

Fungal flora associated with indian and foreign coins and their potential health risks

Flora fúngica asociada a las monedas indias y extranjeras y sus posibles riesgos para la salud

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ABSTRACT

Potential role of spread of pathogenic microflora on coins and currency notes has been evaluated in different countries. Notes and currency coins may serve as universal vehicles for transmission of potentially pathogenic microorganisms among persons either directly, through hand to hand contact, or indirectly, through water and food. The Purpose of study was to do qualitative and quantitative analysis of microflora associated with new and old Indian and foreign coins.

Results of the study revealed that bacteria were present in most of the coins, more than 40% coins showed presence of fungi like *Aspergillus niger*, *Curvularia lunata*, *Chaetomium globosum*, *Fusarium roseum* and *Trichoderma viride*. Fungal species like *Aspergillus niger* and *Fusarium roseum* can cause bronchial diseases and may act as potential allergens and few of these are reported to cause skin problems. The use of

digital transaction will reduce such harmful transmission of pathogenic microbes. Cleaning the coins with water or UV treatment may reduce the fungal load. But it has to be practised at regular intervals. Total 100 coins were screened of which 20 were foreign coins. Isolation from these coins resulted into 20 cultures and 6 non-sporulating mycelial forms. Oldest coins was 141 years and new coin was of the year 2015. Uncirculated Indian coin of 2003 was also tested for fungal occurrence.

Keywords: Currency Coins, Indian, Foreign, *Aspergillus niger*, *Fusarium*, *Chaetomium*, *Penicillium*

1 INTRODUCTION

Money is important for business. The coins and currency notes are used in market to purchase or sell the articles. Money in form of currency notes and coins is handled by persons of varying health and hygiene standards and also stored under varied environmental conditions. Consequently, chances of pathogens being present on money and persisting through multiple handling cannot be under estimated (Michaels 2002). Money in form of coins is used since ancient times. The coins were made in Adil Shahi Dynasty in the 11 - 16th century. The Rupee and other coins are usually round because they move from place to place in the earth which is also round, And it is prevented from disfiguring. The coins are reported to have species of *Aspergillus*, *Mucor* or *Rhizopus* many of such microbes may be potential allergens. It has been established that *E. coli* and *Salmonella enteritidis* can survive up to eleven and nine days respectively on the surfaces of coins, thus making it possible for coins to transfer bacteria to human hands (Jiang and Doyle 1999).

Coins are made up of metals like Fe and Cr, Ag, Cu, Ni and Zn. Experiments have shown that two fungi *Aspergillus niger* and *Penicillium simplicissimum* were able to mobilize Cu and Sn by 65% and Al, Ni, Pb and Zn by more than 95%. It is known that the fungi like *A. niger* can produce organic acids like citric acid which can dissolve the metal or affect the shining of a new coin. Kuria., et al. (2009) studied the presence of bacteria and fungi on coins. They found presence of fungi like *Penicillium*, *Fusarium*, *Rhizopus* and *Alternaria* spp. Since not much studies are conducted on coins we have in our purse. It was thought desirable to study the fungal organisms present in circulating and stored coins.

Money coins can be contaminated during production, storage and subsequent exchangers. Pollen grains and fungal spores may act as aeroallergens hence study was undertaken to access the occurrence of microflora on India and foreign coins and identify the fungal organism by pure culture method. Results are recorded in (Table 1 and 2 and Fig. 1 A-E).

2 MATERIALS AND METHODS

Coins were collected from shopkeepers and coin collectors. During 2017 and 2018 total hundred coins were screened by direct plating methods. Out of these 20 foreign and 80 Indian coins were studied. A medium supplemented with 5% NaCl was also used. Fungi were isolated by direct plating method, and dilution plate method using PDA medium. Isolated fungi were photographed. The isolated fungi are listed in table 1 and 2.

Table 1: List of fungi isolated from Foreign coins during , 2017 -2018.

Sr. No.	Coin Denomination	Country	Year	Occurrence of Fungi
1.	10 cent	Canada	1867	<i>Aspergillus niger</i> van Tieghem
2.	1 Euro	Europe	1914	<i>Aspergillus awamori</i> Nakaz. <i>Chaetomium globosum</i> Kunze.
3.	1000 Lira	Turkey	1919	<i>Chaetomium globosum</i> Kunze.
4.	50 Yen	Japan	1919	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
5.	1 Yen	Japan	1919	Bacteria only No Fungus
6.	10 Pennig	Germany	1950	<i>Aspergillus niger</i> van Tieghem
7.	5 Peso	Mexico	1976	<i>Alternaria alternata</i> (Fr.) Keissl.
8.	1 Peso	Mexico	1976	<i>Alternaria alternata</i> (Fr.) Keissl
9.	5 Chhertum	Bhutan	1979	Bacteria
10.	50 Yen	Japan	1979	<i>Curvularia lunata</i> Boedjn. <i>Chaetomium globosum</i> Kunze.
11.	L. 500	Italy	1983	<i>Aspergillus niger</i> van Tieghem
12.	25 cent	Canada	1985	Nil No. Bacteria/ Fungi
13.	25 cent	“	1985	<i>Chaetomium globosum</i> Kunze.
14.	1 cent	“	1988	<i>Penicillium citrinum</i> Thom
15.	25 cent	“	1988	<i>Thielavia terricola</i> (Gilman & Abbott) Emmons
16.	United Arab emirates 1E10	UAE	1990	<i>Chaetomium globosum</i> Kunze.
17.	1 cent	Canada	1993	<i>Aspergillus awamori</i> Nakaz.
18.	10 cent	“	1993	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
19.	5 cent	USA	1998	<i>Aspergillus awamori</i> Nakaz.
20.	25 cent	USA	2000	<i>Alternaria alternata</i> (Fr.) Keissl.

Table 2: List of fungi isolated from Indian coins during, 2017 -2018.

Sr. No.	Coin Denomination	Year	Occurrence of Fungi
1.	East India Co.	1842	<i>Chaetomium globosum</i> Kunze
2.	One anna	1928	<i>Penicillium citrinum</i> Thom
3.	Quarter Anna	1940	<i>Aspergillus niger</i> van Tieghem
4.	One anna	1913	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
5.	One quarter anna	1889	<i>Aspergillus niger</i> van Tieghem
6.	One quarter anna	1917	<i>Thielavia terricola</i> (Gilman & Abbott) Emmons
7.	Five Paisa	1974	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
8.	Ten Paisa	1986	<i>Alternaria alternata</i> (Fr.) Keissl
9.	Twenty Paise	1984	<i>Aspergillus niger</i> van Tieghem
10.	Twenty Five Paise	1986	<i>Aspergillus awamori</i> Nakaz.
11.	One Rupee	2015	<i>Aspergillus niger</i> van Tieghem
12.	Two rupee	2009	<i>Rhizopus</i> sp.
13.	Five rupee	2010	<i>Chaetomium globosum</i> Kunze.
14.	Five rupee	2010	<i>Aspergillus awamori</i> Nakaz.
15.	Two Rupee	1990	<i>Aspergillus niger</i> van Tieghem
16.	Two Rupees	1998	<i>Aspergillus niger</i> van Tieghem
17.	Five rupees	2010	<i>Aspergillus niger</i> van Tieghem
18.	Ten rupees	2010	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
19.	One rupee	1986	<i>Rhizopus stolonifer</i> (Ehrenb.) Vuill.
20.	Hundred Rs.	2003	<i>Fusarium oxysporum</i> Schldl.

3 RESULTS AND DISCUSSION

Hundred coins, were screened for the presence of Fungal flora. These coins were made by different metals like Ag, Fe, Ni, Cr and Zn etc. In new coins minted after 1947 species of fungi like *A. niger*, *Rhizopus stolonifer* and *Chaetomium globosum* were detected in the month of June - July 2010 and *A. niger*, *Penicillium citrinum* and *Rhizopus stolonifer* during August, September 2010. Fungi present on foreign coins were *Aspergillus awamori*, *A. niger*, *A. terreus*, *Alternaria alternata*, *Thielavia terricola*, *Penicillium citrinum*, *P. chrisogenum*, *Rhizopus stolonifer*, *Chaetomium globosum*, *Trichoderma viride*, etc.

Arya., et al. (2001) and Khandelwal (1991) found that several *Aspergillus* spp. present in air of Baroda and Lucknow (India) may be potential allergens. *Aspergillus* and *Penicillium* may be considered as two most serious organisms. Some of the species of these fungi can survive up to 30 - 40 years (Kuria et al. 2009; Agrawal and Dhawan 1985). Kuria et al. (2009) studied fungi associated with coins in Nairobi, Kenya. They found presence of fungi in 34 out of 40 coins. The significant isolates included *Penicillium* spp. *A. niger*, *Fusarium* spp. *Rhizopus* and *Alternaria* spp. Yeast were present in

14 out of 40 coins. Enumeration of pathogens was found to be extremely difficult. It was found that certain species of fungi may act as allergens, dermatophytes and detrimental to eyes, lungs, urinogenital tracts etc. The coins transferred from shop keepers dealing with eatables or from temples may carry germs of diseases and it is, therefore, advisable to handle food material by some person and handling the money by others.

The metallic composition of pennies has been almost consistent throughout the years. Pennies have been made out of a mixture of copper and zinc and, at times, tin. With the exception of a steel- and zinc-coated version in 1943, however, all pennies are coated in copper, which like other precious metals will tarnish when exposed to oxygen. To restore a penny's shining appearance cleaning is required.

4 CONCLUSION

Aspergilli are weak pathogens and potential carcinogens. These fungal agents may survive on coins having dust and pollens adhering into it. The fungus *Aspergillus niger* was most common agent present on it. Asexual state was more common.

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Fig 1 . A-E Light Microscopic images of Fungal organisms A.) *Aspergillus flavus*, B.) *Chaetomium globosum* C.) *Fusarium* sp. D.) Conidia of *Aspergillus* D.) *Rhizopus stolonifer*

