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ORIGINAL ARTICLE

FUNGAL CONTAMINATION IN THE PAPER CURRENCY NOTES IN THE PUBLIC TRANSPORT OF KOLKATA CITY IN MONSOON

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Abstract: *A study was carried out to observe the potential of the circulating paper currency notes as a source of fungal contamination in the rainy season of 2019, in the public transports in the city of Kolkata, India. Thirty pieces of long-time circulating Indian paper currency notes (5 pieces for each of the denominations of rupees ten, twenty, fifty, one hundred, two hundred and five hundred) were collected from the public of Kolkata city and examined for fungal contamination in laboratory. The currency notes were found to have remarkable fungal contamination. Regarding the level of contamination five-hundred-rupee notes are less contaminated (20%) in comparison to the ten-rupees (75%) and twenty-rupees (56%) currency notes.*

In laboratory, a total number of 242 fungal isolates were recorded from the collected paper currency samples. The isolated fungi belonged to ten genera, among which the most frequent was Aspergillus flavus (25.20%), followed by other genera like Alternaria alternata (13.63%), Rhizopus spp. (12.40%), Trichoderma viridae (11.98%) and others. These fungal members are well known sources of mycotoxins and allergen, which are harmful for human health.

The observations of the study, indicates that awareness development and preventive measures are very much needed to minimize the fungal as well as pathogenic contamination through the circulation of contaminated paper currencies in public transport.

Key Words: Fungal contamination, paper currency notes, public transport, Kolkata city.

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1. INTRODUCTION

Different kinds of currency notes are continuously traded throughout the world [1]. As these are exchanged by several hands every day, there are huge chances of getting contaminated by fungi, bacteria and other pathogens. The probable role of paper currencies and coins were suggested first in 1972 [2]. The paper currency notes may be contaminated during the time of their production, storage and exchange by users [3]. People often handle the currency notes in unhygienic manner in different places like hospital [4], food stalls

[5], etc. In the public transports also, there are reports of currency notes of getting contaminated [6]. In this regard, the paper currency notes provide surface area for attachment to the fungi, bacteria and pathogens. In addition to bacteria [7] and parasites [8], several fungal types like *Aspergillus* and *Penicillium* are frequently found on paper currency notes [9], especially in the times with high level of humidity.

The present study was conducted with the objective to determine the fungal level of fungal contamination on the surface of paper currency notes circulating in public transports of the city of Kolkata, India during the monsoon period of 2019.

2. METHODOLGY

Collection of paper currency sample

For the study, a total of 30 pieces of Indian paper currency notes (5 pieces for each of the denominations of rupees ten, twenty, fifty, one hundred, two hundred and five hundred) were collected from the public transports like buses, auto-rickshaws and taxies of Kolkata city during monsoon (June-September) of 2019.

Determination of fungal contamination on paper currency notes

The surface of the paper currency samples was wiped with sterile moist cotton swab in a septic condition at room temperature (approximately 25°C). The cotton swabs were then used to streak the surface of potato dextrose agar solidified in sterile Petri plates. The incubation of inoculated Petri plates was carried out for seven days, in an incubator. The observed fungal colonies were identified based on the colony and morphological characters observed under microscope, using standard method and references [10-11].

3. RESULTS AND DISCUSSION

It was observed that the sample paper currency notes had remarkable fungal contamination (Figure 1). Regarding the level of contamination five-hundred-rupee notes are less contaminated (20%) in comparison to the ten-rupees (75%) and twenty-rupees (56%) currency notes (Figure 2). This is because the lower currencies have to be passed through a greater number of exchanges in public transport. This result is corroborative to the reports Zimbabwe [12] and South Africa [13], but reverse observation was reported from Egypt [9], where higher denomination paper currency was found to be more contaminated. However, all the observations indicate that the paper currencies, composed of around 75% cotton and 25% linen, everywhere provide the surface area for the growth of microorganisms like bacteria, fungi, etc. There is also a substantial relation between the physical condition and the level of contamination in the paper currency notes. The mutilated paper currencies with remarkable amount of surface dirt, which are in circulation for a long time, is a source of serious level of contamination by bacteria, fungi and parasites [14]. In the present study, 100% level of fungal contamination was recorded in the paper currencies, which are in circulation for at least more than a year, and in moist condition, when collected from public transport, during rainy season.

In the present study, a total number of 242 fungal isolates were recorded from the collected paper currency samples from public transport of the city of Kolkata (Table 1, Figure 3).

Figure 1 (A-F). Samples of Indian currency notes of the denominations of rupees 10, 20, 50, 100 and 500, collected during the exchange in the public transport during June-September, 2019.

The isolated fungi belonged to ten genera, among which the most frequent was *Aspergillus flavus* (25.20%), followed by other genera like *Alternaria alternata* (13.63%), *Rhizopus* spp. (12.40%), Trichoderma *viridae* (11.98%), *Aspergillus niger* (11.60%), *Penicillium* sp. and *Curvularia lunata* (6.61%), *Aspergillus terreus* (4.54%), *Nigrospora* spp. (4.13%) and *Fusarium* spp. (3.30) respectively.

Table 1. Isolated fungal genera and their frequency in different denominations of paper currency notes in the public transport of Kolkata city during study period.

Fungi isolated	Denomination of currency notes in rupees 10	20	50	100	200	500	Total number of isolates	Percentage of occurrence (%)
1. Alternaria alternata	12	8	5	5	1	2	33	13.63
2. Aspergillus flavus	17	14	13	8	4	5	61	25.20
3. Aspergillus niger	11	6	4	4	1	2	28	11.60
4. Aspergillus terreus	4	4	1	1	1	0	11	4.54
5. Curvularia lunata	4	5	2	2	1	2	16	6.61
6. Fusarium spp.	3	1	1	0	2	1	08	3.30
7. Nigrospora spp.	2	3	3	0	2	0	10	4.13
8. Penicillium spp.	5	1	2	3	3	2	16	6.61
9. Rhizopus spp.	10	7	5	3	2	3	30	12.40
10. Trichoderma viridae	7	7	5	3	4	3	29	11.98
	75	56	41	29	21	20	242	

This finding shows similar observation to the study by Sahab *et al.* [9], where *Aspergillus flavus* was the most frequent (27.45%) type of fungi on paper currencies in Egypt. In case of Saudi Arabia, the frequent fungal genera from paper currencies were reported to include *Aspergillus* niger, *A. flavus*, *Candida* spp. *Penicillium* spp. and *Rhizopus* spp. [15].

These fungal genera are well known sources of mycotoxin like aflatoxin of *Aspergillus flavus*, which can initiate severe health hazards [16]. Most of these fungi are allergenic to susceptible individuals and can trigger IgE-mediated hypersensitivity [17].

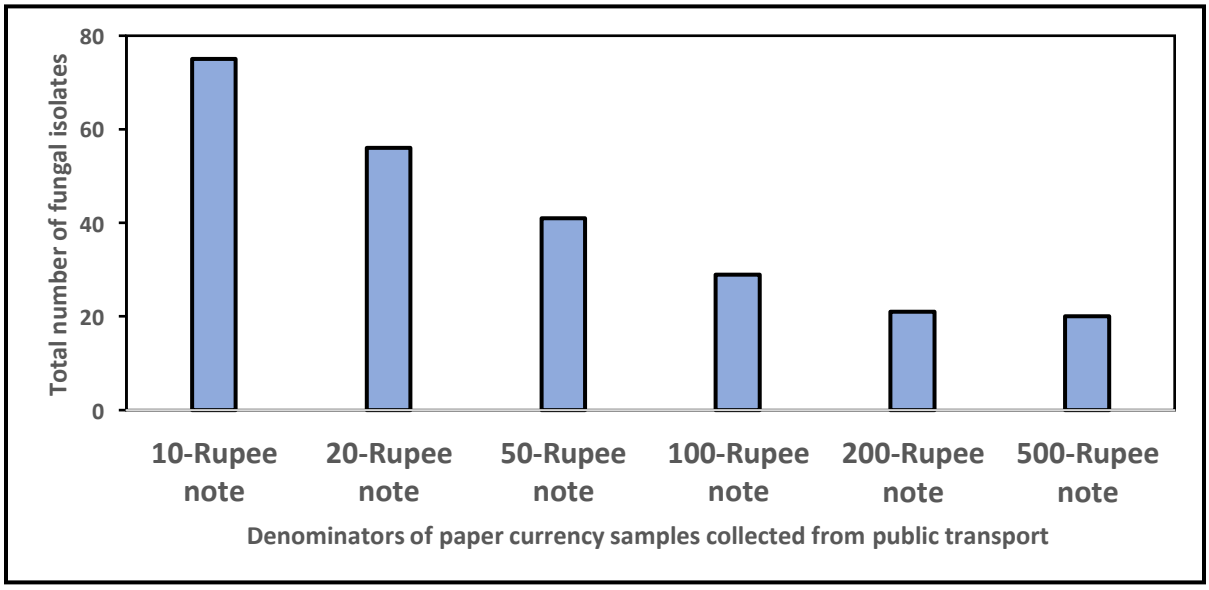

Figure 2. Numerical presentation of the fungal isolates observed in the different denominations of paper currency notes collected from the public transport system of Kolkata city

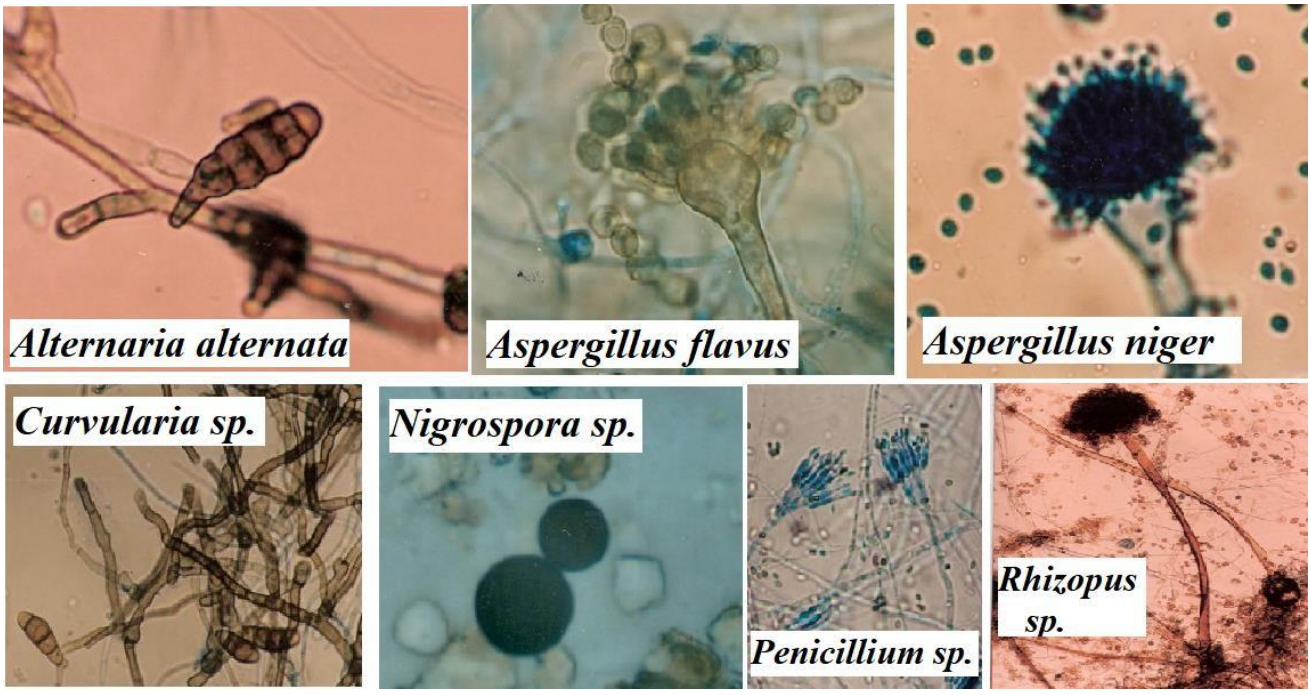

Figure 3. Fungal isolates from the surfaces of paper currency notes collected from public transport in Kolkata city.

4. CONCLUSION

The findings of the present study, clearly depicts that, the paper currency notes, circulating in the local transport system in the city of Kolkata, have the potential to play an important role as a source of fungal contamination, which is harmful for human health. For this, following necessary measures can be adopted to reduce the risk of contamination for the people–

1. Use of washable plastic currencies, with the scope of surface cleaning.
2. Disinfection of paper currencies in bulk in the banks at regular intervals.
3. Awareness development in people, regarding the cleanliness and healthy habits, which in turn minimize the chance of contamination in circulating paper currencies.
4. Periodical replacement of old and contaminated currency notes.

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