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EFFECT OF BAU-BIOFUNGICIDE AND SOME PLANT EXTRACTS AGAINST ROOT-KNOT (*Meloidogyne javanica*) OF PAPAYA

M. AKTARUZZAMAN, D.B. RAY, M.F. HOSSAIN AND T. AFROZ

Department of Plant Pathology, Hajee Mohammad Danesh Science & Technology University, Dinajpur, Bangladesh.

Corresponding author & address: Md. Aktaruzzaman, E-mail: jewellhstu.plp@gmail.com
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ABSTRACT

Aktaruzzaman M, Ray DB, Hossain MF, Afroz T (2012) Effect of BAU-Biofungicide and some plant extracts against root-knot (*Meloidogyne javanica*) of papaya. *Int. J. Sustain. Crop Prod.* 7(1), 1-5.

A lab experiment was conducted at the Hajee Mohammad Danesh Science and Technology University during December 2009 to May 2010 to test the efficacy of Biofungicide and some plant extracts. The efficacy of BAU-Biofungicide, Bashak leaf extract, Pineapple and Mustard oil-cake extracts against root-knot of papaya was evaluated in individual set of pot experiment in the roof. Among the treatments, BAU-Biofungicide and Bashak leaf extract gave better results as it increased shoot and root length as well as fresh weight of shoot and root correspondingly with the lowest galling incidence. Better effect on plant growth characters with lower galling incidence and development of the nematode was observed with Pineapple extract and Mustard oil cake extract as compared to control.

Key words: *BAU-Biofungicide, plant extracts, root-knot, Meloidogyne javanica, papaya*

INTRODUCTION

Papaya (*Carica papaya*) under the family Caricaceae produces fruits throughout the year. It requires less area for trees, comes to fruiting in a year, is easy to cultivate and provides more income/ha land. It has high nutritive and medicinal value (Ahmed 1984; Rashid *et al*. 1997). It contains vitamin A, B, C, nicotinic acid, riboflavin and also a huge amount of moisture, protein, fat, carbohydrate, calcium, phosphorus and iron with some calorific value. Papaya ranks second only to mango as a source of precursor of Vitamin A. They are used in preparation of jam, soft drinks ice cream, flavoring, crystallized fruits and in syrup.

In Bangladesh 13 thousand acres lands is under its cultivation and the total production is 44 thousand M. tons per annum approximately (BBS 2008). This is considerably a low yield as compared to other countries, such as 49.4 to 54.34 tons per ha in India (Iyer 1987) and about 98.8 tons per ha in Hawaii (Hamilton 1987).

Plant parasitic nematodes cause damage mostly to root as migratory endoparasites, sedentary endo- and semi-endoparasites or ectoparasites. When soil population of the plant parasitic nematodes reach to the economic threshold levels that can cause considerable mechanical or physiological root damage which inhibits the growth and prevent the uptake of water and nutrients. As a result yield is greatly hampered. The common species of root-knot nematodes in Bangladesh are *Meloidogyne incognita* and *Meloidogyne javanica.* A preliminary survey conducted by Page (1979) showed that 36 different crops and vegetables were found to be attacked by root-knot disease. As a result, enormous crop loss is incurred every year in Bangladesh.

Biological control of pathogens offers environmentally safe, durable and cost effective alternatives to chemicals (Papavizas and Lumsden, 1980). *Trichoderma* spp. is known to be antagonist to plant pathogenic nematodes. These fungi have also been found to stimulate the growth of the plant (Inber *et al.* 1994)
A little attention has been given for controlling the root-knot disease of papaya in the northern region of Bangladesh using biological means. Hence, the present study is undertaken to control the root-knot of papaya through biological means with the following objectives:

- To determine the effect of BAU-Biofungicide and plant extracts to control root-knot (*Meloidogyne javanica*) of papaya.
- To know the comparative effect of BAU-Biofungicide and plant extracts on growth of papaya.

MATERIALS AND METHODS

Experimental site

The experiments were conducted at the Hajee Mohammad Danesh Science and Technology University, Dinajpur during December 2009 to May, 2010. The efficacy of BAU-Biofungicide, Bashak (*Adhatoda vasica*) leaf extract, Pineapple (*Ananas* sp.) and Mustard (*Brassica campestris*) oil-cake extracts against root-knot of papaya was evaluated in individual set of pot experiment in the roof.

Preparation of pot soil and potting

At first, sandy loam soil, sand and well decomposed cow dung were collected and mixed properly at the ratio of 2:2:1. Sandy loam soil, sand and well decomposed cow dung were collected from the field of HSTU campus; riverside of Punorvoba and dairy farm of HSTU, respectively. Then the mixed soil was sterilized with formalin at the rate of 3% per cubic feet soil.

The treated soil was covered by brown paper for 72 hours without disturbance. After 72 hours, the brown paper was removed and the sterilized soil was exposed to air-drying for 48 hours in order to remove excess vapor of formalin.

Collection and surface sterilization of seeds

Apparently, mature, healthy and disease free seeds of papaya var. BARI Papaya 1 were collected from BADC, Chahelgaji, Dinajpur. Surface sterilization of these seeds was done with low concentration of mercuric chloride solution (0.001%) for 1 minute and subsequently washing was done with water for three times.

Collection of BAU-Biofungicide

BAU-Biofungicides were collected from Disease resistance Laboratory of Prof. Dr. Ismail Hossain, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh.

Preparation of leaf extract

Bashak leaf was collected from the HSTU campus. Leaf (20g) was macerated in an electric blender and soaked separately in l00ml distilled water in several conical flasks and then it was filtered. Thus, these filtrates treated as standard Bashak leaf extract(S). The same procedure was followed for the preparation of leaf extract of Pineapple and Mustard oil-cake (MOC).

Sowing of seeds on the pot

The treated seeds of papaya were sown in each pot (30 cm diameter) with sterilized soil. Optimum moisture in each pot was maintained through sprinkler irrigation, whenever it is necessary.

Design of experiment

The experimental set was carried out to evaluate the effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 60 days and 90 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching. All the pots were arranged in completely randomized design. Standard leaf extracts of Bashak (*Adhatoda vasica*), Pineapple (*Ananas* sp.) and Mustard oil-cake extracts (*Brassica campestris*) as well as BAU-Biofungicide were used per treatments. Altogether, 5(five) treatments including control were maintained in the experiment. Each treatment was replicated 3 times.

Preparation of inoculum and inoculation

Egg-mass was collected from the roots of brinjal plant as previously inoculated individually with a single eggmass of *Meloidogyne javanica*. For inoculation, ten reddish brown mature eggmasses were placed in each pot around the standing plant in 2 holes (2.5cm deep), five eggmasses on each side of the plant. Inoculation was done on whole sets of pot plants at 37 days old seedling.

Application of plant extract and BAU-Biofungicide solution

BAU-fungicide, standard leaf extracts of Bashak, Pineapple and Mustard oil-cake extracts were used in the following treatment:

T_0 = Control (untreated)
T_1 = BAU-Biofungicide (2%)
T_2 = Bashak leaf extract (S)
T_3 = Pineapple extract (S)
T_4 = Mustard oil-cake extract (S)

Parameters studied

After 30, 60 and 90 days of inoculation, plants were uprooted carefully to study the following characters:

1) Length of shoot (cm)
2) Length of root (cm)
3) Weight of shoot g)
4) Weight of root (g)
5) Number of galls/g of root

Counting of galls

After washing, the roots were preserved in 5% formalin solution. The roots were cut into small pieces of (1cm) and one gram of root was randomly taken from the bulk to count the number of galls formed.

Statistical analysis

Data on the length of shoot and root, fresh weight of shoot and root, number of galls/g of fresh root were analyzed statistically to find out the level of significance. The means for all the treatments were counted and the analysis of variance was studied by F-test for the treatment means and replication means. The mean differences were evaluated at P = 0.05 level by Duncan's New Multiple Range Test. Correlation co-efficient and linear regression equations were determined.

RESULTS

Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 60 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Effect on shoot length

The highest 12.40 cm shoot length was found with the treatment T_1 followed by T_2, T_3 and T_4 (Table 1). The treatment T_1 and T_2 did not vary significantly similarly T_3 and T_4 also did not vary significantly. The lowest shoot length was observed in control (Table 1). Almost similar trend was observed with root length, shoot and root weight (Table 1).

Effect on the galling

The highest number of galls were observed in control (T_o). Similar results were observed in T_3 and T_4 (Table 1). The lowest number of galls were observed in T_1 which is statistically similar to T_2.

Table 1. Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 60 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Treatments	Shoot length (cm)	Root length (cm)	Shoot weight (g)	Root weight (g)	Gall number/g root
T_0= Control	7.18 d	10.09 c	0.82 e	0.82 c	7.72 a
T_1= BAU-Biofungicide(2%)	12.40 a	11.85 a	1.31 a	0.98 a	4.05 c
T_2= Bashak leaf extract(S)	11.18 b	10.77 b	1.10 b	0.95 a	4.72 b
T_3= Pineapple extract(S)	8.72 c	10.77 b	0.88 c	0.88 b	7.38 a
T_4= Mustard oil-cake extract(S)	8.62 c	10.47 b	0.87 cd	0.85 bc	7.38 a
% cv	5.71	4.40	3.27	5.88	5.38

Each value is an average of 3(three) replications. In a column, values having same letters do not differ significantly at P = 0.05 level

Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 90 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Effect on shoot length

The highest shoot length (24.12 cm) was observed in T_1 which was statistically similar with T_2 (Table 2). Higher but similar response in shoot length was noticed in T_3 and T_4. The control treatment T_0 had the lowest shoot length. Effect on root length, shoot and root weight followed identical trend.

Effect on the galling

Significan reduction in gall index was observed in different treatments. The highest gall number was found on untreated control (13.05). The lowest number of galls was observed in T_1 follwed by T_1 and T_2, T_3 and T_4 (Table 2).

Table 2. Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 90 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Treatments	Shoot length (cm)	Root length (cm)	Shoot weight (g)	Root weight (g)	Gall number /g root
T_0= Control	19.17 c	13.93c	3.38 d	1.98 d	13.05 a
T_1= BAU-Biofungicide(2%)	24.12 a	17.88 a	6.49 a	3.54 a	8.38 d
T_2= Bashak leaf extract(S)	23.97 a	17.58 a	6.02 b	3.10 b	9.05 c
T_3= Pineapple extract(S)	20.72 b	15.72 b	4.75 c	3.00 c	11.72 b
T_4= Mustard oil-cake extract(S)	20.70 b	15.60 b	4.63 c	2.97 c	11.72 b
% cv	3.08	5.47	5.85	4.19	4.83

Each value is an average of 3(three) replications. In a column, values having same letters do not differ significantly at P = 0.05 level

Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 120 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Effect on shoot length

The highest 40.68 cm shoot length was recorded with treatment T_1 followed by T_2, T_4 and T_3 (Table 3). The control treatment T_0 was recorded with the lowest 30.18 cm shoot length. Almost similar trend was observed in root length, shoot and root weight.

Effect on the galling

The highest 23.72 number of galls was appeared in control treatment T_0 (Table 3). Treatments T_4 and T_3 were recorded with higher and similar number having 18.72 and 17.72 galls, respectively. Lower effect was followed in T_2 having 15.72 galls. The treatment T_1 exhibited the lowest 12.05 number of galls per g of fresh root (Table 3).

Table 3. Effect of soil drenching with BAU-Biofungicide and plant extracts on the growth of 120 days old seedling of papaya inoculated at 30 days of growth stage with *Meloidogyne javanica* after 7 days of drenching

Treatments	Shoot length (cm)	Root length (cm)	Shoot weight (g)	Root weight (g)	Gall number/g root
T_0= Control	30.18 e	20.00 e	3.18 e	3.51 e	23.72 a
T_1= BAU-Biofungicide(2%)	40.68 a	27.62 a	8.21 a	7.67 a	12.05 d
T_2= Bashak leaf extract(S)	38.93 b	26.28 b	6.88 b	6.93 b	15.72 c
T_3= Pineapple extract(S)	34.67 d	22.54 d	5.50 d	4.55 d	18.72 b
T_4= Mustard oil-cake extract(S)	38.93 b	26.28 b	6.88 b	6.93 b	17.72 b
% cv	2.06	3.04	4.74	3.42	4.36

Each value is an average of 3(three) replications. In a column, values having same letters do not differ significantly at P = 0.05 level

DISCUSSION

The present study was carried out with five treatments covering a BAU-Biofungicide, Bashak leaf extract, Pineapple extract, Mustard oil cake extract and a control to observe their effect on the plant growth characters, galling incidence of the nematode *Meloidogyne javanica* in papaya variety BARI Papaya-1.

The results revealed that maximum length of shoot and root, fresh weight of shoot and root were obtained with the treatment T_1 (BAU-Biofungicide) followed by T_2 (Bashak leaf extract), T_3 (Pineapple extract) and T_4 Mustard oil cake extract) (Tables 1, 2, 3). On the other hand, control treatment T_0 with *M. javanica* alone had significantly higher gall index and lower growth parameters.

BAU-Biofungicide and Bashak leaf extract as bio-agents gave better results with numerically higher growth of shoot and root as well as higher weights of shoot and root. These treatments also reduced the gall index significantly. The number of gall/g of root with T_2 (Bashak leaf extract) and T_3 (Pineapple extract) were found to be decreased in comparison to T_4 (Mustard oil cake extract). Similar type of response is reported by several researchers viz. Singh and Sitaramaiah (1966) reported diminution of root knot of okra as well as increased yield of tomato crops also supported by Hameed (1968), Srivastava *et al.* (1972), Khan *et al.* (1973), Khan *et al.* (1974) stated as the liberation of ammonia from the decomposition of oil cakes, mean for the inhibitory effect on nemic activities avenue for the better growth as well as the improvement of the tomato yield.

Mustard oil-cake extracts have been found to be effective as a soil amending agent to control root knot nematode (*Meloidogyne aerenaria*) for some toxic principles in it like phenolic compounds and other acidic substances (Mian and Rodriguez-kabana, 1982). Presence of such toxic substances in treatment T_1 (BAU-Biofungicide) and in other plant extracts used in the present study might have contributed to suppress the nematode activity allowing better plant growth. Similarly, presence of toxic substances in Mustard oil-cake extract as in treatment T_4 and in other plant extracts of it as also found effective in controlling the root-knot disease of tomato are in agreement with Siddiqui *et al.* (1976) and Zaiyd (1977). Trivedi *et al.* (1978) stated that plant height and average root weight with corresponding reduction in gall number with Mustard oil cake gave the highest yield.

In this experiment, all the standard plant extracts (Bashak, Pineapple, Mustard oil-cake), appeared to be superior by increasing plant growth characters with lower galling incidence. While working with 15 indigenous plant extracts on root-knot nematode of brinjal, Ahmad *et al.* (1990) found that standard plant extract of shatamuli (*Asparagus officinalis*) suppresed the activity of *M. javanica* with lower galling incidence and corresponding higher growth characters of brinjal. In another experiment Ahmad and Karim (1991) noted that standard (S) solutions of Dholkalmi (*Ipomoea fistulosa*) suppressed the activity of *M. javanica* with significant lower galling incidence and corresponding higher significant shoot and root length, fresh weight of shoot and root of brinjal. However, at lower concentrations S/10 and S/100 toxicity was reduced and produced higher number of gall per g of root, Prot and Kornprobst (1983) observed that pre-treated with crude seed extreacts of *Azadirachta indica, H. undulata and H. klaineana* inhibited the penetration of *M. javanica* into tomato roots. Goswami and Vijaylakshmi (1986) also reported that the number of galls/g of root were reduced by 9 different plant extracts especially with *Euclipta alba, Shorea robusta and Datura metal.* They also observed that shoot and root length and the shoot weight of tomato cv Pusa ruby infected with *M. incognita* were increased by all the extreacts espically with *Amaranthus* spp. *, Calotropis gigantea, Datura metal and Euclipta alba.*

CONCLUSION

Soil drenching of BAU-Biofungicide as well as Bashak leaf extract recorded increased shoot and root length as well as fresh weight of shoot and root correspondingly with the lowest galling incidence. Therefore, BAU-Biofungicide and Bashak leaf extract may be recommended for the control of root knot of Papaya.

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