

ON THE OCCURRENCE AND IDENTITY OF
URICOLYTIC MICRO-ORGANISMS IN EGYPTIAN SOILS

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ABSTRACT

An attempt was made to throw light upon the occurrence and identity of uricolytic microorganisms in soil samples collected from various regions of Egypt. Results indicate that uricolytic bacteria and uricolytic fungi are present in 81% and 94% of the investigated soil samples respectively. Counts of uricolytic bacteria ranged between 2×10^5 and 8.6×10^5 and that of uricolytic fungi ranged between 1×10^4 and 2.7×10^5 /g oven-dry soil. The uricolytic fungal isolates belong to five genera viz : *Aspergillus*, *Penicillium*, *Fusarium*, *Chaetomium* and *Cephalosporium*. The most dominant genera were *Aspergillus*, *Penicillium* and *Fusarium*. Isolates of uricolytic bacteria belong to the genera *Arthrobacter*, *Bacillus*, *Pseudomonas*, *Flavobacterium*, *Streptomyces*, *Alcaligenes*, *Micrococcus*, *Mycobacterium*, *Streptococcus*, *Corynebacterium*, *Nocardia*, *Micromonospora* and *Sarcina*. The first five genera are the most dominant. Results have revealed a distinct physiological group of microorganisms that would have a role in the nitrogen cycle in nature.

INTRODUCTION

Although many investigations have been carried out on soil microorganisms in various countries, yet reports on the occurrence of uric acid decomposing microorganisms in soil seem to be lacking.

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Durand (1961) and Smith (1963) separately concluded that the uricolytic of soil extract might possibly be due to organisms producing uricase. However, these investigators did not give information of the occurrence and nature of these organisms. Recently El-Naggar and Emara (1980) have detected uricolytic bacteria and uricolytic fungi in 80% and 89% respectively of the investigated Asiri soils. It was felt required to throw light upon the occurrence and identity of uricolytic microorganisms in soil samples collected from various localities of Egypt.

MATERIALS and METHODS

Soil samples :

Eighty four soil samples were collected from the upper 20 cm. layer after removing the exposed surface from different localities of Egypt. Soil samples were collected in polythene bags. Samples were from North coast (27); lower Egypt and Nile Delta (22); Cairo and its districts (19) and Upper Egypt (16).

Media :

Uric acid medium for counting and isolating bacteria of the following composition : NaCl, 0.5g ; $MgSO_4 \cdot 7H_2O$, 0.2 g; $CaCl_2 \cdot H_2O$, 0.1 g.; K_2HPO_4 1 g; glucose 4 g; agar, 20 g. Distilled water 1000 ml. the pH was adjusted at 5.8 - 6 and autoclaving was made at 1.5 atms. for 15 minutes.

Uric acid medium for counting and isolating fungi was the same as that for bacteria but with adding to the

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sterile medium the filter-sterilized antibiotic to give a final concentration of 10 mg % chlorotetracyclin HCl; 2 mg % chloramphenicol and 2 mg % streptomycin sulphate.

Counting of uricolytic and non-uricolytic microorganisms was made using the standardized-spatula spray technique given by Elwan and El-Syed (1964).

Uric acid medium is turbid, the developing uricolytic microorganisms produce uricase that results in the breakdown of uric acid and clearing the medium.

Incubation was made at 30°C for three days in case of bacteria and five days for fungi.

Organisms showing uricolytic activity were isolated, purified and identified. Gilman's Keys (1957) and Barnett's Keys (1960) were used for identifying fungi, Media used for identification of bacterial isolates were similar to those recommended in the Manual of Microbiological Methods, 1957. Identification was made using the Keys of Bergey 1974.

RESULTS

Results (Table 1) of investigating 84 soil samples show that 68 soil samples i.e. about 81% contained uricolytic bacteria and 79 ones i.e. about 94% contained uricolytic fungi. The counts of uricolytic bacteria ranged between 2×10^3 and 8.6×10^5 where the counts of uricolytic fungi ranged between 1×10^2 and 2.7×10^3 colonies /g oven dried soil. About 67% and 85% of North coast soil samples contained uricolytic bacteria and uricolytic fungi respectively. Soil samples from lower Egypt incorporated uricolytic bacteria in 95% and uricolytic fungi in all the soil samples.

68% and 93% of soil samples of Cairo region contained uricolytic bact-

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terea and fungi respectively. All the soil samples of upper Egypt contained uricolytic bacteria and uricolytic fungi.

The census of uricolytic microorganisms gives evidence that bacteria are much higher than fungi.

Table (2) shows the distribution of uricolytic fungal genera in the investigated soil samples. Five fungal genera viz : *Aspergillus*, *Penicillium*, *Fusarium*, *Chaetomium* and *Cephalosporium* were identified. *Aspergillus*, *Penicillium* and *Fusarium* were distributed in all the investigated regions. *Chaetomium* and *Cephalosporium* were recovered from the regions of Cairo and lower Egypt.

Table (3) shows the distribution of uricolytic bacterial genera in the investigated soil samples. Thirteen bacterial genera viz : *Arthrobacter*, *Bacillus*, *Pseudomonas*, *Flavobacterium*, *Streptomyces*, *Alcaligenes*, *Micrococcus*, *Corynebacterium*, *Nocardia*, *Micromonospora*, and *Sarcina* were identified. The genera *Arthrobacter*, *Bacillus*, *Pseudomonas*, *Flavobacterium* and *Streptomyces* were recovered from all the investigated soil samples. *Alcaligenes* and *Micrococcus* were isolated from soil samples of two regions. *Corynebacterium* and *Sarcina* were recovered from soil samples of one region only.

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Table (1) : The occurrence of uricoytic bacteria and fungi in soil samples collected from various regions of Egypt.

Region	No. of investigated samples	No of sample containing uricoytic microorganisms				Range of counts of urico-lytic microorganisms per gram oven dry soil	
		Bacteria %	Fungi %	Bacteria	Fungi		
North Coast	27	18	66.65	23	85.17	$2 \times 10^3 - 5 \times 10^5$	$1.4 \times 10^2 - 1.6 \times 10^3$
Lower Egypt	22	21	95.45	22	100	$3 \times 10^3 - 2.8 \times 10^5$	$3.1 \times 10^2 - 2.7 \times 10^3$
Cairo & its Districts	19	13	68.42	18	93.63	$4 \times 10^3 - 8.6 \times 10^5$	$1 \times 10^2 - 1.1 \times 10^3$
Upper Egypt	16	16	100	16	100	$3 \times 10^3 - 6 \times 10^5$	$2 \times 10^2 - 2 \times 10^2$

Table (2) : Distribution of the uricoytic fungal genera isolated from the investigated soil samples.

	North coast	Cairo & its Districts	Lower Egypt	Upper Egypt
<i>Aspergillus</i>	19	9	11	5
<i>Penicillium</i>	5	4	7	2
<i>Fusarium</i>	1	2	2	2
<i>Chaetomium</i>	0	1	1	0
<i>Cephalosporium</i>	0	2	1	0

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Table (3) : Distribution of the uricolytic bacterial genera isolated from the investigated soil samples.

Uricolytic Bacterial genera	North coast	Cairo & its Districts	Lower Egypt	Upper Egypt
<i>Arthorobacter</i>	14	13	21	15
<i>Bacillus</i>	12	13	21	16
<i>Pseudomonas</i>			18	12
<i>Alcaligenes</i>	2	5	6	0
<i>Flavobacterium</i>	3	4	6	4
<i>Streptomyces</i>	4	4	7	5
<i>Micrococcus</i>		3	4	2
<i>Mycobacterium</i>		1		2
<i>Streptococcus</i>		2	1	
<i>Corynebacterium</i>				2
<i>Nocardia</i>			1	1
<i>Micromonospora</i>	1	1		
<i>Sarcina</i>			1	

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DISCUSSION

Results give evidence of the occurrence, distribution and identity of uricolytic microorganisms in Egyptian soils. About 81% of the investigated soil samples harboured uricolytic bacteria and 94% of them harboured uricolytic fungi. Investigating the occurrence and distribution of uricolytic microorganisms as a distinct physiological group, has not yet been tried in Egypt. However, El-Naggar and Emara (1980) detected uricolytic microorganisms in Assiri soils. They detected uricolytic bacteria and uricolytic fungi in soil samples from Assir region in Saudi Arabia. Estimates of bacterial counts ranged between 2×10^2 and 2.2×10^3 colonies per gram and that of fungi between 2×10^2 and 1.4×10^3 colonies per g. oven dry soil. However, in the present investigation counts are much higher, counts of uricolytic bacteria ranged between 2×10^3 and 8.6×10^5 and that of fungi ranged between 1×10^2 and 2.7×10^3 .

Uric acid being the chief end product of nitrogen metabolism in most insects, reptiles and birds, it accumulates in soil. Durand (1961) detected the presence of urate oxidase (uricase) in soil and Smith (1963) succeeded in extracting the active fractions from soil and attributed them to the activity of soil microorganisms although no data concerning these microorganisms were recorded.

The addition of 0.4% uric acid in uric acid medium used in the present investigation and adjusting the pH at 5.8 - 6 would result in a homogenized turbid medium.

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The active uricolytic developing microorganisms sooner produce uricase that decomposes uric acid resulting in a clear zone. Uricolytic microorganisms were thus easily detected and counted.

The dominance of the genera, *Aspergillus*, *Penicillium* and these genera are widely distributed in Egyptian soils as well as in soils of many Arab countries (Sabet 1935; Montasir et al., 1959; Mahmoud et al., 1964; Elwan et al., 1969; Elwan and Diab , 1971 and Moubasher and Moustafa 1970).

With regard to uricolytic bacteria, thirteen common soil bacterial genera were identified. The dominance of the genera *Anthrobacter*, *Bacillus*, *Pseudomonas* *Flavobacterium* and *Streptomyces* among uricolytic bacteria is also of interest. These bacterial genera are widely distributed in Egyptian and Arabian soils (Montasir et al.; and El-Naggar and Emara, 1980).

Uric acid decomposition is one of the biochemical activities of microorganisms which make substantial contribution to the turn over of nitrogen on which continuance of life on earth depends.

Results indicate that Egyptian soils are not only rich in microbes but also it revealed a distinct physiological group of uricolytic microorganisms that would have a role in the nitrogen cycle in nature.

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