Studies On Some of the Actinomycetales Strains Producing Antibiotics

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C O N T E N T S

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INTRODUCTION

I N T R O D U C T I O N

Actinomycetes are looked upon as the most important groups of soil micro-inhabitants having the capability of producing substances that inhibit the growth of other micro-organisms or even destroy them. These substances were defined as antibiotics and the action of these substances is called antagonism. This phenomenon is familiar between the different groups of micro-organisms and the first scientific demonstration on it was made in 1887 by Pasteur and Joubert.

Numerous investigations were made to identify different micro-organisms as antibiotics producers. Of these, actinomycetes were found to be an extremely rich source of antibiotics. The system of their life, as any living micro-organisms, is highly influenced by the complex combination of the different ecological and environmental factors prevailing in their habitat. It is known that the soil is the principal substrate in which actinomycetes survive. The soil conditions and properties differ from one country to another and even in different places in the same country. This renders it important to investigate the survival of antagonistic actinomycetes under local conditions

Studies of antibiotic producing actinomycetes in Egyptian soils is limited. El-Leithy (1958) made a survey for these micro-organisms in limited places in Egypt. Therefore a more extensive survey for the antagonistic actinomycetes in Egyptian soils of different textures is needed.

For this purpose

This work deals with the following topics :

1) The distribution of actinomycetes in Egyptian soils in relation to the soil properties.
2) The distribution of antibiotic producing actinomycetes in relation to such soil properties.
3) The antibiotic spectra of the isolated antagonistic actinomycetes.
4) Colour grouping and identification of the most active antagonists.
5) The effect of the composition and the physical state of the media on antibiotic production.

REVIEW OF LITERATURE

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ANTIBIOTICS

Antagonism is a familiar phenomenon which takes place between various groups of micro-organisms.

Babes (1885) was the first to demonstrate that microbial antagonism was a result of a definite chemical produced by the antagonistic organism. Garre (1887) stated that antagonism was caused by the secretion of a specific and easily diffusable substance which would inhibit the growth of some species but was completely ineffective against others.

The discovery of penicillin by Fleming (1929) and the recognition of its chemotheraputic properties (chain et al., 1940) stimulated further investigations to discover new antibiotic agents. Great number of antibiotics have been discovered and all are produced by micro-organisms. Only penicillin is produced by moulds, tyrothricin, bacitracin and polymixin are produced by bacteria. Up till now, so far, all the discovered antibiotics are products of the metabolism of actinomycetes. Waksman and Woodruff (1940) were the first to isolate antibiotic substances produced by actinomycetes, such as actinomycin from

Streptomyces antibioticus. Streptomycin was also discovered by Schatz, Bugie and Waksman (1944) as a product of **Streptomyces griseus**.

Only in 1947 the word antibiotic was defined by Waksman as a chemical substance produced by micro-organisms, which has the capacity of inhibiting the growth, and even destroys bacteria and other micro-organisms.

Importance of Actinomycetes in Producing of Antibiotics

It is well known that actinomycetes are of wide-spread occurrence in soils and also that they are one of the major groups of soil inhabitants. The interaction in soil between actinomycetes and other micro-organisms, which may take the form of stimulation or antagonism, between different micro-organisms in the soil population has been of great interest to microbiologists. Interest has been greatly stimulated in the case of actinomycetes by the discovery that many species of these organisms produce antibiotic secretions. Extensive search for such species by a number of workers has revealed the fact that about half of the actinomycetes strains tested in laboratory culture produce secretions antibiotic to various bacteria and fungi (Waksman 1945, 1950).

The extensive study of antagonism between actino-mycetes and other micro-organisms in artificial media has resulted in the development of methods of use to the soil microbiologist and has supplied general information of value to him on such matters as the effect of nutrient supply on antibiotic production, but the more specific results from this work, though of immense value in medicine,

have in most cases not been applicable to the study of antibiotic action in soil. There are several obvious reasons why this is so. The species of actinomycetes most intensively studied have been selected because they produce antibiotics active against certain micro-organisms pathogenic to man and more specifically because antibiotics can be isolated from their secretions that are relatively non-toxic to animals. This selection has excluded from further study many species producing powerful antibiotics of no likely medicinal use. Moreover the antibiotic action has usually been tested under the artificial environment of an agar plate or liquid culture and in a simple biological system comprising the actinomycetes and the test organism alone.

The antagonistic effects of actinomycetes :

The effects of actinomycetes on different micro-organisms depend on the nature of the antibiotic substances produced by them. These substances may inhibit the growth of bacteria, fungi and even actinomycetes. On this basis one can summarize the antagonistic effects of actinomycetes to three main groups :

a) Antibacterial effects :

Liesk (1921) discribed the antagonistic action