Review

Epidemiology of Clinical Sporotrichosis in the Americas in the Last Ten Years

Rigoberto Hernández-Castro 1,†, Rodolfo Pinto-Almazán 2,3,†, Roberto Arenas 4,5,†, Carlos Daniel Sánchez-Cádenas 6, Victor Manuel Espinosa-Hernández 7, Karla Yaeko Sierra-Maeda 1, Esther Conde-Cuevas 7, Eder R. Juárez-Durán 4, Juan Xicohtencatl-Cortes 8, Erika Margarita Carrillo-Casas 9, Jimmy Steven-Velasquez 10, Erick Martínez-Herrera 2,5,†, and Carmen Rodríguez-Cerdeira 5,11,12,†

1 Departamento de Ecología de Agentes Patógenos, Hospital General “Dr. Manuel Gea González”, Ciudad de México 14080, Mexico; rigo37@gmail.com (R.H.-C.); yaeesierra@gmail.com (K.Y.-M.)
2 Sección de Estudios de Posgrado e Investigación, Escuela Superior de Medicina, Instituto Politécnico Nacional, Plan de San Luis y Díaz Mirón, Ciudad de México 11340, Mexico; rodolfo.pintoalmazan@gmail.com
3 Noncommunicable Diseases Research Group, Universidad La Salle-México, Benjamín Franklin 45, Mexico City 06140, Mexico
4 Sección de Micología, Hospital General “Dr. Manuel Gea González”, Tlalpan, Ciudad de México 14080, Mexico; rarenas98@hotmail.com (R.A.); rodrigo575@hotmail.com (E.R.-D.)
5 Efficiency, Quality, and Costs in Health Services Research Group (EFISALUD), Galicia Sur Health Research Institute (IIS Galicia Sur), SERGAS-UVIGO, 36213 Vigo, Spain
6 Servicio de Dermatología, Centro Médico Nacional La Raza, Paseo de las Jarascandas S/N, La Raza, Azcapotzalco, Ciudad de México 02990, Mexico; jefegrillo@gmail.com
7 Maestría en Ciencias de la Salud, Escuela Superior de Medicina, Instituto Politécnico Nacional, Plan de San Luis y Díaz Mirón, Ciudad de México 11340, Mexico; victor.espinosa-azul@hotmail.com (V.M.E.-H.); condeesther999@gmail.com (E.C.-C.)
8 Laboratorio de Bacteriología Intestinal, Hospital Infantil de México “Dr. Federico Gómez”, Ciudad de México 06720, Mexico; juanxicoyo@yahoo.com
9 Departamento de Biología Molecular e Histocompatibilidad, Hospital General “Dr. Manuel Gea González”, Tlapal, Ciudad de México 14080, Mexico; ekarri@gmail.com
10 Hospital General San Juan de Dios, 1ra Avenida “A” 10-50, zona 1, Ciudad de Guatemala 01001, Guatemala; js.velasquez@gmail.com
11 Dermatology Department, Hospital Vithas Vigo and University of Vigo, 36206 Vigo, Spain
12 Campus Universitario, University of Vigo, 36310 Vigo, Spain
* Correspondence: erickmartinez_69@hotmail.com (E.M.-H.); carmen.cerdeira33@gmail.com (C.R.-C.)
† These authors contributed equally to this work.

Abstract: Background: Sporotrichosis is a fungal infection caused by species of the Sporothrix genus. Presently, the prevalence of sporotrichosis in the Americas is unknown, so this study aims to analyze the cases reported in the past 10 years. Methods: An advanced search was conducted from 2012 to 2022 in English and Spanish in PUBMED, SciELO, and Cochrane, with the terms: “sporotrichosis”, “lymphocutaneous sporotrichosis”, “fixed sporotrichosis”, “mycosis”, “Sporothrix spp.”, “Sporothrix complex”, “S. schenckii sensu stricto”, “S. schenckii sensu lato”, “S. globosa”, “S. brasiliensis”, “S. luriei”. Sporotrichosis is a fungal infection caused by species of the Sporothrix genus associated with “pathogenicity” or “epidemiology”. Results: A total of 124 articles were found in the Americas, corresponding to 12,568 patients. Of these, 87.38% of cases were reported in South America, 11.62% in North America, and 1.00% in Central America and the Caribbean. Brazil, Peru, and Mexico had the highest number of cases. The most prevalent etiological agents were S. schenckii complex / Sporothrix spp. (52.91%), S. schenckii (42.38%), others (4.68%), and Not Determined (ND) (0.03%). The most frequent form of the disease was lymphocutaneous infection; however, the infection type was not determined in 5639 cases. Among the diagnostic methods, culture was the most used. Conclusions: There is a high occurrence of cases reported in the literature. South America is the region with the highest number of reports because of its environment (climate, inhalation of spores, etc.), zoontic transmission (scratches and sneezes from contaminated animals), and possible traumatic inoculation due to outdoor activities (agriculture, gardening, and related occupations). Molecular diagnosis has not been sufficiently developed due to its high cost.
Keywords: sporotrichosis; Sporothrix schenckii sensu stricto; Sporothrix schenckii complex; lymphocutaneous sporotrichosis; fixed cutaneous sporotrichosis; disseminated sporotrichosis; the Americas

1. Introduction

Sporotrichosis is a fungal infection caused by thermo-dimorphic fungi species of the Sporothrix genus. Previously, the classification of the species of sporotrichosis was conducted through the classification of the Sporothrix schenckii complex, which included Sporothrix schenckii sensu stricto, Sporothrix brasiliensis (S. brasiliensis), Sporothrix globosa (S. globosa), Sporothrix luriei (S. lurieri), Sporothrix pallida (S. pallida), Sporothrix mexicana (S. mexicana), and Sporothrix chilensis (S. chilensis) [1,2]. However, since 2016, the taxonomical classification of Sporothrix has been changed into a clinical clade that includes Sporothrix schenckii, S. globosa, S. brasiliensis, and S. luriei. On some occasions, the species of the environmental clade, such as S. pallida, S. mexicana, and S. chilensis may cause infection upon contact with an individual [1–4]. The infections occur mainly cutaneously or subcutaneously with lymphatic involvement [1–4]. This infection has been considered the most frequent subcutaneous mycosis in Latin America [2]. Such infections can be difficult to diagnose with the naked eye since they can be similar to infiltrative or ulcerative lesions from vascular and inflammatory disorders [1,3].

For this subcutaneous infection to develop, a direct trauma must occur first. For example, inoculation occurs when the skin is punctured by plants with thorns, gardeners are a classic case of this. Also, inoculation can occur through fomites that contact contaminated soil. For instance, people who wear sandals can suffer trauma from stones, firewood, or thorns with fungal spores on their surface [2,3]. With all the above, it can be inferred that this type of fungal infection is associated with regions where the main livelihood is agriculture, that is, in environments where the climate is tropical and subtropical. Another form of transmission, which has been increasing in recent times in some regions of the continent such as Brazil, Argentina, Paraguay, and Panama, has been reported to result from scratches, bites, pecks, and stings from different animals [1–4].

There are several techniques for detecting sporotrichosis, including Sabouraud dextrose agar cultures, lactophenol blue or erythromycin staining, histopathological studies, and PCR sequencing, among others [5–7] (Figure 1).

Figure 1. Sporothrix spp. culture and erythromycin staining 40×.

As for the clinical forms of sporotrichosis, various types have been described, such as the lymphocutaneous, fixed cutaneous, and, as mentioned earlier, the disseminated or hematogenous forms where both organs and tissues can be affected [5–28]. The latter is the rarest because the recommended antifungal regimens are usually effective; however, in patients with alterations in cellular immunity, these infections can spread [2–4].
2. Materials and Methods

An advanced search was conducted in English and Spanish languages in the engines Medical Literature Analysis and Retrieval System Online (MEDLINE/PUBMED), Scientific Electronic Library Online (SciELO), and Cochrane Database. Because the systematic review was performed for the 10 last years (2012–2022), both taxonomical classifications were used. The applied terms were “sporotrichosis”, “lymphocutaneous sporotrichosis”, “fixed sporotrichosis”, “Sporothrix spp.” and “Sporothrix schenckii complex”, “S. schenckii sensu stricto”, and “S. schenckii sensu lato”, Sporothrix schenckii, (Sporothrix schenckii), Sporothrix brasiliensis (S. brasiliensis), Sporothrix globosa (S. globosa), Sporothrix luriei (S. luriei), Sporothrix pallida (S. pallida), Sporothrix mexicana (S. mexicana), and Sporothrix chilensis (S. chilensis) associated with “pathogenicity” or “epidemiology”. The total number of articles found was 243. The review was performed based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Figure 2). After reading the titles and reviewing the complete text, the most relevant papers to develop this article were identified. At the end of the selection process, 127 articles were chosen. The review was performed based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA).

Figure 2. Flowchart of the different phases of the systematic review.
3. Epidemiology of Sporotrichosis in North America

A total of 48 publications related to sporotrichosis were found in North America [5–52]. There were 1460 patients in total associated with infection caused by species of the genus Sporothrix. According to the previous classification, it was found that in Canada, only two case reports were found, one from Ontario and the other from Toronto [5,6]. In the US, 27 reports containing 1 clinical case were found (81.5% S. schenckii, 18.5% Sporothrix spp., S. schenckii complex, and S. schenckii sensu lato) [7–33]. Of these, seven cases came from California, three from Oklahoma, two cases from Kansas, Texas, Arizona, Minnesota, and Florida, one case from Michigan, Nebraska, Oregon, Pennsylvania, and finally, one case without a specific city or region. In Mexico, there were 19 reports registered with 1431 reported cases (84.7% Sporothrix spp., 14.47% S. schenckii, 0.55% S. globosa, 0.21% S. schenckii sensu stricto, 0.07% S. mexicana) [34–52]. Jalisco reported 1060 cases, Guerrero 150, Nayarit 23, Zacatecas 21, Michoacan 20, Guanajuato 14, Oaxaca 9, Puebla, and San Luis Potosi 8 each, Mexico City 6, Chihuahua, Nuevo León, Querétaro, and Veracruz 2 each, Baja California, Durango, State of Mexico, and Morelos 1 each, and 99 cases were reported with an unspecified city (Table 1). When classifying according to the current taxonomy [1–4], we can mention that in Canada, 50% of the sporotrichosis was due to S. schenckii and 50% to Sporothrix spp. [5,6]. In the US, it was reported that Sporothrix spp. (85.19%) and S. schenckii (14.81%) were responsible for this pathology [7–33]. Finally, in Mexico, 85.05% were due to Sporothrix spp., 14.33% S. schenckii, 0.55% S. globosa, and 0.07% S. mexicana [34–52].

The most frequent variety reported was lymphocutaneous with 956 cases, followed by fixed cutaneous with 388 cases, and the disseminated form with 83 [5–52]. A lymphocutaneous presentation evolved into a disseminated after 10 months. The least frequent varieties were the disseminated cutaneous with 16 cases, disseminated cutaneous with affected mucous membranes and arthritis with 3 cases each, and the pulmonary form with 2 cases. Finally, lymphadenitis, meningitis, laryngotracheal joint, visceral fungemia, visceral infection associated with fungemia, an atypical presentation, and a visceral presentation with fungemia and mucosal involvement were only reported in one case each. The most common reported etiological agent with the new taxonomical classification was Sporothrix spp. with 85.00% (1241/1460), followed by S. schenckii with 14.38% (210/1460), S. globosa with 0.54% (8/1460), and S. mexicana with 0.068% (1/1460) [5–52].

In terms of the diagnosis, fungal culture was the most frequently used diagnostic methodology with 33/48, followed by histopathological examination with 20/48. It is worth noting that the histopathological examination was always accompanied by fungal cultures. PCR sequencing was the third method used in 11/48 studies. For this diagnostic tool, the Calmodulin gene was used in 7 cases, the ITS1-2 region in 3 cases, and an unspecified gene in 1 case. Also, the MALDI-TOF and the agglutination latex test were used for diagnosis in two reports. Finally, the use of the Sporotrichin Skin Test and physical examination was mentioned in one report, and one case was reported without describing the employed diagnostic method [5–52].
Table 1. Epidemiology of Sporotrichosis in North America.

| Region       | Country | City      | Number of Reported Cases | Sex   | Age (Years) | Vulnerable Population | Diagnostic Method                  | Type of Sporotrichosis | Etiological Agents (%) | Taxonomy | References |
|--------------|---------|-----------|--------------------------|-------|-------------|-----------------------|------------------------------------|------------------------|------------------------|-----------|------------|
| North America | USA     | California | 1                        | Male  | 44          | PCR sequencing (ITS region) | Disseminated                     | S. schenckii            | S. schenckii          |           | [5]        |
|              |         | Toronto    | 1                        | Male  | 78          | Fungal culture, Biopsy (Histopathology) | Lymphocutaneous                 | S. schenckii complex      | Sporothrix spp.       | [6]        |
|              |         | California | 1                        | Female | 7           | Fungal culture, Biopsy (Histopathology) | Lymphocutaneous                 | S. schenckii            | Sporothrix spp.       | [7]        |
|              |         | Minnesota  | 1                        | Male  | 61          | Fungal culture | Disseminated          | S. schenckii            | Sporothrix spp.       | [8]        |
|              |         | ND         | 1                        | Female | 87          | Fungal culture | Lymphocutaneous on the eyelid | S. schenckii            | Sporothrix spp.       | [9]        |
|              |         | Pennsylvania | 1                        | Male  | 67          | Fungal culture, Biopsy (Histopathology) | Lymphocutaneous | S. schenckii            | Sporothrix spp.       |           | [10]       |
|              |         | Texas      | 1                        | Male  | 34          | Fungal culture, Biopsy (Histopathology) | Disseminated              | Sporothrix spp. | Sporothrix spp.     |           | [11]       |
|              |         | Texas      | 1                        | Male  | 9           | Fungal culture, Biopsy (Histopathology) | Lymphocutaneous on the eyelid | S. schenckii            | Sporothrix spp.       |           | [12]       |
|              |         | California | 1                        | Female | 41          | Fungal culture |                  | Lymphocutaneous       | S. schenckii            | Sporothrix spp.       |           | [13]       |
|              |         | Oregon     | 1                        | Male  | 53          | Fungal culture | Disseminated          | Sporothrix spp. | Sporothrix spp.     |           | [14]       |
|              |         | Oklahoma   | 1                        | Male  | 66          | Latex agglutination test | Disseminated          | S. schenckii            | Sporothrix spp.       |           | [15]       |
|              |         | Florida    | 1                        | Male  | 33 month-Old | Fungal culture, Biopsy (Histopathology) | Atypical lymphadenitis | S. schenckii            | Sporothrix spp.       |           | [16]       |
|              |         | Minnesota  | 1                        | Male  | 49          | Fungal culture | Pulmonary sporotrichosis | Sporothrix spp. | Sporothrix spp.     |           | [17]       |
|              |         | Arizona    | 1                        | Male  | 56          | Fungal culture | Lymphocutaneous and disseminated (10 months later) | S. schenckii            | Sporothrix spp.       |           | [18]       |
|              |         | California | 1                        | Male  | 39          | Fungal culture | Sporothrical arthritis | S. schenckii            | Sporothrix spp.       |           | [19]       |
Table 1. Cont.

| Region  | Country | City | Number of Reported Cases | Vulnerable Population | Diagnostic Method | Type of Sporotrichosis | Etiological Agents (% | Taxonomy | References |
|---------|---------|------|--------------------------|-----------------------|--------------------|------------------------|------------------------|----------|------------|
|         |         |      |                          | Sex   | Age (Years) |                         |                        | Before 2017 | After 2017 |
| North America | USA |      |                          | Male  | 89         | Fungal culture Biopsy (Histopathology) | Disseminated           | S. schenckii | Sporothrix spp. | [20]    |
|         |         |      |                          | Female | 57         | Fungal culture Biopsy (Histopathology) | Lymphocutaneous        | S. schenckii | Sporothrix spp. | [21]    |
|         |         |      |                          | Male  | 34         | Latex agglutination test | Chronic meningitis     | S. schenckii | Sporothrix spp. | [22]    |
|         |         |      |                          | Male  | 33         | Fungal culture MALDI-TOF | Sporothrical arthritis | S. schenckii | Sporothrix schenckii | [23]    |
|         |         |      |                          | Male  | 44         | Fungal culture Biopsy (Histopathology) | Pulmonary sporotrichosis | S. schenckii sensu lato | Sporothrix spp. | [24]    |
|         |         |      |                          | Male  | 41         | Fungal culture | Sporothrical arthritis | S. schenckii | Sporothrix spp. | [25]    |
|         |         |      |                          | Female | 35         | Fungal culture | Disseminated | S. schenckii | Sporothrix spp. | [26]    |
|         |         |      |                          | Male  | 62         | Fungal culture Biopsy (Histopathology) | Disseminated | S. schenckii | Sporothrix spp. | [27]    |
|         |         |      |                          | Female | 35         | MALDI-TOF | Fixed cutaneous | S. schenckii | S. schenckii | [28]    |
|         |         |      |                          | Male  | 30         | Fungal culture Biopsy (Histopathology) | Disseminated | S. schenckii | Sporothrix spp. | [29]    |
|         |         |      |                          | Male  | 76         | History and physical examination | Lymphocutaneous | Sporothrix spp. | Sporothrix spp. | [30]    |
|         |         |      |                          | Male  | 23         | Fungal culture | Lymphocutaneous | S. schenckii complex | Sporothrix spp. | [31]    |
|         |         |      |                          | Female | 44         | Fungal culture PCR sequencing (ITS 1–2) | Disseminated | S. schenckii | S. schenckii | [32]    |
|         |         |      |                          | Female | 72         | PCR DNA sequencing | Laryngotracheal granulomatous disease | S. schenckii | S. schenckii | [33]    |
| Region     | Country | City       | Number of Reported Cases | Sex | Age (Years) | Vulnerable Population | Diagnostic Method                           | Type of Sporotrichosis                      | Etiological Agents (%) | Taxonomy | References |
|------------|---------|------------|--------------------------|-----|-------------|-----------------------|---------------------------------------------|---------------------------------------------|----------------------------|----------|------------|
| North America | Mexico   | Veracruz   | 1                        | Male | 39          | Fungal culture         | Atypical                                    | S. schenckii                  | Sporothrix spp.          | [34]     |           |
|            |         | Puebla     | 1                        | Male | 36          | Fungal culture         | Disseminated                                 | S. schenckii                  | Sporothrix spp.          | [35]     |           |
|            |         | Oaxaca     | 1                        | Male | 13          | Fungal culture         | Lymphocutaneous on the left hand, forearm, and upper arm | Sporothrix spp.               | Sporothrix spp.          | [36]     |           |
|            |         | Mexico City | 1                        | Male | 54          | Fungal culture         | Disseminated (Testicular involvement)        | S. schenckii                  | Sporothrix spp.          | [37]     |           |
|            |         | Guerrero   | 1                        | Female | 36        | Fungal culture         | Disseminated                                 | Sporothrix spp.               | Sporothrix spp.          | [38]     |           |
|            |         | Durango    | 1                        | Male | 68          | Fungal culture         | Disseminated                                 | Sporothrix spp.               | Sporothrix spp.          | [39]     |           |
|            |         | ND         | 24                       | Male (16) | Female (8) | Average: 35.5          | PCR sequencing (calmodulin gene)             | Cutaneous disseminated 16 (66.7%)
Cutaneous disseminated + Mucosal 3 (12.5%)
Joint 1 (4.1%)
Visceral 1 (4.1%)
Fungaemia 1 (4.1%)
Mucosal + Visceral + Fungaemia: 1 (4.1%)
Visceral + Fungaemia 1 (4.1%) | S. schenckii 23 (95.5%).
S. globosa 1 (4.5%) | S. schenckii 23 (95.5%).
S. globosa 1 (4.5%) | [40]     |           |
|            |         | ND         | 55                       | Male (34) | Female (18) | Sporothrichin Skin Test | Lymphocutaneous 32 (58.2%)
Fixed cutaneous 19 (34.5%)
Disseminated 4 (7.3%) | S. schenckii 54 (98%)
S. globosa 1 (2%) | S. schenckii 54 (98%)
S. globosa 1 (2%) | [41]     |           |
| Region            | Country       | City               | Number of Reported Cases | Sex            | Age (Years) | Diagnostic Method                      | Type of Sporotrichosis                        | Etiological Agents (%) | Taxonomy | References |
|------------------|---------------|--------------------|--------------------------|----------------|-------------|----------------------------------------|-----------------------------------------------|------------------------|----------|------------|
| North America    | Mexico        | Guerrero           | 73                       | Male           | 33 (33)    | Average: 25.8 Fungal culture Biopsy (Histopathology) | Lymphocutaneous: 41 (56.16%)                  | S. schenckii           | S. schenckii | [42]       |
|                  |               |                    |                          | Female         | 40 (40)    |                                        | Fixed cutaneous 24 (32.87%) Disseminated 8 (10.95%) |                        |          |            |
|                  |               | Chihuahua          | 1                        | Female         | 84         | Multiplex PCR (Calmodulin gene)        | Fixed cutaneous (Auricular sporotrichosis)   | S. schenckii (sensu stricto) | S. schenckii | [43]       |
|                  |               | Baja California    | 1                        | Male           | 23         | Fungal culture Biopsy (Histopathology) | Lymphocutaneous                               | S. schenckii           | Sporothrix spp. | [44]       |
|                  |               |                    | 22                       | ND             |            | PCR sequencing                          |                          |                        |          |            |
|                  |               |                    |                          |                |            | (Calmodulin and calcium-calmodulin-dependent kinase genes) |                            |                        |          |            |
|                  | Mexico City   | San Luis           | 8                        |                |            |                                        | Lymphocutaneous: 17 (77.3%)                   | S. schenckii           | S. schenckii | [45]       |
|                  | Puebla        | Puebla 3           | 3                        |                |            |                                        | Fixed cutaneous 4 (18.2%) Disseminated 1 (4.5%) | S. globosa             | S. globosa |            |
|                  | Mexico City   | Guanajuato 2       | 2                        |                |            |                                        |                            |                        |          |            |
|                  | Morelos 1     | Zacatecas 1        | 1                        |                |            |                                        |                            |                        |          |            |
|                  | Michoacan 1   | Michoacan 1        | 1                        |                |            |                                        |                            |                        |          |            |
|                  | Jalisco 1     | Jalisco 1          | 1                        |                |            |                                        |                            |                        |          |            |
|                  | Morelos 1     | Morelos 1          | 1                        |                |            |                                        |                            |                        |          |            |
|                  | State of      | State of Mexico 1  | 1                        |                |            |                                        |                            |                        |          |            |
|                  | Mexico        | Mexico City 3      | 3                        |                |            |                                        |                            |                        |          |            |
|                  |                    | Guadalajara 2      | 2                        |                |            |                                        |                            |                        |          |            |
|                  |                    |                    | 17                       | ND             |            | PCR sequencing                          | Lymphocutaneous: 16 (94.11%) Disseminated: 1 (5.88%) | S. schenckii           | S. schenckii | [46]       |
|                  |                    |                    |                          |                |            | (Calmodulin gene)                       |                            | S. globosa             | S. globosa |            |
|                  |                    |                    |                          |                |            |                                        |                            |                        |          |            |
|                  | Guerrero       | Guerrero           | 76                       | Male           | 35 (35)    | Fungal culture Biopsy (Histopathology) | Lymphocutaneous 43 (56.8%) Fixed cutaneous 24 (32.3%) Disseminated 8 (11%) | Sporothrix spp.         | Sporothrix spp. | [47]       |
|                  | Female         | 41 (41)            |                          |                |            |                                        |                            |                        |          |            |
Table 1. Cont.

| Region       | Country | City            | Number of Reported Cases | Vulnerable Population | Diagnostic Method                      | Type of Sporotrichosis          | Etiological Agents (%) | Taxonomy | References |
|--------------|---------|-----------------|--------------------------|-----------------------|----------------------------------------|-------------------------------|------------------------|-----------|------------|
| North America| Mexico  | Jalisco 1057    |                          | Male (669) Female (465) | ND                                | Lymphocutaneous: 782 (69%)  | S. schenckii complex    | Sporothrix spp. | [48]       |
|              |         | Nayarit 23      |                          | ND                    |                                       | Fixed cutaneous: 308 (27.2%) | S. schenckii            |                       |            |
|              |         | Zacatecas 20    |                          | ND                    |                                       | Disseminated: 44 (38.8%)     | S. schenckii            |                       |            |
|              |         | Michoacan 1134  |                          | ND                    | PCR sequencing (Calmodulin gene)      | Fixed cutaneous sporotrichosis | S. mexicana          | S. mexicana | [50]       |
|              |         | Guanajuato 12   |                          | ND                    | Fungal Culture Biopsy (Histopathology) | Fixed cutaneous: 13 (72.2%)  | S. schenckii            |                       |            |
|              |         | Veracruz 1      |                          | ND                    | PCR sequencing (ITS regions)           | Lymphocutaneous: 17 (94.4%)  | S. schenckii            |                       |            |
|              |         | Chihuahua 1     |                          | ND                    |                                        | Fixed cutaneous: 5 (27.8%)   | S. globosa: 1            | S. globosa: 1       | [51]       |
|              |         | Oaxaca 2        |                          | ND                    | Multiplex PCR (Calmodulin gene)       | Fixed cutaneous: 1 (50%)     | S. schenckii sensu stricto | S. schenckii | [52]       |

ND: Not Determined.
4. Epidemiology of Sporotrichosis in Central America and the Caribbean

Only 8 publications with 126 cases of sporotrichosis were found in Central America and the Caribbean [53–60]. In the only article found from Costa Rica during the search period, 57 isolates were analyzed in San José, finding the presence of 2 species: *S. schenckii* sensu stricto (93%), *S. brasiliensis* (3.5%), and *Sporothrix* spp. (3.5%) [53]. On the other hand, there were 3 reports in Guatemala with 65 cases (98.5% *Sporothrix* spp. and 1.5% *S. schenckii* sensu stricto), with all cases being from Guatemala City [54–56]. Finally, reports of a single case were found in Honduras (Tegucigalpa); the agent responsible for the infection was *S. schenckii*, and in Panama (Correa District), the agent was not determined [57,58]. In the Caribbean, only two reports of *S. schenckii* sensu lato from Cuba were found [59,60].

Regarding the new taxonomic classification, it was determined that in Costa Rica, 93% of the cases were caused by *S. schenckii*, 3.5% by *S. brasiliensis*, and 3.5% by *Sporothrix* spp. [53]. Meanwhile, in Guatemala, the main pathogenic agent was *Sporothrix* spp. with 98.5% and *S. schenckii* with 1.5% [54–56]. In Honduras and Panama, it was observed that the agent *Sporothrix* spp. was responsible for sporotrichosis, with one case per country (100%) [57,58]. In Cuba, there were two reports of a case due to *Sporothrix* spp., which represents 100% [59,60].

The most frequently reported form was lymphocutaneous with 39 cases (30.95%), followed by fixed cutaneous with 26 (20.63%), the disseminated form with 2 (1.59%), 1 case of chancre (0.79%), and 58 ND cases (46.03%) [53–60]. The most common etiological agents noted were *Sporothrix* spp. with 55.56% (70/126), *S. schenckii* with 42.85% (54/126), and *S. brasiliensis* with 1.59% (2/126) [53–60].

Regarding diagnosis, fungal culture was used as a diagnostic method in all articles (8/8), followed by histopathological examination (5/8). In this case, also, the histopathological examination was always accompanied by fungal cultures. PCR sequencing (2/8) employing the calmodulin gene in one article and the ITS1-2 region in the other was also used as a diagnostic tool. Lastly, diagnosis with microscopy using lactophenol blue was mentioned in two reports (Table 2) [53–60].
Table 2. Epidemiology of Sporotrichosis in Central America and the Caribbean.

| Region   | Country      | City         | Number of Reported Cases | Vulnerable Population | Diagnostic Method                                                                 | Type of Sporotrichosis  | Etiological Agents (%) | Taxonomy       | References |
|----------|--------------|--------------|--------------------------|------------------------|-----------------------------------------------------------------------------------|--------------------------|------------------------|------------------------|------------|
|          |              |              |                          |                        |                                                                                   |                          | Before 2017            | After 2017             |            |
| Central  | Costa Rica   | San José     | 57 (1994–2015)          | No data                | Direct microscopy, culture, PCR (enzymatic restriction and sequencing of the calmodulin gen) | ND                       | S. schenckii sensu stricto 53 (93%)  | S. schenckii S. brasiliensis 2 (3.5%) Sporothrix spp. 2 (3.5%) | [53]       |
| America  | Guatemala    | City         | 11                       | Male 7 Female 4        | Average 49 years                                                                   | Fixed cutaneous 9 (81.8%) Lymphocutaneous 2 (18.2%) | Sporothrix spp. (100%) | Sporothrix spp. (100%) | [54]       |
|          | Guatemala    | City         | 53 (2007–2016)          | Male 33 Female 20      | Average 44.1 years                                                                  | Lymphocutaneous 33 (62.2%) Fixed cutaneous 17 (32.1%) Disseminated 2 (3.8%) Chancre 1 (1.9%) | Sporothrix schenckii complex. (100%) | Sporothrix spp. (100%) | [55]       |
|          | Guatemala    | City         | 1                        | ND                     | Fungal culture, PCR sequencing (ITS 1-2 and β-tubulin)                              | ND                       | Sporothrix schenckii sensu stricto | Sporothrix schenckii | [56]       |
|          | Honduras     | Tegucigalpa  | 1                        | Male 1                 | 14 years                                                                            | Lymphocutaneous 1 (100%) | S. schenckii          | Sporothrix spp. | [57]       |
|          | Panamá       | Chorrera District | 1             | Male 1                 | 34 years                                                                            | Lymphocutaneous 1 (100%) | ND                     | Sporothrix spp. | [58]       |
|          | Caribbean    | Cuba         | 1                        | Female 1               | 57 years                                                                            | Lymphocutaneous          | Sporothrix schenckii sensu stricto 10 (100%) | Sporothrix spp. | [59]       |
|          |              | Cumanayagüia | 1                        | Male 67                |                                        | Lymphocutaneous          | Sporothrix schenckii sensu lato 10 (100%) | Sporothrix spp. | [60]       |

ND: Not Determined.
5. Epidemiology of Sporotrichosis in South America

A total of 68 publications with 11,050 cases of sporotrichosis were found in South America [61–131]. Of these, 4 reports were found in Argentina during the analyzed period with 38 cases, of which 9 were caused by S. schenckii sensu stricto (23.68%), 26 by S. brasiliensis (23.68%), 1 by S. globosa (2.6%), 1 by S. schenckii (2.6%), and 1 by S. schenckii complex (2.6%) [61–64]. Brazil reported 42 articles with 5,546 analyzed cases [65–106], identifying Sporothrix spp. and S. schenckii complex as the causative agent in 4906 cases (88.46%), S. schenckii in 302 (5.45%), S. brasiliensis in 125 (2.25%), Sporothrix sensu lato in 110 (1.98%), S. globosa plus S. schenckii in 91 cases (1.64%) Sporothrix sensu stricto in 5 (0.09%), S. globosa in 4 (0.07%), and S. mexicana in 3 (0.05%) during the studied period. In Colombia, 4 reports were found, adding up to 50 cases [56,107–109]. S. Schenckii sensu stricto was identified in 22 cases (44.00%), Sporothrix spp. in 15 (30.00%), S. globosa in 12 (24.00%) and S. schenckii sensu lato in 1 (2.00%). Likewise, in Chile, 3 reported cases detected Sporothrix spp. in 1 (33.33%), S. globosa in 1 (33.33%), and Sporothrix pallida in 1 (33.33%) [110–112].

A total of 13 cases of Sporothrix spp. and S. schenckii complex (100%) were reported in Paraguay [113,114]. In Peru, from 4792 cases, S. schenckii was found in 4656 (97.16%), Sporothrix spp. and the Sporothrix complex in 116 (2.42%), S. schenckii sensu stricto in 19 (0.40%), and Sporothrix sensu lato in 1 (0.02%) [115–123]. There was 1 report of 157 cases of Sporothrix spp. (100%) found in Uruguay [124]. Finally, there were 4 reports from Venezuela with 452 cases of Sporothrix spp., and the Sporothrix complex was found in 220 of those cases (48.67%), S. schenckii sensu lato in 130 (28.76%), S. schenckii in 42 (9.29%), S. Schenckii sensu stricto in 17 (3.76%), S. globosa in 39 (8.63%), 1 case of Ophiostoma stenoceras (0.22%) and 3 cases were ND (0.66%) [125–128].

Regarding the new taxonomic classification, in Argentina, 26.31% were S. schenckii, 68.42% S. brasiliensis, 2.63% S. globosa, and 2.63% Sporothrix spp. [61–64]. In Brazil, the main pathogenic agent was Sporothrix spp. with 95.56%, S. brasiliensis 2.25%, S. globosa plus S. Schenckii 1.64%, S. Schenckii 0.41%, S. globosa 0.07%, and S. mexicana 0.05% [65–106]. In Colombia, S. Schenckii 44.00%, Sporothrix spp. 32.00%, and S. globosa 24.00% were the principal mycotic agents [56,107–109]. Regarding Chile, the pathogenic agents were Sporothrix spp., S. globosa, and S. pallida (33.33% each) [110–112]. In Paraguay, the unique agent found was Sporothrix spp. (100%) [113,114]. For Peru, the most important pathogenic agents were Sporothrix spp. (99.54%), and S. Schenckii (0.46%) [115–123]. In Uruguay, 100% of the cases were due to Sporothrix spp. (100%) [124]. In Venezuela, Sporothrix spp. (80.04%), S. Schenckii (13.38%), and S. globosa (6.57%) were the types of Sporothrix agents [125–128].

The most frequent types of disease were lymphocutaneous with 3293 cases (29.47%), fixed cutaneous with 1947 (17.43%), disseminated cutaneous with 34 (0.30%), systemic form with 18 (0.16%), and others with 177 cases (1.60%). However, there were 5702 cases (51.04%) with undetermined types from all the cases diagnosed as sporotrichosis [56,61–128].

The most common reported etiological agent with the new taxonomical classification was Sporothrix spp. with 95.12%, followed by S. schenckii with 1.23% (136/11,050), S. brasiliensis with 2.27% (251/11,050), S. globosa plus S. Schenckii with 0.82% (91/11,050), S. globosa with 0.52% (57/11,050), S. mexicana 0.027% (3/11,050), and S. pallida with 0.009% (1/11,050) [56,61–120].

With reference to diagnosis, fungal culture was used as a diagnostic methodology in almost all articles (67/71), followed by PCR sequencing (26/71), where the calmodulin gene (15/23), the ITS 1-2 region (6/23), and other genes (15/23) were used. Other types of diagnoses (12/71) were applied, such as direct microscopy (19/71), histopathological examination, always accompanied by fungal culture (18/71), and microscopy with lactophenol blue (9/71) (Table 3).
### Table 3. Epidemiology of Sporotrichosis in Central America and the Caribbean.

| Region | Country | City | Number of Reported Cases | Vulnerable Population | Diagnostic Method | Type of Sporotrichosis | Etiological Agents (%) | Taxonomy | References |
|--------|---------|------|--------------------------|-----------------------|--------------------|------------------------|-------------------------|----------|------------|
|        |         |      |                          |                       | Before 2017         | After 2017             |                         |          |            |
| South America |    |      |                          |                       |                     |                        |                         |          |            |
| Argentina |        | Provincia de Chaco | 1 | Female | 65 | Bronchoalveolar lavage (BAL), Giemsa stain, Fungal culture, PCR sequencing (ITS 1–2) | Pulmonary | S. schenckii | S. schenckii | [61] |
|         |        | Buenos Aires | 16 | Male (4) | Average 32.5 | Fungal culture and PCR sequencing (Calmodulin gene) | Lymphocutaneous | S. brasiliensis | S. brasiliensis | [62] |
|         |        | Misiones | 1 | Female (10) | ND | Fungal culture and PCR sequencing (Calmodulin gene) | Fixed cutaneous | ND (38.1%) | S. schenckii sensu stricto 9 (56.5%) | S. brasiliensis 5 (34.7%) | S. globosa 1 (8.7%) | [63] |
|         |        | El Calafate | 4 | ND (7) | Fungal culture, PCR sequencing (Calmodulin gene) and histopathology | ND | S. brasiliensis | S. brasiliensis | [64] |
| Brazil |        | Rio de Janeiro (Duque de Caxias) | 827 from 2007–2016 | Female (541) | 42 | Fungal culture | Lymphocutaneous | S. schenckii complex | Sporothrix spp. | [65] |
|         |        | Rio de Janeiro ND Teresópolis | ND | Male (16) | Average 47 | Direct microscopy, Fungal culture, PCR sequencing (calmodulin gene) | Sporothrix spp. | S. brasiliensis 45 (90%) | S. schenckii sensu stricto 5 (10%) | [66] |
| Region          | Country | City                  | Number of Reported Cases | Vulnerable Population | Diagnostic Method                             | Type of Sporotrichosis                  | Etiological Agents (% ) | Taxonomy                  | References |
|----------------|---------|-----------------------|--------------------------|-----------------------|-----------------------------------------------|-----------------------------------------|----------------------------------------|--------------------------|--------------------------|
| South America  | Brazil  | Rio de Janeiro        | 21/1750 cases in HIV patients (1.2%) from 1999–2009 | Group 1 adults         | Direct microscopy, Fungal culture             | Lymphocutaneous                         | Sporothrix spp.                     | S. schenckii sensu lato     | [68]                    |
|                |         | Rio de Janeiro        |                          | Group 2 adults         | Direct microscopy, Fungal culture, Histopathology | Disseminated 7(33.3%) widespread cutaneous 5(23.8%) fixed cutaneous 2(9.5%) | Sporothrix spp.                     | S. schenckii sensu lato     | [68]                    |
|                |         | Rio de Janeiro        |                          |                       |                                               | Primary ocular disease (3 lymphocutaneous, 1 fixed cutaneous and 1 disseminated) | Sporothrix spp.                     | S. brasiliensis             | [69]                    |
|                |         | Rio de Janeiro        |                          |                       |                                               |                                         | S. schenckii sensu stricto 18(24%)     | [69]                    |
|                |         | Espíritu Santo        | 73 from 2016–2019        | Male, Female           | Fungal culture, Microscopy with lactophenol cotton blue, PCR sequencing (Calmodulin gene and Mating type (MAT) gene) | ND                                      | S. brasiliensis             | [71]                    |
|                |         | Duque de Caxias 6     |                          |                       |                                               |                                         | S. schenckii sensu stricto 18(24%)     | [71]                    |
|                |         | São José de Meriti 2  |                          |                       |                                               |                                         | S. brasiliensis             | [71]                    |
|                |         | São Gonçalo 1         |                          |                       |                                               |                                         | S. schenckii sensu stricto 18(24%)     | [71]                    |
|                |         | Maricá               |                          |                       |                                               |                                         | S. schenckii sensu stricto 18(24%)     | [71]                    |
### Table 3. Cont.

| Region        | Country   | City               | Number of Reported Cases | Vulnerable Population | Diagnosis Method          | Type of Sporotrichosis | Etiological Agents (%) | References |
|---------------|-----------|--------------------|--------------------------|-----------------------|---------------------------|------------------------|------------------------|-------------|
|               |           |                    |                          |                       | Sex | Age (Years) | Diagnostic Method |                      |             |
| South America | Brazil    | Espírito Santo     | 171 cases from 1982–2012 | Male (138) Female (33) | Average: 33.42 | Fungal culture | ND                      | Sporothrix spp. | [72]        |
|               |           | Rio Grande do Sul  | 83 from 2010–2016       | ND                    | Fungal culture | Lymphocutaneous 22 (51%) Fixed cutaneous 14 (22.5%) Disseminated cutaneous 1 (2.5%) ND 6 (14%) | Sporothrix spp. | [73]        |
|               |           | Rio Grande do Sul  | 43 from 2006–2015       | Male (31) Female (7) | Average: 43  | Fungal culture | ND                      | Sporothrix spp. | [74]        |
|               |           | Minas Gerais       | 282                      | Male (153) Female (129) | Average: 42.52 | Fungal culture, Sporotrichin test, Histophatology, Production of S. schenckii antigens, Enzyme-linked immunosorbent assay | ND                      | S. schenckii | Sporothrix spp. | [75]        |
|               |           | Brasilia           | 91 from 1993–2018       | Male (64) Female (27) | ND | Direct microscopy, Fungal culture, PCR sequencing (Calmodulin gene) | Lymphocutaneous 34 (37.36%) Fixed cutaneous 6 (6.59%) Disseminated 5 (5.49%) ND 46 (50.55%) | S. globosa (ND) | Sporothrix spp. | [76]        |
|               |           | São Paulo          | 25 from 2003–2013.      | Male (18) Female (7) | Average: 42.48 | Fungal culture, Histopathology | Lymphocutaneous 20 (80%) Fixed cutaneous 5 (20%) | S. schenckii sensu lato | Sporothrix spp. | [77]        |
|               |           | São Paulo          | 20 from 2012–2020       | Male (9) Female (11)  | Average: 2.2  | Direct microscopy, Fungal culture, Histopathology | Lymphocutaneous 10 (50%) Multiple-inoculation 5 (25%) Fixed-cutaneous 3 (15%) Ocular-mucosal 2 (10%) | Sporothrix spp. | Sporothrix spp. | [78]        |
### Table 3. Cont.

| Region          | Country   | City         | Number of Reported Cases | Sex | Age (Years) | Vulnerable Population | Diagnostic Method                                      | Type of Sporotrichosis                                      | Etiological Agents (%)          | Taxonomy                  | References |
|-----------------|-----------|--------------|--------------------------|-----|-------------|------------------------|--------------------------------------------------------|-----------------------------------------------------------|-------------------------------|---------------------------|------------|
| South America   | Brazil    | Rio de Janeiro | 1                         | Male | 35          | Direct microscopy, fungal culture | Osteomyelitis                                         | S. schenckii complex, Sporothrix spp. [79]            |                               |                           |            |
|                 |           | Rio de Janeiro | 1                         | Female | 68         | Direct microscopy (KOH), fungal culture (Sabouraud Dextrose Agar 2%, and Mycosel Agar, Brain Heart Infusion Agar, Potato Dextrose Agar), Lactophenol Cotton Blue and MALDI-TOF MS | Ocular                       | S. brasiliensis, S. brasiliensis [80] |                               |                           |            |
|                 |           | Rio Grande do Norte | 1                         | Male | 50          | Direct microscopy (KOH), fungal culture (Mycosel Agar), PCR sequencing (Calmodulin gene) | Pulmonary                                             | S. brasiliensis, S. brasiliensis [81] |                               |                           |            |
|                 |           | Pelotas      | 7                         | ND   | ND          | Gram-stain microscopy, fungal culture (Sabouraud-dextrose agar added with chloramphenicol and Mycosel), PCR sequencing (ITS1 and ITS4 and Calmodulin gene) | Lymphocutaneous (45.1%), Lymphocutaneous (42.9%) | S. brasiliensis, S. brasiliensis [82] |                               |                           |            |
|                 |           | São Paulo    | 1                         | Female | 12         | Histopatology (Grocott stainin), fungal culture. | Immunoreactive cutaneous | Sporothrix spp., Sporothrix spp. [83] |                               |                           |            |
|                 |           | Recife       | 1                         | Male  | 25          | Histopatology (hematoxylin-eosin staining), fungal culture (Sabouraud dextrose agar with chloramphenicol), PCR sequencing (using the species-specific primers Sbra-F and Sbra-R and Calmodulin gene) | Ocular                      | S. brasiliensis, S. brasiliensis [84] |                               |                           |            |
|                 |           | Rio de Janeiro | 1                         | Male | 44          | Fungal culture | Disseminated            | Sporothrix spp., Sporothrix spp. [85] |                               |                           |            |
|                 |           | São Paulo    | 2                         | Male  | 3 and 12    | Fungal culture | Ocular                  | Sporothrix spp., Sporothrix spp. [86] |                               |                           |            |
|                 |           | ND           | 1                         | Female | 45         | Histopathology, Fungal culture (Sabouraud dextrose agar), PCR sequencing (Whole genome sequencing) | Cutaneous carbuncle | S. brasiliensis, S. brasiliensis [87] |                               |                           |            |
|                 |           | Rio de Janeiro | 1                         | Male  | 11          | Fungal culture (Sabouraud’s dextrose agar), Culture microscopy with Lactofenol blue | Facial Cutaneous | Sporothrix spp., Sporothrix spp. [88] |                               |                           |            |
### Table 3. Cont.

| Region          | Country       | City                | Number of Reported Cases | Sex | Age (Years) | Vulnerable Population | Diagnostic Method                                      | Type of Sporotrichosis                          | Etiological Agents (% | Taxonomy | References |
|-----------------|---------------|---------------------|--------------------------|-----|-------------|------------------------|--------------------------------------------------------|-----------------------------------------------|----------------------|-----------|------------|
| South America   | Brazil        | Guarulhos, Sao Paulo| 1                        | Male| 56          | Fungal culture, Histopathology (Periodic Acid Schiff staining), | Disseminated                                      | Sporothrix spp. Sporothrix spp.               | [89]                  |          |            |
|                 |               | Sao Paulo          | 1                        | Female| 39         | Fungal culture (Sabouraud agar)                                | Lymphocutaneous                                    | Sporothrix spp. Sporothrix spp.               | [90]                  |          |            |
|                 |               | Brasilia           | 1                        | Male| 26          | Fungal culture                                                   | Disseminated                                        | Sporothrix spp. Sporothrix spp.               | [91]                  |          |            |
| Rio de Janeiro  |               | 4 from 2006-2016   | Female Age ranged from 18-34 | Average 25 | Fungal culture, PCR sequencing (Primer T3B fingerprinting assay) | Fixed cutaneous 2 (50%) Lymphocutaneous 2 (50%) | Sporothrix spp. 2 (50%) S. brasiliensis 2 (50%) | Sporothrix spp. 2 (50%) S. brasiliensis 2 (50%) | [92]                  |          |            |
| Rio de Janeiro  |               | 3 from 2006 to 2013 | Male Age ranged from 25-43 | Average 32 | Fungal culture, PCR sequencing (primer T3B fingerprinting assay) | Disseminated 3                                      | S. brasiliensis S. brasiliensis                | [93]                  |          |            |
| Palmeira das    |               | Espírito Santo     | 3                        | Female| 30 and 10 | Direct microscopy, fungal culture (Sabouraud dextrose agar, potato dextrose agar, corn meal agar and and brain heart infusion agar), Histopathology, PCR sequencing (Calmodulin gene) | Lymphocutaneous                                    | S. brasiliensis S. brasiliensis                | [94]                  |          |            |
| Missões         |               | ND                  | 1                        | Male| 49          | Fungal culture                                                   | Disseminated                                        | S. brasiliensis S. brasiliensis                | [95]                  |          |            |
| Rio de Janeiro  |               |                     |                           | Male| 6           | Fungal culture                                                   | Invasive Sinusitis                                  | S. brasiliensis S. brasiliensis                | [96]                  |          |            |
|                 |               |                     |                           | Male| 56         | Fungal culture, PCR sequencing (calmodulina gene)                 | Meningitis, Lymphocutaneous                          | S. brasiliensis S. brasiliensis                | [97]                  |          |            |

**References:**

[89] Reference 1
[90] Reference 2
[91] Reference 3
[92] Reference 4
Table 3. Cont.

| Region          | Country | City                  | Number of Reported Cases | Vulnerable Population | Diagnostic Method | Type of Sporotrichosis | Etiological Agents (%) | References |
|-----------------|---------|-----------------------|--------------------------|-----------------------|--------------------|------------------------|-------------------------|------------|
|                 |         |                       |                          | Sex                   | Age (Years)        |                        |                         |            |
|                 |         |                       |                          | Male                  | Age ranged from    | Fungal culture         | ND                      | Sporothrix spp.         | [104]      |
|                 |         |                       |                          | Females               | 2-81 mean 32.2 ± 25.10 |                        |                         | Sporothrix spp.         | [104]      |
| South America   | Brazil  | São Paulo             | 20 from 2012–2020        | Male                  | ND                 | Fixed cutaneous        | Sporothrix spp.         | [105]      |
|                 |         | Rio de Janeiro        | 64 from 2013–2015        | ND                    | Fungal culture     | Lymphocutaneous 43 (67%) | S. schenckii sensu lato | Sporothrix spp.         | [106]      |
|                 |         | Minas Gerais 1        | 6                        | ND                    | Fungal culture     | Lymphocutaneous 2 (33.3%) | S. mexicana 3 (50%)     | Sporothrix spp.         | [106]      |
|                 |         | Ceará                 |                          | ND                    | Carbohydrate assimilation tests, PCR sequencing | S. globosa 3 (50%) | S. schenckii sensu lato | Sporothrix spp.         | [106]      |
|                 |         | Goiás 1               |                          | ND                    | PCR sequencing     |                        |                         | Sporothrix spp.         | [106]      |
|                 |         | Pernambuco2           |                          | ND                    |                        |                         |                         | [56]       |
|                 |         | São Paulo 1           |                          | ND                    |                        |                         |                         |            |
|                 | Colombia| Antioquia             | 34                       | ND                    | Fungal culture, PCR sequencing | S. schenckii sensu stricto | S. schenckii         | Sporothrix spp.         | [107]      |
|                 |         | Bogotá                | 2.28% (14 cases/612 patients) | Male                  | ND                  | Fungal culture         | ND                      | Sporothrix spp.         | [107]      |
|                 |         | Casanare              | 1                        | Male                  | 18                  | Fungal culture, Histopathology | Vernucose | Sporothrix spp.         | [108]      |
|                 |         | Marandúia             | 1                        | Female                | 48                  | Fungal culture, Histopathology | Fixed cutaneous | Sporothrix spp.         | [109]      |
|                 |         | Santiago              | 1                        | Male                  | 54                  | Histopathology          | Lymphocutaneous         | Sporothrix spp.         | [110]      |
|                 |         | Valparaíso            | 1                        | Female                | 75                  | Fungal culture          | Lymphocutaneous         | Sporothrix spp.         | [111]      |
|                 |         | Viña del Mar          | 1                        | Female                | 64                  | Direct microscopy, Fungal culture (Sabouraud with cycloheximide and potato dextrose agar) nitrogen-based agar, sequencing (D1/D2 region of the fungal 26S rRNA gene, β-tubulin gene, ITS 1 and 2, and the 5.8S gene (SU)). | Onychomycosis | Sporothrix pallida       | [112]      |
Table 3. Cont.

| Region     | Country     | City                              | Number of Reported Cases | Sex      | Age (Years) | Number of Cases | Vulnerable Population | Diagnostic Method                                                                 | Type of Sporotrichosis                                       | Etiological Agents (% Taxonomy) | References |
|------------|-------------|-----------------------------------|--------------------------|----------|-------------|-----------------|-----------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------|------------|
| Paraguay   | Ità         |                                   |                          | Male     | 52          | 2               |                       | Histopathology (Peryodic Acid Schiff), Fungal culture, direct microscopy with Giensa stain | Lymphocutaneous 1 (50%), Fixed cutaneous 1 (50%)            | Sporothrix spp. Sporothrix spp. | [113]     |
|            | Cordillera  | Guairá, Central 2                 |                          | Male     | Mean Age: 37.6 ± 20 Range: 24-69 | 2               |                       | Direct microscopy (KOH 10%), fungal culture (Sabouraud agar with glucose 2%, potato dextrose agar with chloramphenicol), | Lymphocutaneous 11 (100%)   | Sporothrix spp. Sporothrix spp. complex | [114]     |
|            | Misiones 2  | San Pedro 2                       | 11 from 1997–2019.      | Female   | 65          | 2               |                       | Direct microscopy, Giemsa stain Culture, Microscopy with lactophenol cotton blue, Carbohydrate assimilation test (sucrose and raffinose) in nitrogen base | Fixed cutaneous                       | S. schenckii S. schenckii       | [115]     |
|            | Caaguazú 1  |                                   |                          | Female   | 67          | 1               |                       |                                                                                  |                                                                     |                          | [116]     |
| Perú       | Apurimac    | 2                                 |                          | Female   | 65          | 2               |                       |                                                                                  |                                                                     |                          | [117]     |
|            | Apurimac    | 21                                |                          | Male     | Average: 9  | 12 (12)         | Female (9)            | Fungal culture                                                      | Lymphocutaneous 13 (62%), Fixed cutaneous 8 (38%)          | Sporothrix spp. Sporothrix spp. | [116]     |
|            | Cajamarca   | 30                                |                          | Male     | ND          | 1734            | Female 1255          | Fungal culture, Microscopy with lactophenol cotton blue and PCR sequencing | Lymphocutaneous 2942 (63%), Fixed cutaneous 1728 (37%)    | S. schenkii 4651 (99.6%), S. schenkii sensu stricto 19 (0.4%)       | [117]     |
|            | 1500        |                                    |                          |          |             |                  |                       |                                                                     |                                                                     | Sporothrix spp. 4651 (99.6%) S. schenkii 19 (0.4%)               | [117]     |
|            | La Libertad | 4                                 |                          |          | ND          |                  |                       |                                                                     |                                                                     |                          | [117]     |
|            | 100         |                                    |                          |          |             |                  |                       |                                                                     |                                                                     |                          | [117]     |
| Cusco      | 200         | 2                                 |                          |          |             |                  |                       |                                                                     |                                                                     |                          | [117]     |
|            | 2          |                                    | ≤1 (0.1/100,000)         |          |             |                  |                       |                                                                     |                                                                     |                          | [117]     |
| Otras regiones | 20 |                                  |                          |          |             |                  |                       |                                                                     |                                                                     |                          | [117]     |
| Abancay    | 1           | Male                              | 6                       |          |             |                  |                       | Fungal culture                                                      | Lymphocutaneous                       | Sporothrix spp. Sporothrix spp. | [118]     |
| Lima       | 1           | Male                              | 23                      |          |             |                  |                       | Fungal Culture Microscopy with lactophenol blue, MALDE-TOF MS, PCR sequencing (D1/D2 region of the fungal 26S rRNA gene) | Fixed cutaneous                       | S. schenckii S. schenckii       | [119]     |
| Lima       | 1           | Male                              | 42                      |          |             |                  |                       | Histopathology, Microscopy, Fungal Culture                            | Disseminated cutaneous                               | S. schenkii sensu lato Sporothrix spp. | [120]     |
Table 3. Cont.

| Region     | Country | City          | Number of Reported Cases | Vulnerable Population | Diagnostic Method | Type of Sporotrichosis | Etiological Agents (%) | Taxonomy   | References |
|------------|---------|---------------|--------------------------|-----------------------|-------------------|-----------------------|------------------------|------------|------------|
|            |         |               |                          |                       |                   | Before 2017 | After 2017 |                        |            |            |
| Cajamarca  |         |               | 94 from 1991 to 2014    | Males (67) Female (27) | Average: 36       | Direct microscopy, Gram and Giemsa stain, Fungal culture, Histopathology | Lymphocutaneous 44 (47%) Fixed cutaneous 37 (39%) Disseminated cutaneous 11 (12%) Extra-cutaneous 1 (1%) ND 1 (1%) | S. schenckii | Sporothrix spp. | [121] |
| Apurímac   | Amazonas|               |                          |                       |                   |                        |                        |            |            |
| Ancash     |         |               | 1                        | Male 58               | Fungal culture     | Lymphocutaneous       | S. schenckii | Sporothrix spp. | [122] |
| Cusco      |         |               | 1                        | Female 53             | Fungal culture (Sabouraud) | Disseminated       | S. schenckii | Sporothrix spp. | [123] |
| Uruguay    |         |               | 157 from 1983 to 2020    | Male (152) 13–79 age range | Gram staining and culture in Sabouraud | Nodular Lymphatic 120 (76.4%) Fixed cutaneous 30 (19.1%) ND 7 (4.5%) | Sporothrix spp. | Sporothrix spp. | [124] |
| Region       | Country | City           | Number of Reported Cases | Vulnerable Population | Diagnostic Method                        | Type of Sporotrichosis | Etiological Agents (%) | References |
|--------------|---------|----------------|--------------------------|-----------------------|------------------------------------------|------------------------|------------------------|------------|
|              |         |                |                          |                       |                           |                        |                        |            |
|              |         |                |                          |                       |                                          |                        |                        |            |
| Venezuela    |         |                |                          |                       |                                          |                        |                        |            |
|              |         |                |                          |                       |                                          |                        |                        |            |
| Caracas      |         |                | 68                       | ND                    | Fungal culture, PCR sequencing          | ND                     | S. schenckii 42 (62%)  | [125]      |
|              |         |                |                          |                       | (Calmodulin locus and ITS regions)      |                        | S. globosa 42 (38%)   |            |
|              |         |                |                          |                       |                                          |                        |                        |            |
| Aragua 55    |         |                | 133 from                 | Male (95) Female (38) | 0–15 15–30 >30 Direct microscopy  | Lymphocutaneous 84 (63.15%) | S. schenckii sensu lato 130 (97.7%) | [126]      |
| Miranda 32   |         |                | 1963–2019                |                       | Fungal culture                        | Fixed cutaneous 48 (36.09%) | ND (3.2%) |            |
| Other states |         |                | 46                       |                       |                                          | Cornea 1 (0.7%)         |                        |            |
|              |         |                |                          |                       |                                          |                        |                        |            |
| Bolivar 14   |         |                | 0.55%                    | ND                    | 25–45 years Microscopy and fungal culture | ND                     | Sporothrix spp.       | [127]      |
| Caracas 160  |         |                | 0.55%                    | ND                    |                                          |                        | Sporothrix spp.       |            |
| Carabobo 6   |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Falcón 3     |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Lara 5       |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Mérida 1     |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Monagas 24   |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Sucre 1      |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Táchira 2    |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
| Zulia 4      |         |                | 0.55%                    | ND                    |                                          |                        |                        |            |
|              |         |                |                          |                       |                                          |                        |                        |            |
| Costal Range |         |                | 31 from 1973–2013        | Male 64% Female 36%   | Microscopy, fungal culture,             | Fixed cutaneous 18 (60%) | S. schenckii sensu stricto 17 | [128]      |
| Andes 7      |         |                |                          |                       | PCR sequencing (Calmodulin gene and ITS 4–5) | Lymphocutaneous 11 (36.33%) | S. globosa 13 |            |
| Plains 2     |         |                |                          |                       |                                          | Disseminated 1 (3.33%) | S. globosa 13 and Ophiostoma stenoceras 1 |            |

ND: Not Determined.
6. Discussion

A total of 124 publications were found with reports related to sporotrichosis in the Americas in the last 10 years, with 12,636 patients associated with infection caused by species of the genus *Sporothrix*. Interestingly, it was observed that 87.45% (11,050) of these cases were reported in South America, 11.55% (1,460) in North America, and 1.00% (126) in Central America and the Caribbean [5–128]. The countries that presented the highest number of cases during the analyzed period were Brazil (5,546—43.89%), Peru (4,792—37.92%), and Mexico (1,431—11.32%). It should be noted that in the case of Brazil and Peru, there were various reports with several cases from a time period ranging from 25 to 50 years [66,67,75,86]. As previously mentioned, sporotrichosis is a disease caused by a thermodynamic fungus of the genus *Sporothrix*. It is known that this subcutaneous disease, although cosmopolitan, generally occurs in both tropical and subtropical regions. The latter could explain, in some part, the high prevalence in Latin America, being endemic in this region [1–4,129]. However, three countries (Brazil, Peru, and Mexico) have specific characteristics that increase the number of cases. In Brazil and adjacent countries (for example, Argentina and Paraguay), an increasing number of cases have been associated with zoonotic infection, mainly from infected cats through scratches or sneezes [3,4]. Since the zoonotic transmission of *S. brasiliensis* is the most important form of communication, it is recommended that hygiene measures be taken regarding domestic animals such as cats, rodents, etc., due to possible infections. If it is diagnosed in animals, it must be treated immediately, and gloves must be used when handling animals with injuries [2–4].

In Mexico, sporotrichosis is considered endemic and an occupational disease due to the different sources of infection. The climate of some regions in Mexico is perfect for the characteristics of this type of mycosis to increase its incidence. Although tropical and subtropical climates are preferred by this fungus, in this country, the cold and dry seasons are the contagion peaks of these pathological agents. The states that are more affected are Mexico City, Puebla, Jalisco, Michoacan, the State of Mexico, and Guanajuato. In these states, agriculture is one of the most important economic activities, which explains the high incidence of the *Sporothrix* contagion [130]. Thus, the principal recommendation in this region is the use of gloves or long-sleeved clothing when carrying out work activities where these species are endemic.

Regarding the etiological agents responsible for the types of sporotrichosis, it is important to specify that they were referred to both in the table and in the text in the way they were named in the articles that were analyzed. Since most of them were written and published before the changes in taxonomical classification, they do not consider the clinical and environmental clades classification instead of the *Sporothrix schenckii* complex.

As for the etiological agent of sporotrichosis, the most prevalent, according to the reports with the old taxonomical classification, were *S. schenckii* complex and *Sporothrix* spp. with 6,624 cases (52.41%), *S. schenckii* with 5,302 (41.95%), *S. schenckii* sensu lato with 245 (1.94%), *S. schenckii* sensu stricto with 147 (1.16%), *S. brasiliensis* with 153 (1.21%), *S. globosa* plus *S. Schenckii* sensu stricto with 91 (0.72%), *S. globosa* with 65 (0.51%), *S. mexicana* with 4 (0.03%), *S. pallida* 1 (0.008%), *Ophiostoma stenoceras* 1 (0.008%), and 4 ND cases (0.032%). It is worth mentioning that, although there are other species, such as *Sporothrix luriei*, there were no reports found in the studied period in the Americas [1,131].

Likewise, within the systematic review, *Ophiostoma stenoceras* appears, which in the taxonomic classification of *Sporothrix* is represented in its sexual state, in the year the report was made. Nevertheless, in 2016, Beer et al. concluded through phylogenetic analyzes that the genus *Sporothrix* was different from the genus *Ophiostoma*, but that was before considering its sexual state. Officially, the sexual status of *Sporothrix* is not known, and in this case, *Ophiostoma stenoceras* was included according to the regulations that governed the taxonomy before the divorce between the two genders occurred [132].

After analyzing the articles to carry out the classification according to the new taxonomy, we found that the most common reported etiological agent was *Sporothrix* spp. with
94.34% (11,922/12,636), followed by *S. schenckii* with 3.16% (400/12,636), *S. brasiliensis* with 1.21% (153/12,636), *S. globosa* plus *S. schenckii* with 0.72% (91/12,636), *S. globosa* with 0.51% (65/12,636), *S. mexicana* 0.03% (4/12,636), and *S. pallida* with 0.007% (1/12,636) [61–128].

On the other hand, the most frequent type of sporotrichosis was the lymphocutaneous with 4288 cases, followed by the fixed cutaneous with 2340 cases, the disseminated or systemic with 103, the disseminated cutaneous with 52 cases, other with 215 cases, and 5760 cases were ND. By being a subcutaneous mycosis, the lymphocutaneous form is the most frequent one because sporotrichosis mainly affects the lymph nodes of the skin and the subcutaneous tissue, producing ulcers and thereby affecting the lymphocutaneous system [133]. The infection begins in the form of an inoculation chancre. Subsequently, erythematosus nodular lesions arise, which follow the trajectory of the lymphatic vessels, mainly affecting the face and upper and lower limbs. Another common form is the fixed cutaneous, which occupies the second place in the Americas to the present date. This type is of a fixed form at the inoculation site of the fungus, affecting mainly children, and it is observed as a verrucose plaque. Its presence demonstrates a high immunity response from the patient. Being a disease of this body region, it has a low prevalence in other organs or tissues. However, the disseminated or hematogenous form may be cutaneous or systemic [5–8]. Systemic sporotrichosis can cause respiratory and lung disorders, osteomyelitis, arthritis, and meningitis. It is important to note that the type of condition affecting the patients (5760 cases) was not mentioned in several of the reported cases analyzed in this publication.

Concerning diagnosis, various methods, both phenotypic and genotypic, have been used to detect the infection caused by this etiological agent [129]. Within the phenotypic methods, we can name (1) mycological cultures. This technique seeks the growth of the colony in a radial form (approximately 3 to 4 days) with a creamy consistency, and subsequently, the development of mycelium is observed for its identification (Gold Standard). Finally, it is suggested to perform a lactophenol blue staining to observe the microconidia in a sympodial arrangement along the mycelium. (2) serological diagnosis using sporotricine and immunodiffusion tests, immunoelectrophoresis, latex agglutination, etc. (3) histopathological diagnosis, an excisional biopsy of the nodular lesion is performed that may show granulomatous and necrotizing dermatitis, which can be stained with Hematoxylin and Eosin (HE) Schiff’s Periodic Acid (PAS), or Grocott-Gomori Methenamine Silver (MSG) to confirm the presence of asteroid bodies [5–8].

Nonetheless, genotypic identification tests are preferred since phenotypic techniques have disadvantages, such as being laborious, presenting variable results from the clinical field, and requiring many samples to reach a diagnosis. Therefore, different PCR techniques have been used for genotypic identification tests utilizing diverse genetic or molecular markers that have been developed [5].

In this systematic review, the culture turned out to be the most used diagnostic method throughout the continent, being performed in 107 of the 127 articles reviewed. Histopathological examination was the second most used diagnostic technique, found in 43 publications. In addition, PCR sequencing was used 38 times, direct microscopy 21 times, and microscopy with lactophenol blue was reported in 9 articles. Lastly, other techniques were used to detect sporotrichosis; however, these were not utilized routinely.

**Author Contributions:** R.H.-C., R.P.-A., R.A. and E.M.-H. designed the study and wrote the manuscript, contributing equally to the accomplishment of the work; R.P.-A., C.R.-C., C.D.S.-C., V.M.E.-H. and E.R.-D. contributed to the writing of the manuscript; K.Y.S.-M., E.M.-H., C.R.-C., E.C.-C., J.X.-C. and E.M.C.-C. planned, extracted data, wrote, and critically reviewed the manuscript; R.H.-C., J.S.-V., C.R.-C. and E.M.-H. wrote and critically reviewed the manuscript. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.
Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Lopes-Bezerra, L.M.; Mora-Montes, H.M.; Zhang, Y.; Nino-Vega, G.; Rodrigues, A.M.; de Camargo, Z.P.; de Hoog, S. Sporotrichosis between 1898 and 2017: The evolution of knowledge on a changeable disease and on emerging etiological agents. *Med. Mycol.* 2018, 56, S126–S143. [CrossRef] [PubMed]

2. Rabello, V.B.S.; Almeida, M.A.; Bernardes-Engemann, A.R.; Almeida-Paes, R.; de Macedo, P.M.; Zancopé-Oliveira, R.M. The Historical Burden of Sporotrichosis in Brazil: A Systematic Review of Cases Reported from 1907 to 2020. *Braz. J. Microbiol.* 2022, 53, 231–244. [CrossRef] [PubMed]

3. Rodrigues, A.M.; Della Terra, P.P.; Gremião, I.D.; Pereira, S.A.; Orofino-Costa, R.; de Camargo, Z.P. The threat of emerging and re-emerging pathogenic *Sporothrix* species. *MycoPathologia* 2020, 185, 813–842. [CrossRef] [PubMed]

4. Gremião, I.D.F.; Evangelista Oliveira, M.M.; Monteiro de Miranda, L.H.; Saraiva Freitas, D.F.; Peraira, S.A. Geographic Expansion of Sporotrichosis, Brazil. *Energ. Infect. Dis.* 2020, 26, 621–662. [CrossRef]

5. Bunce, P.E.; Yang, L.; Chun, S.; Zhang, S.X.; Trinkaus, M.A.; Matukas, L.M. Disseminated sporotrichosis in a patient with hairy cell leukemia treated with amphotericin B and posaconazole. *Med. Mycol.* 2012, 50, 197–201. [CrossRef]

6. Tai, F.; Jakubovic, H.; Alabdulrazzaq, S.; Alavi, A. A case of sporotrichosis infection mimicking pyoderma gangrenosum. *J. Fungi* 2022, 8, 368. [CrossRef]

7. Hayfron, K.; Wiedeman, J.A. A 7-year-old girl with ulcerative lesion after a rodent bite. *Pediatr. Infect. Dis. J.* 2010, 29, 185–193. [CrossRef] [PubMed]

8. Kamal, A.; Orenstein, R. Disseminated sporotrichosis. *J. Hosp. Med.* 2010, 5, E29–E30. [CrossRef]

9. Lyengar, S.S.; Khan, J.A.; Brusco, M.; FitzSimmons, C.J. Cutaneous *Sporothrix schenckii* of the human eyelid. *Ophthalmic Plast. Reconst. Surg.* 2010, 26, 305–306. [CrossRef]

10. Adnan, M.M.; Fierro-Fine, A.; Zhao, L.; Khalil, M.O. Metastatic melanoma masquerading as disseminated sporotrichosis. *J. Community Support. Oncol.* 2014, 12, 339–340. [CrossRef]

11. Assi, M.; Lakakis, I.E.; Wheat, L.J. Cross-reactivity in the *Histoplasma* antigen enzyme immunoassay caused by sporotrichosis. *Clin. Vaccine Immunol.* 2011, 18, 1781–1782. [CrossRef] [PubMed]

12. Parekh, P.K.; Butler, D.F. What is your diagnosis? Periorbital granulomatous plaque. *Pediatr. Dermatol.* 2011, 28, 457–458. [CrossRef] [PubMed]

13. Rees, R.K.; Swartzberg, J.E. Feline-transmitted sporotrichosis: A case study from California. *Dermatol. Online. J.* 2011, 17, 2. [CrossRef]

14. Sharon, V.R.; Kim, J.; Sudhakar, S.; Fung, M.A.; Maniar, A. Disseminated cutaneous sporotrichosis. *Lancet Infect. Dis.* 2013, 13, 95. [CrossRef]

15. Adnan, M.M.; Fierro-Fine, A.; Zhao, L.; Khalil, M.O. Metastatic melanoma masquerading as disseminated sporotrichosis. *J. Community Support. Oncol.* 2014, 12, 339–340. [CrossRef]

16. Adnan, M.M.; Fierro-Fine, A.; Zhao, L.; Khalil, M.O. Metastatic melanoma masquerading as disseminated sporotrichosis. *J. Community Support. Oncol.* 2014, 12, 339–340. [CrossRef]

17. Adnan, M.M.; Fierro-Fine, A.; Zhao, L.; Khalil, M.O. Metastatic melanoma masquerading as disseminated sporotrichosis. *J. Community Support. Oncol.* 2014, 12, 339–340. [CrossRef]

18. Trotter, J.R.; Srioroon, P.; Berman, D.; Petrovic, A.; Leiding, J.W. *Sporothrix schenckii* lymphadenitis in a male with X-linked chronic granulomatous disease. *J. Clin. Immunol.* 2014, 34, 49–52. [CrossRef]

19. Bahr, N.C.; Janssen, K.; Billings, J.; Loor, G.; Green, J.S. Respiratory failure due to possible donor-derived *Sporothrix schenckii* infection in a lung transplant recipient. *Case Rep. Infect. Dis.* 2015, 2015, 925718. [CrossRef]

20. Hassan, K.; Turker, T.; Zangeneh, T. Disseminated sporotrichosis in an immunocompetent patient. *Case Rep. Plast. Surg. Hand Surg.* 2016, 3, 44–47. [CrossRef]

21. Lederer, H.T.; Sullivan, E.; Crum-Cianflone, N.F. Sporotrichosis as an unusual case of osteomyelitis: A case report and review of the literature. *Med. Mycol.* 2016, 54, 31–35. [CrossRef]

22. Adnan, M.M.; Fierro-Fine, A.; Zhao, L.; Khalil, M.O. Metastatic melanoma masquerading as disseminated sporotrichosis. *J. Community Support. Oncol.* 2014, 12, 339–340. [CrossRef]

23. Trotter, J.R.; Srioroon, P.; Berman, D.; Petrovic, A.; Leiding, J.W. *Sporothrix schenckii* lymphadenitis in a male with X-linked chronic granulomatous disease. *J. Clin. Immunol.* 2014, 34, 49–52. [CrossRef]

24. Bahr, N.C.; Janssen, K.; Billings, J.; Loor, G.; Green, J.S. Respiratory failure due to possible donor-derived *Sporothrix schenckii* infection in a lung transplant recipient. *Case Rep. Infect. Dis.* 2015, 2015, 925718. [CrossRef]

25. Patel, R.; Busby, L.P.; Motamedi, D. Delayed diagnosis in a case of smoldering sporotrichal monarthropathy. *J. Radiol. Case Rep.* 2019, 13, 17–23. [CrossRef]
27. White, M.; Adams, L.; Phan, C.; Erdag, G.; Totten, M.; Lee, R.; Lu, X.; Mehta, S.; Miller, L.S.; Zhang, S.X. Disseminated sporotrichosis following iatrogenic immunosuppression for suspected pyoderma gangrenosum. *Lancet Infect. Dis.* 2019, 19, e385–e391. [CrossRef]

28. Kaadan, M.I.; Dennis, M.; Desai, N.; Yadavalli, G.; Lederer, P. One health education for future physicians: A case report of cat-transmitted sporotrichosis. *Open Forum Infect. Dis.* 2020, 7, ofaa049. [CrossRef]

29. Parker, N.; Strong, N.; Pichetsurinthorn, P.; Lalich, D.; Moore, T. Disseminated sporotrichosis with brain abscesses in an HIV-infected patient. *Cureus* 2020, 12, e8016. [CrossRef]

30. Shah, D.; Kim, A.E.; Elbadri, S.; Desai, B.; Ganti, L. An uncommon rash in the emergency department: *Sporotrichosis Schenckii*. *Cureus* 2021, 13, e16125. [CrossRef]

31. Wellington, T.; Hauschild, J.; Krauland, K.J.; Verowie, E.G.; Markelz, A.E. Sporotrichosis in a U.S. Army basic trainee. *Mil. Med.* 2021, usab463. [CrossRef] [PubMed]

32. Zambrano, A.L.; Church, E.C.; McKay, K.M.; Morse, R.J.; Leveque, T.K.; Roxby, A.C. A disfiguring rash. *Open Forum Infect. Dis.* 2021, 8, ofab332. [CrossRef] [PubMed]

33. Kenny, H.; Dougherty, M.; Churnin, I.; Early, S.; Gupta, A.; McGarey, P.O., Jr. Chronic laryngotracheal granulomatous disease secondary to *Sporotrichosis Schenckii* in an immunocompromised patient. *Ann. Otol. Rhinol. Laryngol.* 2022, 34894211073002. [CrossRef] [PubMed]

34. Gutierrez-Morales, J.L.; Domínguez Romero, R.; Morales Esponda, M.; Rossiere Echazaleta, N.L.; Reyes Bonifant, G.; Santos Ramírez, A. Esporotricosis micematoide con invasión a la médula espinal. *Rev. Mex. Neuroci.* 2011, 12, 50–54.

35. Romero-Cabello, R.; Bonifaz, A.; Romero-Feregrino, R.; Sánchez, C.J.; Linares, Y.; Zavala, J.T.; Romero, L.C.; Romero-Feregrino, R.; Vega, J.T. Disseminated sporotrichosis. *BMJ Case Rep.* 2011, 2011, bcr2010103404. [CrossRef]

36. Rojas-Padilla, R.; Pastrana, R.; Toledo, M.; Valencia, A.; Mena, C.; Bonifaz, A. Esporotricosis cutánea linfangítica por mordedura de araña. *Dermatol. Rev. Mex.* 2013, 57, 479–484.

37. Espinoza-Hernández, C.J.; Jesús-Silva, A.; Toussaint-Caire, S.; Arenas, R. Disseminated sporotrichosis with cutaneous and testicular involvement. *Actas Dermosifiliogr.* 2014, 105, 204–206. [CrossRef]

38. Chávez-López, G.; Estrada-Castañón, R.; Estrada-Chávez, G.; Vega-Memije, M.E.; Moreno-Coutiño, G. Esporotricosis cutánea diseminada: Un caso de la región de la montaña del estado de Guerrero, México. *Dermatol. Rev. Mex.* 2015, 59, 228–232.

39. Cotino Sánchez, A.; Torres-Alvarez, B.; Gurrola Morales, T.; Méndez Martínez, S.; Saucedo Gárate, M.; Castanedo-Cazares, J.P. Mycosis fungoides-like lesions in a patient with diffuse cutaneous sporotrichosis. *Rev. Iberoam. Micol.* 2015, 32, 200–203. [CrossRef]

40. Bonifaz, A.; Tirado-Sánchez, A.; Paredes-Solís, V.; Cepeda-Valdés, R.; González, G.M.; Treviño-Rangel, R.J.; Fierro-Arias, L. Cutaneous disseminated sporotrichosis: Clinical experience of 24 cases. *J. Eur. Acad. Dermatol. Venereol.* 2018, 32, e77–e79. [CrossRef]

41. Bonifaz, A.; Torriolo, C.; Araiza, J.; Ramírez-Soto, M.C.; Tirado-Sánchez, A. Sporotrichin skin test for the diagnosis of sporotrichosis. *J. Fungi* 2018, 4, 55. [CrossRef] [PubMed]

42. Estrada-Castañón, R.; Chávez-López, G.; Estrada-Chávez, G.; Bonifaz, A. Report of 73 cases of cutaneous sporotrichosis in Mexico. *An. Bras. Dermatol.* 2018, 93, 907–909. [CrossRef] [PubMed]

43. Ochoa-Reyes, J.; Ramos-Martínez, E.; Treviño-Rangel, R.; González, G.M.; Bonifaz, A. Auricular sporotrichosis. Atypical case report simulating bacterial cellulitis. *Rev. Chil. Infectol.* 2018, 35, 83–87. [CrossRef] [PubMed]

44. Puebla-Miranda, M.; Vásquez-Ramírez, M.; González-Ibarra, M.; Torres-López, I.H. Esporotricosis. Reporte de un caso ocupacional. *Rev. Hosp. Juá. Mex.* 2018, 85, 246–250.

45. Rangel-Gamboa, L.; Martínez-Hernandez, F.; Maravilla, P.; Flisser, A. A population genetics analysis in clinical isolates of *Sporotrichosis Schenckii* based on calmodulin and calcium/calmodulin-dependent kinase partial gene sequences. *My coses 2018, 61, 383–392. [CrossRef]

46. Rojas, O.C.; Bonifaz, A.; Campos, C.; Treviño-Rangel, R.J.; González-Alvarez, R.; González, G.M. Molecular identification, antifungal susceptibility, and geographic origin of clinical Strains of *Sporotrichosis Schenckii* complex in Mexico. *J. Fungi* 2018, 4, 86. [CrossRef]

47. Estrada-Castañón, R.; Estrada-Chávez, G.; Chávez-López, M.G. Diagnosis and management of fungal neglected tropical diseases in community settings-mycetoma and sporotrichosis. *Trop. Med. Infect. Dis.* 2019, 4, 8. [CrossRef]

48. Mayorga-Rodriguez, J.; Mayorga-Garibaldi, J.L.; Muñoz-Estrada, V.F.; De León Ramirez, R.M. Esporotricosis: Serie de 1134 casos en una zona endémica de México. *Med. Cut. Ibero Lat. Am.* 2019, 47, 24–28.

49. Álvarez-Rivero, V.; Hernandez-Castro, R.; Moreno-Coutiño, G.; Lozano-Platonoff, A. Disseminated sporotrichosis: An important differential diagnosis for venous ulcers. *Adv. Skin. Wound Care* 2020, 33, 1–3. [CrossRef]

50. Bonifaz, A.; Morales-Peña, N.; Tirado-Sánchez, A.; Jiménez-Mendoza, D.R.; Treviño-Rangel, R.J.; González, G.M. Atypical sporotrichosis related to *Sporotrichos mexicana*. *Mycopathologia* 2020, 185, 733–735. [CrossRef]

51. Bonifaz, A.; Tirado-Sánchez, A.; Araiza, J.; Treviño-Rangel, R.; González, G.M. Deep mycoses and pseudomycoses of the foot: A single-center retrospective study of 160 cases, in a tertiary-care center in Mexico. *Foot 2021, 46, 101770. [CrossRef] [PubMed]

52. Martínez-Herrera, E.; Arenas, R.; Hernández-Castro, R.; Frias-De-León, M.G.; Rodríguez-Cerdeira, C. Uncommon clinical presentations of sporotrichosis: A two-case report. *Pathogens 2021, 10, 1249. [CrossRef] [PubMed]
76. Filho, J.E.; dos Santos, I.B.; Reis, C.M.S.; Patané, J.S.L.; Paredes, V.; Bernardes, J.P.R.A.; Poggiani, S.D.S.C.; Castro, T.D.C.B.; Gomez, O.M.; Pereira, S.A.; et al. A novel Sporothrix brasiliensis genomic variant in Midwestern Brazil: Evidence for an older and wider sporotrichosis epidemic. *Emerg. Microbes Infect.* 2020, 9, 2515–2525. [CrossRef] 

77. Marques, G.F.; Martins, A.L.G.P.; Sousa, J.M.P.; Brandão, L.S.G.; Wachholz, P.A.; Masuda, P.Y. Characterization of sporotrichosis cases treated in a dermatologic teaching unit in the State of São Paulo-Brazil, 2003–2013. *Bras. Dermatol.* 2015, 90, 273–275. [CrossRef] 

78. Veasye, J.; Neto, M.; Ruiz, L.; Zaitz, C. Clinical and laboratory profile of urban sporotrichosis in a tertiary hospital in the city of São Paulo. *Bras. Dermatol.* 2021, 96, 243–245. [CrossRef] 

79. Ferreira, L.C.; Barroso, P.F.; Tonomura, E.; Akita, T.; Rodrigues, K.M. Osteomyelitis caused by *Sporothrix schenckii* in an immunocompetent patient. *Rev. Soc. Bras. Med. Trop.* 2016, 49, 527–529. [CrossRef] 

80. Matos, A.M.F.; Moreira, L.M.; Barczewski, B.F.; De Matos, L.X.; De Oliveira, J.B.V.; Pimentel, M.I.F.; Almeida-Paes, R.; Oliveira, M.G.; Pinto, T.C.A.; Lima, N.; et al. Identification by MALDI-TOF MS of *Sporothrix brasiliensis* Isolated from a Subconjunctival Infiltrative Lesion in an Immunocompetent Patient. *Microorganisms* 2020, 8, 22. [CrossRef] 

81. do Monte Alves, M.; Pipolo Milan, E.; da Silva-Rocha, W.P.; Soares de Sena da Costa, A.; Araújo Maciel, B.; Cavalcante Vale, P.H.; de Albuquerque, P.R.; Lopes Lima, S.; Salles de Azevedo Melo, A.; Messias Rodrigues, A.; et al. Fatal pulmonary sporotrichosis caused by *Sporothrix brasiliensis* in Northeast Brazil. *PLoS Negl. Trop. Dis.* 2020, 14, e0008141. [CrossRef] 

82. Xavier, J.R.B.; Wally, S.B.; Osório, L.D.G.; Vives, P.S.; Albano, A.P.N.; de Aquiair, E.S.V.; Ferreira, M.R.A.; da Conceição, F.R.; de Faria, R.O.; Meireles, M.C.A.; et al. Human sporotrichosis outbreak caused by *Sporothrix brasiliensis* in a veterinary hospital in Southern Brazil. *J. Mycol. Med.* 2021, 31, 101163. [CrossRef] 

83. de Souza Pessoa, A.; Martins Brotas, A. Systemic sporotrichosis in an alcoholic patient. *Dermatol. Online J.* 2012, 8, 8. [CrossRef] 

84. Lacerda Filho, A.M.; Cavalcante, C.M.; Da Silva, A.B.; Inácio, C.P.; de Lima-Neto, R.G.; De Andrade, M.C.L.; Magalhães, O.M.C.; Dos Santos, F.D.A.G.; Neves, R.P.; High-Virulence Cat-Transmitted Ocular Sporotrichosis. *Mycopathologia* 2019, 184, 547–549. [CrossRef] 

85. de Moura Barros, N.; de Souza Pessoa, A.; Martins Brotas, A. Systemic sporotrichosis in an alcoholic patient. *Dermatol. Online J.* 2020, 95, 737–739. [CrossRef] 

86. Fichman, V.; Valle, A.C.F.D.; de Macedo, P.M.; Pereira, S.A.; et al. A novel *Sporothrix brasiliensis* genomic variant in Midwestern Brazil: Evidence for an older and wider sporotrichosis epidemic. *Emerg. Microbes Infect.* 2020, 9, 2515–2525. [CrossRef] 

87. Henckens, N.F.T.; Rovers, J.F.J.; van Dommelen, L.; Bovens, H.J. Can cats cause colossal contagious cutaneous carbuncles? *Retin. Cases Brief Rep.* 2020, 14, e0008141. [CrossRef] 

88. Lemes, L.R.; Veasye, J.V.; Soutto-Mayor, S.; Contín-Proenca, C. Ocular involvement in sporotrichosis: Report of two cases in children. *Bras. Derm.* 2021, 96, 349–351. [CrossRef] 

89. Dos Santos, F.D.A.G.; Neves, R.P. High-Virulence Cat-Transmitted Ocular Sporotrichosis. *Mycopathologia* 2020, 184, 547–549. [CrossRef] 

90. Araújo, M.C.C.L.; Jo Maciel, B.; Cavalcante Vale, P.H.; De Andrade, M.C.L.; Magalhães, O.M.C.; Dos Santos, F.D.A.G.; Neves, R.P.; High-Virulence Cat-Transmitted Ocular Sporotrichosis. *Mycopathologia* 2019, 184, 547–549. [CrossRef] 

91. Arantes-Ferreira, G.S.; Watanabe, A.L.C.; Trevizoli, N.C.; Jorge, F.M.F.; Cajio, M.C.C.L. Disseminated Sporotrichosis in a Liver Transplant Patient: A Case Report. *Transpl. Proc.* 2019, 51, 1621–1624. [CrossRef] 

92. Fichman, V.; Valle, A.C.F.D.; de Macedo, P.M.; Freitas, D.F.S.; Oliveira, M.M.E.; Almeida-Paes, R.; Gutierrez-Galhardo, M.C. Cryosurgery for the treatment of cutaneous sporotrichosis in four pregnant women. *PLoS Negl. Trop. Dis.* 2018, 12, e0006434. [CrossRef] 

93. Biancardi, A.L.; Freitas, D.F.; Vitor, R.D.; Andrade, H.B.; de Oliveira, M.M.; do Valle, A.C.; Zancope-Oliveira, R.M.; Galhardo, M.C.; Curi, A.L. Multifocal choroiditis in disseminated sporotrichosis in patients with HIV/AIDS. *Retin. Cases Brief Rep.* 2017, 11, 67–70. [CrossRef] 

94. Fischman-Gompertz, O.; Rodrigues, A.M.; Fernandes, G.F.; Bentubo, H.D.L.; Pires de Camargo, Z.; Petri, V. Atypical Clinical Presentation of Sporotrichosis Caused by *Sporothrix globosa* Resistant to Itraconazole. *Am. J. Trop. Med. Hyg.* 2016, 94, 1218–1222. [CrossRef] 

95. Aparecida-Grazziotin, N.; Gonçalves, I.L.; Todeschini, D.; Grazziotin-Vedana, L.; Canello-Todeschini, C.M.; Grazziotin, C. Squamous cell carcinoma subsequent to scarring caused by sporotrichosis: A case report. *Rev. Iberoam. Micol.* 2019, 36, 83–85. [CrossRef] 

96. Ribeiro, B.N.; Ribeiro, R.N.; Penna, C.R.; Frota, A.C. Bone involvement by *Sporothrix schenckii* in an immunocompetent child. *Pediatr. Radiol.* 2015, 45, 1427–1430. [CrossRef] 

97. Freitas, D.F.; Santos, S.S.; Almeida-Paes, R.; de Oliveira, M.M.; do Valle, A.C.; Gutierrez-Galhardo, M.C.; Zancope-Oliveira, R.M.; Nosanchuk, J.D. Increase in virulence of *Sporothrix brasiliensis* over five years in a patient with chronic disseminated sporotrichosis. *Virulence* 2015, 6, 112–120. [CrossRef] 

98. Nassif, P.W.; Granado, I.R.; Ferraz, J.S.; Souza, R.; Nassif, A.E. Atypical presentation of cutaneous sporotrichosis in an alcoholic patient. *Dermatol. Online J.* 2012, 18, 12.
99. Falqueto, A.; Bravim-Maiferde, S.; Araujo-Ribeiro, M. Unusual clinical presentation of sporotrichosis in three members of one family. *Int. J. Dermatol.* 2012, 51, 434–438. [CrossRef]

100. Marques-de-Macedo, P.; Sztabinjok, D.C.N; Camargo, Z.P.; Rodrigues, A.M.; Lopes-Bezerra, L.M.; Bernardes-Engemann, A.R.; Oroño-Costa, R. Dacrocystitis due to *Sporothrix brasiliensis*: A case report of a successful clinical and serological outcome with low-dose potassium iodide treatment and oculoplastic surgery. *Br. J. Dermatol.* 2015, 172, 1116–1119. [CrossRef]

101. Fichman, V.; Saravia-Freitas, D.F.; Marques-de-Macedo, P.; Francesconi-do-Valle, A.C.; Almeida-Silva, F.; Zancopé-Oliveira, R.M.; Almeida-Paes, R.; Gutiérrez-Gallardo, M.C. Sporotrichosis After Tattooing Caused by *Sporothrix*. *Bras. Mycopathol.* 2022, 187, 137–139. [CrossRef] [PubMed]

102. Nempmuceno Araújo, M.J.C.L.; Nihey, C.H.; Rodrigues, A.M.; Higashino, H.; Ponzo, V.; Campos Pignatari, A.C.; Barcellos, M.A.; Braga, O.; Duayer, I.F. Case Report: Invasive Sinusitis due to *Sporothrix Brasiliensis* in a Renal Transplant Recipient. *Am. J. Trop. Med. Hyg.* 2021, 105, 1218–1221. [CrossRef]

103. Lima, M.A.; Vallier, R.; Silva, M.M. *Sporothrix brasiliensis* meningitis in an immunocompetent patient. *Pract. Neurol.* 2021, 21, 241–242. [CrossRef]

104. Veasey, J.V.; Carvalho, G.S.M.; Ruiz, L.R.B.; Neves-Neto, M.F.; Zaitz, C. Epidemiological and geographical distribution profile of urban sporotrichosis in the city of São Paulo. *Bras. Derm.* 2022, 97, 228–230. [CrossRef]

105. Antonio, L.D.F.; Pimentel, M.I.F.; Lyra, M.R.; Madeira, M.D.F.; Miranda, L.D.F.C.; Paes, R.A.; Brito-Santos, F.; Carvalho, M.H.G.F.; Schubach, A.D.O. Sporothrix schenckii Sensu Lato identification in fragments of skin lesion cultured in NNN medium for differential diagnosis of cutaneous leishmaniasis. *Diagn. Microbiol. Infect. Dis.* 2017, 87, 118–120. [CrossRef] [PubMed]

106. Rodríguez, A.M.; de Hoog, S.; de Camargo, Z.P. Emergence of pathogenicity in the *Sporothrix schenckii* complex. *Rev. Peru Med. Exp. Salud Publica* 2015, 8, 322. [CrossRef] [PubMed]

107. Nieva, J.; León, L.; Carbia, M.; Arteta, Z.; Perera, P. Clinical and Epidemiological Characteristics of Sporotrichosis. *Int. J. Dermatol.* 2015, 54, 55–51. [CrossRef] [PubMed]

108. Macías, P.; Ordoñez, J.; Arenas, C.M.; Rodríguez, G. An eighteen-year-old man with tropical verrucous syndrome: Leishmaniasis vs. sporotrichosis. *Biomedica* 2021, 41, 240–246. [CrossRef]

109. Arenas-Soto, C.M.; Téllez-Kling, A.M.; Alvarado-Alvarez, Z.L. A Lesion on the Ear Resulting From Infection Acquired in the Tropics. *Actas Dermosifiliogr.* 2016, 107, 599–600. [CrossRef]

110. Niklitschek, S.; Porras, N.; González, S.; Romero, W. Sporotrichosis. *Med. Clin.* 2015, 145, 418. [CrossRef]

111. Cruz, R.; Vieille, P.; Oschilewski, D. *Sporothrix globosa* isolation related to a case of lymphocutaneous sporotrichosis. *Rev. Chil. Infectol.* 2012, 4, 401–405. [CrossRef]

112. Ruiz-Merino, I.; Orrego, R.; Acuña, M.; Ramírez, J.; Arenas, C.M.; Rodríguez-Sánchez, G.; Mendoza, M.; Camacho, E.; González, S.; Niño-Vega, G.A. Geographical distribution and ecological niche modeling of the etiological agents of human sporotrichosis in Venezuela. *Braz. J. Microbiol.* 2021, 52, 63–71. [CrossRef] [PubMed]
126. Mata-Essayag, S.; Delgado, A.; Colella, M.T.; Landaeta-Nezer, M.E.; Rosello, A.; de Salazar, C.P.; Olaizola, C.; Hartung, C.; Magaldi, S.; Velasquez, E. Epidemiology of sporotrichosis in Venezuela. *Int. J. Dermatol.* 2013, 52, 974–980. [CrossRef]

127. Martínez-Méndez, D.; Hernández-Valles, R.; Alvarado, P.; Mendoza, M. Mycoses In Venezuela: Working Groups in Mycology Reported Cases (1984–2010). *Rev. Iberoam. Micol.* 2013, 30, 39–46.

128. Camacho, E.; León-Navarro, I.; Rodríguez-Brito, S.; Mendoza, M.; Niño-Vega, G.A. Molecular epidemiology of human sporotrichosis in Venezuela reveals high frequency of *Sporothrix globose*. *BMC Infect Dis.* 2015, 15, 94. [CrossRef]

129. Orofino-Costa, R.; Marques-de-Macedo, P.; Messias-Rodrigues, A.; Bernardes-Engemann, A.R. Sporotrichosis: An update on epidemiology, etiopathogenesis, laboratory and clinical therapeutics. *Braz. Dermatol.* 2017, 92, 606–620. [CrossRef]

130. Rimma, Z.; Hernández Hernández, F. Sporotrichosis: The most frequent subcutaneous mycosis in Mexico. *Rev. Fac. Med.* 2019, 62, 48–55.

131. Chakrabarti, A.; Bonifaz, A.; Gutierrez-Galhardo, M.C.; Mochizuki, T.; Li, S. Global epidemiology of sporotrichosis. *Med. Mycol.* 2015, 53, 3–14. [CrossRef] [PubMed]

132. de Beer, Z.W.; Duong, T.A.; Wingfield, M.J. The divorce of *Sporothrix* and *Ophiostoma*: Solution to a problematic relationship. *Stud. Mycol.* 2016, 83, 165–191. [CrossRef] [PubMed]

133. Toriello, C.; Brunner-Mendoza, C.; Ruiz-Baca, E.; Duarte-Escalante, E.; Pérez-Mejía, A.; Reyes-Montes, M.R. Sporotrichosis in Mexico. *Braz. J. Microbiol.* 2021, 52, 49–62. [CrossRef] [PubMed]