Case Report: Evidence of Tungiasis in the Amazon Rain Forest of Ecuador

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Abstract. Tungiasis occurs in tropical and subtropical areas in Central and South America and sub-Saharan Africa and is a Neglected Tropical Disease. We diagnosed three cases of tungiasis in a Dutch family visiting indigenous communities in the Amazon basin of Ecuador. Eight days after returning, they presented papular, pruritic, and painful lesions on the feet, with a whitish halo and a blackish central point with abundant whitish eggs upon extraction. For the first time, we demonstrate that *Tunga* spp. transmission is present in remote indigenous communities in the Amazon rainforest of Ecuador. It will be important to investigate the occurrence of tungiasis and associated morbidity among local inhabitants and consider prevention measures among locals and travelers to these areas.

INTRODUCTION

Tungiasis is an ectoparasitic disease caused by the penetration of female sand fleas (*Tunga penetrans*; in some areas also *Tunga trimamillata*) into the skin. Since 2017, along with scabies and myiasis, it has been classified as a Neglected Tropical Disease.¹ Tungiasis is a zoonosis that affects humans, domestic animals (e.g., pigs, dogs, and cats), and sylvatic animals. It occurs mainly in rural and peri-urban settings in conditions of poor hygiene where people live in houses with dirt floors. Tungiasis is considered an “exotic” pathology in rural inhabitants of countries of Africa, the Caribbean, Central and South America. This includes indigenous Amazonian inhabitants of Colombia, Venezuela, and Brazil^{2–5} as well as international travelers who visit these regions.^{6,7}

In the Amazon basin of Ecuador, tungiasis is called “nigua or pique” in Kichwa; “aju” by the Shuar, Achuar, and Shiwiar; and “wanca” by the Huaorani indigenous communities. However, there are no previous published studies or reports from the Ecuadorian Amazon. According to the official data of the National Institute of Vital Statistics, seven cases of tungiasis (ICD-10 code B88.1) were registered between 2013 and 2017, all of which came from the Pacific Coastal region.⁸ While in the Automated Daily Registry of Outpatient Consultations and Attention of the Ministry of Public Health of Ecuador, 79 cases were registered between 2013 and 2015.⁹

Ecuador is a country located in the northwest of South America, bisected by the Andes mountains from north to south, dividing the country into three regions: central Andean region with a temperate climate, the western coastal Pacific region, and the eastern Amazon region, the latter bordered by Colombia and Peru, both with a tropical climate (Figure 1). Indigenous communities of various ethnic groups reside in the interior of the Amazon region in small, dispersed communities without sanitary infrastructure and with limited access to healthcare because of distance and poor access.

Here we report cases of tungiasis in a resident European family that traveled to three rural indigenous communities in the Ecuadorian Amazon. We emphasize the importance of increasing awareness of tungiasis among locals and travelers to remote Amazon communities and informing local health

authorities of the presence of this Neglected Tropical Disease to guide future surveillance activities.

DESCRIPTION OF THE PATIENTS' TRIP AND CLINICAL FEATURES

A Dutch family of eight members, a 33-year-old father and mother with six children (the oldest 11 years old and the youngest 6 months old), accompanied by two local residents, visited four indigenous communities, located in the Central Amazon of the provinces of Pastaza and Morona Santiago-Ecuador (Figure 1). They visited the communities of Shiwar, Shuar, and Kichwa, located 67, 50, and 40 km, respectively, from the city of Puyo, the capital of Pastaza province. They traveled by plane, vehicle, and foot, and they spent a night in each of the communities. The communities are inhabited by indigenous peoples who live in wooden huts, with roofs made of palm leaf or zinc and floors of sand and dry earth or wood. Children and adults do not wear shoes while they are at home or when playing or walking in the community. They sleep on the wooden floor or in hammocks. Inside their houses they had animals such as dogs, cats, chickens, free-living pigs, and wild animals such as tapirs, peccaries, monkeys, birds, and wild rodents that are family pets. Their diet is based on fish and meat from domestic and hunted wild animals. The two infected children wore open rubber sandals and had contact with a tapir (*Tapirus terrestris*) that was kept close to the house in one of the communities.

Eight days after returning to the city of Puyo, the father and two children of 9 and 7 years observed the presence of raised lesions with a whitish halo, pruritic at night, that increased in size and became more painful in the following days, making walking difficult. All those affected were in good health, afebrile, with normal clinical signs. Physical examination of the father's feet revealed two lesions located on the sole of the left foot (Figure 2A). One lesion was found on each child, located on the sole of the right foot of one child and on the tip of the fourth toe of the other child. We observed papular lesions of 5–6 mm in diameter with a blackish central point and a well-circumscribed whitish border, painful on pressure and when walking. No other skin lesions were seen. On the recommendation of indigenous people living in the area, the mother of the children and the wife of the adult patient perforated the lesions transversely and longitudinally with a clean needle using antiseptic alcohol, yielding abundant whitish

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FIGURE 1. Map of Ecuador. The Andes mountain range is the central Andean region with a temperate climate. To the west is the Pacific Coast; to the east is the Amazon basin. Triangles indicate the communities visited and contagious by the Dutch travelers. The Amazon, with altitude below 750 m, comprises 116,588.10 km², representing 45.47% of the Ecuadorian continental territory. It has a humid tropical climate throughout the year.

eggs. Within 2–3 days, the lesions crusted and healed (Figure 2B) without further complications. Tetanus toxoid was not administered because all had received the vaccine within the previous 10 years, and antibiotics were not considered necessary because none had signs of bacterial infection. The two local resident travelers did not report similar lesions. The *Tunga* species was not identified. The father signed informed consent to publish the cases.

DISCUSSION

We documented for the first time cases of tungiasis in the Ecuadorian Amazon in a European family visiting indigenous communities in an isolated tropical rain forest region. Tungiasis has a specific name in the languages of the three indigenous nationalities visited (Shiwiar, Shuar, and Kichwa). Our observations indicate that these communities are endemic for the “sand flea” *Tunga* spp., confirming previous reports in indigenous peoples of the Amazon basin of Colombia, Venezuela, and Brazil.^{2–5}

In Ecuador, official national data have reported tungiasis from the Pacific Coast, and health authorities consider tungiasis to be endemic.^{8,9} The actual incidence and geographic distribution is unknown because there are no national studies. Furthermore, tungiasis is not a mandatory epidemiological notifiable disease, thus reducing the opportunity to register in national statistics. The rural inhabitants recognize tungiasis, and lesions are managed locally with “punctures.” Infected individuals rarely visiting health centers, leading to

underreporting of official health statistics. There is a need for future studies to determine of occurrence, prevalence, and geographical distribution of tungiasis in Amazon communities and other geoclimatic regions of the country; the development of a locally appropriate conceptual framework for the control of tungiasis through public health action has been recommended for tungiasis.¹⁰

In this report, three of the eight family travelers acquired tungiasis after spending three nights in the Amazon indigenous communities. The combination of dry earth floors and the presence of reservoir animals within houses created a perfect habitat for the maintenance of the life cycle of the “sand flea.” The infected children had close contact with a tapir (*Tapirus terrestris*), which could be a reservoir of tungiasis, although it is not currently included among potential reservoirs.¹¹ Future research is needed to determine the role of “semi-domesticated” tapirs, a typical wild mammal of South America, in the life cycle of *Tunga* spp. In such communities, tapirs are prized for their meat and are captured young and raised to maturity before being slaughtered.

International and domestic travelers returning from the tropics frequently have dermatological problems. Although most present with common dermatoses such as eczema, acne, insect bites, or fungal or bacterial infections, a small number have tropical skin diseases as leishmaniasis, tungiasis, cutaneous larva migrans, and myiasis.^{6,7} A male Canadian tourist was diagnosed with typical lesion of tungiasis after spending 3 months in Ecuador.¹²

FIGURE 2. (A) Sole of the left foot of the adult patient. The two papular lesions are observed (rounded, 6 mm in diameter). The well-defined halo corresponds to the hypertrophy of the abdomen full of eggs. The blackish point in the center corresponds to the abdominal tip of the adult female flea that is embedded in the skin. (B) Right foot of the infected child. Healing ulceration is observed 2 days after manual extraction of *Tunga* sp. made by her mother. Not given antibiotics or local anesthesia.

Previously, treatment of tungiasis consisted of complete sterile excision of the flea. A topical treatment with two-component dimeticone (NYDA®; Pohl-Boskamp GmbH & Co., Hohenlockstedt, Germany) has been used since 2014¹³ but is not yet available in Ecuador. In the present cases, self-treatment by needle perforation was effective without complications. However, several authors reported bacterial superinfection and risk of transmission of HIV and hepatitis B and C virus caused by self-extraction in endemic communities.¹⁴ This practice has to be avoided because rupture of the parasite increases the risk of intense local inflammation.¹⁴

An awareness of tungiasis and its geographical distribution in Ecuador would help national and international travelers to these endemic areas avoid infection through the use of closed shoes and not sandals. Rapid epidemiological assessments are now needed to define the epidemiology of tungiasis in communities in the Amazon and potentially endemic regions of Ecuador and to target prevention and treatment programs by government and nongovernmental organization partners to reduce the morbidity in these communities attributable to this potentially debilitating ectoparasitic infection.

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