

## ***In Vitro* Effect of Plant Extracts, Fungicides and Antibiotics on the Isolates Associated with Damping-Off Disease of Crucifers**

K.S. Hossain<sup>1\*</sup> and M.A. Bashar<sup>2</sup>

**Abstract:** Damping-off of seedlings of Cabbage, Cauliflower and Kohlrabi is very common in the nursery beds of the Dhaka city. *Fusarium oxysporum*, *F. pallidoroseum* and *Rhizoctonia solani* were found to be consistently associated with higher frequency with the diseased seedlings. The effect of extracts of 10 angiospermic plants, 7 fungicides and 3 antibiotics on the vegetative growth of these 3 isolates were studied *in vitro*. The plant extract of *Datura innoxia* was found to be most inhibitory on the growth of *F. oxysporum* and *F. pallidoroseum* followed by that of *Polygonum orientale*. The plant extract of *Allium sativum* was caused maximum growth inhibition of *R. solani* followed by those of *D. innoxia*, *Asparagus racemosus* and *P. orientale*. The inhibitory effects of 2 fungicides viz. Bavistin and Knowin on the growth of these 3 isolates were remarkable. The inhibitory effect of Calixin, Cupravit and Dithane M-45 was also promising. Of the 3 antibiotics, Grisovin and Ketoral effectively inhibited the growth of *F. oxysporum* and *F. pallidoroseum* but Streptomycin stimulated the growth of the 3 fungal species. The result of this study will be helpful in suggesting some effective chemical control measures of damping-off disease of these 3 crucifers.

**Key words:** Antibiotic, Crucifer, Damping-off, Fungicide, *Fusarium*, Plant extract, *Rhizoctonia*

### **Introduction**

During November, 2006 the seedlings of Cabbage (*Brassica oleracea* var. *capitata*), Cauliflower (*B. oleracea* var. *botrytis*) and Kohlrabi (*B. oleracea* var. *gangyloides*) were found infected lesser to moderately with damping-off disease in some plant nurseries of the Dhaka city. Damping-off disease of seedlings occurs worldwide in tropical and temperate climates and in greenhouse. Several species of *Fusarium*, *Phytophthora*, *Pythium* and *Rhizoctonia* cause this disease [1]. A survey of the relevant literatures indicated that very few attempt has been made in Bangladesh, to study the damping-off disease of winter vegetable crops like Cabbage, Cauliflower and Kohlrabi [2 – 4].

Thus, an attempt was made to find out the fungi associated with damping-off infected seedlings of Cabbage, Cauliflower and Kohlrabi and to assess the effect of some angiospermic plant extracts, fungicides and antibiotics on the vegetative growth of some isolates *in vitro*. It is expected that the results of this study will be helpful in suggesting some effective chemical control measures of damping-off disease of Cabbage, Cauliflower and Kohlrabi.

<sup>1</sup> Assistant Professor, Dept. of Botany, Jagannath Univ., Dhaka, Bangladesh.  
E-mail: ksh19688@yahoo.com

<sup>2</sup> Professor of Botany, University of Dhaka, Bangladesh.

\* Corresponding author.

### Materials and Methods

15 to 25 days old damping-off infected seedlings of Cabbage, Cauliflower and Kohlrabi were collected from 3 selected plant nurseries at Kamalapur, Mohammadpur and Uttara in Dhaka city during November, 2006. The seedlings were raised from seeds those were mainly imported from Netherlands and were treated with a seed dressing fungicide (Thirum). However, about 10 to 35% seedlings of the crucifers were found to be affected by damping-off disease in the selected nursery beds. The diseased seedlings were carefully dug out with the help of sterilized trowel and were gently tapped to remove the loosely adhering soil particles. The shriveled and blackened portions with some adjacent healthy parts of the infected seedlings were cut off, kept in a sterilized polyethylene bag and brought at the laboratory for isolation work.

**Isolation of the pathogen:** Fungi associated with diseased parts of seedlings of each crucifer were isolated separately following tissue planting method [5]. In each case, a total of 200 inocula were placed in 50 Petri plates containing PDA medium. Percentage frequency of the occurrence of each fungal isolates was calculated by adopting the following formula.

$$\% \text{ frequency} = \frac{\text{Number of inocula from which a fungal isolate was obtained}}{\text{Number of inocula cultured}} \times 100$$

Identities of the isolates were determined following standard literatures [6, 7].

**Effect of plant extracts, fungicides and antibiotics on three isolates:** Three fungal species, viz., *Fusarium oxysporum* Sah., *F. pallidroseum* (Cooke) Sacc. and *Rhizoctonia solani* Kühn which were found to be consistently associated in higher frequency with damping-off infected seedlings and are reported causal agents of this disease were selected as test isolates [1]. 10 angiospermic plant parts, 7 fungicides and 3 antibiotics were selected to evaluate their effect on the test isolates. All these were collected from the Dhaka city and their particulars are shown in table 2 and 3. Extract of each desired plant parts and medium preparation was done by following same methods described in Hossain [4]. The effect of each plant extract was tested following poison food technique at 20% concentration whereas it was 25, 50, 100, 200, 400 and 800 ppm in case of fungicides and antibiotics. The radial growths of the colonies were measured after 3 days in case of *R. solani* while 7 days in case of *Fusarium* spp.

**The effect was expressed as percentage of inhibition/ stimulation of growth of the test pathogen and was calculated by using the formula given below:**

$$\text{Per cent growth inhibition/ stimulation} = \frac{C-T}{C} \times 100$$

**Where, C = growth in control, T = growth in treatment, Inhibition=C> T, Stimulation= C < T (+ sign was put before the calculated value).**

The results were statistically analyzed by t-test following Steel and Torrie [8].

### Results and Discussion

Fungi found to be associated with damping-off infected seedlings of Cabbage, Cauliflower and Kohlrabi were distributed over 4 genera (Table 1). The average

percentage frequency of occurrence of *Rhizoctonia solani* was highest (43.67%) followed by *Fusarium oxysporum* and *F. pallidoroseum* (27.33%). Amongst the isolates, *R. solani* is known as the causal agent for damping-off of seedling of Cabbage and Cauliflower [9 – 11].

**Table 1:** The fungi associated with damping-off infected seedlings of Cabbage, Cauliflower and Kohlrabi of nursery beds of the Dhaka city.

Fungi isolated	% frequency in different host			Average % frequency
	Cabbage	Cauliflower	Kohlrabi	
<i>Alternaria</i> spp.	6	4	7	5.67
<i>Curvularia</i> spp.	8	11	6	8.33
<i>Fusarium</i> spp. ( <i>F. oxysporum</i> Sch. <i>F. pallidoroseum</i> (Cook) Sacc.)	23	32	27	27.33
<i>Rhizoctonia solani</i> Kühn	38	44	49	43.67

A number of strains of *F. oxysporum* are recorded as serious wilt pathogens of Cabbage, Cauliflower and Kohlrabi. *F. pallidoroseum* is known as a secondary invader of plant tissues and often associated with disease complexes. Its contribution to the damping-off of tomato seedlings in cultural studies was demonstrated by some workers [6].

The role of these *Fusarium* species in the damping-off of seedlings of Cabbage, Cauliflower and Kohlrabi is yet to be determined.

**Table 2:** Effect of plant extracts on the growth of *Fusarium oxysporum* [FO], *F. pallidoroseum* [FP] and *Rhizoctonia solani* [RS] at 20% concentration.

Plant species [Native name]	Plant parts used	Per cent growth inhibition/ stimulation of three isolates at 20% concentration		
		FO	FP	RS
<i>Allium cepa</i> L. [Piaz]	Bulb*	3.05	6.81 <sup>b</sup>	26.39 <sup>a</sup>
<i>Allium sativum</i> L. [Rosoon]	Bulb*	+42.38 <sup>a</sup>	+38.35 <sup>a</sup>	<b>100.00<sup>a</sup></b>
<i>Ampelgynon salarkhanii</i> Hasan [Girish sovon shak]	Leaf**	4.54	6.98 <sup>c</sup>	+23.4 <sup>b</sup>
<i>Asparagus racemosus</i> L.[Satamuli]	Root*	+13.37 <sup>b</sup>	+ 8.12 <sup>c</sup>	59.29 <sup>a</sup>
<i>Azadirachta indica</i> A.Juss.[Neem]	Leaf**	9.64 <sup>c</sup>	10.80 <sup>c</sup>	8.12 <sup>c</sup>
<i>Cassia alata</i> L. [Dadmordan]	Leaf**	3.98	3.10	1.23
<i>Curcuma longa</i> L. [Holud]	Rhizome*	12.49 <sup>a</sup>	19.47 <sup>b</sup>	26.76 <sup>b</sup>
<i>Datura innoxia</i> Mill. [Dhutra]	Leaf**	<b>61.37<sup>a</sup></b>	<b>52.61<sup>a</sup></b>	<b>100.00<sup>a</sup></b>
<i>Mikania scandens</i> Cl. [Assamlata]	Leaf**	+76.92 <sup>a</sup>	+89.44 <sup>a</sup>	+61.87 <sup>a</sup>
<i>Polygonum orientale</i> L.[Bishkatali]	Leaf**	25.26 <sup>b</sup>	30.11 <sup>b</sup>	41.81 <sup>a</sup>

\* Extract prepared without adding water.

\*\* Distilled water was added in the ratio of 1:1(w/v) during extract preparation.

a, b and c significant at p=0.001, 0.01 and 0.05 respectively.

+ indicates stimulation of growth.

**Effect of plant extracts, fungicides and antibiotics on three isolates:** Effect of plant extracts of 10 selected angiospermic plants on the growth of 3 test isolates, viz., *Fusarium oxysporum*, *F. pallidoroseum* and *Rhizoctonia solani* is presented in table 2. The plant extracts as used in the present work, differed with respect to their effect on growth of the test isolates. Out of the 10 plant extracts, only 6 obtained from *Allium cepa*, *Azadirachta indica*, *Cassia alata*, *Curcuma longa*, *Datura innoxia* and *Polygonum orientale* were found to inhibit the growth of all the 3 isolates. However, the leaf extract of *Mikania scandens* stimulated the growth of all the test isolates. Several studies also demonstrated the inhibitory and stimulatory effects of plant extracts on various pathogens [12 – 14].

The plant extract of *D. innoxia* was found to be most inhibitory to *F. oxysporum* and *F. pallidoroseum* (61.37% and 52.61% respectively) followed by that of *P. orientale*. The inhibitory effects of plant extracts of *A. cepa*, *A. indica*, *C. alata* and *C. longa* against these 2 isolates were not so encouraging. The maximum inhibition (100.0%) of *R. solani* was found with plant extracts of *A. sativum* and *D. innoxia* followed by *A. racemosus* (59.29%). It was also noticed that the sclerotia formation of *R. solani* was directly related with the degree of inhibition of its mycelial growth.

The bulb extract of *A. sativum* showed 100% inhibition of *R. solani* but stimulated the growth of *F. oxysporum* and *F. pallidoroseum*. Similar trends of results were also noticed in case of *A. racemosus*. These results are in good agreement with the findings of Hossain [4]. It is evident from the foregoing findings that the toxicity of a plant extract may differ with the fungal pathogenic species. A plant extract which is inhibitory to a number of pathogens may have also a stimulatory effect on other fungal pathogen. The inhibitory effect of a plant extract is owing to the presence of antifungal agents of various groups like antibiotics, phenolic compounds etc. [1].

These antifungal agents may be of narrow spectrum and effective against a particular fungus or a group of fungal pathogens but can not inhibit others. Likewise, the presence of one or more growth promoting or nutritional factors in a plant extract may attribute for its stimulatory effect on some fungal pathogen. In fact, many fungal pathogens are grown in culture medium supplemented with extracts of plant parts, particularly the extracts of plant parts of the host plant for growth and sporulation [15].

Amongst the 7 fungicides used in the present investigation, Bavistin and Known and Calixin are systemic while Cupravit, Dithane M-45, Macuprax and Thiovit are non-systemic, contact fungicides. The 3 antibiotics– Grisovin, Ketoral and Streptomycin also used in the present investigation are systemic in their action.

All the fungicides inhibited the radial growth of the 3 isolates (Table 3). The effect of inhibition varied amongst the 3 isolates, however, inhibition of fungicides increased with their increasing concentrations. The complete inhibition of the growth of 3 isolates was observed with Bavistin and Knowin at all concentration used. The complete inhibition was also observed in *F. oxysporum* and *F. pallidoroseum* with Dithane M-45 and Cupravit at 50 and 800 ppm concentrations respectively. Calixin inhibit the growth of 3 isolates.

**Table 3:** Effect of fungicides and antibiotics on the growth of *Fusarium oxysporum* [FO], *F. pallidroseum* [FP] and *Rhizoctonia solani* [RS] at different concentrations.

Name [Active ingredient/s]	Isolates	Per cent growth inhibition / stimulation of three isolates at different concentrations (ppm)					
		25	50	100	200	400	800
<b>Fungicides:</b>							
Bavistin [50% Carbendazim]	FO	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
	FP	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
	RS	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
Calixin [75% Tridemorph]	FO	53.55 <sup>a</sup>	66.71 <sup>a</sup>	71.56 <sup>a</sup>	82.04 <sup>a</sup>	87.01 <sup>a</sup>	95.67 <sup>a</sup>
	FP	75.78 <sup>a</sup>	77.28 <sup>a</sup>	79.06 <sup>a</sup>	83.07 <sup>a</sup>	86.38 <sup>a</sup>	93.89 <sup>a</sup>
	RS	46.19 <sup>a</sup>	56.97 <sup>a</sup>	66.67 <sup>a</sup>	78.59 <sup>a</sup>	80.61 <sup>a</sup>	91.13 <sup>a</sup>
Cupravit [50% Copper oxychloride]	FO	9.06 <sup>b</sup>	18.67 <sup>b</sup>	35.54 <sup>b</sup>	67.63 <sup>a</sup>	95.68 <sup>b</sup>	<b>100.00<sup>a</sup></b>
	FP	5.46 <sup>b</sup>	9.28 <sup>b</sup>	21.33 <sup>c</sup>	45.02 <sup>b</sup>	86.99 <sup>b</sup>	<b>100.00<sup>a</sup></b>
	RS	0.00	4.23	7.84 <sup>b</sup>	15.17 <sup>b</sup>	23.51 <sup>c</sup>	30.49 <sup>a</sup>
Dithane M-45 [80% Mancozeb]	FO	68.19 <sup>a</sup>	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
	FP	15.98 <sup>a</sup>	24.30 <sup>a</sup>	31.41 <sup>a</sup>	59.59 <sup>a</sup>	80.94 <sup>a</sup>	84.39 <sup>a</sup>
	RS	21.76 <sup>b</sup>	34.13 <sup>b</sup>	44.35 <sup>a</sup>	54.73 <sup>a</sup>	69.83 <sup>a</sup>	74.29 <sup>a</sup>
Knowin [50% Carbendazim]	FO	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
	FP	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
	RS	<b>100.00<sup>a</sup></b>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>	100.00 <sup>a</sup>
Macuprax [58% Neutral Bordeaux Mixture + 7%Cufraneb]	FO	0.00	1.72	3.89 <sup>c</sup>	11.37 <sup>b</sup>	28.60 <sup>a</sup>	38.93 <sup>a</sup>
	FP	1.80	3.19 <sup>b</sup>	7.29 <sup>b</sup>	16.13 <sup>b</sup>	23.61 <sup>b</sup>	29.76 <sup>a</sup>
	RS	2.15	6.94 <sup>c</sup>	16.17 <sup>c</sup>	21.19 <sup>c</sup>	26.87 <sup>c</sup>	29.37 <sup>b</sup>
Thiovit [80% Sulpher]	FO	3.86	7.01 <sup>c</sup>	9.66 <sup>b</sup>	14.80 <sup>b</sup>	20.96 <sup>c</sup>	29.43 <sup>b</sup>
	FP	5.01	7.44 <sup>c</sup>	9.64 <sup>b</sup>	12.14 <sup>c</sup>	14.59 <sup>c</sup>	18.75 <sup>b</sup>
	RS	11.16 <sup>b</sup>	17.35 <sup>b</sup>	25.84 <sup>b</sup>	29.88 <sup>b</sup>	35.66 <sup>b</sup>	42.17 <sup>a</sup>
<b>Antibiotics:</b>							
Grisovin-FP [Griseofulvin, 500 mg/tablet]	FO	40.36 <sup>a</sup>	42.02 <sup>a</sup>	44.81 <sup>a</sup>	45.33 <sup>a</sup>	48.23 <sup>a</sup>	50.88 <sup>a</sup>
	FP	48.16 <sup>a</sup>	52.39 <sup>a</sup>	54.86 <sup>a</sup>	55.91 <sup>a</sup>	55.27 <sup>a</sup>	57.81 <sup>a</sup>
	RS	30.49 <sup>a</sup>	32.05 <sup>a</sup>	33.12 <sup>a</sup>	33.43 <sup>a</sup>	34.11 <sup>a</sup>	35.98 <sup>a</sup>
Ketoral [Ketoconazole, 200 mg/tablet]	FO	64.23 <sup>a</sup>	68.99 <sup>a</sup>	74.77 <sup>a</sup>	83.34 <sup>a</sup>	88.28 <sup>a</sup>	<b>91.35<sup>a</sup></b>
	FP	67.71 <sup>a</sup>	69.67 <sup>a</sup>	71.26 <sup>a</sup>	71.55 <sup>a</sup>	72.64 <sup>a</sup>	73.59 <sup>a</sup>
	RS	17.34 <sup>b</sup>	18.23 <sup>c</sup>	18.74 <sup>c</sup>	19.88 <sup>b</sup>	20.91 <sup>b</sup>	21.39 <sup>b</sup>
Streptomycin [Streptomycin sulphate, 1g/ampule]	FO	+7.89 <sup>c</sup>	+10.11 <sup>c</sup>	+12.40 <sup>b</sup>	+14.79 <sup>b</sup>	+18.84 <sup>c</sup>	+20.31 <sup>b</sup>
	FP	+12.14 <sup>b</sup>	+13.20 <sup>b</sup>	+13.76 <sup>b</sup>	+14.39 <sup>b</sup>	+14.89 <sup>b</sup>	+15.61 <sup>c</sup>
	RS	+93.64 <sup>a</sup>	+94.88 <sup>a</sup>	+95.87 <sup>a</sup>	+97.64 <sup>a</sup>	+99.37 <sup>a</sup>	+102.89 <sup>a</sup>

a, b and c significant at p=0.001, 0.01 and 0.05 respectively.

+ indicates stimulation of growth.

Significantly, however, inhibitory effects of Macuprax and Thiovit are insignificant.

Bashar reported that Bavistin check the growth of *F. oxysporum* Sah. f.sp. *cicei* (Padwick) Snyder and Hans. at 100 ppm while Dithane M-45 fail to check the growth of

the pathogen even at 3,000 ppm concentration [16]. Sen and Kapoor observed that Bavistin and Dithane M-45 were most effective in inhibiting the growth of *R. solani* causing collar rot of cauliflower at 100 ppm concentration [17].

It is evident from the foregoing discussion that considerable differences exist in the findings of various workers as regards the effect of some fungicides like Bavistin and Dithane M-45 on pathogenic fungi like *F. oxysporum* and *R. solani*. It is not unlikely that different isolates of *R. solani* or different strains of *F. oxysporum* will react differently against one or more fungicides. This is because of the differences in biology of different isolates or strains of a pathogenic fungal species [18].

The effect of these 3 antibiotics on the growth of 3 test isolates is shown in table 3. The antifungal ones– Grisovin-FP and Ketoral caused inhibition and the antibacterial antibiotic– Streptomycin caused stimulation of growth of the 3 isolates. Ketoral caused maximum growth inhibition of *F. oxysporum* (91.35%) and *F. pallidorozeum* (73.59%) at 800 ppm concentrations. The effects of Ketoral and Grisovin on the growth of *R. solani* are found insignificant. For obvious reasons the antifungal antibiotics are always more effective against fungal pathogens. This observation is in accord with the finding of Basher [19].

It is anticipated from the present study that the *A. sativum* and *D. innoxia* may serve as candidate plant species for their exploitation as potent fungitoxicants for controlling damping-off disease of Cabbage, Cauliflower and Kohlrabi. More over, Bavistin, Knowin and Calixin can be used in suitable chemical control measures of damping-off disease of these 3 crucifers.

## References

1. Agrios G. N., 1997, Plant pathology, 4<sup>th</sup> edition, Academic Press, London, p. viii + 634.
2. Ishaque M. and Talukder M. J., 1967, Survey of fungal flora of East Pakistan, Agriculture Pakistan, **18(1)**: 17 – 26.
3. Talukder M. A., 1974, Plant diseases in Bangladesh, *Bangladesh J. of Agri. Res.*, **1(1)**: 61 – 83.
4. Hossain K. S., 1993, A study on the fungi associated with damping-off infected seedlings of cabbage, cauliflower and kohlrabi of nursery beds of the Dhaka city and the effect of some fungicides, antibiotics and plant extracts on the growth of three isolates, M.Sc. Thesis, Dhaka University, Dhaka, p. IV + 58.
5. Ashraffuzzaman M. H., 1976, Laboratory manual of plant pathology, 1<sup>st</sup> edition, Bangladesh Agriculture University, Mymensingh, p. II + 98.
6. Booth C., 1971, The Genus Fusarium, The Commonwealth Mycological Institute, England, p. 273.
7. Barnett H. L. and Hunter B. B., 1972, Illustrated Genera of Imperfect Fungi, 3<sup>rd</sup> edition, Bungess Publishing Company, U.S.A., p. iii+241.
8. Steel R. G. D. and Torrie J. H., 1960, Principles and Procedures of Statistics, Mac Graw Hill Book Co., New York, p. 16+481
9. Rai J. N., Tewari J. P., Singh R. P., and Saxena V. C., 1974, Fungal diseases of Indian Crucifers, *Nova Hedwigia*, **47**: 447 – 486.

10. Roy A. K., 1975, Pathogenicity of *Rhizoctonia solani* and its control, *Indian Phytopath.*, **28**: 184 – 188.
11. Singh S. J., and Pavgi M. S., 1980, Diseases of cruciferous crop in Varanasi, *Indian Phytopath.*, **38**: 321 – 324.
12. Saha K., 1997, Fungitoxicity of extracts of forty higher plants on four fungal plant pathogens, M.Sc. Thesis, Dhaka University, Dhaka, p. i + 53.
13. Eksteen D., Pretorius J. C., Nieuwoudt T. D., Zietsman P. C., 2001, Mycelial growth inhibition of plant pathogenic fungi by extracts of South African plant species, *Annals of Applied Biol.*, **139** (2) , 243–249.
14. Hasan M. M., Chowdhury S. P., Alam S., Hossain B. and Alam M. S., 2005, Antifungal effects of plant extracts on seed-borne fungi of wheat seed regarding seed germination, seedling health and vigour index, *Pakistan J. Biol. Sci.*, **8**(9): 1284-1289.
15. Anonymous, 1968, Plant Pathologist's Pocket Book, The Commonwealth Mycological Institute, England, p. 267.
16. Bashar M. A., 1992, Laboratory evaluation of some pesticides on *Fusarium oxysporum* f. sp. *ciceri* causing wilt of chickpea, *Bangladesh J. Bot.*, **21**(1): 157-159.
17. Sen B. and Kapoor L. J., 1975, Control of *Rhizoctonia solani* collar rot of cauliflower, *Pesticides*, **9**: 35 – 36.
18. Singh N. and Singh R. S., 1970, Development of wilt causing species of *Fusarium* in fungicide treated soil, *Indian Phytopath.*, **23**: 545 – 552.
19. Bashar M. A., 1992, Effect of antibiotics on growth of *Fusarium oxysporum* f. sp. *ciceri* causing wilt of chickpea, *Bangladesh J. of Life Sci.*, **4**:7-11.