Correspondence

Possible roles of 2 basidiomycetous fungi in allergic fungal respiratory disease

To the Editor:

We would like to comment on the article by Knutsen et al.[1] The possible role of basidiospores as airborne allergens was already reported, and their review listed 19 species belonging to the phylum Basidiomycota as causative organisms. The results of our series of studies in patients with allergic lower respiratory tract diseases suggest that 2 additional basidiomycetous (BM) fungi should be added to their review.

Schizophyllum commune (SC) is a BM fungus that can cause allergic bronchopulmonary mycosis.[2] Our recent studies suggested that SC is an important causative fungal antigen of bronchial asthma.[3] Therefore, this BM fungus may be a candidate organism influencing the clinical manifestations of asthma via sensitization to this fungus, similar to *Aspergillus*.[4] Our multivariate analysis demonstrated that SC sensitization is correlated with both asthma severity and exacerbation frequency,[5] and therefore it is important to determine the correlation between SC sensitization and decline of lung function. The efficacy of antifungal drugs against fungal-sensitized asthma is an important issue,[1] but their routine use in fungus-sensitized asthma requires further evaluation.[4] Clinical studies concerning this issue regarding sensitization to this fungus may yield important new insights.

Bjerkandera adusta is well known in the field of agricultural science because it secretes multiple lignin peroxidase isozymes, but its clinical significance has not been clarified.[6] Our recent studies indicated that *B adusta* is an important environmental fungi due to its potential role in enhancing the severity of cough symptoms by sensitization to this fungus.[7] Further studies indicated growth of the filamentous *B adusta* at 4°C to 37°C on Sabouraud's dextrose agar and showed that abundant asexual spores, arthroconidia, were produced from the hyphae of this fungus (Fig 1). The yearlong sensitization caused by *B adusta* may therefore be part of the reason why this fungus, which is a mushroom growing primarily in fields, acts as an allergen in winter as well as in summertime.

SC and *B adusta* are correlated with common diseases encountered in ordinary clinics, that is, bronchial asthma and chronic cough, respectively. Therefore, it is important to investigate the interactions of inflammatory cells and cytokines induced on the bronchial wall by these BM fungi, to evaluate the relationships between sensitization to these fungi and patients' clinical manifestations, and to plan strategies including antifungal therapy that have shown potential advantages *in vitro*.

The role of climate change in fungus-related respiratory tract diseases has also been discussed.[1] As both fungi colonize rotting wood and are distributed throughout the world, their growing conditions may always be affected by natural environmental factors, such as global climate change and other geographical characteristics. Thus, among the approximately 30,000 species in the BM phylum, we suggest 2 additional BM fungi that should be taken into consideration when managing such patients.

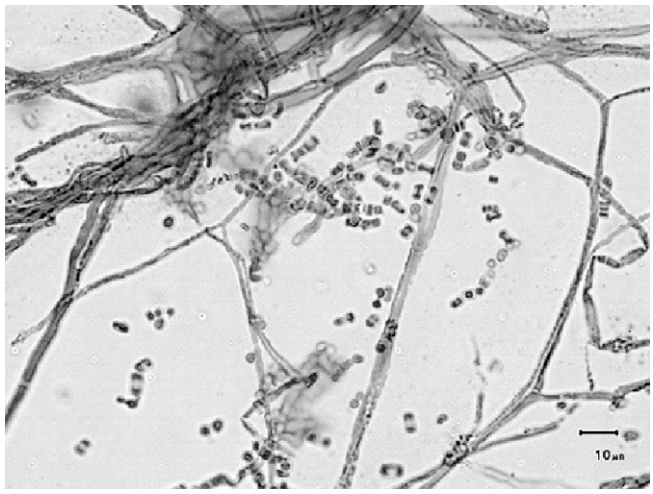

FIG 1. The growth of the filamentous *Bjerkander adusta* showing abundant asexual spores, arthroconidia, at 37°C on Sabouraud's dextrose agar.

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Haruhiko Ogawa, MD, PhD[a]
Masaki Fujimura, MD, PhD[b]
Yasuo Takeuchi, MD, PhD[c]
Koichi Makimura, MD, PhD[d]

From [a]the Division of Pulmonary Medicine, Ishikawa-ken Saiseikai Kanazawa Hospital, Kanazawa, Japan; [b]Respiratory Medicine, Cellular Transplantation Biology, Kanazawa University Graduate School of Medical Sciences, Kanazawa, Japan; [c]the Division of Respiratory Medicine and Clinical Allergy, Fujita Health University, Toyoake, Japan; and [d]the Department of Molecular Biology and Gene Diagnosis, Institute of Medical Mycology and Genome Research Center, Graduate School of Medical Science, Teikyo University, Hachioji, Japan. E-mail: saiseikh@po3.nsknet.or.jp.

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REFERENCES

1. Knutsen AP, Bush RK, Demain JG, Denning DW, Dixit A, Fairs A, et al. Fungi and allergic lower respiratory tract diseases. J Allergy Clin Immunol 2012;129:280-91.
2. Kamei K, Unno H, Nagao K, Kuriyama T, Nishimura K, Miyaji M. Allergic bronchopulomonary mycosis caused by the basidiomycetous fungus *Schizophyllum commune*. Clin Infect Dis 1994;18:305-9.
3. Ogawa H, Fujimura M, Takeuchi Y, Makimura K. Two cases of Schizophyllum asthma: is this a new clinical entity or a precursor of ABPM? Pulm Pharmacol Ther 2011;24:559-62.
4. Agarwal R, Gupta D. Severe asthma and fungi: current evidence. Med Mycol 2011;49(suppl 1):S150-7.
5. Ogawa H, Fujimura M, Takeuchi Y, Makimura K. The influence of *Schizophyllum commune* on the severity and exacerbation of asthma. Lung 2011;189:485-92.
6. Gonzalez GM, Sutton DA, Thompson E, Tijerina R, Rinaldi MG. In vitro activities of approved and investigational antifungal agents against 44 clinical isolates of basidiomycetous fungi. Antimicrob Agents Chemother 2001;45:633-5.
7. Ogawa H, Fujimura M, Takeuchi Y, Makimura K. Is *Bjerkandera adusta* important to fungus-associated chronic cough (FACC) as an allergen? Eight cases' report. J Asthma 2009;46:849-55.

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