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Management of collar rot of tomato caused by *Sclerotium rolfsii*

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Abstract

Collar rot of tomato (*Lycopersicum esculentum* Miller) caused by *Sclerotium rolfsii* Sacc. is one of the most destructive diseases in tomato throughout the world. Effective and efficient management of the crop disease is generally achieved by the use of synthetic pesticides. These pesticides are known to pollute the environment, soil and water besides causing deleterious effects on human health and biosphere.

Amendments (Neem cake, oil cake, cow dung, rabbit manure and chicken manure) were used in tomato seedlings to observe growth promotion and percentage increase in shoot length in healthy and treated tomato seedlings of two varieties, F_1 Hybrid Arjuna and Pahuza S-22. Results revealed that growth of the tomato seedlings was significantly increased following amendment with neem cake and oil cake in the treated *Sclerotium rolfsii* inoculated plants than in untreated uninoculated plants as recorded. Oil cake had better effect than neem cake. Similarly, amendment with cow dung, rabbit manure and chicken manure it has been observed that the growth of tomato seedlings increased in treated uninoculated than treated inoculated tomato seedlings. Among the three treatments, cow dung gave better growth of tomato seedlings than that of rabbit manure and chicken manure.

Keywords: Organic amendment; Pathogen; Manure.

1. Introduction

Tomato (Lycopersium esculentum Miller) is one of the second most popular vegetable crops of world. It is attacked by a large number of fungal, viral and bacterial pathogens. Sclerotium rolfsii is one of the important fungal pathogens that causes collar rot resulting in substantial yield losses. This disease appears in the nursery grown tomato seedlings. The fungus is a soil borne rotting pathogen of very aggressive nature and causes considerable damage to young tomato seedlings in the nursery which is very common in the plains but rare in the hills. It occurs in diverse soils, has a very wide host range and worldwide distribution [1].

However effective and efficient management of crop diseases is generally achieved by the use of synthetic pesticides. These pesticides are known to pollute the environment, soil and water besides causing deleterious effects on human health and biosphere. The present investigation is related to the study of the management of collar rot disease of tomato by organic amendments.

2. Materials and method

Plant material

Two tomato varieties F_1 Hybrid Arjuna and Pahuza S-22 were grown in pots and were used for experimental purpose.

Fungal culture

Source of cultures

Virulent culture of *Sclerotium rolfsii* Sacc was obtained from Immuno-Phytopathology Laboratory, Department of Botany, North Bengal University**.** This was originally isolated from Teen Ali-17/1/54 and after completion of Kock's Postulate, the organism was identified by Global Plant Clinic, Diagnostic and Advisory Service, CABI Bioscience UK and designated as Sr-1.

Maintenance of stock cultures

The fungus thus obtained has been sub-cultured on PDA slants. After two weeks the culture has been stored under three different conditions (0ºC, 4ºC and at room temperature 28ºC). The culture of *S. rolfsii* was examined at regular intervals to test its pathogenicity.

Effect of organic amendments on tomato seedling in pot culture

Pot culture experiment were conducted with different organic amendments treated in the tomato seedlings to observe growth promotion and percentage increase in shoot length in healthy and treated tomato seedling varieties. The earthen pots were filled with autoclaved 1kg of soil. Mustard oil cakes were allowed to decompose for a week in a clay pot covered with polythene. 100 ml of decomposed oil cake solution, 100 g powdered neem cake, 100 g cow dung, 100 g chicken and 100 g rabbit manure were added in pots containing sterilized soil separately and watered.

After one week, the seedlings of two varieties of tomato (F_1 Hybrid Arjuna and Pahuza S-22) were grown in soil amended with neem cake, oil cake, cow dung, rabbit and chicken manure separately before inoculation with 100 g *Sclerotium rolfsii* and watered lightly. Then these pots were inoculated with the test pathogen multiplied on sand-maize medium and watered lightly. The seedlings were planted in the earthen pots without amendments but inoculated with the pathogen and were maintained as control. Each treatment consisted of 10 plants, in triplicate and the values are an average of 30 plants. The observations were recorded after two months.

Results and Discussion

Results (Tables 1 & 2) revealed that the growth of the tomato seedlings was significantly increased following amendment with neem cake and oil cakes in the treated *S. rolfsii* inoculated seedlings than in untreated inoculated seedlings as recorded after two months. Oil cake had better effect than neem cake. It had been observed that the percentage increase in shoot length after two months of treatment with neem cake and oil cake in treated inoculated with *S. rolfsii* the tomato seedlings was more than in the untreated inoculated tomato seedlings.

Table 1: Growth promotion in tomato seedlings following soil amendment with neem cake and oil cake

Tomato variety	One month				Two months			
	Healthy		Infected		Healthy		Infected	
	Increase in height (cm)	Increase number of compound leaves	Increase in height (cm)	Increase number of compound leaves	Increase in height (cm)	Increase number of compound leaves	Increase in height cm	Increase number of compound Leaves
F_1 Hybrid Arjuna Untreated	29±1.24	10±1.01	20±1.22	7±0.06	36±1.35	12±1.14	34± 1.29	9±0.07
Treated Neem cake	20±1.19	7±0.06	19±1.18	6±0.04	32±1.32	11±1.17	40±2.42	13±1.14
Oil cake	23±1.26	8±0.05	25±1.23	9±0.08	58±2.12	19±1.19	55±2.11	18±1.17
Pahuza S-22 Untreated	28±1.29	9±0.02	17±1.16	6±0.05	35±1.34	11±1.09	32±1.33	8±0.02
Treated Neem cake	19±1.13	6±0.03	17±1.15	5±0.04	31±1.30	10±1.02	30±1.34	10±1.09
Oil cake	21±1.21	7±0.09	23±1.21	8±0.07	56±2.10	18±1.17	46±2.01	16±1.17

Average of 3 replicates ± Standard error.

Table 2: Percentage increase in shoot length in tomato seedlings following treatment with neem cake and oil cake

Tomato variety	Percentage increase in shoot length after two months treatment	
	Healthy	Infected
F_1 Hybrid Arjuna Untreated	24.14	70.0
Treated Neem cake	60.0	110.0
Oil cake	163.64	120.0
Pahuza S-22 Untreated	93.94	25
Treated Neem cake	63.16	73.53
Oil cake	176.19	97.83

It revealed that the growth of tomato seedlings had been increased in treated uninoculated than treated inoculated tomato seedlings (Table 3). Among the three treatments, cow dung gave very good and healthy growth of tomato seedlings (Plate 1: Fig. D) than rabbit and chicken manure (Plate 1: Fig. E & F).

Table 3: Growth promotion in tomato seedlings by different organic components after inoculation with *Sclerotium rolfsii*

Tomato variety	**One month**				**Two months**			
	Healthy		**Infected**		**Healthy**		**Infected**	
	Increase in height (cm)	Increase number of compound leaves	Increase in height (cm)	Increasenumber of compound leaves	Increase in height (cm)	Increase number of compound leaves	Increase in height (cm)	Increase number of compound leaves
F_1 Hybrid Arjuna Untreated	30±1.45	10±1.01	11±1.02	7±0.08	3±0.05	13±1.07	33±1.10	10±1.03
Treated Cow dung	19±1.25	9±0.02	18±1.23	8±0.06	54±1.49	19±1.04	41±1.20	16±1.07
Rabbit manure	18±1.24	7±0.07	15±1.13	4±0.05	42±1.55	14±1.13	28±1.21	11±1.12
Chicken Manure	27±1.22	10±1.09	24±1.08	9±0.09	47±1.22	15±1.07	45±1.43	14±1.15
Pahuza S-22 Untreated	28±1.26	9±0.06	17±1.11	6±0.07	35±1.26	12±1.09	30±1.28	9±0.08
Treated Cow dung	17±1.09	7±0.04	16±1.09	6±0.02	47±1.29	16±1.18	36±1.46	15±1.09
Rabbit Manure	26±1.31	9+0.05	16±1.03	5±0.02	46±1.23	15±1.14	24±1.20	10±1.01
Chicken Manure	27±1.22	8±0.07	23±1.33	8±0.09	44±1.46	14±1.16	42±1.38	13±1.15

Average of 3 replicates ± Standard error.

A botanist [2] who had reported that mustard cake was found effective in reducing the incidence of *Fusarium oxysporum* f. sp. *lycopersici*. Neem cake was found as effective for the control of *F. oxysporum* f. sp. *cubense* in banana [3,4].

Organic amendments increase the availability of nutrients besides improving physical condition of soil, increase the yield and reduce the soil-borne diseases [5]. Organic soil amendments have also been reported to be effective in controlling the pathogen [6-9]. The superiority of this amendment may be due to release of some inhibitory substances like nimbicidin, nimbin or azadirachtin on the decomposition, effecting the population of pathogen. Besides the nutrient content of these amendments may have a possible role in enhancing the host growth and vigour, increasing antagonistic microbial activity and enabling them to resist the attack of pathogen.

Plate 1 (Figures A-F): Tomato plants following treatment with biocontrol agent and organic amendments.
(A) Untreated inoculated with *S. rolfsii*.
(B & C) Untreated healthy.
(D) Amended with cow dung manure.
(E) Amended with chicken manure.
(F) Amended with rabbit manure.

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