Aspergillus spp. andazole-resistance characterization on Filtering Respiratory Protective Devices from waste sorting industry

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Introduction

Filtering Respiratory Protective Devices (FRPD) are disposable after one-day use (workshift) and their use is mandatory in Portuguese waste-sorting industries. During FRPD use, humidity and temperature conditions provide a favorable environment for the growth of retained Aspergillus. The aim of this study was to characterize the presence of Aspergillus spp. in the FRPD interior layer and in exhalation valves, as well as to detect possibleazole-resistant isolates in this complex indoor environment.

Materials and Methods

120 FRPD

FRPD Interior Layer

FRPD Exhalation Valves

Fungal load was extracted from both matrices with 30 mL of 0.1% Tween™ 80 saline solution (NaCl 0.9%) for 30 min at 250 rpm

150 μL of those extracts were streaked onto malt extract agar (MEA) supplemented with chloramphenicol (0.05%) and dichloran glycerol agar (DG18)

After incubation at 27 °C for 5 to 7 days Aspergillus spp. densities (CFU/m2) were calculated

The frequency of azole-resistance was determined by inoculation of the extracts onto screening agar plates containing Sabouraud dextrose agar media supplemented with 4 mg/L itraconazole (ITRA), 1 mg/L voriconazole (VORI), and 0.5 mg/L posaconazole (POSA), incubated at 27 °C for 5 days.

Aspergillus sections were identified through macro and microscopic characteristics

Results

Aspergillus spp. was detected in both interior layers (77 out of 120; 64.17%) and exhalation valves (63 out of 120; 52.5%).

- Among the Aspergillus genera, section Fumigati showed the highest frequency of detection, both in exhalation valves (76.57% MEA; 87.24% DG18) and in interior layers (75.81% MEA; 51.22% DG18).
- Fumigati and Nigri were the Aspergillus sections more frequently isolated on MEA. In addition, Flavi, Circumdati and Candidi sections were also frequently isolated on DG18. Restricti and Aspergilli sections were observed occasionally.
- DG18 allowed the detection of a more diversified set of Aspergillus sections than MEA (in both FRPD matrices).
- In azole-supplemented media, Aspergillus spp. was the genus more frequently found on exhalation valves (75.0% of the isolates that grew onto ITRA), suggesting that isolates resistant to the tested concentration of ITRA might be present in this occupational environment.

Conclusions

This study reports contamination of FRPD used by workers at waste industry with Aspergillus isolates exhibiting reduced susceptibility to azoles. Future trials should be performed to test the protective efficacy of FRPD and to establish deadlines for FRPD replacement. Monitoring of the establishment of azole-resistant strains in this work environment should be continued to reduce the risk of exposure and consequent development of fungal infections.

Acknowledgments: This work was supported by FCT – Fundação para Ciência e Tecnologia for funding the project EXPOE (02/SAICT/2016 – Project nº 23222), Instituto Politécnico de Lisboa, Lisbon, Portugal for funding the Project “Waste FRPD” (IPL/2018/WasteFRPD_ESTeSL).