Is Candida stellatoidea Disappearing from the Vaginal Mucosa?

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A total of 681 vaginal isolates of germ tube-positive or germ tube-untested white, yeastlike fungi obtained from patients in various cities of the United States were tested for the presence of Candida stellatoidea (type I). Only 1 of the 681 isolates was identified as C. stellatoidea.

Candida stellatoidea has been isolated from a number of clinical sources but most frequently from the human vaginal tract. In the studies of Jones and Martin et al. of vaginal flora in 1937 to 1938 at Duke University Hospital, Durham, N.C., 68 yeast isolates were recovered from 52 pregnant and 16 nonpregnant women (9, 14). Of these, 29 (43%) were C. stellatoidea, 19 (28%) were C. albicans, and 20 (29%) were other yeasts. No information as to the frequency of recovery of C. stellatoidea from pregnant versus nonpregnant women was included in their articles. Furthermore, they did not indicate whether the patients had symptomatic vaginitis. In 1948, Johnson and Mayne reported a similar high recovery (37%) of C. stellatoidea from vaginal swabs of pregnant women in New Orleans, La. (8).

While subsequent authors have reported the isolation of C. stellatoidea primarily from vaginal specimens of patients with or without symptomatic vaginitis (4), the yeast has been infrequently recovered from other sources, such as sputum (4), oral cavities (3), urine (6), and a surgical specimen of the thrombus from a patient with endocarditis (7).

Isolates of C. stellatoidea have almost always been distinguished from C. albicans by their lack of sucrose assimilation. Recent studies by Kwon-Chung et al. (11, 12), however, demonstrated that the isolates identified as C. stellatoidea on the bases of carbon assimilation tests can be either type I or type II, depending on their electrophoretic karyotypes. The isolates designated as type II were considered to be sucrose-negative C. albicans, while type I isolates were considered to be C. stellatoidea. The culture derived from the type specimen of C. stellatoidea (ATCC 11006) was found to be type I, i.e., C. stellatoidea.

During these genetic studies, we have found that most of the C. stellatoidea isolates (about 20) available from world culture depositories and various major mycological centers were all originally obtained from the collection of N. F. Conant at Duke University. They were isolated at least 25 years ago, with some of them having been derived from the original cultures of Jones and Martin (9).

The limited number of more recent isolates was thought to be primarily due to the fact that most clinical laboratories have abandoned the practice of separating C. stellatoidea from C. albicans. Since the majority of both species (>95%) produce germ tubes (16) and since there is a high percent homology in their total DNAs, C. stellatoidea has been treated by many mycologists as a synonym for C. albicans since 1979 (15).

In an attempt to identify type I C. stellatoidea among recent (1983 to 1988) vaginal Candida isolates, we screened 681 cultures of nonpigmented germ tube-positive and germ tube-untested yeastlike fungi obtained from several clinical facilities in the United States (Table 1). The isolates were recovered from patients with or without symptomatic vaginitis. Although 357 isolates from Philadelphia, Pa., and Detroit, Mich., were all from nonpregnant women, information as to the pregnancy status of the patients from the other geographic areas was not available. Single colonies were isolated and maintained on Sabouraud glucose agar slants at 25 or 30°C. All germ tube-positive isolates and the germ tube-untested isolates from Maryland (total, 401) were initially screened for their ability to assimilate sucrose by streaking cells from 2-day-old cultures onto yeast nitrogen base plus sucrose (2%) agar plates. More complete carbon assimilation profiles of those isolates found to be incapable of utilizing sucrose were then assessed with the API 20C system. The 280 germ tube-untested isolates from Albany, N.Y., were first screened for their ability to form chlamydospores and blastoconidia on cornmeal agar. Those isolates identified as C. albicans on the bases of morphological criteria were then further tested for their ability to utilize sucrose with Sucrose Assimilation Medium (SAM; Flow Laboratories, Inc., McLean, Va.). Isolates identified as C. stellatoidea were further screened for their electrophoretic karyotype to differentiate type I from type II. Only 1 of 681 isolates was identified as type I C. stellatoidea using contour-clamped homogeneous electric field electrophoresis as described by Chu et al. (1). The remaining isolates were found to be C. albicans (98.9%) and other yeasts (1.1%).

The only type I C. stellatoidea isolate had been originally recovered from a patient in Albany, N.Y., in 1988, and its karyotype was found to be identical to that of C. stellatoidea ATCC 11006. The frequency of C. stellatoidea among yeasts recovered from vaginal specimens in this study is therefore 0.15%. These results suggest that C. stellatoidea is on the verge of being eliminated from the vaginal mucosa of women in the United States. Although the frequency is lower than what Jones and Martin reported in 1938 (9), recent studies from Mexico (13) and Nigeria (2, 5) have indicated that C. stellatoidea may still be isolated from vaginal mucosa more frequently than in the United States, i.e., 8.7 and 2.0 to 8.7%, respectively. The possibility exists, however, that the isolates from Mexico and Nigeria are sucrose-negative C. albicans (type II C. stellatoidea) rather
than *C. stellatoidea* (type I). Nevertheless, it appears that more sucrose-negative yeasts are being identified as *C. stellatoidea* in those two countries than in the United States.

The rarity of *C. stellatoidea* among recent vaginal yeasts isolated in the United States may be due to the improvement of health care during the last few decades. *C. stellatoidea* cells are known to adhere less efficiently to buccal epithelial cells than do *C. albicans* cells (10). *C. stellatoidea* is also less virulent than *C. albicans* in experimental animals (12). In vitro studies have shown that *C. stellatoidea* has a longer generation time and is more susceptible to mutagens such as UV light (12) or ethyl methane sulfonate (unpublished data) than *C. albicans*. Consequently, as personal hygiene and general health care have improved over the last few decades in the United States, *C. stellatoidea* may have been losing its major ecological niche to *C. albicans*.

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**LITERATURE CITED**


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**TABLE 1. Frequency of *C. stellatoidea* among vaginal swab isolates of yeasts in the United States**

<table>
<thead>
<tr>
<th>Date of isolation</th>
<th>Location</th>
<th>Frequency*</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1937–1938</td>
<td>Durham, N.C.</td>
<td>20/68†</td>
<td>Jones and Martin (9)</td>
</tr>
<tr>
<td>1948</td>
<td>New Orleans, La.</td>
<td>91/244†</td>
<td>Johnson and Mayne (8)</td>
</tr>
<tr>
<td>1983–1985</td>
<td>Philadelphia, Pa.</td>
<td>0/100†</td>
<td>Present study</td>
</tr>
<tr>
<td>1986–1988</td>
<td>Detroit, Mich.</td>
<td>0/257†</td>
<td>Present study</td>
</tr>
<tr>
<td>1988</td>
<td>Bethesda, Md.</td>
<td>0/25†</td>
<td>Present study</td>
</tr>
<tr>
<td>1988–1989</td>
<td>Durham, N.C.</td>
<td>0/19†</td>
<td>Present study</td>
</tr>
<tr>
<td>1983–1988</td>
<td>Albany, N.Y.</td>
<td>1/280†</td>
<td>Present study</td>
</tr>
</tbody>
</table>

* Number of *C. stellatoidea* isolates/number of yeast isolates.
† From pregnant women only.
‡ Germ tube-positive isolates from women with symptomatic *Candida* vaginitis.