 (1.72)	6.96 (2.63)	9.33 (3.05)	13.33 (3.65)	15.55 (3.94)	20.29 (4.50)	22.66 (4.76)
T10	5.03 (2.24)	8.00 (2.82)	11.70 (3.42)	16.15 (4.02)	18.66 (4.32)	21.33 (4.62)	25.48 (5.05)
T11	3.70 (1.91)	7.26 (2.69)	11.11 (3.33)	14.96 (3.86)	17.92 (4.23)	21.03 (4.59)	25.33 (5.03)
T12	3.11 (1.76)	6.96 (2.64)	10.37 (3.22)	14.63 (3.82)	16.00 (4.00)	20.15 (4.49)	22.37 (4.73)
T13 (Control)	6.37 (2.52)	10.51 (3.24)	13.77 (3.71)	17.77 (4.22)	20.00 (4.47)	23.11 (4.81)	29.62 (5.42)
F Test	SIG	SIG	SIG	SIG	SIG	SIG	SIG
S.E (M)±	0.10	0.12	0.12	0.16	0.14	0.09	0.10
C.D (p=0.05)	0.31	0.36	0.36	0.47	0.42	0.27	0.30

** : mean of three replications
Figure in parenthesis * indicate Square root values

Table 2: Effect of different treatments on intensity of leaf spot of safed musli caused by *Phoma* spp. (2016-2017)

Treatments	Per cent intensity at**						
	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS
T1	0.29 (0.44)*	0.88 (0.92)	1.33 (1.14)	1.48 (1.21)	1.77 (1.32)	2.07 (1.44)	2.51 (1.58)
T2	0.73 (0.85)	1.03 (1.01)	1.33 (1.14)	1.62 (1.27)	1.92 (1.38)	2.37 (1.54)	2.66 (1.63)
T3	0.15 (0.22)	0.44 (0.53)	0.88 (0.92)	1.18 (1.08)	1.33 (1.14)	1.62 (1.25)	2.07 (1.44)
T4	1.33 (1.15)	1.62 (1.27)	1.77 (1.32)	2.07 (1.44)	2.37 (1.54)	2.51 (1.58)	2.81 (1.68)
T5	1.33 (1.14)	1.48 (1.21)	1.77 (1.32)	1.92 (1.38)	2.07 (1.44)	2.36 (1.53)	2.66 (1.63)
T6	0.88 (0.76)	1.18 (1.05)	1.47 (1.20)	1.77 (1.32)	1.92 (1.37)	2.37 (1.54)	2.51 (1.58)
T7	0.74 (0.66)	1.33 (1.12)	1.62 (1.24)	1.92 (1.37)	2.22 (1.48)	2.51 (1.57)	2.96 (1.71)
T8	0.59 (0.61)	1.33 (1.14)	1.47 (1.20)	1.77 (1.32)	2.07 (1.44)	2.37 (1.54)	2.66 (1.63)
T9	0.59 (0.75)	0.88 (0.92)	1.18 (1.08)	1.48 (1.21)	1.62 (1.27)	1.92 (1.38)	2.37 (1.54)
T10	1.18 (1.08)	1.63 (1.27)	1.92 (1.38)	2.07 (1.43)	2.37 (1.53)	2.66 (1.63)	2.81 (1.67)
T11	1.03 (1.01)	1.48 (1.19)	1.77 (1.31)	1.92 (1.37)	2.22 (1.48)	2.37 (1.54)	2.96 (1.72)
T12	0.59 (0.75)	0.88 (0.92)	1.33 (1.14)	1.62 (1.27)	1.92 (1.38)	2.22 (1.48)	2.52 (1.58)
T13 (Control)	1.77 (1.32)	2.22 (1.48)	2.37 (1.54)	2.66 (1.63)	2.96 (1.71)	3.25 (1.80)	3.70 (1.92)
F Test	SIG	SIG	SIG	SIG	SIG	SIG	SIG
S.E (M)±	0.07	0.06	0.06	0.05	0.05	0.05	0.05
C.D (p=0.05)	0.20	0.18	0.11	0.15	0.15	0.15	0.15

** : mean of three replications
Figure in parenthesis * indicate Square root values

Effect of bioagents and intercropping on leaf spot disease incidence and intensity of safed musli (2017-2018)

The disease was first appeared on upper portion of young leaves on 31st July 2017 (35 DAS). It was noticed that the leaf spot disease caused by *Phoma* spp. occurred when the prevailing temperature was within range of 25 to 34 ºC, relative humidity about 75 to 80 per cent and the average rainfall around 5.45 mm per day. The result presented in Table 3 and 4, revealed that at all days of observations the different factors of bioagents and intercropping system were statistically significant over disease incidence caused by *Phoma* spp.

The data on diseases incidence and intensity of *Phoma* spp. was statistically significant. The lowest disease incidence (2.96%) and intensity (0.74%) caused by *Phoma* spp. on safed musli was observed in T_3 (safed musli + *T. viride* + pigeon pea) at 35 DAS. Whereas the highest disease incidence was recorded in sole safed musli crop T_{13} (7.55%) and intensity (2.07%). The data on incidence of leaf spot at 42 DAS, the results were statistically significant. The least disease

incidence (5.77%) and intensity (1.03%) was observed in T_3 of 3:1 ratio of intercropping (safed musli + *T. viride* + pigeon pea). The maximum disease incidence (10.51%) and intensity (2.51%) was recorded in $T_{13.}$ The treatment combination safed musli + *T. viride* + pigeon pea were statistically superior to all over treatments. The data on diseases incidence of *Phoma* spp. was statistically significant at 77 DAS. The lowest disease incidence (21.62%) and intensity (2.36%) caused by *Phoma* spp. on safed musli was observed in T_3 (safed musli + *T. viride* + pigeon pea) at 77 DAS and it was followed by T_6 (safed musli + *T. viride* + *P. fluorescens* + pigeon pea) which showed 23.85 per cent disease incidence and 2.51 per cent intensity.

Similar findings were agreement with Naidu (2011) [7] studied and gave symptoms of some important foliar and soil borne diseases of safed musli and reported *Phoma* sp. causing brown spots as one of the foliar disease of safed musli and Hammoudi *et al.* (2012) [8] showed that the effectiveness of bacterial and fungal isolates to control *Phoma lingam*. Also Ingle *et al*. (2014) [2] reported similar interaction effects of sowing dates and different treatments on incidence and intensity of foliar disease caused by *Phoma* spp. in safed musli.

In this study, several antagonistic microorganisms including bacteria and fungi were tested at field conditions to check their efficacy against the leaf spot disease of safed musli caused by *Phoma* spp. For effective protection against plant pathogens, the antagonist must be able to colonize successfully the rhizosphere of the plant. The antagonists must compete with other microorganisms in the root system of the plants in order inhibit the attack of pathogens. In an our field experiment we can concluded that the treatment number T_3 (safed musli + *T. viride* + pigeon pea), T_6 (safed musli + *T. viride* + *P. fluorescens* + pigeon pea) and T_9 (safed musli + *T. viride* + *B. subtilis* + pigeon pea) were showed best efficacy reaction against soil borne as well as air borne pathogen due to the optimal temperature for growth of *P. fluorescens* and *P. putida in vitro* is 25-30 °C, but root colonization by these bacteria is generally .greatest below 20 °C. Microbial activity in the soil increases as soil temperatures increase; thus better colonization at lower temperatures probably reflects less competition from indigenous micro flora (Weller 1988) [9].

Table 3: Effect of different treatments on incidence of foliar disease caused by *Phoma* sp. (2017-2018)

Treatments	Per cent incidence at**						
	35 DAS	**42 DAS**	**49 DAS**	**56 DAS**	**63 DAS**	**70 DAS**	**77 DAS**
T1	3.85 (1.96)*	6.81 (2.61)	10.51 (3.24)	14.96 (3.87)	17.77 (4.22)	21.62 (4.65)	24.14 (4.91)
T2	4.29 (2.07)	7.11 (2.66)	11.11 (3.33)	15.40 (3.92)	17.92 (4.23)	22.07 (4.70)	25.48 (5.05)
T3	2.96 (1.71)	5.77 (2.40)	8.88 (2.98)	12.59 (3.55)	14.96 (3.87)	18.37 (4.29)	21.62 (4.65)
T4	4.88 (2.20)	8.00 (2.83)	11.11 (3.33)	15.70 (3.96)	18.66 (4.32)	22.51 (4.74)	26.22 (5.12)
T5	5.18 (2.27)	8.44 (2.90)	12.14 (3.48)	15.25 (3.91)	18.51 (4.30)	22.66 (4.76)	25.92 (5.09)
T6	3.85 (1.96)	7.70 (2.77)	11.11 (3.33)	14.22 (3.77)	17.18 (4.41)	20.59 (4.54)	23.85 (4.88)
T7	5.03 (2.24)	8.14 (2.85)	11.11 (3.33)	15.70 (3.96)	18.81 (4.34)	22.81 (4.78)	26.51 (5.15)
T8	4.59 (2.14)	7.85 (2.80)	12.00 (3.46)	16.29 (4.04)	19.55 (4.42)	23.26 (4.82)	26.81 (5.18)
T9	4.29 (2.06)	7.55 (2.75)	10.96 (3.31)	14.66 (3.83)	17.33 (4.16)	20.59 (4.54)	24.74 (4.97)
T10	4.88 (2.21)	8.00 (2.83)	11.70 (3.42)	15.26 (3.90)	18.66 (4.32)	22.81 (4.78)	26.66 (5.16)
T11	5.48 (2.34)	8.14 (2.85)	12.44 (3.53)	16.15 (4.02)	18.96 (4.35)	22.66 (4.76)	26.96 (5.19)
T12	4.00 (2.00)	7.11 (2.66)	11.40 (3.38)	14.07 (3.75)	17.03 (4.13)	20.00 (4.47)	24.29 (4.93)
T13 (Control)	7.55 (2.75)	10.51 (3.24)	13.92 (3.73)	18.37 (4.29)	21.48 (4.63)	25.18 (5.02)	28.88 (5.37)
F Test	SIG	SIG	SIG	SIG	SIG	SIG	SIG
S.E (M)±	0.09	0.08	0.05	0.09	0.10	0.11	0.14
C.D (p=0.05)	0.27	0.24	0.23	0.27	0.31	0.33	0.42

** : mean of three replications

Figure in parenthesis * indicate Square root values

Table 4: Effect of different treatments on intensity of leaf spot of safed musli caused by *Phoma* spp. (2017-2018)

Treatments	Per cent intensity at**						
	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS
T1	1.18 (1.08)*	1.62 (1.27)	1.77 (1.33)	2.07 (1.44)	2.22 (1.48)	2.51 (1.58)	2.81 (1.68)
T2	1.33 (1.14)	1.33 (1.14)	1.62 (1.27)	1.92 (1.38)	2.37 (1.54)	2.51 (1.58)	2.81 (1.67)
T3	0.74 (0.70)	1.03 (0.99)	1.18 (1.05)	1.48 (1.16)	1.77 (1.31)	2.07 (1.42)	2.36 (1.53)
T4	1.48 (1.21)	1.62 (1.27)	1.77 (1.32)	1.92 (1.37)	2.07 (1.43)	2.22 (1.48)	2.66 (1.63)
T5	1.18 (1.08)	1.48 (1.21)	1.77 (1.33)	2.07 (1.44)	2.36 (1.53)	2.66 (1.63)	2.96 (1.71)
T6	0.88 (0.92)	1.18 (1.08)	1.48 (1.21)	1.77 (1.33)	1.92 (1.38)	2.22 (1.48)	2.51 (1.58)
T7	1.18 (1.08)	1.48 (1.21)	1.62 (1.27)	1.92 (1.38)	2.37 (1.54)	2.81 (1.68)	3.11 (1.76)
T8	1.03 (1.01)	1.33 (1.14)	1.63 (1.27)	1.92 (1.37)	2.37 (1.53)	2.66 (1.63)	2.96 (1.72)
T9	0.88 (0.92)	1.18 (1.08)	1.48 (1.21)	1.63 (1.27)	1.92 (1.38)	2.22 (1.49)	2.66 (1.63)
T10	1.33 (1.15)	1.62 (1.27)	1.77 (1.33)	2.07 (1.44)	2.36 (1.53)	2.81 (1.67)	3.11 (1.76)
T11	1.62 (1.27)	1.92 (1.38)	2.07 (1.44)	2.22 (1.48)	2.51 (1.58)	2.96 (1.72)	3.26 (1.80)
T12	0.88 (0.92)	1.18 (1.08)	1.33 (1.15)	1.62 (1.27)	1.92 (1.38)	2.37 (1.54)	2.66 (1.63)
T13 (Control)	2.07 (1.44)	2.51 (1.58)	2.81 (1.68)	2.96 (1.72)	3.26 (1.80)	3.55 (1.88)	3.85 (1.96)
F Test	SIG	SIG	SIG	SIG	SIG	SIG	SIG
S.E (M)±	0.05	0.05	0.05	0.06	0.05	0.05	0.05
C.D (p=0.05)	0.16	0.15	0.12	0.18	0.16	0.15	0.17

** : mean of three replications

Figure in parenthesis * indicate Square root values

References

1. Anonymous. Annual Progress Report for 2013-14. Krishi Vigyan Kendra, Jalgaon Jamod Dist: Buldana. 2013-14, pp.12.
2. Ingle RW, Shende S, Deshmukh VV, Joshi MS. Interaction effect of sowing dates and different treatments on disease incidence and intensity of *Phoma* sp. on Safed Musali. American Inter. J. Res. Formal, Appl. & Natural Sci. 2014; 7(1):69-73.
3. Oudhia Pankaj. Safed musali (*Chlorophytum borivilianum* L.): Medicinal and wonder crop. Society for Parthenium Management (SOPAM). Pankaj, 2001. oudhia@usa.net.
4. Rao VG, Narendra DV. An undescribed disease of *Chlorophytum* from Maharashtra. Curr. ent Sci. 1974; 43(9):295.
5. Sattar A, Alam M, Khaliqu A, Shukla RS, Khanuja SP. First report of leaf blight disease of *Chlorophytum borivilianum* caused by *Colletotrichum capsici* in Northern India. Plant Pathology. 2006; pp.55.
6. Singh BP, Arora K, Khurana SMP. Tech, Bull no. 41 (Revised), Central Potato Crop Research Institute, Shimla. 2002, 74.
7. Naidu S. Management of foliar and soil borne diseases of safed musali. M.Sc. (Agri.) Thesis (unpub.), Dr. PDKV, Akola, 2011.
8. Hammoudi O, Salman M, Abuamsha R, Ehlers. Effectiveness of bacterial and fungal isolates to control *Phoma lingam* on oilseed rape *Brassica napus*. American Journal of Plant Sciences. 2012; 3:773-779.
9. Weller DM. Biological Control of Soilborne Plant Pathogens in the Rhizosphere with Bacteria. Annual Reviews of Phytopathology. 1988; 26(1):379-407.