

INDOOR MOLD SPECTRUM IN THE BUILDINGS OF SINGAPORE

N.K. UDAYA PRAKASH

IAQ CONSULTANTS PTE LTD

Blk 3016, Bedok North Ave 4, # 03-08, Eastech Bldg, Singapore 489947.

ABSTRACT

Health implications of indoor fungal contaminants have become an issue of increasing concern nowadays. Thus, the knowledge on the presence of mold within indoor is important to take remedial measures and provide relief to the people involved in those environments. Hence, a study was conducted to find out the spectra of mold present in the buildings of Singapore. Samples of indoor air (84 samples) and other indoor materials like, Carpet dusts (63 samples), wall surfaces (45 samples), upholsteries (10 samples) and filters of Air Handling Units (18 samples) were studied for the presence of mold. Altogether 56 species of fungi were recorded from all the sources within buildings. Among them, Air sample yielded maximum number of species (38 species) followed by Carpet dust (33 species) and Upholsteries (31 species). The following fungi, i.e. *Aspergillus fumigatus*, *A. niger*, *Aureobasidium pullulans*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Paecilomyces variotii* and *Penicillium oxalicum* are recorded from all the sources. Hence, it is recommended to give due importance to study the impact of the above said molds in inducing health hazards.

KEY WORD'S : Indoor Molds, Building Mycoflora, Mold spectrum, Singapore.

INTRODUCTION

Health implications of indoor fungal contaminants have become an issue of increasing concern nowadays. The molds found indoor, contribute to the diseases, including both infectious and hypersensitivity diseases. In addition acute toxicosis is reported due to the exposure to Toxin and Volatile Organic Compounds produced by molds. They are implicated as one among the possible causes of Sick Building Syndrome (SBS) and Building Related Illness (BRI). The indoor residents reports, eye irritation, nose irritation, throat irritation, skin irritation, headache, nausea, drowsiness, reduced mental capacity as their symptoms. Apart from this, they are frequently reporting respiratory allergy. This is quite evident by the frequent absence of workforce. Thus, the knowledge on the presence of mold within indoor is important. However, the presence of mold and their impact on health of the people working in those environ-

ment depends upon other synergistic parameters like air ventilation, local substrate availability, humidity, moisture content etc.

The buildings of Singapore are characterized by their high raised structure and huge enough in size. The ventilation system within the buildings is controlled by common Air Handling Units (AHU) which circulates air within the buildings. Other than AHU's no other air-circulation takes place and are completely blocked. Thus, the buildings are airtight in nature. This made an interest in conducting a study to know about the spectrum of molds present within the buildings of Singapore.

MATERIALS AND METHODS

Singapore

The island is located at 1° 16' N, 103° 51' E and with an altitude of 16 metres above sea level. The main

island is 42 km long by 23 km wide, with a total area of approximately 570 km². Singapore has tropical climate, with high temperatures moderated by the influence of sea. Average daily temperature and humidity are high, with a mean maximum of 31°C and a relative humidity of 70 to 80 percent in the afternoon. The average annual rainfall is 237 centimeters.

Sampling Procedure

The buildings investigated include a range of commercial, institutional, governmental establishments, schools, hospitals, hotels etc., a total of 84 air samples, 55 carpet dusts, 45 surface samples near A/c vents, 10 surface samples from upholsteries within buildings and 18 surface samples from the filters of Air Handling Units were collected for the present study.

Air Sampling

Air sample within the buildings were carried out using an Andersen Microbial air sampler which is a portable sampler operated using a high volume vacuum pump. The airflow was set at 28.3 litres per minute. The portable sampler was disinfected by wiping with alcohol swabs and then loaded with petridish containing Potato Dextrose Agar. The media was amended with Streptomycin to arrest the bacterial growth. The sampler was placed at a height of 1 meter and was operated for 5 minutes duration at each sampling. After sampling, the plates were brought to the laboratory and incubated at 25 ± 2° C in an incubator. The developing colonies were counted, isolated and identified after 4 to 5 days of incubation.

Sampling Carpet Dust

The carpet dust samples from different buildings were collected using 25 mm diameter three-piece polycarbonate filter cassettes (pore size of 0.8 microns). The suction was generated using a high volume airflow vacuum pump. The airflow of the pump was set at 20 L per minute. Surface of 1 meter x 1 meter area of the carpet was vacuumed using the sampler. It was ensured that the collected dust samples exceed 1 gm. After collection the cassettes were sealed and brought to the laboratory. The sampled cassettes were dismantled in the laboratory under sterile condition and the dust samples were weighed, gram of dust sample was extracted, in sterile distilled water containing 100 ml and further dilutions were made serially to get the concentration of 1/1000 dilution. One

ml of diluted sample was plated in petridishes containing Potato Dextrose Agar. The plates were maintained in Triplicates and are incubated at 25 ± 2° C in an incubator. The developing colonies were counted, isolated and identified after 4 to 5 days of incubation.

Surface Samples

The surfaces which are suspected to have a mold growth are sampled using swab culturette. The areas near A/C vent in 45 buildings, and the airfilters present in Air Handling Units of 18 different buildings were swabbed for the presence of molds. After sampling, the sampled swab culturettes were brought to the laboratory. The swab samples were plated in petridishes containing Potato Dextrose Agar by streaking the agar plate with swab surface. The plates were incubated at 25 ± 2° C in an incubator. The developing colonies were counted, isolated and identified after 4 to 5 days of incubation.

Surface Sample from Upholsteries

Few upholsteries present within the buildings of Singapore are investigated for the presence of molds. Petridishes containing Potato Dextrose Agar plates were rubbed against the surface of upholsteries to isolate the molds. The sampled petridishes are sealed using parafilm. The sampled petridishes were brought to the laboratory. The plates were incubated at 25 ± 2° C in an incubator. The developing colonies were counted, isolated and identified after 4 to 5 days of incubation.

Data Presentation

The data received were analysed and presented as average CFU/ m³ of air and isolation frequency for the air samples undertaken within the buildings. For carpet dust samples, data on average cfu/ gm of dust and isolation frequency are calculated. However, for surface samples from other indoor materials, the data is not quantity based and hence, their isolation frequency alone is presented.

The colonies isolated were converted to Colony Forming Units (CFU)/ m³ of air as follows :

$$X = \frac{Y_1 + Y_2}{(0.1415)}$$

Whereby, X = number of CFU/ m³
 Y₁ = number of colonies on plate 1
 Y₂ = number of colonies on plate 2
 0.1415 = amount of sampled air (m³)

The other parameters are calculated as follows:

$$\begin{aligned} \text{Average CFU/m}^3 \text{ of air} &= \frac{\text{Total CFU/ m}^3 \text{ of air of a species}}{\text{Total number of samplings (84)}} \\ \text{Avg. CFU/gm of carpet dust} &= \frac{\text{Total CFU/ gm of carpet dust of a species}}{\text{Dilution factor (10}^2\text{)}} \times \\ &\quad \frac{\text{Total number of samplings (55)}}{\text{Total CFU/ m}^3 \text{ of an individual species}} \\ \text{Percent contribution} &= \frac{\text{Total number of CFU/ m}^3 \text{ of all species}}{\text{Total number of CFU/ m}^3 \text{ of all species}} \times 100 \\ \text{Isolation Frequency} &= \frac{\text{No. of samplings in which the species was recorded}}{\text{Total number of samplings}} \times 100 \end{aligned}$$

RESULT

Mold Spectrum in Indoor Air

Altogether, 38 species belonging to 16 genera were recorded from the Indoor air of Buildings in Singapore. Among the genera, the genus, *Aspergillus* was represented by maximum number (12) of species followed by *Penicillium* (11) and *Trichoderma* (2). The remaining genera were represented by single species each. Among the species, *Cladosporium cladosporioides* was dominant with 39 cfu/m³ of air followed by *Aspergillus niger* (29.6 cfu/m³) and *Aspergillus fumigatus* (24.8 cfu/m³) on an average. The fungus, *Aspergillus flavus* is the other significant contributor which recorded more than 10 cfu/m³ of air on an average. The isolation of Non-sporulating colonies (15 cfu/m³) is also high in number. The fungus *Aspergillus niger* was recorded in 47 % of the samplings and it is followed by *Cladosporium cladosporioides* (30.9 %) and *Aspergillus flavus* (29.7%). The following fungi, i.e. *Aspergillus flavus*, *A. versicolor*, *Paecilomyces variotii*, *Penicillium citrinum* and *Penicillium oxalicum* were recorded from more than 10 % of the total samplings. The yeast colonies were recorded nearly from almost 25 % of the samplings. List of species isolated, their average cfu/m³ of air and their isolation frequency are given in Table 1.

Mold Spectrum in Carpet Dust

Altogether, 33 species belonging to 18 genera were recorded from the Carpet dust samples collected from the Buildings in Singapore. Among the genera, the genus, *Aspergillus* was represented by maximum number (11) of species followed by *Penicillium* (4), *Curvularia* and *Trichoderma* (2 each). The remaining

genera were represented by single species each. Among the species, *Aspergillus niger* was dominant with 995.2 x 10² CFU/gm of carpet dust followed by *Paecilomyces variotii* (795.2 x 10² cfu/gm), *Penicillium frequentans* (350 x 10² cfu/gm), *Aspergillus fumigatus* (243.6 x 10² cfu/gm) and *Curvularia lunata* (175.4 x 10² cfu/gm) on an average. The following species, *Nigrospora sphaerica*, *Aspergillus flavus* and *Trichoderma harzianum* are the other significant contributor which recorded more than 50 x 10² cfu/gm of dust on an average. The isolation of Non-sporulating colonies (323 x 10² cfu/gm) is also high number in the carpet dust. The fungus *Aspergillus niger* was recorded from maximum number of samplings (92 %) followed by *Curvularia lunata* (50.8 %), *Paecilomyces variotii* (47.6 %) and *Aspergillus fumigatus* (42.8 %). List of species isolated, their average cfu/gm of carpet dust and their isolation frequency are given in Table 2.

Mold Spectrum of Indoor Surfaces

Altogether, 24 species belonging to 11 genera were recorded from the surfaces of indoor in Buildings of Singapore. Among the genera, the genus, *Aspergillus* was represented by maximum number (8) of species followed by *Penicillium* (4), *Trichoderma* (3) and *Curvularia* (2). The remaining genera were represented by single species each. The species, *Aspergillus niger* was recorded from 44 % of the total 45 samplings. The following fungi, *Penicillium restrictum* (28 %), *Aspergillus fumigatus* and *Paecilomyces variotii* (8.9%) were recorded from more number of samplings when compared with other species. The species recorded from the surface sample within indoor of Buildings in Singapore and their isolation frequency is given in Table 3.

Mold Spectrum of Filters of Air Handling Units

Altogether, 14 species belonging to 11 genera were recorded from the filter surfaces of indoor in Buildings of Singapore. Among the genera, the genus, *Aspergillus* was represented by maximum number (4) of species, and the remaining genera were represented by single species each. The species, *Aspergillus niger* was recorded from 33 % of the total 18 samplings. The following fungi, *Curvularia lunata* (22 %), *Aspergillus fumigatus* (16.6 %) and *Trichoderma harzianum* (11 %) were recorded from more number of samplings when compared with other species. The species recorded from the surface sample of Air Handling Units in the Buildings of Singapore and their isolation frequency is given in Table 4.

Table 1. List of fungi isolated from Indoor Air in Buildings of Singapore

S. No.	Species	Total average cfu/m ³ of air	Isolation Frequency (n=84)
1.	<i>Acremonium strictum</i>	1.93	5.95
2.	<i>Aspergillus flavus</i>	10.67	19.04
3.	<i>A. fumigatus</i>	24.79	29.76
4.	<i>A. glaucus</i>	4.79	5.95
5.	<i>A. japonicus</i>	0.67	7.14
6.	<i>A. nidulans</i>	0.92	5.95
7.	<i>A. niger</i>	29.66	47.61
8.	<i>A. ochraceus</i>	0.08	1.19
9.	<i>A. restrictus</i>	0.33	4.71
10.	<i>A. tamari</i>	1.00	1.19
11.	<i>A. terreus</i>	0.08	1.19
12.	<i>A. ustus</i>	2.43	5.95
13.	<i>A. versicolor</i>	2.60	13.00
14.	<i>Aureobasidium pullulans</i>	2.35	3.57
15.	<i>Chrysosporium pannorum</i>	1.34	5.95
16.	<i>Cladosporium cladosporioides</i>	38.99	30.95
17.	<i>Curvularia lunata</i>	0.50	4.71
18.	<i>Fusarium oxysporum</i>	0.67	5.95
19.	<i>Geotrichum candidum</i>	0.08	1.19
20.	<i>Gliocladium roseum</i>	0.08	1.19
21.	<i>Monilia sitophila</i>	0.16	2.38
22.	<i>Paecilomyces variotii</i>	3.36	13.00
23.	<i>Penicillium chrysogenum</i>	0.25	2.38
24.	<i>P. citrinum</i>	4.62	16.66
25.	<i>P. fellutanum</i>	0.75	1.19
26.	<i>P. frequentans</i>	2.26	8.33
27.	<i>P. funiculosum</i>	1.00	9.52
28.	<i>P. islandicum</i>	0.42	3.57
29.	<i>P. oxalicum</i>	4.11	13.00
30.	<i>P. purpurescens</i>	0.16	2.38
31.	<i>P. purpurogenum</i>	0.25	3.57
32.	<i>P. restrictum</i>	0.0	1.19
33.	<i>P. rugulosum</i>	1.08	1.19
34.	<i>Rhizopus stolonifer</i>	0.9	3.57
35.	<i>Scolecobasidium hunticola</i>	0.16	1.19
36.	<i>Syncephalastrum racemosum</i>	0.08	1.19
37.	<i>Trichoderma harzianum</i>	0.81	3.57
38.	<i>T. viride</i>	9.33	1.19
	Yeast colonies	0.66	23.80
	Non-sporulating colonies	15.04	47.61

Mold Spectrum of Upholsteries

Altogether, 31 species belonging to 18 genera were recorded from the surface of upholsteries in Buildings of Singapore. Among the genera, the genus, *Aspergillus* was represented by maximum number (9) of species, followed by *Penicillium* (4), *Drechslera* and *Fusarium* (2 each). The remaining genera were represented by single species each. The species, *Cladosporium cladosporioides* and *Aspergillus niger* were recorded from 80 % and 70 % of the samplings respectively. The species recorded from the surface of upholsteries from the Buildings of Singapore and their isolation frequency is given in Table 5.

Table 2. List of fungi isolated from Carpet dust in Buildings of Singapore

S. No.	Species	Total average cfu/(x 10 ²)	Percent Frequency (n=63)
1.	<i>Absidia corymbifera</i>	4.76	6.34
2.	<i>Acremonium strictum</i>	0.79	1.58
3.	<i>Aspergillus flavus</i>	52.38	28.57
4.	<i>A. fumigatus</i>	243.65	42.85
5.	<i>A. japonicus</i>	80.95	31.74
6.	<i>A. nidulans</i>	6.35	6.34
7.	<i>A. niger</i>	995.24	92.06
8.	<i>A. ochraceus</i>	3.17	3.16
9.	<i>A. restrictus</i>	0.79	1.58
10.	<i>A. tamari</i>	8.73	6.34
11.	<i>A. terreus</i>	3.17	1.58
12.	<i>A. ustus</i>	20.63	9.52
13.	<i>A. versicolor</i>	13.49	7.93
14.	<i>Aureobasidium pullulans</i>	30.95	3.16
15.	<i>Chaetomium globosum</i>	21.42	7.93
16.	<i>Chrysosporium pannorum</i>	18.25	7.93
17.	<i>Cladosporium cladosporioides</i>	5.55	6.34
18.	<i>Curvularia lunata</i>	175.39	50.79
19.	<i>C. paleocens</i>	9.52	3.16
20.	<i>Fusarium oxysporum</i>	3.17	3.16
21.	<i>Lasiodiplodia theobromae</i>	3.17	3.16
22.	<i>Monilia sitophila</i>	10.31	7.93
23.	<i>Mucor racemosus</i>	3.96	4.76
24.	<i>Nigrospora sphaerica</i>	56.34	15.87
25.	<i>Paecilomyces variotii</i>	795.23	47.61
26.	<i>Penicillium citrinum</i>	40.47	14.28
27.	<i>P. frequentans</i>	350.0	25.39
28.	<i>P. funiculosum</i>	6.34	3.16
29.	<i>P. oxalicum</i>	41.26	14.28
30.	<i>Rhizopus stolonifer</i>	15.07	12.69
31.	<i>Syncephalastrum racemosum</i>	18.25	12.69
32.	<i>Trichoderma harzianum</i>	52.38	23.80
33.	<i>T. viride</i>	8.73	7.93
	Yeast colonies	14.28	4.76
	Non-sporulating colonies	323.80	71.42

DISCUSSION

For the past 2 decades interest on indoor air quality of buildings are increasing. This is due to the interest focused on the problem of 'Sick Building Syndrome' and 'Building Related Illness'. It is evident that indoor air quality has a profound effect on both the performance and health of building occupants, since people spend most of their lives within buildings. However studies on the mold spectrum within Buildings are very few and the same in South East Asia are scanty. The study available on airborne molds in Singapore is conducted by Lim *et al.* (1998) which was confined with outdoor mycoflora of Singapore. Udaya Prakash (2002 and 2003) conducted the study on indoor mycoflora of high rise building and office environments in Singapore. Whereas, this present paper deals with the mold spec-

Table 3. List of fungi isolated from Surface samples of Buildings in Singapore

S.No. Species	No. of Occurrence (n=45)
1. <i>Acremonium strictum</i>	2.22
2. <i>Aspergillus chevalieri</i>	2.22
3. <i>A. clavatus</i>	2.22
4. <i>A. flavus</i>	8.88
5. <i>A. fumigatus</i>	4.44
6. <i>A. japonicus</i>	2.22
7. <i>A. niger</i>	44.4
8. <i>A. tanarii</i>	2.22
9. <i>A. ustus</i>	2.22
10. <i>Aureobasidium pullulans</i>	2.22
11. <i>Chaetomium globosum</i>	2.22
12. <i>Cladosporium cladosporioides</i>	2.22
13. <i>Curvularia lunata</i>	2.22
14. <i>C. palescens</i>	2.22
15. <i>Geotrichum candidum</i>	2.22
16. <i>Monilia sitophita</i>	2.22
17. <i>Paecilomyces variotii</i>	8.88
18. <i>Penicillium citrinum</i>	4.44
19. <i>P. frequentans</i>	4.44
20. <i>P. oxalicum</i>	4.44
21. <i>P. restrictum</i>	28.88
22. <i>Trichoderma harzianum</i>	2.22
23. <i>T. pifulliferum</i>	2.22
24. <i>T. viride</i>	4.44
Yeast colonies	2.22
Non-sporulating colonies	13.33

Table 4. List of fungi isolated from the filters of Air Handling Units in Buildings of Singapore

S. No. Species	No. of Occurrence (n=18)
1. <i>Aspergillus fumigatus</i>	16.66
2. <i>A. glaucus</i>	5.55
3. <i>A. niger</i>	33.33
4. <i>A. ustus</i>	5.55
5. <i>Aureobasidium pullulans</i>	5.55
6. <i>Cladosporium cladosporioides</i>	5.55
7. <i>Cylindrocladum</i> sp.	5.55
8. <i>Curvularia lunata</i>	22.22
9. <i>Fusarium oxysporum</i>	5.55
10. <i>Nigrospora sphaerica</i>	5.55
11. <i>Paecilomyces variotii</i>	5.55
12. <i>Penicillium oxalicum</i>	5.55
13. <i>Scolecobasidium humicola</i>	5.55
14. <i>Trichoderma harzianum</i>	11.11
Yeast colonies	22.22
Non-sporulating colonies	33.33

trum found within the buildings which comprises a cluster of commercial, institutional, governmental establishments, schools, hospitals, hotels etc., The study reveals that the indoor environment of Buildings in Singapore is rich in its mycoflora. Altogether 56 species belonging to 28 genera were recorded from different sources within Buildings of

Table 5. List of fungi isolated from Surface samples of Upholsteries in Buildings of Singapore

S. No. Species	No. of Occurrence (n=10)
1. <i>Absidia corymbifera</i>	10
2. <i>Alternaria alternata</i>	10
3. <i>Aspergillus clavatus</i>	10
4. <i>A. flavus</i>	20
5. <i>A. fumigatus</i>	10
6. <i>A. japonicus</i>	20
7. <i>A. nidulans</i>	10
8. <i>A. niger</i>	70
9. <i>A. ochraceus</i>	10
10. <i>A. restrictus</i>	10
11. <i>A. terreus</i>	10
12. <i>Aureobasidium pullulans</i>	30
13. <i>Chrysosporium pannorum</i>	10
14. <i>Cladosporium cladosporioides</i>	80
15. <i>Curvularia lunata</i>	40
16. <i>Drechslera australiensis</i>	10
17. <i>D. rostratum</i>	10
18. <i>Fusarium oxysporum</i>	10
19. <i>Fusarium</i> sp.	10
20. <i>Nigrospora sphaerica</i>	20
21. <i>Paecilomyces variotii</i>	10
22. <i>Penicillium citrinum</i>	30
23. <i>P. frequentans</i>	10
24. <i>P. oxalicum</i>	10
25. <i>P. restrictum</i>	10
26. <i>Pestalotiopsis</i> sp.	20
27. <i>Phoma</i> sp.	10
28. <i>Pleospora</i> sp.	10
29. <i>Syncephalastrum racemosum</i>	20
30. <i>Torula herbarum</i>	10
31. <i>Trichoderma viride</i>	10
Yeast	10
Non-sporulating colonies	50

Singapore. Among different sources studied, Air sample within buildings of Singapore yielded maximum number of species (39 species) followed by Carpet dust (33 species) and upholsteries (31 species). Among them the genus, *Aspergillus* was represented by maximum number of species (14) followed by *Penicillium* (11), *Trichoderma* (3) and *Curvularia*, *Drechslera* and *Fusarium* (2 each). All other genera are represented by single species. Isolation of fungi in large numbers and diversity among their species proves that the indoor environment of Buildings in Singapore is not free of molds.

The following genera, *Aspergillus*, *Cladosporium* and *Penicillium* are recorded in large number in the indoor air in the Buildings of Singapore. Predominance of these genera within office buildings in Brazil was reported by Leila *et al.*, (1998). Tan *et al* (1992) recorded *Curvularia lunata* and *Nigrospora sphaerica* as a predominant mold from the outdoor atmosphere of Singapore. However, they are absent within air of

indoor in Buildings of Singapore, which may be due to non availability of air transactions between indoor and outdoor. The buildings in Singapore are found to be airtight. Air circulations in the buildings are controlled by centralized Air Handling Units in Singapore. However, their absence in the air of indoor may also be due to their size and absence of local atmospheric disturbances within buildings.

The carpet dust samples from the Buildings of Singapore yielded a total of 3438×10^2 cfu/gm. Scott and Hodgson (1998) recorded 303×10^2 cfu/gm from the carpet dusts collected from control buildings in USA. Among 33 species recorded the following species, *Aspergillus niger*, *Paecilomyces variotii*, *A. fumigatus* and *Curvularia lunata* are predominant. Kemp *et al.*, (2002) recorded *Penicillium* spp., *Aspergillus niger* and *Zygomycetes* as dominant fungi from carpet dusts.

Isolation of large number of species from upholsteries proves that they too serve as a good source for the growth of mold within Buildings. It is suspected that mold spores from outdoor are found to adhere to the external cover-ups of the occupants of Buildings and they may get deposited on upholsteries and on carpets which in turn provide favourable niche for their growth. Kemp *et al.*, (2002) reported that furnishings and mattresses without moisture damage can provide a habitat with enough moisture to support fungal growth despite the lack of an obvious moisture source.

Isolation of 24 species near A/c vent and 14 species from the filters of Air Handling Units (AHU) proves that the mold spores within the building are spread through air circulation. Menetrez and Foarde (2004) explain the role of HVAC system in the spread of toxic mold spores. Nearly 70 % of the species recorded from the Air Handling Units are isolated near A/c vents and in Indoor Air too which proves that they are disseminated through Air Handling systems. The moisture present in the filters of AHU and near A/c vent favours the growth of mold spores. The organic stub dropped due to eating and drinking habits of the workforce or occupants within buildings provide an organic source for their growth in carpets and upholsteries.

The health hazard posed by these fungi to the occupants is categorized as allergenicity, toxigenicity and pathogenicity. Isolation of *Paecilomyces variotii* i.e. a keratinophilic fungi in large number raise the doubt that this may act as an agent of skin irritant. Nearly 19 % of childrens are reported to be allergic to molds (Kidon *et al.*, 2004). Chew *et al.* (2000) reported 26-32

% atopic reaction to *Curvularia* spp. and 31 % to *Drechslera* like species in Singapore. The toxigenicity of these fungi was not yet studied and it is stressed to conduct study on this aspect.

The following fungi, i.e. *Aspergillus fumigatus*, *A. niger*, *Aureobasidium pullulans*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Paecilomyces variotii* and *Penicillium oxalicum* are recorded from all the sources within the buildings of Singapore and it is expected that the occupants or workforce involved in those buildings are prone to come in contact with above said molds. Hence, it is recommended to give due importance to study the impact of the above said species in inducing health hazards.

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