

First Report of *Aloe vera* Rust (*Uromyces aloes*) Disease from Ethiopia

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ABSTRACT

Aloe vera is a well-known medicinal plant for its potential biological activities in the health, pharmaceutical, and cosmetic industries. Aloes in Ethiopia currently face threats from fungal diseases, particularly rust caused by *Uromyces aloes*, which significantly alter their quality, quantity, and overall production. The study aims to identify fungal pathogens associated with *Aloe vera* leaf disease for possible treatment interventions. The study aims to identify fungal pathogens associated with *Aloe vera* leaf disease for possible management interventions. Leaf spot diseases were commonly observed in nurseries and private gardens in Addis Ababa, Ethiopia. Diseased samples with clear symptoms were carefully examined and the disease was found to be rust disease caused by *Uromyces aloes*. The diseased samples with clear symptoms were carefully examined and the disease was found to be rust disease caused by *Uromyces aloes*. The finding highlights the potential threat of rust diseases to *Aloe vera* in Ethiopia and underscores the importance of further research and effective disease management strategies. Currently, because of a lack of capacity for molecular identification, morphological characteristics were utilized for this preliminary report. However, to achieve a more accurate and comprehensive understanding of *Uromyces aloes*, future studies should incorporate standard molecular techniques. These techniques include sequencing of the internal transcribed spacer of ribosomal DNA with sequencing of other informative gene regions such as β -tubulin and EF1- α will be essential.

Keywords: *Aloe vera*; Rust; *Uromyces aloes*; Ethiopia

INTRODUCTION

Aloe vera is a perennial plant that comprises herbs, shrubs, and trees that originated in South East Africa and are now native to various regions, including sub-Saharan Africa, the island of Madagascar, the Canaries and the Mediterranean [1]. It is well-recognized for its leaf gel which contains amino acids, enzymes, lignin, minerals, mono and polysaccharides, phenolics, salicylic acid, saponins, and vitamins with potential biological activities useful in the health, pharmaceutical, and cosmetic industries [2].

In Ethiopia, *A. vera* is widely distributed and is rapidly expanding for medicinal, commercial and horticultural purposes that contribute to poverty reduction, economic empowerment, and social well-being [1]. There are about 46 recognized species of *A. vera* species in Ethiopia, of which the majority (66%) are endemic or near-endemic to the country. Fungal diseases pose significant threats to *A. vera*, severely affecting its growth and overall production. Rust disease is an emerging disease that causes chlorosis and stunted growth in Aloes [3]. Besides the wide distribution and economic importance of the *A. vera* species in Addis Ababa, the species was observed to be severely affected by emerging leaf spot disease at present. The study aims to identify the fungal pathogen associated with *Aloe vera* leaf disease for possible management interventions. This research serves as the first report on *Aloe vera* disease in Ethiopia, laying the foundation for future studies and sustainable disease management practices.

MATERIAL AND METHODS

A survey of plantation trees, nursery, ornamental, and medicinal plants was conducted in selected sub-cities of Addis Ababa during the spring growth season of 2024. Leaf spot diseases were commonly observed on *Aloe vera* in the nurseries and private gardens of Yeka, Lemi Kura, Bole, Gulele, and Akaki Kaliti sub-cities. The diseased leaves sample with patches were carefully examined, collected in a clean poly bag, and studied at the Ethiopian forest development laboratory for identification. The collected samples were sequentially washed using tap water and then with sterile water to remove any debris or contaminants that could interfere with microscopic examination. A small portion of each pustule sample from reddish spots in concentric circulars of rust teliosori on the leaves was aseptically taken using a sterile needle and mounted in a drop of sterile water on a clean microscopic slide. The slides were then covered with a coverslip to crest wet mount. The prepared slides were examined under an Olympus BX53 fluorescent digital microscope (Japan) and microphotographs of the fungal spore were taken.

RESULTS AND DISCUSSION

During our survey, we observed leaf spot disease symptoms with the appearance of rounded yellowish patches with small brown pustules in the center concentric rings of the center associated with necrotic tissues on the surface (Figure 1). Mosaics of large numbers of yellowish patches on the leaves finally progress, and merge forming severe necrosis, coalescing and dried leaves, which finally result in a loss of photosynthetic efficiency in the plant [4]. Based on the observed symptoms, the disease was identified as *Aloe vera* rust disease.

Microscopic examination showed that the teliospores and Urediniospores of *Uromyces aloes* exhibit distinct morphological characteristics of *Uromyces aloes*. Teliospores were observed with single-celled, hyaline, concentric, ringed, ovoid, often irregular and rounded apex [5,

6] 13.7-19.6 x 11-24 μm , verrucose wall-1.8 μm thick with long hyaline pedicles or spikes 1.3-2.3 to 3.5-6.4 μm at the tip (Figure 2). The Urediniospores were light brown and globular in shape, surrounded by a visible pigmented wall measuring around 15–20 \times 18–26 μm which is in line with [7]. Based on microscopic features, the fungus was identified as *Uromyces aloes* (Cooke) Magnus, which has not been previously properly identified and reported from Ethiopia to date.



Fig. 1 *Uromyces aloes* rust disease symptoms with varying degrees of severity on *Aloe vera* leaves as observed in the survey fields.

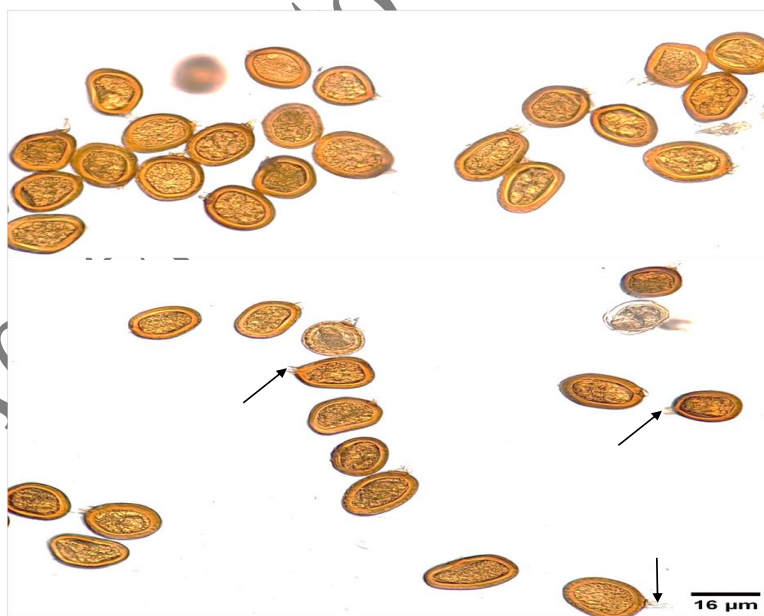


Fig. 2 Fungal Urediniospores and teliospores with spikes (arrows) of *Uromyces aloes* identified from diseased *A. vera* samples as seen under the Olympus fluorescent digital microscope BX53 (Japan).

Uromyces (Link) Unger, a genus of rust fungi, proposed by Unger in 1833 are the causal agent of rust diseases on various agricultural, horticultural, and forest plantation trees [4]. The species of the genus were recorded on host plants belonging to

the *Asteraceae*, *Euphorbiaceae*, *Fabaceae*, *Liliaceae*, *Loranthaceae*, *Aloeaceae*, and *Poaceae* families. *A. vera* species have been widely exported as ornamental and medicinal plants, so *U. aloes* are now becoming widely distributed in the world.

A. vera rust was first recorded by Ajrekar and Tonapy in 1923 from Talegaon, Pune, Maharashtra [5]. The genus *Aloe* is essentially widespread in the South and East of the African continent [8]. *U. aloes* have been recorded from different parts of the world, namely Africa (Kenya, Lesotho, Madagascar, Malawi, Rhodesia, Tanzania, and Uganda), India, and Europe, but this is the first report from Ethiopia with a complete morphological description.

Rust fungi are obligate biotrophic, diverse, and wide in host range causing massive destruction on host plants, especially in agricultural and horticultural crops, resulting in huge losses in terms of quality, quantity, and considered as a limiting factor for successful cultivation [3]. The detection of *A. vera* rust in Ethiopia raises concerns about the possible impacts of the diseases on *A. vera* production. The economic implications of this finding for local farmers are significant. The presence of rust disease of *Uromyces aloes* can lead to reduce *A. vera* growth, directly affecting farmers' income. Leaf spot disease in *A. vera* can significantly affect the morphological properties such as plant height, quality and texture of leaves including leaf color, shape, length and width, total number, fresh weight, mucilaginous gel result and biochemical constituents [2]. Field survey observation showed that inadequate spacing, poor sanitation, inadequate watering, and poor soil fertility are assumed to be the main factors for the suitability of *A. vera* to *Uromyces aloes* rust disease in study sites. Given that *Aloe vera* is cultivated for both medicinal and commercial purposes, a decline in its production could strain the financial resources of smallholder farmers. Additionally, rising production costs related to disease management can further affect livelihoods. This underscores the necessity of research on effective management strategies to ensure sustainable cultivation and support the well-being of these farmers.

Although this preliminary report relied on morphological characteristics for identification, there is a pressing need for standard molecular techniques involving sequencing of the ITS of rDNA in combination with other informative gene regions such as β -tubulin and EF1- α will be essential for a complete and accurate understanding in future research to design effective disease management option and improve the resilience and productivity of *Aloe vera* cultivation in Ethiopia.

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