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ORIGINAL ARTICLE

Effect of Growth Hormones on Production of Antibiotic Substance by *Streptomyces* Species

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ABSTRACT

Actinomyces particularly species of streptomyces are known to produce many antibiotics. In the present study, three species viz; Streptomyces carcinomycicus, S. galbus and S. hygroscopcus isolated from soils of unusual habitats were grown in glucose asparagines broth supplemented with different concentrations of 2, 4-D, 1BA and 1AA for different durations to see the effect of these hormones on antibiotic substance production. It was noted that the growth hormones in general promoted the production of antibiotic substance out of there hormones, 2,4 D at the concentration of 100µgm/lt., caused maximum production of antibiotic substance after 15 days of incubation period in case of S. carcinomycicus and S. hygroscopicus. However, 1 BA at this concentration and duration produced maximum antibiotic substance in case of S. galbus on the basis of production of antibiotic substance, the species can be graded in descending order as S. carcinomyces > S. galbus > S. hygroscopicus.

Key words: *Streptomyces, antibiotic, growth hormones*

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INTRODUCTION

Among all groups of micro-organisms, the actinomycetes are the richest source of antibiotics. The antibiotics production by microbes is affected by environmental factors and nutritional factors such as pH of the medium, incubation temperature, period of incubation, carbon and nitrogen sources, vitamins and hormones (Iyenger, 1979). Pratt and Dufrenoy (1945) noted that the production of penicillin was considerably facilitated by the use of indole-3 acetic acid and naphthalene acetic acid in the culture medium. Naito and Tani (1956) isolated an antibiotic from *Gleosporium olivorum* grown in media containing 2-methyl, 4 chloro phenoxy acetic acid (MCPA) and 2, 4, 5 trichlorophenoxy acetic acid. These reports indicate that growth hormones have stimulatory effect on antibiotic production and growth of micro-organisms in culture medium.

Therefore, it was considered worthwhile to study the effect of some growth hormones on the production of antibiotic substances by *Streptomyces carcinomycicus, S. galbus* and *S. hygroscopicus*. The findings so obtained are presented in this communication.

METERIALS AND METHODS

The Streptomyces species viz; *S. carcinomycicus, S. galbus* and *S. hygroscopicus* were isolated from soils of unusual habitats and were found to be antibiotic producer. These species were maintained on tryptone yeast extract agar medium. For the production of antibiotics 30 ml glucose-asparagine broth was used in 250 ml Erlnmeyer flasks in triplicate the pH of the medium was adjusted at 6.5.

Growth hormones viz; 2-4 dichlorophenoxy acetic acid, indole – 3 acetic acid and indole butyric acid were added to the medium separately under aseptic conditions in four different concentrations at the rate of 0.1, 1, 10 and 100µg per litre. This experiment was carried out with three replicates and a control. In all these cases, the antibiotic activity present in the culture filtrate was ascertained at 5, 10 and 15 days of incubation at 28± 1˚C in B.O.D. incubator by spore germination method following hanging drop method using spores of Brain 1957 *Collectotrichum gloeosporiodes* (a plant pathogen). The data obtained for the percentage inhibiton of spore germination was subjected to the lest of significance using "analysis of variance" method Further, at the end of 15th day of incubation, mycelial mat from the flasks was removed by filtration through previously weight whatman no. 1 filter paper and mycelial dry weight was determined following Naito and Tani (1957). The initial pH of the medium and final pH of the culture filtrate obtained after incubation period was determined by Cambridge glass electrode pH meter.

Table 1: Effect of different hormones on the growth and productions of antibiotic substance by the strain of *S.carcinomycicus* (isolate A-3)

Treatment	Conc. µgm/lt.	Percentage of inhibition of spore germination (Mean of 30 observations) Incubation period in days			Mean of 3 Replicates	
		5	10	15	Mycelial dry weight in gms after 15 days of growth	Final pH
2 : 4D	0.1	32.18	44.47	52.25	0.1862	6.7
	1.0	42.62	52.48	58.62	0.1948	6.8
	10.0	52.68	60.29	64.92	0.2065	7.0
	100.0	61.28	71.92	82.53	0.2596	7.1
1AA	0.1	25.29	33.47	51.62	0.1805	6.7
	1.0	34.96	42.38	55.96	0.1968	6.9
	10.0	44.32	55.03	64.14	0.2163	7.0
	100.0	57.37	68.32	78.42	0.2493	7.3
1 BA	0.1	33.94	42.75	50.15	0.1852	6.7
	1.0	41.63	50.92	58.75	0.1947	6.8
	10.0	51.43	61.36	70.47	0.2168	6.9
	100.0	60.92	69.47	80.42	0.2493	7.1
Control	-	30.0	40.0	50.0	0.1362	6.8

RESULT AND DISCUSSION

It is clear from the Table 1, 2 and 3 that the growth hormones in general stimulate the production of the antibiotic substance. Further, there are significant difference in the treatments in relation to incubation period and concentration of hormones out of the three hormones tested 2-4 D (2, 4 dichlorophenoxy acetic acid) supported the maximum production of antibiotic substance for *S. carcinomycicus*.Next in descending order was 1.B.A (Indole-3-butyric acid). However, 1AA (Indole-3-acetic acid) proved to be least effective in supporting production of antibiotic substance by *S. carcinomycicus*.

Table 2: Effect of different hormones on the growth and production on antibiotic substance by the strain of *S. galbus* (isolate S-9)

Treatment	Conc. µgm/lt.	Percentage inhibition of spore germination (Mean of 30 observations) Incubation period in days			Mean of 3 Replicates	
		5	10	15	Mycelial dry weight in gms after 15 days of growth	Final pH
2 : 4D	0.1	41.29	53.68	61.52	0.1982	6.7
	1.0	51.25	59.63	66.32	0.2075	6.8
	10.0	62.98	69.74	71.62	0.2479	6.9
	100.0	71.52	81.93	93.69	0.3257	7.2
1AA	0.1	23.52	41.63	59.98	0.1846	6.7
	1.0	44.25	51.74	65.83	0.1993	6.9
	10.0	53.92	64.74	74.16	0.2168	7.1
	100.0	69.58	79.82	89.51	0.2957	7.3
1 BA	0.1	41.16	46.92	61.82	0.1953	6.8
	1.0	49.53	61.83	72.92	0.2364	6.9
	10.0	61.85	71.83	83.56	0.2572	7.0
	100.0	74.98	84.83	90.87	0.3165	7.2
Control	-	30.00	45.00	60.00	0.1697	6.8

It is evident from the observations that concentration of hormone used has the most significant effect on the production of antibiotic substance. All the three hormones are least effective, when applied in the concentration of 0.1µgm/lt. However, with further increase in concentration of growth hormones, there was a significant enhancement in the antibiotic activity as the incubation period increases from 5 to 15 days. The maximum activity was observed at the end of 15 days in all the cases.

It is noteworthy to record that at 100 µgm/lt. concentration and 15 days incubation period maximum percent inhibitioin of spore germination was noted in case of all species of *streptomyces*. Further the values of percent inhibition in case of 2, 4-D were 82.53, 93.69 and 78.98% for *Streptomyces carcinomycicus, S. galbus* and *S. hygroscopicus* respectively which were significantly more than the control (medium without growth hormone). In all the cases, *Streptomyces hygroscopicus* was found to be least effective in antibiotic production as it could inhibit the spore germination up to 78.98, 75.53 and 75.59 percent I case of medium supplemented with 2-4-D, 1.A.A and I.B.A respectively at the concentration of 100µgm/lt and 15 days incubation period. Thus, it can be concluded that 2-4 D can be used at the concentration of 100µgm/lt. for maximum production of antibiotic substance by Streptomyces species considering 15 days incubation period as optimum. The results are in agreement with the earlier reports (Naito *et al*; 1958; Gupta, 1967).

Table 3: Effect of different hormones on the growth and production of antibiotic substance by the strain of *S. hygroscopicus* (isolate F-14)

Treatment	Conc. µgm/lt.	Percentage inhibition of spore germination (Mean of 30 observations) Incubation period in days			Mean of 3 Replicates	
		5	10	15	Mycelial dry weight in gms after 15 days of growth	Final pH
2 : 4D	0.1	28.85	40.63	49.67	0.1763	6.6
	1.0	38.92	47.65	54.12	0.1896	6.7
	10.0	48.42	57.36	60.93	0.2152	6.9
	100.0	58.67	68.46	78.98	0.2397	7.0
1AA	0.1	21.63	30.92	48.75	0.1705	6.6
	1.0	30.16	38.53	50.16	0.1792	6.7
	10.0	40.28	50.72	61.38	0.1942	6.8
	100.0	53.14	62.52	73.53	0.2258	7.0
1 BA	0.1	28.16	38.92	46.56	0.1692	6.7
	1.0	38.14	46.38	54.93	0.1853	6.8
	10.0	47.35	57.82	66.52	0.2256	6.9
	100.0	56.14	65.92	75.59	0.2316	7.1
Control	-	30.00	40.00	50.00	0.1285	6.8

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