21-year retrospective study of the prevalence of *Scopulariopsis brevicaulis* in patients suspected of superficial mycoses

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**Abstract**

**Introduction:** In the genus *Scopulariopsis*, *Scopulariopsis brevicaulis* is the most common aetiological agent of infections in humans. It usually affects nails and is one of the commonest moulds associated with onychomycoses. Other forms of infections (skin, subcutaneous, deep tissues, and disseminated infections) have also been described.

**Aim:** To examine the prevalence of *S. brevicaulis* in clinical materials obtained from patients suspected of keratinized tissues mycoses.

**Material and methods:** The analysis of the prevalence of *S. brevicaulis* in clinical specimens was based on mycological test's results carried out for patients who were referred with a suspicion of superficial mycoses to the Department of Mycology, Chair of Microbiology, Jagiellonian University Medical College from 1992 till 2012.

**Results:** In the years 1992–2012 16,815 clinical samples (nail scrapings, nail swabs, skin scrapings, skin swabs, hair) were collected. Pathogenic fungi were detected in 7193 samples and *S. brevicaulis* was present in 255 (3.5%). The prevalence of *S. brevicaulis* in males and females was comparable. The species was most often isolated from toenails (80%), both from males and females. In the analysed period we observed a decrease in the prevalence of *S. brevicaulis*. In most cases (60%) *S. brevicaulis* occurred alone in 40% of *S. brevicaulis* positive cultures, other fungi were also isolated. The fungi most frequently isolated with *S. brevicaulis* were *Trichophyton rubrum*, *T. mentagrophytes*, *Penicillium* sp., *Candida* sp., and *Aspergillus* sp.

**Conclusions:** *Scopulariopsis brevicaulis* is not a common cause of superficial fungal infections of keratinized tissues, but is a typical mould associated with toenail onychomycosis. A proper identification of this species in onychomycoses is essential for the implementation of effective antifungal therapy.

**Key words:** *Scopulariopsis brevicaulis*, superficial mycoses, onychomycosis.

**Introduction**

Fungi from the genus *Scopulariopsis* occure in soil, air, organic waste, food, feed, plants, animals, and humans [1–6]. In humans they have been mainly associated with superficial infections of keratinized tissues, especially with onychomycoses [7–17]. They have also been described as a cause of cutaneous, subcutaneous, and deep tissues mycoses, e.g. endocarditis, pulmonary infection, bronchial infection, keratitis, endophthalmitis, sinusitis, otomycosis, meningitis, and disseminated infections [18–26]. These invasive infections are relatively rare but during the last two decades have been increasingly reported, particularly in immunocompromised patients.

In the genus *Scopulariopsis*, *S. brevicaulis* is the most common aetiological agent of infections in humans. *Scopulariopsis brevicaulis* is considered to be resistant to most antifungal drugs currently available, including amphotericin B andazole compounds [27–29]. The treatment of infections due to this species might be ineffective and invasive infections can directly threaten patient's life.

**Aim**

The aim of this study was to examine the prevalence of *S. brevicaulis* in clinical specimens obtained from patients suspected of superficial mycoses.
Material and methods

The retrospective analysis of the mycological test results was performed.

Samples for mycological examination were collected from patients suspected of superficial mycoses who were referred to the Department of Mycology, Chair of Microbiology, Jagiellonian University Medical College from 1 January 1992 to 31 December 2012. The collected materials contained nail scrapings, nail swabs, skin scrapings, skin swabs, and hair.

The isolation and identification of the fungi were made in accordance with conventional mycological procedures.

Results

A total of 16,815 test results were analysed: 9600 from females and 7215 from males. Seven thousand one hundred and ninety-three (42.8%) samples were positive for fungi, 3837 (40%) in females and 3356 (46.5%) in males. Out of 7193 fungi-positive specimens, 255 (3.5%) yielded Scopulariopsis brevicaulis. The number of S. brevicaulis isolates was comparable in females and males – 125 (49%) vs. 130 (51%) isolates, respectively. The comparison of the mean prevalence of S. brevicaulis in positive materials in males and females yielded no statistically significant difference (p = 0.242106).

During the 21-year observation period the total number of mycological test results was increasing, while the number of positive test results and the number of S. brevicaulis isolates was decreasing (Figures 1 and 2). The trends were statistically significant (p < 0.05).

The prevalence of S. brevicaulis in various clinical materials is shown in Figure 3. The most common localization for this species was toenails (80%), both for females and males (respectively 80.8% and 79.2% of total S. brevicaulis isolates for each of the sex). The other localizations were as follows: fingernails (7%), hand (6%), foot (5%), trunk (1%), groin (1%) for women, and foot (9%), fingernails (4%), hand (2%), face (2%), trunk (2%), and groin (1%) for men.

In the analysed period 10,470 nail samples were collected. Onychomycosis was diagnosed in 4806 (45.9%) cases. Moulds were reported as an aetiological agent of
those infections in 1080 (22.5%) cases and *S. brevicaulis* was identified in 218 – which comprised 4.5% of total onychomycoses and 22.5% of total mould-related onychomycoses. In the analysed period, the mean prevalence of *S. brevicaulis* in nail samples was 2.4%. The percentage of *S. brevicaulis* isolates from nails in females and males was comparable – the mean prevalence for females was 2% and for males 2.9%.

*Scopulariopsis brevicaulis* was mainly isolated from toenails (about 94% of nail isolates), occasionally from fingernails (about 6% of nail isolates). The prevalence of *S. brevicaulis* in toenails during the analysed period was 2.5% (mean: 3.1%), and the species was responsible for 5.5% (mean: 5.7%) of total toenail mycoses and 23.4% (mean: 28.3%) of moulds-related toenail infections. The mean prevalence of *S. brevicaulis* in fungi-positive toenails samples was 5.6% in females and 5.8% in males, and the mean prevalence of this species in mould-related toenail mycoses was 24.2% and 32.9%, respectively. In both cases the differences between the sexes were not statistically significant (*p* = 0.489039 and *p* = 0.597148, respectively). We noticed a decrease in the prevalence of *S. brevicaulis* in toenails, both in females and males, what was statistically significant (*p* < 0.05) (Figure 4).

*Scopulariopsis brevicaulis* was isolated from 14 fingernail samples and the mean prevalence of the species in this clinical material was 0.6%. There were no differences in the prevalence between the sexes (0.6% and 0.5% in females and males, respectively). *Scopulariopsis brevicaulis* was an aetiological agent of 1.3% of total fingernail mycoses (mean: 1.5%). The mean prevalence of *S. brevicaulis* in fingernail mycoses was comparable in females and males (1.2% and 2%, respectively; *p* = 0.343876). In the analysed period, *S. brevicaulis* was identified as a cause of 6.8% of mould-related fingernail mycoses (mean: 11%) – the mean prevalence of this species in females was 15.1% and in males 6.9%, and the difference was not statistically significant (*p* = 0.164926).

*Scopulariopsis brevicaulis* was isolated predominantly as the sole aetiological agent. In 40.4% of cases also other fungi were cultured. *Scopulariopsis brevicaulis* coexisted both with dermatophytes, other moulds, and yeasts. The predominant coexisting species was *Trichophyton rubrum*. The list of fungi isolated together with *S. brevicaulis* is shown in Table 1.

**Discussion**

*Scopulariopsis brevicaulis* may cause various infections in humans – from superficial to life-threatening invasive mycoses. Superficial infections are usually caused by dermatophytes or yeasts, however, *S. brevicaulis* is one of the predominant species among nondermatophytic filamentous fungi in onychomycoses [7–15].

![Figure 3. Prevalence of *Scopulariopsis brevicaulis* isolates in different clinical materials](image)
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20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0

Figure 4. Percentage of *Scopulariopsis brevicaulis* in toenails. The lines show a statistically significant \((p < 0.05)\) decrease in the *S. brevicaulis* prevalence in fungi-positive toenails samples, both in females and males.

Table 1. Other fungi isolated with *Scopulariopsis brevicaulis*

| Group of fungi | Genus/species (number of isolates) | Total number of isolates (% of *S. brevicaulis* positive samples) |
|---------------|-----------------------------------|---------------------------------------------------------------|
| Dermatophytes | *Trichophyton rubrum* (24)         | 42 (16.5%)                                                   |
|               | *Trichophyton mentagrophytes* (17)|                                                               |
|               | *Epidemophyton flaccosum* (1)      |                                                               |
| Moulds        | *Penicillium* sp. (22)            | 44 (17.3%)                                                   |
|               | *Aspergillus* sp. (11)            |                                                               |
|               | *Cephalosporium* (3)              |                                                               |
|               | *Alternaria* sp. (2)              |                                                               |
|               | *Mucor* sp. (2)                   |                                                               |
|               | *Trichoderma* sp. (2)             |                                                               |
|               | *Acremonium* sp. (1)              |                                                               |
|               | *Trichothecium roseum* (1)        |                                                               |
| Yeasts        | *Candida* sp. (20)                | 26 (10.2%)                                                   |
|               | *Rhodotorula* sp. (3)             |                                                               |
|               | *Trichosporon* sp. (3)            |                                                               |

There have been also reports which indicate that *S. brevicaulis* is rather rare cause of moulds-related onychomycoses. The Turkish investigators out of 33 cases of mould onychomycosis found only one (3%) *Scopulariopsis* isolate [34]. As well Dhib *et al.* in the 22 years’ retrospective study of onychomycoses in Tunisia yielded
Scopulariopsis in a low percentage – 0.3% of fungi-positive nail samples [35]. The causative agents of onychomycoses were studied also by Bokhari et al. on Lahore (Pakistan) population and Gupta et al. on patients from Himachal Pradesh (India). They revealed the presence of S. brevicaulis in 2% and 2.1% of positive test results, respectively [36, 37]. Bassiri-Jahromi and Khaksar in the study of aetiological agents of fungal nail infections found S. brevicaulis to be a cause of 2.1% cases of whole nondermatophytic onychomycoses [9].

Scopulariopsis brevicaulis predominantly affects toenails, especially the big toe nail. It is rarely isolated from fingernails [10, 11, 13, 30, 31]. Our study confirms these data – 93.6% of nail isolates were cultured from toenails and 6.4% from fingernails.

Despite the fact that S. brevicaulis is not considered to be a typical skin pathogen, several case reports of skin infections due to this species have been reported. Scopulariopsis brevicaulis has been described as an aetiological agent of skin infections of: face [16, 17, 38, 39], lower limbs (including foot) [40, 41], and trunk [42]. Petanović et al. found this species in the following skin locations: limbs, head, trunk, and armpits [30]. In the study by Issakainen et al. Scopulariopsis was isolated from similar parts of the skin – feet, hands, upper body [31]. In our study, skin infections due to S. brevicaulis occurred sporadically. During a 21-year study we isolated from the skin only 37 (14.5%) strains, mainly from the foot or hand/palm.

Scopulariopsis brevicaulis could be a primary pathogen or a co-pathogen of the skin and nails, but usually it has been reported as a secondary pathogen with dermatophytes [43]. The results of our study do not support these data. About 60% of S. brevicaulis isolates were identified as the sole aetiological agent of infection and only about 17% were cultured together with dermatophytes. Similarly in Issakainen et al.’s study, 30% of cases of Scopulariopsis isolations were associated with dermatophytes [31].

The pathogenicity of S. brevicaulis in superficial mycoses is unclear and still disputable. Keratin degradation which determines the ability of fungi to cause skin and nail mycoses does not appear to be species specific in S. brevicaulis. Some S. brevicaulis strains are keratinolytic while others are not [44]. Isolation and identification of S. brevicaulis in nail and skin samples is not equivocal to infection. As other saprotrophic fungi, S. brevicaulis could be only the colonizer of the skin and nails, or a contaminant of a clinical material or culture. Therefore, to make a proper diagnosis, the clinical picture of the lesion and mycological test result should be considered. The isolation of S. brevicaulis from clinical materials collected from skin or nails, as well as other moulds, should be repeated in consecutive cultures from additional samples. In the mixed cultures, particular attention should be paid to the presence of other pathogenic fungi, especially dermatophytes, which are an undisputed cause of superficial mycoses. In simultaneous isolation of S. brevicaulis and dermatophytes, S. brevicaulis is usually considered as a secondary invader.

Conclusions

Scopulariopsis brevicaulis is not a common cause of superficial fungal infections of keratinized tissues, but is a typical mould associated with toenail onychomycosis. A proper diagnosis of a causative agent of mycosis is essential to implement appropriate treatment. In the case of S. brevicaulis infection, this is of particular importance, because the species has been reported to be resistant in vitro to broad-spectrum antifungal agents available today and responds more poorly to a variety of treatment methods than dermatophytes [27–29].

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Conflict of interest

The authors declare no conflict of interest.

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