J. Mycopathol. Res. **59(4)** : 407-411, 2021*;* (ISSN 0971-3719)

Influence of different substrates in disease suppression and growth of coffee seedlings

A. P. RANJINI[1], RAJANAIKA[2], SANTOSHREDDY MACHENAHALLI[1], MADHU S. GIRI[1], S. B. HAREESH[1], S. DAIVASIKAMANI[1] AND M. SUDHA[1]

[1]Central Coffee Research Institute, Coffee Research Station - 577 117, Chikkamagaluru, Karnataka;
[2]Department of Applied Botany, Kuvempu University, Jnana Sahyadri, Shankaraghatta - 577 451, Shivamogga, Karnataka.

Received : 25.6.2021 Accepted : 15.10.2021 Published : 27.12.2021

Due to demand for quality seedlings, continuous dwindling of natural resource like forest soil has led to other problems like soil erosion, loss of soil texture etc. wherein coffee farmers are enforced to use other substrates. Hence, the present study was taken up for the period of two years (2017 & 2018) to know the influence of different substrates on growth of the seedling and their role in suppressing the major nursery pathogen *Myrothecium roridum*. The outcome of the study indicated that, among the nursery mixtures used for the experiment, vermicompost+sand (4:1) was the best medium followed by coir pith +vermicompost 1:1 ratio for growing coffee seedlings. Both nursery mixtures could supress the disease and recorded less disease incidence and severity and were on the par with recommended nursery mixture. Further, the growth of seedling and nutrient status of the leaves was optimum in these nursery mixtures when compared to others. During the experimental period the leaf spot disease incidence was minimum (4.79%) in the seedlings grown in vermicompost+sand in the ratio of 4:1, whereas the disease incidence was observed maximum (19.75%) in seedlings which grown in soilrite+FYM+sand (6:2:1 ratio). However, the leaf spot severity was maximum (10.33%) in the seedlings grown in soilrite+FYM+sand (6:2:1 ratio) and minimum (2.64%) in coir pith +vermicompost (1:1). The recommended nursery mixture was on par with vermicompost+sand (4:1) both in supressing the disease and development of the seedlings. Hence, the mixture of vermicompost+sand (4:1) can be used as an alternative nursery substrate to the recommended one for the growth of coffee seedlings.

Key words: Coffee, *Myrothecium roridum*, seedlings, nursery, leaf spot, substrates

INTRODUCTION

Coffee is one of the main agricultural commodity produced worldwide. Coffee is grown in different soil types and various climatic conditions. Coffee cultivation plays an important economic and social role by generating jobs and fetching foreign exchange revenue to the producing countries. The success of new planting in a perennial crop like coffee, depends primarily on planting of vigorous, pest and disease free seedlings in the field.

In such a condition, additional care has to be taken to bring up healthy seedlings. Nursery plays a major role in setting-up, extending or reviving a coffee plantation, as the good seedlings are selected for planting in the field from the nursery. This gains a long term productivity and in turn long term income to the planter (Ranjini *et al*. 2017). Nursery mixture used for raising a coffee seedlings play a major role in maintaining the health of the seedling. The standard nursery medium used in the coffee nursery includes mixture of fertile jungle soil, well decomposed farm yard manure (FYM) and river sand in the ratio of 6:2:1 (Anonymous, 2014). The increasing demand for quality coffee has motivated coffee farmers to increase the area of healthy plantations which has resulted in demand for the good quality coffee seedlings. This lead to the gradual exploitation of the natural resources like, virgin jungle soil which leads other problems like loss of soil structure, soil erosion, nutrient degradation. In this situation, coffee farmers are compelled to use other potting or nursery mixtures, which are readily available in the market. But there is possibility that all these nursery mixtures, may perhaps not pro

ccpranju@gmail.com

mote vigorous growth of the seedlings. There may also be possible attack of diseases like leaf spot disease, caused by the pathogen *M. roridum* which ends in the production of weak and unhealthy seedlings. This makes the seedlings unfit for planting in the field (Daivasikamani *et. al*. 2016). So it is important to find an alternative component to the jungle soil which will promote vigorous disease free seedlings. In view of the above specified reasons, to find out alternative and feasible nursery mixture for raising healthy coffee seedlings, some of the potting mixtures available in the market were evaluated, along with conventional standard nursery mixture i.e., jungle soil+FYM+sand (6:2:1). Different materials used for nursery mixtures, such as jungle soil, farm yard manure, sand, coir pith, soilrite mixture and vermicompost were evaluated for the growth and development of coffee seedlings and their impact on incidence and severity of *Myrothecium* leaf spot disease of coffee seedlings.

MATERIALS AND METHODS

The nursery experiments were conducted at Central Coffee Research Institute (CCRI) near Balehonnur, Koppa taluk, Chikmagalur district, Karnataka State, India. The study area is situated at 13° 22" North Latitude and 75° 28" East Longitude at an elevation of 824 to 884 meters above MSL. Locally available substrates like sieved jungle soil, sand, farm yard manure, coir pith, soilrite and vermicompost were used for the experiment. These materials were used in different combinations (Fig.1). The treatment details are presented in Table 1.

Table 1: Details of treatments laid out in the experiments in the

Treatment No.	Nursery mixture used	Ratio
T_1	Jungle soil+FYM+Sand	6:2:1
T_2	Soilrite+FYM+Sand	6:2:1
T_3	Coir pith+FYM+Sand	6:2:1
T_4	Vermicompost+FYM+Sand	6:2:1
T_5	Vermicompost+Sand	4:1
T_6	Coir pith+Sand	4:1
T_7	Coir pith+Vermicompost	1 :1

A total of seven different combinations of nursery mixtures were evaluated against, *Myrothecium* leaf spot incidence and severity. Seedling vigour from all the treatments was recorded and nutrient status of the leaves of the seedlings grown in different nursery mixtures was also analysed. The experiment was carried out for the period of two years 2017 and 2018. The coffee variety *Coffea arabica* L. cv. Chandragiri which was found most susceptible to Myrothecium leaf spot disease among the varieties released from CCRI was used for the study. The experiment was laid out in a Completely Randomized Design (CRD) with seven treatments and four replications with eight seedlings per replication. The seeds sown in primary seed bed were transplanted into seedling trays filled with different combinations of nursery mixture when they attained topee stage. After transplanting of the seedlings the trays were kept in open conditions in the net house. Observations on leaf spot disease incidence and severity was recorded 90 days after transplanting (DAT) of seedlings after the initial development of the disease. The observations were recorded at 15 days interval till the seedlings were ready for planting in the field (180 DAT).

The leaf spot disease incidence was calculated by using the formula described by Santoshreddy *et al*. (2019) as given below:

$$\text{Per cent disease incidence} = \frac{\text{Total number of infected leaves}}{\text{Total number of leaves observed}} \times 100$$

Observations on leaf spot disease severity were recorded by following 0-9 point scale as described by Mayee and Datar (1986) and per cent disease severity was expressed using the formula as given below:

Disease rating scale

Grade	Per cent leaf area infected
0	0
1	1 - 10
3	11 - 2 5
5	26 - 50
7	51 - 75
9	>75

$$\% \text{ Disease severity} = \frac{\text{Sum of all numerical disease ratings}}{\text{Total No. of samples observed x Maximum disease rating grad}} \text{ X } 100$$

Observations on seedling vigour

The arabica coffee seedlings cv. Chandragiri planted and maintained in seedling trays were removed after 180 days of transplanting. Observations on root and shoot length and seedling height were recorded.

Nutrient status in leaves of coffee seedlings planted in different nursery mixture

Leaves were collected coffee seedlings growing in different nursery mixture treatment. The leaves collected were processed and analysed for their nutrient content, using standard analytical procedure. The leaves were analysed for major nutrient element viz., Nitrogen (N), Phosphorus (P) and Potassium (K) and for micronutrients viz., Calcium (Ca), Magnesium (Mg), Copper (Cu), Zinc (Zn), Iron (Fe), Magnesium (Mn) (Jackson, 1973).

Statistical analysis

Observations recorded for two consecutive years of 2017 and 2018 on percentage *Myrothecium* leaf spot disease incidence and severity on *Coffea arabica* L. cv. Chandragiri in the nursery experiments were analysed statistically using standard statistical procedure (Gomez and Gomez, 1984; Panse and Sukhatme 1985).

RESULTS

The studies indicated among the nursery mixtures used for the experiment, vermicompost+sand was the best medium followed by coir pith+vermicompost 1:1 ratio for growing coffee seedlings. Both nursery mixtures could supress the disease and recorded less disease incidence and severity and were on the par with recommended nursery mixture. Further, the growth of seedling and nutrient status of the leaves was optimum in these nursery mixtures when compared to other treatments

During the year 2017, Mean data of seven fortnightly observations on *Myrothecium* leaf spot disease incidence indicated that, minimum disease incidence (4.40%) in treatment containing nursery mixture of vermicompost+sand (4:1 ratio) followed by (4.74%) jungle soil+farm yard manure+sand (6:2:1 ratio). Whereas, mean maximum leaf spot disease incidence (20.25%) was recorded in the nursery mixture of soilrite+FYM+sand (6:2:1 ratio). During the year 2018, similar trend was observed, minimum (5.18%) disease incidence was recorded in treatment containing nursery mixture of vermicompost+ sand (4:1 ratio) followed by, (5.28%) jungle soil+farm yard manure+sand (6:2:1 ratio). Whereas, mean maximum (19.25%) leaf spot disease incidence was recorded in the nursery mixture of soilrite+FYM+sand in the ratio of 6:2:1. Pooled analysis of the data on the incidence of leaf spot disease for the season 2017 and 2018 indicated that, *Myrothecium* leaf spot disease incidence was maximum (19.75%) in soilrite+FYM+sand (6:2:1 ratio) mixture and minimum (4.79%) disease incidence in vermicompost+sand (4:1 ratio) nursery mixture (Fig.1).

Severity of *Myrothecium* leaf spot disease was also observed for both the seasons. During the season 2017, mean minimum disease severity (2.80%) was recorded in treatment T_7-coir pith+vermicompost (1:1 ratio) and was on par with the treatment vermicompost+FYM+sand (2.95%) and maximum severity (10.61%) in soilrite+FYM+sand (6:2:1 ratio). The mean disease severity was comparatively low in treatments jungle soil+FYM +sand and vermicompost+sand with disease severity of 3.08% and 3.10% respectively. The results obtained during the succeeding year of the experiment was corresponding with previous year. Mean leaf spot disease severity was maximum (10.05%) in treatment soilrite+farm yard manure+sand 6:2:1 ratio and minimum (2.58%) in coir pith+vermicompost 1:1 ratio. Leaf spot disease severity recorded for the two of the experimental period pooled and analysed. The two seasons pooled data analysis revealed that, mean maximum (10.33%) leaf spot disease severity was found in soilrite+FYM+sand (6:2:1 ratio). Whereas, mean minimum (2.64%) leaf spot disease severity was observed in treatment Coir pith +Vermicompost (1:1) (Fig.2).

The growth of coffee seedlings (Chandragiri) were recorded 180 days after transplantation. Mean data of two years indicated the corresponding results with disease incidence and severity, mean maximum height (25.73 cm) of coffee seedlings were recorded in the treatment which recorded minimum incidence of myrothecium leaf spot i.e, vermicompost+sand in the ratio of 4:1. Second best treatment was the combination of jungle soil, farm yard manure and sand in the ratio of 6:2:1, where the height of seedlings was 24.0 cm. Combination of vermicompost, farm yard manure and sand in the ratio of 6:2:1 recorded average seedling height of 23.80 cm with 11.0 cm root length and 12.80 cm shoot length. It was also observed that the seedling grown in the mixture of soilrite+FYM+sand and coir pith+sand had minimum height with stunted growth and yellowing of the leaf could be observed and they were not as healthy and vigorous. (Fig. 3).

DISCUSSION

Amendment of organic matter in soil or horticultural container medium in green house, with suitable substrates is essential to improve physical, chemical and biological properties of the soil. It helps in managing soil-borne phytopathogens by changing the soil and rhizosphere environment. It affects the life cycle of pathogens adversely and enables plants to resist their attack by achieving better vigor of seedlings. Albaho *et al*. (2009), from their studies on straw berry found that, crop cultivars also tend to respond differentially in growing medium. In the present study, it was observed that, different nursery mixture combinations varied in their efficacy as reflected on the disease reduction and plant growth characteristics such as root length, shoot length and total height of the coffee seedlings. These findings are matching with the findings of Albaho *et al*. (2009). Different proportions of vermicompost on the growth and health of patience-plant (*Impatiens wallerana*) was evaluated by Asciutto *et al.* (2006). Their studies revealed that, vermicompost when used at 75% provided better control of damping-off caused by *R. solani* and plants had highest values for leaf area and aerial fresh weight which concorded with the present studies. Atiyeh *et al*. (2000) found that, growth of marigold and tomato seedlings in a standard horticultural greenhouse container medium was enhanced significantly with vermicompost substitution. In the present study also it was found that, substitution of 80% vermicompost and 20% sand to jungle soil, cattle manure (FYM) gave better results and also reduced the incidence and severity of *Myrothecium* leaf spot disease of coffee seedlings.

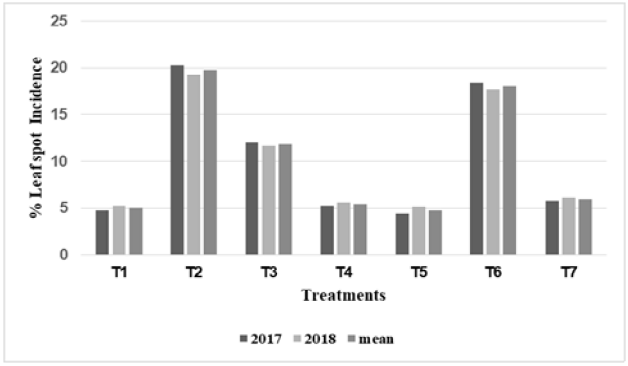

Fig. 1. Effect of different nursery mixture on *Myrothecium* leaf spot disease incidence of coffee seedlings

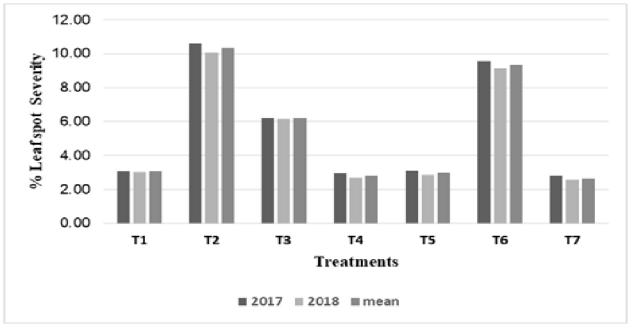

Fig. 2. Effect of different nursery mixture on *Myrothecium* leaf spot disease severity of coffee seedlings

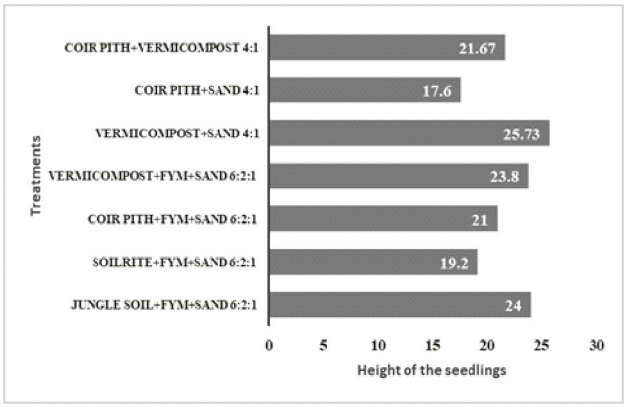

Fig. 3. Influence of different nursery mixture on height, root and shoot length of coffee seedlings (180 days after transplanting)

Nutrient status of the leaves as influenced by different nursery mixture combinations were carried out after 180 days of transplantation and indicated that, there is abundance in primary nutrients *viz.,* Nitrogen (N), Phosphorous (P), Potassium (K) and some off micronutrients were minimum in some of the treatments.

ACKNOWLEDGEMENT

The authors wish to thank the Director of Research, Coffee Board for permitting to use the required facilities to carry out the research work.

REFERENCES

Albaho, M., Bhat, N., Abo-Rezq, H., Thomas, B. (2009). Effect of three different substrates on growth and yield of two cultivars of strawberry. *Eur. J. Scient.Res.* **28**: 227- 233.

Anonymous (2014). Coffee Guide-A manual of coffee cultivation. Published by Coffee Board of India. 262 p.

Asciutto, K., Rivera, M.C., Wright, E.R., Morisigue, D., Lopez, M.V. (2006). Effect of vermicompost on the growth and health of *Impatiens wallerana. Inter. J. Exp. Bot.* **75**: 115-123.

Atiyeh, R.M., Edwards, C.A. Subler, S. and Metzger, J.D. (2000). Earthworm processed organic wastes as components of horticulture potting media for growing marigold and vegetable seedlings. *Compost Sci. Utiliz*. **8**: 215-223.

Daivasikamani, S., Ranjini, A.P., Raghuramulu, Y. (2016). Diseases

of Coffee and their management. In: *Plant Pathogens and their Management, (*ed. P.C. Trivedi), Avaishkar Publishers, Distributors, Jaipur, Rajasthan, India. 19-50 pp.

Gomez, K.A. , Gomez, A.A. (1984). Statistical procedures for agricultural research. *John Wiley and Sons, Inc.* New York. 680 p.

Jackson, M.L. (1973). Soil Chemical Analysis. Printice Hall of India Pvt. Ltd., New Delhi. 496-545 pp.

Kale, R.D., Karmegam, N. (2010). The role of earthworms in Tropics with emphasis on Indian Ecosystems. *Appl.Environ.Soil Sci.* 41: 43-56.

Mayee, C.D., Datar, V.V. (1986). Phytopathometry, Technical Bulletin-1 (Special Bulletin-3) Marathwada Agricultural University, Parbhani, Maharashtra, India. 95 p.

Panse, V.G. and Sukhatme, P.V. (1985) Statistical methods for Agricultural Workers, ICAR Publications, New Delhi, India, 359 P.

Ranjini, A.P., Uma, M.S., Daivasikamani, S., Raghuramulu, Y. (2017) Coffee nursery: Pest and disease management. *Indian Coffee, LXXXI* : 22-24.

Santoshreddy M., Ranjini, A.P., Madhu S. Giri, Sudha, M., Daivasikamani, S. (2019). Efficacy of fungicides against Coffee brown eye spot disease caused by *Cercospora Coffeicola. J.Plant Dis. Sci.* **14**: 124-128.