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The Impact of Pathogenic Fungi on Soil Contamination in the Center of the Al-Munadhirah District

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KEYWORDS
Pathogenic fungi,
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Opportunistic pathogens

ABSTRACT:
The study, titled "The Impact of Pathogenic Fungi on Soil Contamination in the Al-Munadhirah District Center," collected 31 soil samples from different locations, analyzed them in the laboratory, and identified the types of pathogenic fungi. The study found that all the existing fungal species are opportunistic pathogens that can cause various diseases in humans, animals, and plants. Additionally, new species of fungi were discovered, including previously unrecorded ones such as Mucorracemosus, Fusarium culmorum, and Paecilomyces sp. These fungi were found to vary both temporally and spatially, increasing in locations with higher human activity and decreasing in areas farther from human pollutants. Furthermore, their population fluctuates throughout the seasons, with higher numbers during the spring and autumn and lower numbers during the summer and winter, influenced by both natural and human factors.

Introduction
Title: The presence of pathogenic fungi in the soil of the study area is widespread and has a clear impact on soil contamination. This is a result of the soil's nature, as well as the influence of natural and human factors that provide a fertile environment for the growth of fungi, which can adversely affect humans, animals, and plants by causing dangerous diseases resulting from human activities and the resulting waste. This leads to changes in soil characteristics and its suitability for use, ultimately leading to pollution and a negative impact on the living organisms within it and the ecosystem. In light of this, the study aims to investigate the types of pathogenic fungi present in the soil and their impact on environmental pollution in the Al-Munadhirah district center, specifically the diseases they cause to living organisms.
Research Problem: Are there pathogenic fungi prevalent in the soil of the study area in the Al-Munadhirah district center?
Research Hypothesis: Pathogenic fungi exist in the soil and have a clear impact on environmental pollution in the study area due to the diseases they cause in humans, animals, and plants.
Research Objective: The study aims to identify the types of pathogenic fungi in the soil and assess their impact on environmental pollution in the Al-Munadhirah district center by studying the diseases they cause to living organisms.
Scope of the Research: The Al-Munadhirah district center is located in the north of Al-Najaf province, covering an area of approximately 49.71 square kilometers. It shares borders with Al-Kufa district to the north, Al-Mishkhab district to the south, the administrative boundaries of Al-Qadisiyah province to the east, and the Al-Hira district to the west. The temporal boundaries of the study were from August 28, 2021, to August 22, 2022, relying on data such as climate, population, agriculture, satellite imagery, and maps during the year 2021. The spatial boundaries involve a spatial analysis of environmental pollution in the Al-Munadhirah district center, focusing on the natural and human characteristics influencing environmental pollution in the study area, particularly the physical, chemical, and biological properties, and

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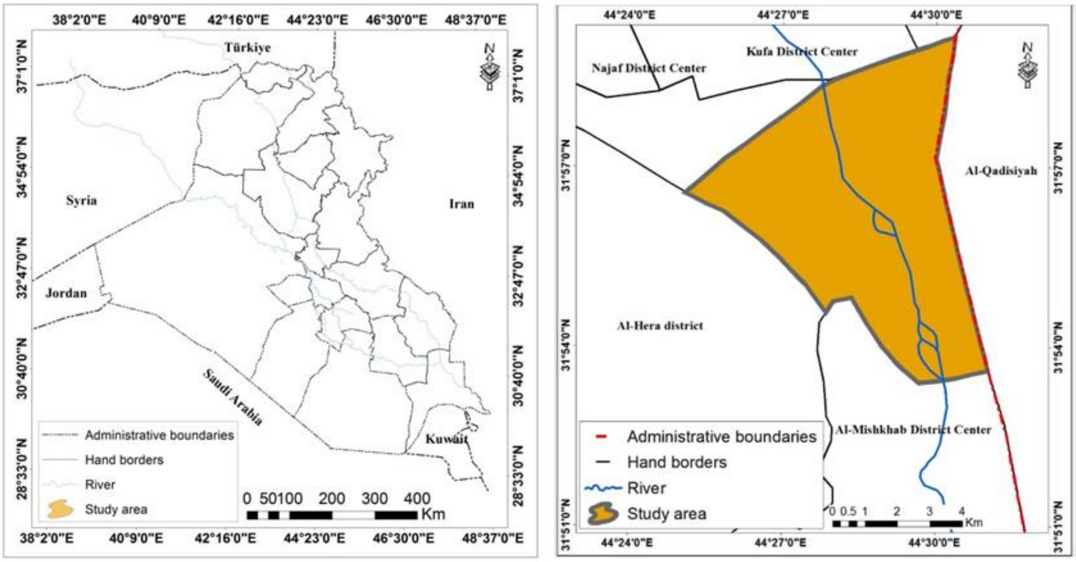
evaluating their suitability for various uses according to local and international standards [1].



Map 1: Location of the study area in Iraq [1]

Research Structure:

Source: - The General Authority for American Satellite Visual Survey 2021 LandSat, the administrative map of Iraq using ArcMap software.

Research Structure: The study's structure encompasses the theoretical framework, including the research problem, hypothesis, research objective, study area boundaries, types of pathogenic fungi, results, and sources.

Types of Soil-Contaminating Fungi in the Study Area:

Mucor racemosus:

This fungus is found throughout the environment, especially in soil and decomposing organic materials like tree leaves, compost heaps, rotten wood, grain remnants, vegetables, and organic matter. It belongs to the fast-growing species of fungi and can cause a dangerous fungal infection known as mucormycosis, or mucormycotic infection. Humans can contract this infection by coming into contact with fungal germs in the environment, inhaling these germs, and affecting the lungs or nasal sinuses. People with underlying health conditions or those taking medications that reduce the body's ability to fight germs are particularly susceptible. It can also enter the human body through wounds or burns. Symptoms of mucormycotic brain infection include facial swelling, headache, and nasal congestion, while symptoms of pulmonary mucormycosis include fever, cough, chest pain, and shortness of breath. On the other hand, cutaneous mucormycosis, which turns the affected area black, exhibits symptoms such as redness and swelling around the wound, abdominal pain, vomiting, nausea, and gastrointestinal bleeding [2].

Maps 2 and 3 demonstrate spatial and temporal variations in soil contamination by Mucor racemosus. There is spatial variation from one location to another and temporal variation throughout the seasons. The summer map (Maps 2, 3) shows that the distribution of this type of fungus is represented in two regions, namely "Low" and "Medium." The "Low" region for this fungus appears in (27) sites, including S1, S2, S3, S4, S5, S7, S8, S9, S10, S11, S12, S13, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S31, with the number of colonies ranging from 0 to 4 colonies per 1 ml out of a total of (75) colonies. In this season, the lowest number of colonies for Mucor racemosus was recorded, and its spatial extension is visible in all parts of the study area [3].

As for the "Medium" region, it is visible in (4) sites, including S6, S14, S29, S30, with colony numbers ranging from 5 to 7 colonies per 1 ml, and its spatial extension is visible in the northern part of the study area.

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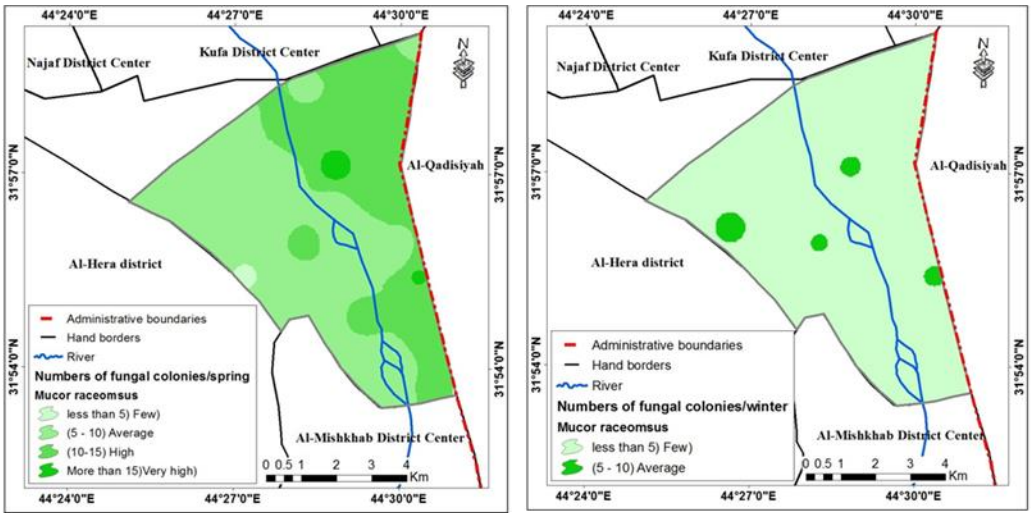

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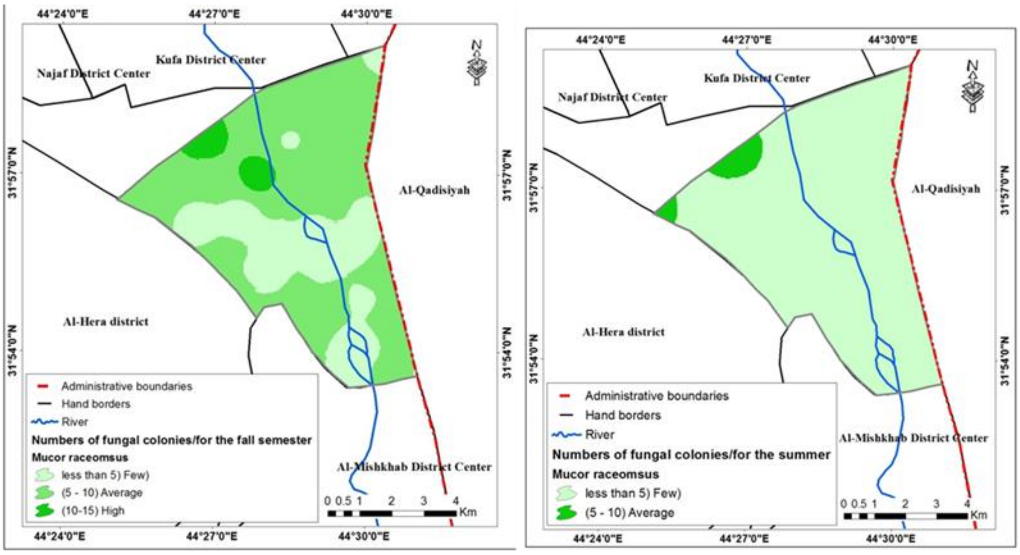
Map (2) for the number of colonies of a. Mucor racemosus for the autumn season, b. Mucor racemosus for the summer season.



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Map (3) for the number of colonies of a. Mucor racemosus for the spring season., b. Mucor racemosus for the winter season.

As evident from the data in Map 3 for the autumn season, the distribution of this type of fungus, Mucor racemosus, is seen in three regions: "Low," "Medium," and "High." The "Low" region for this fungus appears in (14) sites, including S1, S6, S9, S10, S11, S14, S16, S17, S20, S23, S24, S25, S27, S28, with the number of colonies ranging from 1 to 4 colonies per 1 ml out of a total of (192) colonies. Its spatial extension is visible in the central part of the study area and the southern part.

As for the "Medium" region, it is visible in (12) sites, including S2, S3, S4, S5, S7, S8, S9, S15, S19, S20, S22, S26, with the number of colonies ranging from 5 to 9 colonies per 1 ml, and its spatial extension is visible in all parts of the study area.

The "High" region for this type of fungus appears in (5) locations, including S13, S16, S29, S30, S31, with colony numbers ranging from 10 to 15 colonies per 1 ml, and its spatial extension is visible in the northern part of the region.

In the winter season, as shown in Table 1 and Map 5, the distribution of this type of fungus is represented in two regions: "Low" and "Medium." The "Low" region for this fungus appears in (22) sites, including S3, S4, S5, S6, S9, S10, S11, S12, S14, S16, S17, S18, S19, S20, S21, S22, S23, S25, S26, S27, S29, S30, with colony numbers ranging from 0 to 4 colonies per 1 ml out of a total of (90) colonies. Its spatial extension is visible in all parts of the study area.

As for the "Medium" region, it is visible in (9) sites, including S1, S2, S7, S8, S13, S15, S24, S28, S31, with colony numbers ranging from 5 to 6 colonies per 1 ml, and its spatial extension is visible in various parts of the region, including the eastern, western, and southern parts.

During the spring season, it is clear from Table 1 and Map 4 that the distribution of this type of fungus is observed in four regions: "Low," "Medium," "High," and "Very High." The "Low" region for this fungus appears at only one location, S26, with a total of (4) colonies out of (298) colonies in these locations. This season records the highest number of colonies for Mucor racemosus, and its spatial extension is visible in the eastern and southern parts of the area [4].

As for the "Medium" region, it is visible in (18) sites, including S7, S4, S9, S11, S12, S17, S18, S19, S21, S22, S23, S25, S26, S27, S28, S29, S30, S31, with colony numbers ranging from 5 to 9 colonies per 1 ml, and its spatial extension is visible in the northern and eastern parts.

The "High" region appears in (11) sites, including S2, S3, S5, S6, S8, S10, S14, S15, S16, S20, S25, with colony numbers ranging from 10 to 15 colonies per 1 ml, and its spatial extension is visible in the northern part, extending to the southern part.

The "Very High" region for this type of fungus appears in (2) locations, S7 and S13, with colony numbers ranging from 16 to 19 colonies per 1 ml, and its spatial extension is visible in the central part of the study area.

It is evident that this type of fungi grows in all the studied locations, which aligns with the natural scientific context of the study area. The spring and autumn seasons rank highest in terms of colony numbers. This is due to the fertile environmental conditions for fungal growth, with optimal temperature and relative humidity. These locations are also affected by the sewage waste from urban activities, which affects the area through contaminated irrigation water, posing a risk of fungal contamination. In addition, agricultural activities and the disposal of tree debris and compost piles on the soil provide an ideal growth environment for the fungi. Farmers in the region are at risk of contracting mucormycosis due to injuries that occur during their work or contact with vegetables and fertilizers [5].

In the summer season, which comes second in terms of colony numbers despite the high temperatures, the growth of this type of fungus is attributed to increased agricultural activity in the agricultural lands on either side of the river. The use of fertilizers and fertilizers settles on the soil, providing a conducive environment for fungal growth. However, during the winter season, which records the lowest number of colonies for this type of fungi, there is reduced agricultural activity. This is in addition to the decrease in sewage levels despite the presence of moisture. Industrial waste from industries such as door manufacturing workshops and car wash stations in these areas does not contribute to the growth of this type of fungus.

2- Aspergillus niger:

Aspergillus niger is a type of filamentous fungus known for its rapid and widespread growth in soil and air. It can cause various diseases in humans, including bronchopulmonary aspergillosis, which is a type of lung infection. It can also affect other parts of the body, such as the lungs, eyes, and ears, leading to fungal ear inflammation and even corneal inflammation, which may result in vision loss.

As evident from Table 2 and Maps 5, 6, 7, and 8, there is spatial and temporal variation in soil contamination with Aspergillus niger. The spatial distribution varies from one location to another, and it also fluctuates seasonally. In the summer season, represented in Map 5, the distribution of this fungus is observed in two regions: "Low" and "Medium." The "Low" region for Aspergillus niger appears in (19) sites, including S2, S3, S4, S5, S6, S8, S9, S12, S13, S14, S15, S16, S17, S18, S22, S23, S24, S25. The number of colonies ranges from 1 to 4 colonies per 1 ml, out of a total of 126 colonies. Its spatial extension is visible in various parts of the area, including the northern part, extending to the southern part [6].

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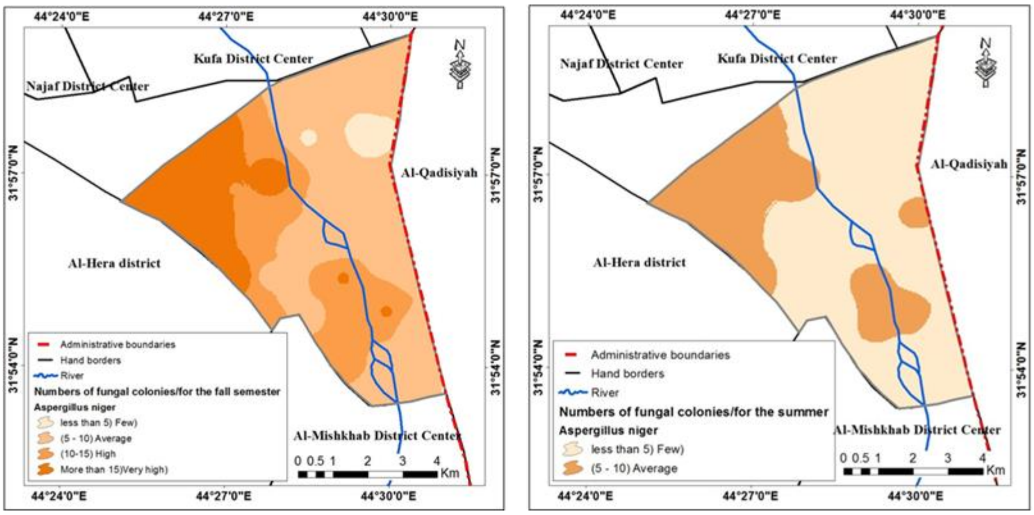

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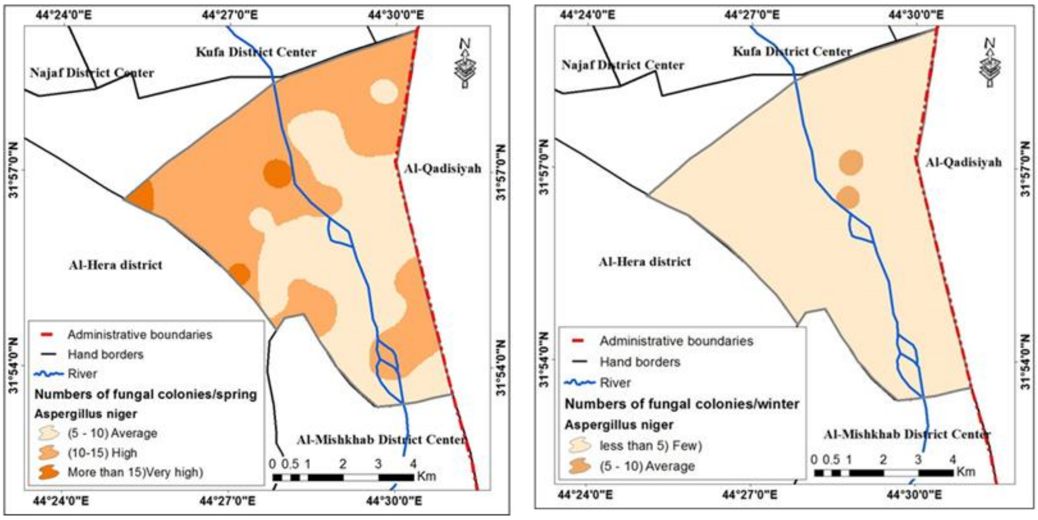
Map 4 for the number of colonies of a.Aspergillus niger during the autumn season, b. Aspergillus niger during the summer



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Map 5 for the number of colonies of a.Aspergillus niger during the spring season, b. Aspergillus niger during the winter season

Region 2 (Intermediate) appears in 13 locations (S1, S7, S10, S14, S19, S20, S21, S26, S27, S28, S29, S30, S31) with a number of colonies ranging from (5-9) cells/1 ml. Its spatial extension is observed in the western and southern parts of the region.

It is evident from the data in Map 4 for the autumn season that the distribution of this type of fungus is represented in four regions: Low, Intermediate, High, and Very High. The first region (Low) for this type of fungus appears in two locations (S5, S6) with a number of colonies ranging from (1-4) cells/1 ml. The total number of colonies in these locations reached 323 colonies, and its spatial extension is observed in the northeastern part.

The second region (Intermediate) for this type of fungus appears in 17 locations (S1, S2, S3, S4, S8, S9, S11, S12, S13, S15, S16, S17, S18, S22, S23, S24, S25) with a number of colonies ranging from (5-9) cells/1 ml, and its spatial extension is observed in various parts, appearing in the northern part, extending to the southern part.

The third region (High) for this type of fungus appears in five locations (S7, S10, S19, S20, S27) with a number of colonies ranging from (number not provided) cells/1 ml, and its spatial extension is observed in various parts of the region, appearing in the western and southern parts.

The fourth region (Very High) for this type of fungus appears in seven locations (S14, S21, S26, S28, S29, S30, S31) with a number of colonies ranging from (16-23) cells/1 ml, and its spatial extension is observed in the western part of the study area.

In the winter season, as shown in Map 5, the distribution of this type of fungus is represented in two regions: Low and Intermediate. The first region (Low) for this type of fungus appears in 26 locations (S1, S2, S3, S4, S6, S8, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S31) with the number of colonies ranging from (1-4) cells/1 ml from a total of 89 colonies. Its spatial extension is observed in all parts of the study area. The second region (Intermediate) for this type of fungus appears in five locations (S5, S7, S9, S10, S30) with a number of colonies ranging from (5-6) cells/1 ml, and its spatial extension is observed in the central part of the study area.

During the spring season, as shown in Map 5, the distribution of this type of fungus is represented in two regions: Intermediate and High. The first region (Intermediate) for this type of fungus appears in 11 locations (S6, S7, S8, S10, S11, S12, S16, S18, S19, S20, S25) with a number of colonies ranging from (5-9) cells/1 ml from a total of 334 colonies in these locations. This season recorded the highest number of colonies for Aspergillus niger, and its spatial extension is observed in various parts of the region, appearing in the northern, eastern, and southern parts [7].

The second region (High) for this type of fungus appears in 20 locations (S1, S2, S3, S4, S5, S9, S13, S14, S15, S17, S21, S22, S23, S24, S26, S27, S28, S29, S30, S31) with a number of colonies ranging from (10-18) cells/1 ml, and its spatial extension is observed in the eastern part of the region.

From the presented data, it is clear that this type of fungi appears in all studied soil locations. This is due to the high concentrations of pollutants in the soil. The increased number of colonies during the autumn and spring seasons is attributed to the favorable conditions for growth, including moderate temperatures and high humidity. The region is also exposed to pollutants resulting from agricultural activities and the use of organic fertilizers in the soil, which provide essential nutrients for the growth of these fungi that settle on the soil surface and contaminate it. Additionally, the remnants of decomposed plant parts contribute to the contamination. This exposes the residents of the area to respiratory diseases, known as aspergillosis, which affects the lungs and can lead to ear inflammation and the risk of blindness due to corneal inflammation. On the other hand, during the summer season, which ranks second in terms of the number of colonies, despite the high temperatures, we observe the growth of this type of fungus due to the increase in the agricultural areas of water-loving crops, the use of organic fertilizers, and the high levels of sewage that help increase the activity of fungi in surface waters used for irrigation and soil washing, contributing to contamination. In contrast, the winter season, which ranks fourth in terms of colony numbers, records the lowest number compared to other seasons. This is due to the unfavorable conditions for its growth, including the reduction in agricultural areas and the limited use of organic fertilizers, which are considered the essential nutrients for the growth of these fungi that settle on the soil surfaces. Additionally, these locations are far from industrial pollution sources [8].

Fungus Aspergillus sp:

This fungus is one of the most widespread fungi due to its rapid growth in nature. It is found in soil and air. The genus of this fungus belongs to the filamentous fungi family. Some of its species are pathogenic opportunists, while others are saprophytic. This fungus causes several diseases in humans and animals, including ear infections in humans, referred to as "Otomycoses," and it causes fungal skin diseases affecting human skin, known as "fungal diseases." Additionally, it can cause lung diseases in livestock, birds, and horses. It also leads to the rotting of plant fruits like tomatoes during their growth stages and results in the rotting of onion plants, commonly known as "black smut."

As indicated in Maps 6 and 7, there is spatial and temporal variation in soil contamination by Aspergillus sp. The spatial variation ranges from place to place, and the contamination levels fluctuate during different seasons. From the summer map (Map 1), it is evident that the distribution of this type of fungus is represented in two regions: Low and Intermediate. The first region (Low) for this type of fungus appears in 18 locations (S3, S5, S6, S9, S11, S12, S13, S16, S17, S18, S19, S20, S21, S22, S23, S28, S29, S30) with a number of colonies ranging from (0-4) cells/1 ml, out of a total of 191

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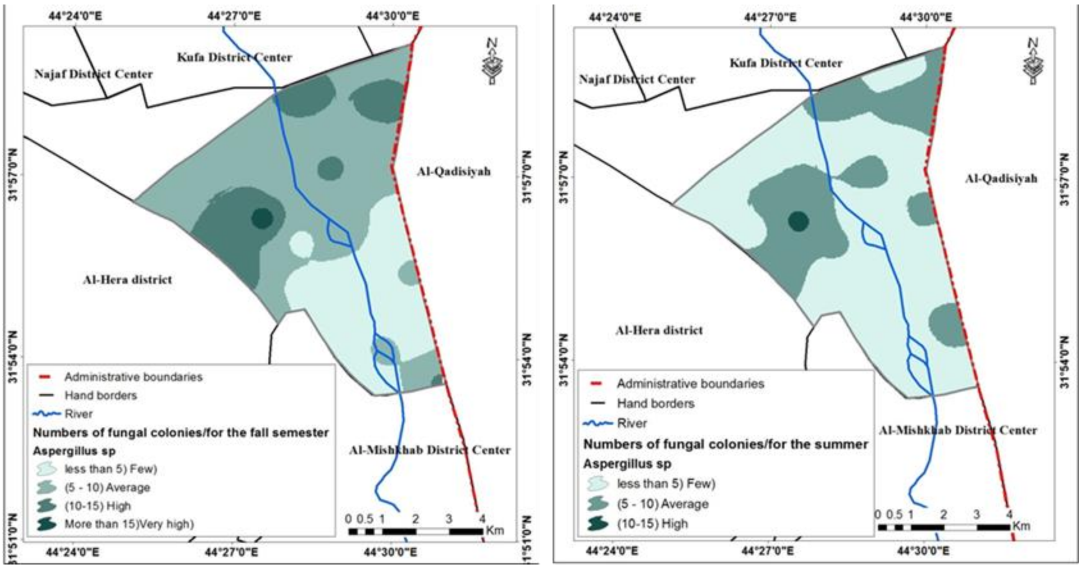
colonies. Its spatial extension is observed in all parts of the study area [9].



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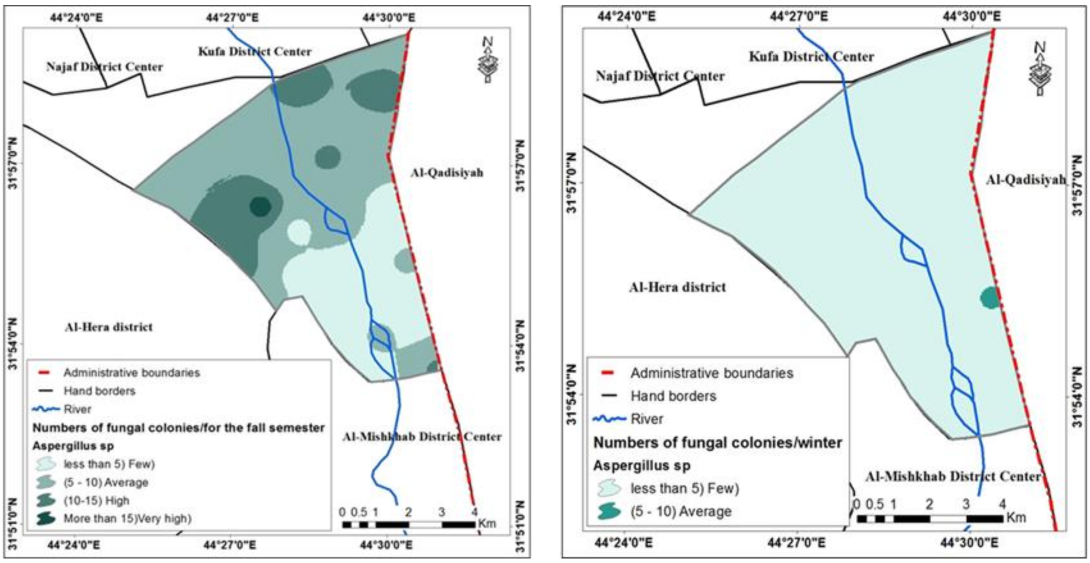
Map 6 for the number of colonies of a.Aspergillus sp for the autumn season, b.Aspergillus sp for the summer season



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Map 7 for the number of colonies of a. Aspergillus sp for the spring season b.Aspergillus sp for the winter season

Regarding the second region (medium), it appears at 8 locations (S1, S2, S4, S7, S8, S10, S14, S15) with a number of colonies ranging between (5-9) colonies per 1 ml. Its spatial distribution extends to the southern and eastern parts of the study area, extending to the southern part. As for the third region (high), it appears in one location (S27) with a concentration of (12) colonies per 1 ml, and its spatial distribution is in the western part.

As evident from the data in Map 6 for the autumn season, the distribution of this type of fungus is divided into three regions (few, medium, high). The first region (few) appears at 10 locations (S10, S12, S14, S15, S18, S19,

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S21, S22, S23, S24) with a number of colonies ranging between (1-4) colonies per 1 ml out of a total of (219) colonies. Its spatial distribution extends to the southern part of the region.

The second region (medium) for this type of fungus appears in 13 locations (S2, S3, S5, S8, S9, S11, S13, S17, S20, S28, S29, S30, S31) with a number of colonies ranging between (5-9) colonies per 1 ml. Its spatial distribution is in various parts of the study area, appearing in the northern, western, and southern parts.

The third region (high) for this type of fungus appears in 8 locations (S1, S6, S13, S16, S25, S26, S27, S31) with a number of colonies ranging between (10-14) colonies per 1 ml. Its spatial distribution is in various parts of the study area, appearing in the northern, western, and southern parts.

As for the fourth region (very high), it appears in only one region, which is S27, with a concentration of (18) colonies per 1 ml. Its spatial distribution is in the western part of the study area.

On the other hand, in the winter season, as shown in Map 7, the distribution of this type of fungus is divided into two regions (few, medium). The first region (few) for this type of fungus appears in 26 locations, including (S3, S4, S5, S6, S7, S9, S10, S11, S12, S14, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S30, S31), with a number of colonies ranging between (0-4) colonies per 1 ml out of a total of (89) colonies. In this season, the lowest number of colonies for Aspergillus sp was recorded, and its spatial distribution is in all parts of the study area.

The second region (medium) for this type of fungus appears in 5 locations, including (S1, S2, S8, S13, S15), with a number of colonies ranging between (5-6) colonies per 1 ml. Its spatial distribution is in the eastern part of the study area [10].

During the spring season, as shown in Map 7, the distribution of this type of fungus is divided into three regions (few, medium, high). The first region (few) for this type of fungus appears at 2 locations, including (S10, S20), with a number of colonies ranging from (3-4) out of a total of (245) colonies. In these locations, the highest number of colonies for Aspergillus sp was recorded during this season, and its spatial distribution is in the southern part of the region.

The second region (medium) for this type of fungus appears in 22 locations, including (S2, S3, S4, S5, S7, S8, S9, S11, S12, S14, S15, S17, S18, S19, S20, S21, S22, S23, S24, S28, S29, S30), with a number of colonies ranging between (5-9) colonies per 1 ml. Its spatial distribution is in all parts of the study area.

The third region (high) for this type of fungus appears in 8 locations, including (S1, S6, S13, S16, S25, S26, S27, S31), with a number of colonies ranging between (10-14) colonies per 1 ml. Its spatial distribution is in various parts of the study area, appearing in the northern, western, and southern parts.

This analysis reveals that the growth of this type of fungi does not occur in all the studied locations, which corresponds to the scientific sites of the study area. The high number of colonies for this type of fungi during the autumn and spring seasons is due to the ideal temperature and humidity conditions for their growth, as well as the increase in pollutant concentrations resulting from agricultural activity and its byproducts, which encourage the growth of these fungi. This poses a risk to the residents of the area, causing skin diseases and affecting farm. From Maps 8, and 9, it's evident that there is spatial and temporal variation in soil contamination with Aspergillus ibericus fungus. This variation occurs from place to place and during different seasons of the year.

In the summer season, as depicted in Map 8, the distribution of this type of fungus is divided into two regions (few and medium). The first region (few) for Aspergillus ibericus appears in 22 locations (S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S18, S21, S22, S23, S25, S28, S29, S30), with the number of colonies ranging between (0-4) colonies per 1 ml out of a total of 107 colonies. In this season, the lowest number of colonies for Aspergillus ibericus was recorded, and its spatial distribution covers all parts of the study area.

The second region (medium) for this type of fungus appears at 9 locations (S1, S15, S17, S19, S20, S24, S26, S27, S31) with the number of colonies ranging between (5-7) colonies per 1 ml. Its spatial distribution is in various parts of the region, including the western and southern parts.

In the autumn season, as indicated by Map 9, the distribution of Aspergillus ibericus fungus is divided into three regions (few, medium, high). The first region (few) for this type of fungus appears at 7 locations (S1, S6, S11, S21, S28, S29), with the number of colonies ranging between (1-4) colonies per 1 ml out of a total number of colonies that reached(221) Colonies of this fungus are found, and its spatial distribution is evident in various parts of the study area, primarily in the northern and western sections. As for the second region (medium), this type of fungus appears in 18 locations (S2, S3, S4, S5, S7, S8, S10, S12, S13, S14, S16, S18, S22, S23, S24, S25, S30, S31), with colony numbers ranging from (5-9) colonies per 1 ml, and its spatial distribution covers all parts of the study area.

As for the third region (high) for this type of fungus, it is observed in 6 locations (S15, S17, S19, S20, S26, S27) with colony numbers ranging from (10-14) colonies per 1 ml. Its spatial distribution is primarily in the western and southern parts of the study area.

In contrast, in the winter season, as shown in Map 9, the distribution of this fungus falls into two regions (few and medium). The first region (few) of this fungus appears in 18 locations (S3, S4, S5, S6, S9, S10, S11, S12, S16, S17, S19, S23, S25, S26, S27, S28, S29, S30), with colony numbers ranging from (0-4) colonies per 1 ml out of a total of 112 colonies. The spatial distribution covers all parts of the study area.

The second region (medium) for this type of fungus appears in 12 locations (S1, S2, S7, S8, S13, S14, S15, S18, S21, S22, S24, S31), with colony numbers ranging from (5-6) colonies per 1 ml. Its spatial distribution is mainly in the central part of the study area and the southern part.

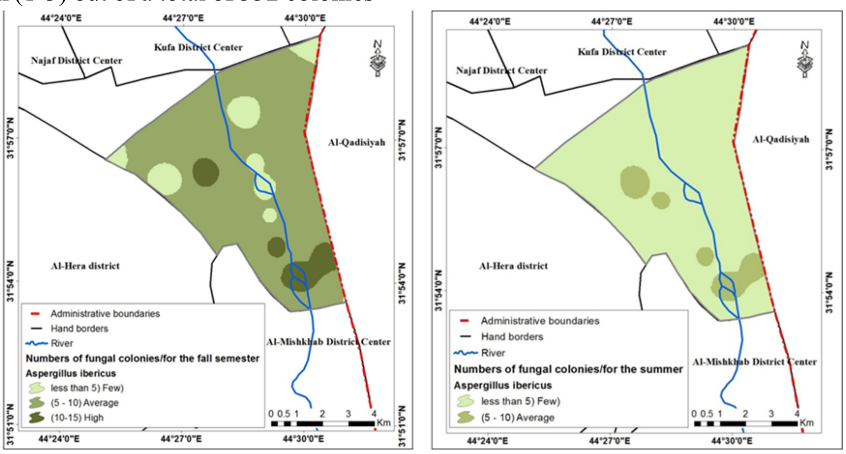
During the spring, as shown in Map 9, the distribution of this fungus is categorized into four regions (few, medium, high, very high). The first region (few) of this fungus is found in two locations (S2, S6) with colony numbers ranging from (1-3) out of a total of 332 colonies in these locations. This season records the highest number of colonies for Aspergillus ibericus, and its spatial distribution is primarily in the northern part of the study area.

The second region (medium) for this type of fungus appears in 12 locations (S3, S4, S9, S11, S16, S17, S19, S20, S21, S26, S28, S29), with colony numbers ranging from (5-10) colonies per 1 ml, covering all parts of the study area.

The third region (high) is found in 12 locations (S1, S5, S7, S10, S12, S14, S18, S22, S23, S24, S27, S30), with colony numbers ranging from (10-15) colonies per 1 ml, and its spatial distribution covers all parts of the study area.

The fourth region (very high) for this type of fungus appears in 5 locations (S8, S13, S15, S25, S31), with colony numbers ranging from (17-16) colonies per 1 ml, and its spatial distribution is scattered throughout the region, including the eastern, western, and southern parts.

In summary, this type of fungus doesn't appear in all studied locations within the study area, which aligns with the global pattern for the region due to increased salt concentrations in the soil, hindering fungal growth. The highest number of colonies was recorded during spring and autumn, mainly due to favorable environmental conditions, including moderate temperatures, suitable humidity, and the impact of agricultural activity residues and fertilizer use. However, during the summer and winter, fewer colonies were observed due to unfavorable conditions for growth.



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Map (8) for the number of colonies of a.Aspergillus ibericus for the autumn season, b.Aspergillus ibericus for the summer season

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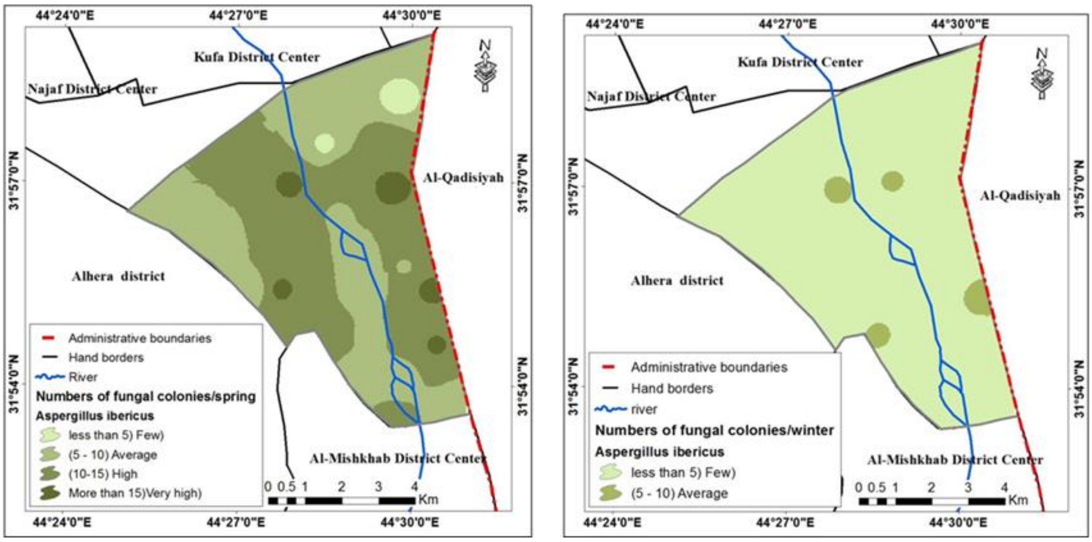

a b

Map (9) for the number of colonies of a.Aspergillus ibericus for the spring season, b.Aspergillus ibericus for the winter season

Results

The study, based on soil laboratory results from the studied locations, revealed spatial and temporal variations in fungal growth. Fungal growth varies from one place to another and also varies seasonally.

The study clarified that the numbers of pathogenic fungi increase in locations affected by urban and agricultural activities' byproducts, while their numbers decrease as one moves away from these sources.

The study indicated that there is temporal variation in fungal numbers, with higher numbers during the spring and fall seasons and the lowest numbers during the winter and summer. These variations are attributed to the climatic conditions that differ throughout the seasons.

According to the laboratory results, the study demonstrated that all types of fungi present pose a risk to humans, animals, and plants due to the diseases they can cause.

Conclusions

The study has highlighted the dynamic nature of fungal growth, emphasizing its sensitivity to both spatial and seasonal factors. Urban and agricultural activities have a notable impact on the proliferation of pathogenic fungi, and a closer proximity to these sources corresponds to higher fungal counts. Seasonal fluctuations in fungal populations were observed, with the spring and fall seasons showing higher fungal numbers, while the winter and summer seasons recorded lower counts. These variations can be attributed to the changing climatic conditions across different seasons. The study underscores the potential health risks associated with the presence of various fungal species, as they can cause diseases in humans, animals, and plants. Overall, this research provides valuable insights into the distribution and dynamics of fungi in the study area, shedding light on the environmental and health implications of their presence.

References

1. Republic of Iraq. General Commission for Survey. Administrative Map of Iraq.
2. Omar Ali Saeed Muftah and others, "Pollution with Heavy Metals: Estimation of Cadmium and Lead Content in Some Vegetables, Fruits, and Grain Products," Faculty of Arts and Sciences, Benghazi University, Journal of Science and Humanities Studies, Issue 21, 2016, p. 2.
3. Almudhafar, S.M. Spatial Variation of Biological Contamination of Soil from Najaf City. Indian Journal of Environmental Protection this link is disabled, 2020, 40(2), pp. 192–196.
4. Almudhafar, S.M., Alattabi, I.A. Effect of environmental factors on drainage water network in Najaf governorate, Iraq. Indian Journal of

Environmental Protection this link is disabled, 2019, 39(11), pp. 1050–1056.
5. Almudhafar, S.M. Environmental assessment of shut alkufa in Iraq. Plant Archives, 2018, 18(2), pp. 1545–1551.
6. Almudhafar, S.M., Abboud, H.A. Spatial variation of surface water contamination by heavy elements in Alhira relative to tourism. African Journal of Hospitality, Tourism and Leisure, 2018, 7(4)
7. KR Kadhim, S Almudhafar, BA Almayahi, 2023. An environmental assessment of the non-living natural resources and the available capabilities and their investment in Al-Najaf Governorate, HIV Nursing 23 (3), 265–273
8. IA Alattabi, SM Almudhafar, BA Almayahi (2023). Natural constituents of the elements affecting soil pollution and health effects and changing their properties by wastewater in Najaf district center, Solid State Technology 63 (6), 5438-5452.
9. A sensitivity and mold file, a report published online at the following website: https://healthmatters.io/understand-blood-test-results/mucor-racemosus.
10. Jaafar Al-Assaf and others, the inhibitory effect of extracts from some medicinal plants on Aspergillus niger fungus, Journal of Basic Education Research, Volume 10, 2011.