Occurrence and In Vitro Antifungal Susceptibility of Candida Spp. Isolated from Decayed Tree Parts in Green Urban Areas from Pisa (Central Italy)

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Abstract

Trees and grass are proven sources of potentially pathogenic yeasts. Among fungi regarded as human/animal pathogens, several Candida Spp. are involved. Since wooded areas are frequented by people and their pets, aim of the present study was to investigate the occurrence of potentially pathogenic yeasts on decaying vegetal material from trees in 2 city parks in Pisa, Italy. A total of 186 samples was collected. The antimycotic drug sensitivity pattern of cultured Candida spp. was evaluated versus fluconazole, voriconazole, caspofungin and amphotericin B, by Etest. Sixteen trees out of 31 (51.6%) scored positive for yeasts, and twenty-six fungal isolates were cultured. Thermotolerant strains, such as Candida Famata (6/6), Candida Guilliermondii (4/4), Candida Membranaefaciens (2/3) and Candida Parapsilosis (1/1), were obtained. All the yeasts were sensitive to amphotericin B, 2 C. Famata were resistant to assayed azoles, and this fungal species was the only one susceptible to caspofungin, while fluconazole was effective versus all C. Guilliermondii isolates. Although the relatively small sample size, decaying vegetal material from trees growing in sampled recreational green areas, would seem to be a natural site harboring potentially pathogens yeasts, characterized by low sensitivity against some important antimycotic drugs.

Introduction

Yeasts can act as important pathogens both in animals and humans and it is well known that most of them occur as saprophytes in the environment, being able to grow on not viable organic matter. Moreover, these organisms are frequently able to form biofilms [1] and some among them are characterized by intrinsic and/or acquired resistance to one or more commonly administered antifungal drugs [2]. Among fungi regarded as human and animal pathogens, several Candida spp. are reported. Candida Albicans represents the main causative agent for human candidiasis, although the numerous non-albicans species have increased their occurrence in candidiasis in the last decades to >50% of bloodstream infections throughout the world [3]. Droppings of domestic as well as free ranging birds are proven sources of potentially pathogenic yeasts [4-7], such as decomposing plant material, trees and grass [8]. For instance, Cryptococcus neoformans and Cryptococcus gattii have been cultured from decaying vegetal materials [9-11], while several other yeasts would dwell onto different trees.

In particular Candida tropicalis, Candida parapsilosis and C. albicans have been recovered from trees [12-14] as well as woodland are considered a privilege site for Saccharomyces spp. [15]. Furthermore, wooded and green areas are visited by large numbers of people and their pets, and in the last years reports of mycoses caused by yeasts, mostly referring to fungi belonging to Candida genus, are more frequently encountered than in the past [2,3,16,17]. For these reasons, considered also the increased occurrence of immunocompromised patients, the knowledge of the ecology of these fungal species may be of interest. To the best of our knowledge, there are no reports about the presence of yeast species, in particular Candida spp., associated with trees in Italy. Therefore, aim of the present study was to investigate the occurrence of potentially pathogenic yeasts on decaying vegetal material from trees in 2 city parks in Pisa, Italy, evaluating also the drug sensitivity pattern of Candida spp. isolated versus some among the most common used antifungals in human medicine.
Materials and Methods

Specimens were drawn from trees growing in 2 green recreational areas, within the urban area of Pisa (43°42’30” N 10°0’24” E), Central Italy, visited by both people and pet dogs. Thirty-one trees were sampled. In detail 6 Pinus pinea, 4 Tilia platyphyllos, 1 Platanus acerifolia, 1 Fagus sylvatica, 1 Chicas revoluta and 1 Taxus baccata from site 1, and 4 P. pinea, 2 Salix babylonica, 1 P. acerifolia, 3 Quercus ilex, 1 Chamaecyparis lawsoniana, 1 Morus alba, 1 Laurus nobilis, 1 Nerium oleander, 1 Carpinus betulus and 1 Glidisia triachantos. Except for one site, a species identification based on phenotypic features, showing a high degree of similarity (>99%) with the deposit species sequences described in the GenBank database determined by BLAST. Cryptococcus neoformans/gattii was never was isolated during the study. All Candida isolates were sensitive to amphotericin B. 2 C. famata were resistant to all azoles assayed, while fluconazole was effective versus all C. guillermondii isolates. Interestingly, C. famata was the sole yeast species fully sensitive to caspofungin. More detailed data about the source of yeasts and drug sensitivity pattern are reported.

Results

Sixteen trees out of 31 (51.6%) scored positive for yeasts in at least one sampled site. Twenty-six fungal isolates were cultured and identified as Candida spp., Debaryomyces polymorphus, Rhodotorula sp. and Pichia etchellsii. In particular, thermotolerant Candida isolates were obtained from 6 trees (6/6), Candida guillermondii (4/4), Candida membranaefaciens (2/3) and Candida parapsilosis (1/1). Eight P. pinea out of 10 scored positive, with Candida spp. as the most prevalent genus, recovered from at least 1 site. Candida spp. were isolated from 1 T. platyphyllos, 2 S. babylonica, 1 C. lawsoniana and 1 L. nobilis. Different fungal species from the same tree were detected in 3 P. pinea, 1 T. platyphyllos and 1 P. acerifolia. PCR analysis confirmed in all cases the presumptive Candida species identification based on phenotypic features, showing a high degree of similarity (>99%) with the deposit species sequences described in the GenBank database determined by BLAST. Cryptococcus neoformans/gattii was never isolated during the study. All Candida isolates were sensitive to amphotericin B. 2 C. famata were resistant to all azoles assayed, while fluconazole was effective versus all C. guillermondii isolates. Interestingly, C. famata was the sole yeast species fully sensitive to caspofungin. More detailed data about the source of yeasts and drug sensitivity pattern are reported.

Discussion

The fungal species isolated are in agreement with the findings of Maganti et al. [12], who report the occurrence of Candida, Rhodotorula and Pichia Genera from tree hollows in urban areas. A limitation of this study is the low number of sampled trees, indeed. Unfortunately, it was not possible to overpass this problem, since the study design was focused on deciding trees only that were present in low numbers in sampled areas. Among Candida spp., C. parapsilosis is an important etiological agent of invasive candidiasis [21], representing the second or third most common species isolated in human candidemia worldwide. The isolate obtained in our study showed resistance to fluconazole and caspofungin. These findings agree with literature data, and the fluconazole resistance of some strains within this yeast species has been related to an overexpression of MRR1 [22]. C. famata was the most prevalent recovered yeast species and it is considered as a rare, but emergent [23] cause of candidiasis, with a prevalence ranging from 0.2% to 2% [24]. These yeasts have been reported as agents associated to urinary tract infection in pets, characterized by similar antifungal drug sensitivity patterns [25]. In the present study, 5 out of 6 isolates were resistant to fluconazole, while the other one had a dose dependent sensitivity. Moreover, 2 isolates resulted resistant to voriconazole. This finding would appear of interest, showing that isolates characterized by high rates of resistance would be widely spread in urban environment. C. guillermondii has been reported as a cause of candidemia in neoplastic patients [26], being involved in up to 2% of human cases [27], and in a joint infection in a dog [16]. Three out of 4 strains scored resistant to caspofungin, while the other one showed intermediate sensitivity, in agreement with Marcus-Zambrano et al. [27]. C. membranaefaciens is a yeast infrequently reported in intravenous catheter-associated invasive infections [28,29], whose sensitivity to fluconazole is a matter of debate [28]. The isolates obtained in our work seem to confirm the resistance to fluconazole. The intermediate sensitivity of all the three isolates to caspofungin appears to be an interesting finding. The results obtained from this study would indicate that decaying vegetal material from trees occurring in investigated recreational green areas, seems to harbor potentially pathogenic yeasts, characterized by low sensitivity against some currently used antymycotic drugs.

Disclosure of Interest

The authors declare no conflict of interest.
References


