Arthrographis kalrae onychomycosis: isolation and implications for diagnosis and treatment.

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Introduction

Onychomycosis is a prevalent condition affecting approximately 10% of the global population, caused by various fungal species, including dermatophytes, yeasts, and non-dermatophyte moulds like *Arthrographis kalrae*.

However, there is a notable scarcity of literature on Arthrographis-induced onychomycosis.

A kalrae is a hyaline saprophytic (2) ascomycetous asexual fungus, seldom implicated in onychomycosis. It has primarily been associated with corneal, sinus, and soft tissue infections, but its pathogenicity has been underestimated due to its weak pathogenic potential. *A kalrae* thrives within a wide temperature range (15–45°C) and exhibits a penchant for keratin.

It has virulence factors like haemolytic and cytotoxic secretions, as demonstrated in mouse models. Its history dates back to 1938 when it was first reported as the causative agent of a nail lesion and classified as *A. langeronii* in France(4). Subsequently, in 1963, it was isolated from a lung specimen in India, initially described as *Oidiodendron kalrae*, unaware of prior research (4). In 1976, it was officially recognized as *Oidiodendron kalrae* kalrae, implicated in severe mycotic keratitis. Sigler and Carmichael later revalidated its classification as *A. kalrae (4)*. Clinical cases of invasive infections involving *A. kalrae* have risen recently, although it is often considered a contaminant when identified. It has been linked to various human infections, including pulmonary infections (7), mycotic keratitis (3), onychomycosis (5), refractory knee joint infections (1), sinusitis in Cystic Fibrosis patients, and ophthalmic issues. Infection prevention primarily relies on avoiding inoculation and restoring host immunity, as there is currently no vaccine available.

Aim: This work aims to document and emphasise the isolation of this rarely encountered fungus.

Objective: To foster awareness , spark discussion and enhance scientific knowledge.

This work's clinical significance goes beyond addressing concerns related to targeted therapy and antimicrobial resistance. It also encompasses several other crucial aspects like other infections, patient outcomes, reduced healthcare cost, clinical guidelines, public health, and research and drug development.

Methodology

Materials:

Sterile forceps and scalpels, Sabouraud dextrose agar supplemented with chloramphenicol, Sabouraud dextrose agar with actidione, 10% potassium hydroxide, fluorescence light microscope, incubator set to 30°C, Calcofluor white , Lactofuchsin(6) and Bruker Maldi-tof.

Samples:

Routine samples from patients with suspected onychomycosis.

Method:

Microscopy: The nail fragments/clippings from persons with suspected onychomycosis were transferred into a sterile petri dish. A small portion of the nail sample was crushed and transferred into a test tube with a few drops of 10 % potassium hydroxide (KOH) solution for 30 minutes. This was then mounted on a glass slide with a drop of Calcofluor white. The slide was then examined for the presence of fungal hyphae/elements and spores(6).

Culture: Macerated nail fragments were also cultured on Sabouraud agar plate supplemented with chloramphenicol to inhibit bacterial growth and another with actidione. These plates were incubated at 25-30°C for 3 weeks with weekly examination.

Identification: The grown colonies were examined for their macroscopic and microscopic characteristics. *A kalrae*, typically forms white to cream-coloured colonies usually fissuring into the agar (7) with distinctive conidiophores and conidia.

The Maldi-tof technique employed during this study (which was performed according to Manufacturer instructions) sufficiently confirmed the identification of *A. kalrae* with log score values of >2.0.

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Results

For the purpose of this study, we considered *A. kalrae* isolates in patients with clinical details suggestive of onychomycosis for the year 2022. Presented below are the findings.

Isolate	Sample type	Microscopy result	Culture result	Clinical details	Gender	Age
1	Nail Clipping	Fungal Elements Seen	*Arthrographis kalrae*	Fungal nail	Female	40 years
2	Nail Clipping	Fungal Elements Seen	*Arthrographis kalrae, T. rubrum, Candida species*	Fungal nail infection	Male	80 Years
3	Nail Clipping	Fungal Elements Seen	*Arthrographis kalrae*	Fungal nail infection	Male	68 Years
4	Nail Clipping	Fungal Elements NOT Seen	*Arthrographis kalrae*	? Fungal nail infection	Male	57 years
5	Nail Clipping	Fungal Elements Seen	*Arthrographis kalrae*	Fungal nail	Male	Unknown
6	Nail Clipping	Fungal Elements Seen	*Arthrographis kalrae*	Fungal nail	Male	17 Years

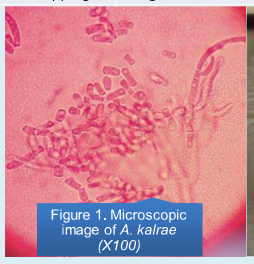

Figure 1. Microscopic image of *A. kalrae* (X100)

Figure 2. Obverse colony aspect of *A. kalrae 30C after 1 week on SABC*

Figure 3. Reverse colony aspect of *A. kalrae 30C after 1 week on SABC*

Discussion

Various fungal species may exhibit distinct response to antifungal treatment, in this case, susceptibility testing on these *A. kalrae* isolates is yet to be done.

In the event *A. kalrae* demonstrates resistance to conventional antifungals typically employed in onychomycosis therapy, this could have far reaching implications for treatment selection.

Gaining insights into the prevalence and geographical distribution of related onychomycosis cases holds significant value for epidemiological purposes, thereby informing public health policies and strategies. The discovery of less common fungal species such as *A. kalrae* in onychomycosis cases serves as a catalyst for further exploration into its biology and the identification of optimal treatment approaches. Could Climate change be a significant factor in its prevalence? This research endeavour has the potential to pave the way for the development of more efficacious therapies. On an individual level for patients grappling with onychomycosis, pinpointing the specific fungal species responsible for their condition can facilitate tailored treatment plans and the ability to predict outcomes. The identification of *A. kalrae* can prove challenging, necessitating expertise in recognising morphological characteristics in addition to the utilization of molecular techniques and Maldi-tof mass spectrometry. Consequently, there exists a possibility that *A. kalrae* is frequently overlooked or dismissed as a contaminant.

Conclusion

In conclusion, the isolation of *A. kalrae* in cases of onychomycosis over the course of a year underscores the importance of vigilance in both diagnosis and treatment amongst the Biomedical Scientist and Clinical fraternity.

As we continue to expand our understanding of the fungal world, it becomes evident that comprehensive diagnostic approaches and tailored treatment strategies are essential in managing even the most uncommon fungal infections.

The identification of *A. kalrae* in patient samples highlights the ever-evolving landscape of medical mycology, reinforcing the need for on-going research and surveillance to stay ahead of emerging pathogens. By fostering collaboration between clinicians, mycologists, and researchers, we can not only enhance our ability to detect and diagnose fungal infections but also develop more effective treatments that improve the quality of life for those affected. In the face of such challenges, the healthcare community must remain dedicated staying at the forefront of mycological knowledge. Only through this commitment can we hope to provide the best possible care to patients battling onychomycosis and other fungal diseases. Together, we can ensure that the isolation of rare pathogens like *A. kalrae* serves as a catalyst for continued advancements in the field of medical mycology, ultimately leading to better outcomes for those who depend on our expertise and care.

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