

Mapping the Potential Risk of Mycetoma Infection in Sudan

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In 2013, the World Health Organization (WHO) recognized mycetoma as one of the neglected tropical conditions due to the efforts of the Mycetoma Consortium. This same consortium formulated knowledge gaps that require further research. One of these gaps was that few data are available on the epidemiology and transmission cycle of the causative agents. Previous work suggested a soil-borne or Acacia thorn-prick-mediated origin of mycetoma infections, but no studies have investigated effects of soil type and Acacia geographic distribution on mycetoma case distributions.

Here, we map risk of mycetoma infection across Sudan and South Sudan using Ecological Niche Modeling (ENM). For this study, records of mycetoma cases were obtained from the scientific literature and GIDEON; Acacia records were obtained from the Global Biodiversity Information Facility. We developed ENMs based on digital GIS data layers summarizing soil characteristics, land-surface temperature, and greenness indices to provide a rich picture of environmental variation across Sudan and South Sudan. ENMs were calibrated in known endemic districts and transferred countrywide; model results suggested that risk is greatest in an east-west belt across central Sudan. Visualizing ENMs in environmental dimensions, mycetoma occurs under diverse environmental conditions. We compared niches of mycetoma and Acacia trees, and could not reject the null hypothesis of niche similarity. This study revealed contributions of different environmental factors to mycetoma infection risk, identified suitable environments and regions for transmission, signaled a potential mycetoma-Acacia association, and provided steps towards a robust risk map for the disease.