

Original Research Article

Field Evaluation of Bio-Control Agent and Phyto-Extract against Intensity of Sigatoka Leaf Spot and Yield of Banana cv. Ardhapuri

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ABSTRACT

A field experiment was conducted during 2013-14 on the farm of Banana Research Station, Nanded, "To study the effect of bio-control agents and phyto-extracts against Sigatoka leaf spot diseases of banana. Three bio-control agents viz. *Trichoderma viridae*, *Trichoderma harzianum* and *Pseudomonas fluorescens* and five phytoextracts viz. leaf extracts of marigold, Dhathura, Neem, Parthenium and garlic were evaluated at 10 percent concentration in three replication in Randomized Block Design against Sigatoka leaf spot diseases of banana. The sprayings were started after one month of planting the crop and were continued upto the flowering at 30 days interval. Considering the effectiveness of bio-agents and phytoextracts, significantly minimum percent diseases index of Sigatoka leaf spot were recorded by the treatment T₇ that is spraying of parthenium @10 % (4.72 %) followed by the treatment T₆ (Spraying of neem leaf extract @ 10 % (6.03 %) during every month recorded as compared with rest of the treatment under study. Significantly maximum yield of banana were recorded by the treatment T₇ i.e. spraying of parthenium @ 10 % (87.8 Mt/ha) followed by the treatment T₅ i.e. spraying of dhatura @ 10% (86.5 Mt/T) and treatment T₆ i.e. spraying of neem leaf extract @10 % (83.2 Mt/ha) as compared with rest of the treatments and control.

Keywords

Bio-agents,
Phyto-extracts,
Sigatoka,
Banana

Introduction

Yellow Sigatoka leaf spot disease caused by *Mycospharella musicola* is considered the most damaging and costly diseases of banana (Jacome and Schuh, 1992). By attacking the leaves with the fungus disrupts the process of photosynthesis that feeds the growing bunch. Infected plants have fewer leaves, which lead to fewer and smaller fruits, a delayed harvest and lower quality fruits (Ramsay *et al.*, 1990).

The banana growers in Maharashtra are maintaining periodic agrochemical spray

programme for the control of banana leaf diseases and have been criticized on the grounds of environmental and human health concern. The situation encouraged banana industry and scientists to look for alternative methods of leaf diseases control. Searching for sustainable alternatives to synthetic chemicals obviously is the best long term goal for leaf disease control, especially for small holding farmers who cannot afford the costly synthetic chemical spray. As a preliminary stage, to provide additional tools for diseases management alternatives with

different mechanisms of action than chemical pesticides the present study reported the field evaluation of bio-agents and plant extracts against *Mycosphaella musicola*. Bio- control agents and plant extracts or oil from Piper betel, capsicum and garlic reported having antimicrobial and antioxidant activities against rages microbial pathogens. (Erturk, 2016; Irkin and Korukluoglu, 2009; Portz *et al.*, 2006)

Materials and Methods

Field experiment was conducted on the farm of Banana Research Station, Nanded of V.N. Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra during the year 2013-14 in Randomized Block Design with three replications. Nine treatments were used along with control. The details of the treatments used were T₁- Spraying of *Trichoderma viridae* @ 10 percent, T₂- Spraying of *Trichoderma harzianum* @ 10 percent T₃- Spraying of *Pseudomonas fluorescens* @ 10 percent, T₄- Spraying of leaf extracts of marigold @ 10 percent T₅- Spraying of leaf extracts of dhatura @ 10 percent, T₆ - Spraying of leaf extracts of neem @ 10 percent T₇ - Spraying of leaf extracts of parthenium @ 10 percent, T₈ - Spraying of extracts of garlic bulb and T₉ – Control (no spray). The spraying was started after one month of planting the crop and wer continued upto the flowering at 30 days interval. Five reproductive plants were selected from each treatment for recording the observations. Finally yield and yield characters of banana were recorded at the time of harvest of the crop. The data were analyzed as per the methods given by Panse and Sukhatme (1985).

Diseases assessment

Diseases development and efficacy of each treatment were assessed at monthly interval

on five plants of similar maturity per plot using the younger leaf spotted method (Stover and Pickson, 1970). The diseases severity index were assessed by using Gauhl's modification of Stover's severity scoring system (Gauhl *et al.*, 1993).

The proportion of leaf area showing symptoms was recorded on a scale of 0 to 6 as follows,

- 0 = No disease symptoms
- 1 = less than 1 percent symptoms
- 2 = 1-5 percent showing symptoms
- 3 = 6- 15 percent showing symptoms
- 4 = 16- 33 percent showing symptoms
- 5 = 34- 50 percent showing symptoms
- 6 = more than 50 percent showing symptoms

Disease Severity Index (DSI) was calculated as follows.

$$DSI = \frac{\sum nb}{(N-1) T} \times 100$$

Where,

- n = number of leaves in each grade
- b = grade
- N = number of grades used (7)
- T = total number of leaves graded on each plant

Results and Discussion

Data presented in Table 1 revealed that the effect of spraying of bio-agents and phyto-extracts on the intensity of Sigatoka leaf spot diseases were found significant. Significantly minimum percent diseases index of sigatoka was recorded by the treatment T₇, i.e. spraying of parthenium at 10 percent at 30 days interval (4.72 %) followed by the treatment T₆ i.e. spraying of neem leaf extract at 10 percent at 30 days

interval (6.03 %) and treatment T₅ i.e. spraying of Dhatura leaf extract at 10 percent at 30 days interval (6.14 %), in all the months over rest of the treatments under

study. Maximum percent disease index of sigatoka leaf spot was noticed in control treatment (21.67 %).

Table.1 Effect of bio-agents and phyto extracts on incidence of sigatoka leaf spot disease of banana

Treatments	Percent disease of index of Sigatoka							Ave. PDI of Sigatoka
	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	
T ₁ - Spraying of <i>Trichoderma viridae</i> @ 10 percent	9.9	10.8	9.2	8.7	8.8	9.9	11.0	9.46
T ₂ - Spraying of <i>Trichoderma harzianum</i> @ 10 percent	9.63	10.5	8.8	8.7	8.1	8.9	9.8	9.05
T ₃ -Spraying of <i>Pseudomonas fluorescens</i> @ 10 percent	10.67	10.9	9.2	8.7	8.1	8.7	9.2	9.1
T ₄ - Spraying of leaf extracts of marigold @ 10 percent	8.23	8.5	7.1	6.7	6.7	7.1	7.1	7.14
T ₅ - Spraying of leaf extracts of dhatura @ 10 percent	6.37	6.3	6.2	5.9	6.1	6.5	6.7	6.14
T ₆ - Spraying of leaf extracts of neem @ 10 percent	6.07	6.2	6.1	6.0	5.9	6.2	6.2	6.03
T ₇ - Spraying of leaf extracts of parthenium @ 10 percent,	4.8	4.8	4.4	4.4	4.8	5.1	5.0	4.72
T ₈ - Spraying of extracts of garlic bulb	6.53	6.7	6.6	6.5	6.7	6.9	7.1	6.65
T ₉ – Control (no spray)	20.9	22.7	23.3	22.3	22.5	22.7	23.4	21.67
SE	0.33	0.35	0.27	0.27	0.24	0.25	0.31	-
CD @ 5%	0.99	1.04	0.81	0.80	0.71	0.75	0.94	-

Table.2 Effect of bio-agents and phyto-extractants on yield and yield contributing characters of banana cv. Ardhapuri

Treatments	No. of hands/bunch	No. of fingers/bunch	Bunch weight (kg)	Banana yield (Mt/ha)	Percent increase in yield over control
T ₁ - <i>Trichoderma viridae</i> @ 10%	8.27	136.7	17.21	76.5	8.82
T ₂ - <i>Trichoderma harzianum</i> @10%	7.17	132.3	17.67	78.6	10.56
T ₃ - <i>Pseudomonas fluorescens</i> @ 10%	7.73	131.7	17.60	78.2	10.10
T ₄ - Marigold (<i>Tagetis erecta</i>) @ 10%	7.33	132.3	18.0	79.8	11.90
T ₅ - Dhatura (<i>Dhatura metal</i>) @ 10 %	8.57	138.0	19.46	76.5	18.73
T ₆ -Neem (<i>Azardirachata indica</i>) @ 10	8.03	131.3	18.72	83.2	15.5
T ₇ -Parthenium (<i>Parthenium ysterophorus</i>) @ 10%	9.33	142.3	19.76	87.8	19.93
T ₈ - Garlic (<i>Alium sativum</i>) @ 10%	7.20	132.0	18.13	80.7	12.88
T ₉ – Control (no spray)	6.80	128.3	15.82	70.3	-
SE	0.25	2.49	0.35	1.42	-
CD @ 5%	0.75	7.45	1.04	4.27	-

Data presented in Table 1 revealed that the effect of spraying of bio-agents and phytoextracts on the intensity of Sigatoka leaf spot disease were found significant. Significantly minimum percent disease index of Sigatoka was recorded by the treatment T₇ i.e. spraying of parthenium leaf extract @10 percent at 30 days interval (4.72 %) followed by the treatment T₆ i.e. spraying of neem leaf extract @ 10 percent at 30 days interval (6.03 %) and treatment T₅ i.e. spraying of Dhatura leaf extract @10 % at 30 days interval (6.14%) in all the months over rest of the treatments under study.

Maximum percent disease index of Sigatoka leaf spot was noticed in control treatment (21.67 %).

Data presented in Table 2 showed that the differences due to spraying of bio-agent and phyto extracts on yield and yield contributing characters were found significantly maximum number of hands/bunch, number of fingers/bunch and bunch weight were recorded by the treatment T₇ i.e. spraying of parthenium leaf extract @ 10percent and treatment T₅, i.e. spraying of Dhatura leaf extract @ 10 percent were found at par with each other.

Maximum banana yield (Mt/ha) were obtained from treatment T₇ i.e. spraying of parthenium leaf extract @ 10 percent (87.8 Mt/ha) and treatment T₅ i.e. spraying of

Dhatura leaf extract @ 10 percent (86.5 Mt/ha), which were found at par with each other and significantly superior over rest of the treatments under study.

Data presented in Table 1 and 2, it can be concluded that 4 to 5 spraying of parthenium

leaf extract @ 10 percent at 30 days interval helps in minimizing the intensity of Sigatoka leaf spot disease and increased yield of banana upto 19.93 percent.

References

- Erturk, O. (2006). Antibacterial and antifungal activity of ethanolic extracts from eleven spice plants. *Biol. Bratislava*, 61: 275-278.
- Gauhl, F., Pasberg Gauhl, C., Vuylstek, D and Ortiz R, (1993). Multilocation evaluation of black sigatoka resistance in banana and plantain. International Institute of Tropical Agriculture (IITA), Research Guide, 47 I budan, Nigeria, Pp. 9.
- Irkin, R, Korakluoglu, M. (2009). Control of some filamentous fungi and yeast by dehydrated *Allium* extracts. *J. Verbr. Lebensm*, 4: 3-6.
- Jacome L.H., Schulh, W. (1992). Effect of leaf wetness duration and temperature on development of black sigatoka disease on banana infected by *Mycosphaerella fijiensis* var. *difformis*. *Phytopathol.*, 82:515-520.
- Panse, V.G., Sukhatme, P.V. (1985). Statistical methods for agricultural workers (2nd edn.), Indian Council of Agricultural Research, New Delhi.
- Portz D, Koch E, Slusarenko AS (2008). Effects of garlic (*Allium sativum*) juice containing alliin on phytophthora infestans and downymildew of cucumber caused by *Pseudoperenospora cubensis*. *Eur. J. Plant Pathol.* 122:197-206
- Ramsay, M.D. Daniells J.W. and Anderson, V.J. (1990). Effects of Sigatoka leaf spot (*Mycosphaerella musicola* leach) on fruit yield, fruit ripening and greenlife of banana in North Queensland. *Sci. Horticul.*:41: 305-313.
- Stover, R.H. and Dickson, J.D (1970). Leaf spot of banana caused by *Mycosphaerella musicola*: Methods of measuring spotting prevalence and severity. *Tropical Agriculture (Trinidad)* 47: 289-302.
- Suppakal P, Sanla-Ead N, Phoopuritham P (2006). Antimicrobial and antocidant activities of betel oil. *Keseksart J. Nat.Sci.* 40:91-100.