

A Survey of Yeasts Found in the Air of El-Minia City, Egypt

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이집트, El-minia市 공기중에서 발견되는 효모

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ABSTRACT: 208 yeast strains were isolated from air at El-Minia city, Egypt. Using 22 morphological and physiological merkmals, these strains were identified and assigned to eight species belonging to seven genera. *Rhodotorula mucilaginosa* and *Cryptococcus albidus* were the most dominant species followed by *Debaryomyces hansenii*. These yeast species occurred regularly, whereas other species appeared sporadically. *Rh. rubra*, *Saccharomyces kluyveri* and *Rh. aurantiaca* were also isolated from the sampled air. The results of this study showed that time, hight and area of air sampling affect composition and total counts of yeast microflora in the air.

KEYWORDS: Yeast, air borne yeast, *Rhodotorula mucilaginosa*, *Cryptococcus albidus*

Introduction

There are several reports on the occurrence of yeasts in the air (Connell and Skinner, 1953; Di Menna, 1955; Hamilton, 1959; Hyde and Adams, 1960; Gregory, 1961; Turner, 1966; Voros-Felkai, 1966, 1967; Al-Doory, 1967; Lidia, 1969). The results of these investigations showed that time, hight and place of air sampling affect the total count of yeast cells as well as the spectrum of yeast species. Moreover, it was revealed that species of *Cryptococcus*, *Rhodotorula*, *Sponobolomyces* and *Debaryomyces* were dominant and no seasonal variations concerning the incidence of yeast species at the ground levels. With regard to the origin of the air yeast microflora, the available data indicated the possibility of originating from the vegetation layer above the soil surface and soil dust particles dissiminating by air currents. Information along that line in Egypt and particularly at the El-Minia area is lacking especially with regard to the pathogenic species. Accordingly, it was of interest to start a survey of the yeasts

in the air at El-Minia city in Upper Egypt, as a part of a general survey of yeasts in the air and in the soil in Egypt, in an attempt to throw light on the possible hazard which might be created by the pathogenic species on human health.

Materials and Methods

Plates of yeast malt agar medium (Lodder, 1970) adjusted to pH 3.5 were exposed weekly in the morning (between 8 and 10 am) during a period of one year (1991) at a hight of 8 meters from the ground level inside El-Minia city on the roofs of two floor buildings located at different locations and at similar hights on the University buildings situated 3 km outside the city within fields. In order to examine effects of hight and time of sampling on the occurrence of yeasts, air sampling was performed twice every day at different hights (5, 8, 11, 14 meters) from the ground for a week period at 8-10 am. and 3-5 pm. Plates were incubated at 20°C for 2-3 days and developing yeast colonies were examined microscopica-

Table 1. Relation ship between time, hight and total count of yeast cells in the air at El-Minia city.

Parameters		Time		Hight (meter)			
		8-10 am.	3-5 pm.	5	8	11	14
Number of yeast colonies (average) of 7 readings)	outside the city	8	4	8	7	5	4
	inside the city	9	5	6	9	6	5

Table 2. Distribution of yeasts in the air outside and inside El-Minia city.

Parameters	Total	Zone	
	number of strains (208)	outside the city	inside the city
Number of samples tested			
Number of samples containing yeasts	48	48	
Percentage of yeast occurrence (%)	39	42	
	81.3%	87.5%	
Species			
<i>Rhodotorula mucilaginosa</i>	78	60(19)*	18(9)
<i>Cryptococcus albidus</i>	60	50(16)	10(5)
<i>Kluveromyces marxianus</i>	10	4(2)	6(3)
<i>Torulaspora delbrueckii</i> **	10	—	10(6)
<i>Saccharomyces kluyveri</i>	8	2(1)	6(3)
<i>Rhodotorula aurantiaca</i> **	8	4(1)	4(1)
<i>Hansenula polymorpha</i> **	4	—	4

*Number of samples in which yeast species is dominant.

**Yeast species were recorded for the first time in Egypt.

lly, purified, preserved on YM agar slants and stored at 4°C. Identification of the isolated yeast strains was performed according to Lodder (1970), Barnett *et al.* (1983) and Kreger van Rij (1984).

Results and Discussion

Table 1 shows that sampling time as well as the hight at which air was studied affect total yeast count. Numbers of yeast colonies isolated in the morning were almost twice those clones isolated in the afternoon. The highest number of yeast cells was recorded at 8 meters hight from the ground decreasing above or lower this level. Similar observation was also reported by Gregory (1952, 1961). Isolation of more yeast cells from the air at the morning as compared to the afternoon was explained by other authors to be due to differences in relative humidity of the air which

is usually higher in the morning than in the afternoon (Gregory and Hirst, 1957; Hamilton, 1959 and Hyde and Adams, 1960). Such explanation seems to be applicable to our case.

Table 2 shows the distribution of yeast species inside and outside El-Minia city at 8 meters hight as well as the percentage of the air samples containing yeasts. One notes that the percentage of incidence of yeasts as well as the total number of the isolated yeast species were generally greater inside than outside the city. Moreover, there were also differences in the pattern of yeast species of both areas. *Debaryomyces hansenii* was the dominant species inside the city and *torulaspora delbrueckii* and *Hansenula polymorpha* were only isolated from this area. *Rh. mucilaginosa* and *C. albidus* were represented by obviously fewer numbers of strains inside the city than the outside. Dominance of *Rh. rubra* and *C. albidus* outside

Table 3. Physiological and morphological properties of the isolated yeast species.

Yeast species	Number of isolates tested	Fermentation					Assimilation										Growth at		building of					
		glucose	galactose	maltose	sucrose	lactose	galactose	L-sorbose	D-ribose	D-xylose	L-arabinose	L-rhamnose	sucrose	maltose	lactose	mannitol	succinate	citrate	37°C	42°C	ascospores	true mycelium	pseudomycelium	
<i>Rhodotorula rubra</i>	78	0	0	0	0	0	54	46	46	100	100	39	100	100	0	54	54	31	15	0	0	0	0	
<i>Cyphococcus albidus</i>	60	0	0	0	0	0	100	40	40	90	70	100	100	90	100	100	100	30	10	0	0	0	0	
<i>Debaryomyces hansenii</i>	30	100+	20	40	80	0	100	100	20	100	0	60	100	100	40	100	100	100	20	0	0	100	0	60
<i>Kluyveromyces marxianus</i>	10	100	100	0	40	0	100	100	40	100	100	0	100	100	20	100	100	20	0	100	0	100	0	100
<i>Torulasporea delbrueckii</i>	10	100	20	20	20	0	100	100	0	100	0	100	0	60	80	0	80	0	0	100	0	100	0	60
<i>Saccharomyces kluyveri</i> *	8	100	100	100	100	0	100	50	50	0	0	100	100	0	50	0	0	0	100	0	100	0	0	0
<i>Rhodotorula aurantiaca</i> *	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0
<i>Hansenula polymorpha</i> *	4	100	0	100	100	0	100	100	100	100	0	100	100	0	100	0	0	0	100	100	100	0	0	0

+Percentage of positive reactions of isolates.
*Species were recorded for the first time in Egypt.

the city was related to their occurrence on the surfaces of plant flowers grown in this area (Haridy, unpublished results) indicating that the composition of the yeast air flora is related to the sources of air contamination by yeast cells particularly from the vegetation layer above the soil.

Table 3 shows the physiological and morphological characteristics of the isolated yeast species. On the basis of 22 properties, 208 yeast strains were assigned to 8 species belonging to 7 genera. *Rhodotorula rubra* and *C. albidus* were the most dominant species followed by *Debaryomyces hanse-nii*. These species occurred regularly in most of the samples. Similar results were reported by Di Menna, 1955), Voros-Felkai (1966; 1967) and Al-Doory (1967) who found that species of *Cryptococcus*, *Rhodotorula*, *Sporobolomyces* and *Debaryomyces* were the most dominant species in New Zealand, Budapest and Texas. Other species were of low occurrence (Table 3).

It is of interest to note that *Torulopsis delbrueckii*, *Sac. kluyveri* and *Rh. aurantiaca* which were isolated in this study are new records to the Egyptian yeast flora. Strains of *Rhodotorula aurantiaca* were differentiated from *Rhodotorula mucilaginosa* strains by their negative assimilation of D-xylose, L-arabinose, sucrose and maltose (Table 3). *Rhodotorula mucilaginosa* which is an opportunistic pathogenic yeast species according to Rosalinde *et al.* (1987) was also recorded in the sampled air.

摘 要

이집트, El-Minia시의 공기중에서 208 효모들을 분리하였으며, 이들을 22개의 형태적 및 생리적인 특성을 이용하여 동정한 결과 7속 8종으로 나타났다.

*Rhodotorula rubra*와 *Cryptococcus Albidus*은 가장 많이 발견되는 우점종들이었다. 이러한 효모들은 일반적으로 많이 발견되었으나, 다른 것들은 계절적인 변화에 따라 다르게 나타났다. *Rh. mucilaginosa*, *Saccharomyces Kluyveri* 및 *Rh. aurantiaca*는 또한 발견되었다. 이 연구의 결과, 효모의 프로라나 구성은 시간(주기) 고도 및 채취 지역에 따라 다르면을

보였다.

Acknowledgement

The author wishes to express sincere gratitude to Prof. Dr. Mohamed A. El-Naghy, Vice President, El-Minia University for his reading of the manuscript and valuable help during discussion of the present work.

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Accepted for Publication on August 20, 1992