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Evaluation of CM product to promote some plant growth

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CM product is a new formulated combination of Chaetomium bio-fungicide and Mycephyt-plant growth stimulant. CM product tested for water convolvulus (*Ipomoea aquatica*) at 15 days was highly significant in plant height that the non treated control was 7.98 cm, treated amino was 12.36 cm., treated CM product 4 ml/2L was 13.43 cm, treated chitosan was 7.88 cm, treated CM product 2 ml/2L was 11.92 cm and treated liquid compost was 6.12 cm. water convolvulus cultivation at 20 days used CM product at 4 ml/2 L and amino acid at 4 ml/2L gave significantly higher in plant height than another treatments and followed by treated with CM product at 2 cc/ 2 L, the plant height was 20.31 cm. After 25 days, it showed that treated CM product at 4 cc/2 L and amino at 4 cc/2 L revealed that the plant heights were 28.95 and 25.90 cm, respectively, that was significantly higher than treated CM product at 2 ml/4L (21.36 cm) when compared to the other treatments of chitosan and liquid compost. It is clearly showed that application of CM product at 4 cc/2 L gave significantly highest in plant fresh weight (172 g) and followed by treatment of CM product at 2 cc/ 2 L and amino which were 113 and 105 g, respectively. The result of coriander (*Coriandrum sativum*) showed that using CM product at 4 ml/2 L gave the highest in plant height (29.45 cm) and fresh weight (130 g) and followed by treated with CM product at 2 ml/2 L which plant height was 23.24 cm and fresh weight was 80 g that significantly different when compared to the non-treated control, plant height was only 11.70 cm and fresh weight was the lowest of 8 g. The result showed that a CM product was significantly higher than treated with amino at 2 ml/2 L, chitosan at 4 ml/2 L and liquid compost at 4 ml/2 L. Result in Kales (*Brassica oleracea* var *albograbra*) showed that treated CM product 4 ml/2 L at harvest gave significantly highest in plant height, root length and plant fresh weight which were 29 cm, 17 cm and 24 g/plant, respectively and followed by treated with CM product 2 ml/2L which were 23 cm, 15 cm and 16 g. respectively.

Key words: CM product, *Ipomoea aquatica*, *Coriandrum sativum*, *Brassica oleracea* var *albograbra*

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Introduction

Chaetomium is commercialized as a new broad spectrum biological fungicide in powder or suspension concentration forms that mixing 22-strains of *Chaetomium cupreum* and *C. globosum*. The mechanism of disease control is competition, antibiosis/lysis, antagonism, induced immunity in plants and hyphal interference. *Ch. cupreum* found to produce rotiorinol (Kanokmedhakul *et al.,* 2006) and *Ch. globosum* produces chaetoglobosin-c (Kanokhamedhakul *et al*., 2001), those antibiotic substances could inhibit several plant pathogens. It has been registered as patent rights namely: *Chaetomium* as a new broad spectrum mycofungicide: Int. cl.[5] AO 1 N 25/12. The main key is to prevent soil-borne plant pathogens eg. *Phytophthora* spp., *Pythium* spp. (Pornsuriya *et al.,* 2010), and *Fusarium* spp (Soytong *et al*., 1992). etc. It is compatible for mixing with selected chemical pesticides which can alternative sprayed with many pesticides at the rate of 3-5 kg or L per hectare. Successful applications in the fields have been demonstrated in several countries, e.g. Thailand, P.R. China, Costa Rica, Vietnam, Laos, Philippines, Bangladesh, Cambodia, Georgia and Russia (Soytong, 1992; Shternshis *et al*., 2005; Kaewchai, *et al*.,2009 and Sophea *et al*., 2010). Mycephyt acts as plant growth stimulator that is a natural plant growth stimulator represents biologically active, naturally balanced complex, prepared from the growth medium of the mycorhizal fungi. Mycephyt contains phytohormones, amino acids, carbohydrates, unsaturated fatty acids, and microelements. Mycephyt is effective for seed treatment prior sowing and for the plants at various stages of vegetation. Mycephyt enhances symbiotic nitrogen fixation; favors inorganic element consumption; and improve plant resistance to abiotic and biotic stresses. It can be applied as aqueous solutions are used for the seeds and plants treatments and working concentration of the Mycephyt in the solutions depends on the type of the plants. It is recommended to apply 100 ppm Mycephyt for the seeds and plants treatment. However, for some plants the concentration of Mycephyt as low as 10 ppm was shown equally effective. Mycephyt application is effective both outside and in greenhouses. Mycephyt is safe for humans and environment: non-toxic; non-mutagenic; does nit irritate skin and eyes. Mycephyt application easily fits to standard plant growth protocol. The preliminary test of formulated combination of Chaetomium bio-fungicide and Mycephyt was done in tomato that gave very good result (Soytong *et al*, 2010). The objective of this research project was to test the combination of Chaetomium bio-fungicide and Mycephyt plant growth stimulant for testing plant growth e.g. water convolvulus (*Ipomoea aquatica*), Coriander *(Coriandrum sativum*) and Kale (*Brassica oleracea* var *albograbra*).

Materials and methods

The tested plants were used as follows:- water convolvulus or kangkong (*Ipomoea aquatica*), Coriander *(Coriandrum sativum*) and Kale (*Brassica oleracea* var *albograbra*).

The test of water convolvulus that consisted of 6 treatments as follows:- T1 = non-treated control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/ 2L. , T5=CM 2ml/2L and T6= liquid compost at 4 ml/2L. Testing for Coriander that consisted of 6 treatments as follows:T1 = control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/2L, T5 = CM product 2 ml/2L and T6 = Liquid compost 4 ml/2L. The experiment of Kales consisted of 5 treatments as follows: T1 = non-treated control, T2 = Chitosan 4 ml/2L, T3 = CM product 4 ml/2L, T4 = Amino 4 ml/2L and T5= CM product 2 ml/2L. All experiments that the seeds were separately soaked at application rate in each treatment before planting. Thereafter two weeks, each treatment was interval sprayed at every 15 days until harvest. Soil preparation in the experiment was prepared as soil mixture of clay soil: sand: compost at that ratio of 10:2:1 v/v. and put into the pot (3o cm diameter). Data were collected as plant height (cm) and plant fresh weight (g) and statistically computed analysis of variance (ANOVA) according to Randomized Complete Block Design (RCBD) with four replications. Treatment means were compared using Duncan's Multiple Range Test (DMRT) at P=0.05 and P=0.01.

Results and discussion

Water convolvulus (Ipomoea aquatica)

Results showed that plant height at 8 day was not significantly different in all treatments. After planting for 15 days, it was showed highly significantly in plant height which the non-treated control was 7.98 cm, amino treatment was 12.36 cm, CM product (4 ml) was 13.43 cm, chitosan was 7.88 cm, CM product (2 ml) was 11.92 cm and liquid compost was 6.12 cm. The cultivation at 20 days used CM product at 4 ml/2 L and amino acid at 4 ml/2L gave significantly higher in plant height than another treatments and followed by treated with CM product at 2 ml/ 2 L, the plant height was 20.31 cm. After 25 days, it showed that treated CM product at 4 ml/2 L and amino at 4 ml/2 L, plant heights were 28.95 and 25.90 cm, respectively, that was significantly higher in plant height than treated CM product at 2 ml/2L (21.36 cm) when compared to the other treatments of chitosan and liquid compost (Table1 and Fig.1, 2, 3). It is clearly showed that application of CM product at 4 ml/2 L gave significantly highest in

plant fresh weight (172 g) and followed by treatment of CM product at 2 ml/ 2 L and amino treatment which were 113 and 105 g, respectively. The non-treated control (44 g) was the lowest and not significantly different when compared to liquid compost treatment (40 g). Similar result had been reported by Sibounnavong, *et al.* (2006) that tested chaetomium for organic crop production and stated that this product could increase plant growth and protect the diseases of several plants.

Table 1. Plant height and fresh weight of water convolvulus after planting in pot experiment.

Treatments	Plant Height (cm) 8 days	15 days	20 days	25 days	Fresh weight(g)
control	2.80 a[1]	7.98 b	14.46 c	13.57 c	44c
Amino	2.62 a	12.36 a	23.78 ab	25.90 a	113b
CM 4 ml	2.29 a	13.43 a	26.20 a	28.96 a	172a
Chitosan	2.60 a	7.88 b	13.88 c	13.46 c	43c
CM 2 ml	2.80 a	11.92 a	20.31 b	21.36 b	105b
compost	2.07 a	6.12 b	11.40 c	10.66 c	40c
CV (%)	15.38	12.04	11.45	13.03	18.28

[1]Average of four repeated experiments. Means followed by a common letter are not significantly different at P=0.01.

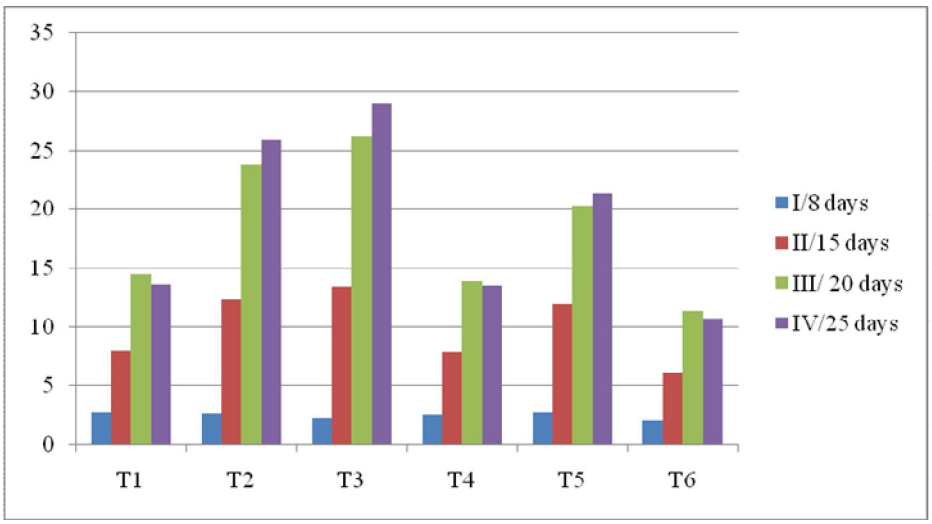

Fig. 1. The highest of water convolvulus in different experiment. Where T1 = control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/2L, T5 = CM product 2 ml/2L and T6 = Liquid compost 4 ml/2.

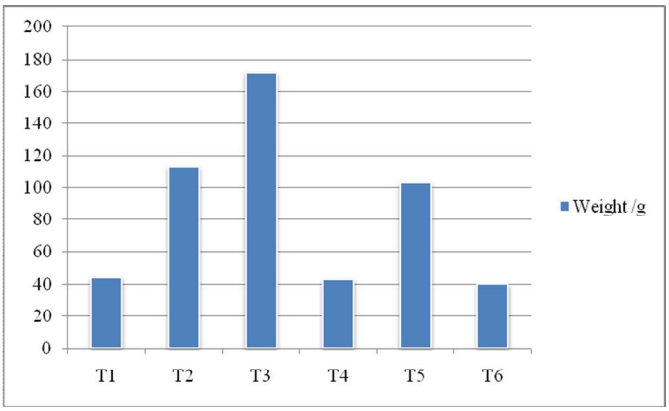

Fig. 2. Fresh weight of water convolvulus in different experiment. Where T1 = control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/2L, T5 = CM product 2 ml/2L and T6 = Liquid compost 4 ml/2L.

Fig. 3. Comparison between treatments after harvesting. Where, T1 = control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/2L, T5 = CM product 2 ml/2L and T6 = Liquid compost 4 ml/2L.

Coriander (*Coriandrum sativum)*

Coriander testing showed that applying CM product at 4 ml/2 L gave the highest in plant height (29.45 cm) and fresh weight (130 g) and followed by treated with CM product at 2 ml/2 L which plant height was 23.24 cm and fresh weight was 80 g that significantly different when compared to the non-treated control, plant height was only 11.70 cm and fresh weight was the lowest of 8 g. The result showed that CM products was significantly higher than treated with amino at 2 cc/2 L, chitosan at 4 cc/2 L and liquid compost at 4 cc/2 L as seen table 2, Fig. 4,5. As stated by Soytong *et al*.(2010) that The CM product

developed from *Chaetomium*-mycofungicide, patented Thailand and Mycephyt which is a biologically active compound from endophyte from Russia gave significantly better disease control and growth stimulant of tomato than the non-treated control. The treated mycephyt 0.1 g/L, treated CM product 1 (*Chaetomium* 0.5 g/L, treated *Chaetomium* 0.5g/L plus Mycephyt 0.1g/L) and treated CM product 2 (*Chaetomium* 1.0 g/L plus Mycephyt 0.2 g/L), and treated chemical prochoraz 30 ml/20L of water after 60 and 80 days gave non significantly different in control *Fusarium* wilt but significantly differ from inoculated with the pathogen alone. However, 80 days after inoculation, Mycephyt, *Chaetomium*, CM product1 and CM product2 gave the lowest disease incidence. This finding indicates that Mycephyt, *Chaetomium*, CM product1 and CM product2 were effective reduced *Fusarium* wilt caused by *F. oxysporum* f. sp. *lycopersici.* It is interesting that Mycephyt, *Chaetomium*, CM product1 and CM product2 could decrease disease incidence of 50.10, 50.10, 35.75, 42.82 %, respectively while prochoraz could decrease disease only 35.75 %. The CM product 2 could increase in fruit number, fruit and plant weights of 53.00, 69.13 and 28.41 %, respectively. The treated CM product 1 could increase in fruit number, fruit and plant weights of 50.09, 53.20 and 14.92 %, respectively. While, treated chemical prochoraz could increase fruit number, fruit and plant weights only 27.32, 22.34 and 2.14 %, respectively.

Table 2. Plant height, root length and fresh weight of coriander.

Treatments	Plant height (cm)	Root length (cm)	Fresh weight (g)
Control	11.70 d[1]	7.08 c	8 d
Amino	19.54 bc	11.28 a	56 bc
CM 4 ml	29.45 a	10.58 ab	130 a
Chitosan	12.29 d	8.58 bc	19 cd
CM 2 ml	23.24 b	8.91 bc	80 b
Compost	15.87 cd	8.79 bc	29 cd
CV (%)	11.55	10.40	41.02

[1]Average of four replications. Means followed by a common letter are not significantly different at P=0.01.

Fig. 5. Comparison between treatments in coriander. Where, T1 = control, T2 = amino 2 ml/2L, T3 = CM product 4 ml/2L, T4 = Chitosan 4 ml/2L, T5 = CM product 2 ml/2L and T6 = Liquid compost 4 ml/2L.

Kale (*Brassica oleracea* var *albograbra*)

It was showed that treated CM product 4 ml/2 L gave significantly highest in plant height (19 cm) and followed by treated with CM product 2 ml/2L and chitosan 4 ml/2L which were 22 and 19 cm, respectively at 49 days. There was not significany different between treated chitosan and non-treated one as seen in Table 3 and 4 and Fig. 6. The research finding is similar resulted in the part of application of Chaetomium that could increase the growth of *B. olreacea* var. *albograbra* in good agricultural practices (GAP), Pesticide-Free Production (PFP) and organic crop production (Pumsing, 2005).

Result in Kales showed that treated CM product 4 ml/2 L at harvest gave significantly highest in plant height, root length and plant fresh weight which were 29 cm, 17 cm and 24 g/plant, respectively and followed by treated with CM product 2 ml/2L which were 23 cm, 15 cm and 16 g, respectively. While, treated with chitosan, amino and non-treated one showed non-significantly different as seen in Table 4. As a result, Soytong, *et al.,* (2001) also stated that Chaetomium couldbe promoted several plant growth and increased in yield egg tomato etc. This was also reported by Soytong, *et al.,* (2004).

Table 3. Plant height of kale in the pots after planning on 49 days.

Treatments	14 days	28 days	42 days	49 days
Control	2 b	4 a	9 c	10 c
Chitosan	2 ab	5 a	14 bc	17 bc
CM 4 ml	3 ab	5 a	23 a	27 a
Amino	3 ab	5 a	18 ab	19 ab
CM 2 ml	3 a	6 a	19 ab	22 ab
CV(%)	14.92	17.19	22.15	19.80

[1]Average of four repeated experiments. Means followed by a common letter are not significantly different at P=0.01.

Table 4. Plant Height, Roots length and Fresh weight of Kale after harvesting.

Treatments	Plant height	Roots length	Plant fresh weight
Control	11 c	9 b	4 c
Chitosan	18 bc	11 ab	11 bc
CM 4 ml	29 a	17 a	24 a
Amino	21 ab	11 ab	14 abc
CM 2 ml	23 ab	15 ab	16 ab
CV (%)	18.43	22.79	32.28

[1]Average of four repeated experiments. Means followed by a common letter are not significantly different at P=0.01.

Fig. 6. Comparison between treatments. Where, T1 = non-treated control, T2 = Chitosan 4 ml/2L, T3 = CM product 4 ml/2L, T4 = Amino 4 ml/2L and T5= CM product 2 ml/2L.

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