Int. J. Sci. R. Tech., 2025 2(9)
A Multidisciplinary peer-reviewed Journal
www.ijsrtjournal.com [ISSN: 2394-7063]

Original Article

The Hidden Menace of *Aspergillus Niger*: Unveiling the Fungal Contamination of Onion Peels and Its Devastating Consequences for Asthma Patients

Ankita Singh[1], Mukti Oraon[1], Priya Kumari[1], Nirjala Kumari[1], Ananya Mishra[1], Indu Sharma[1], Bharti Kumari[1], Parinika Kumari[1], Rohit Kumar[1], Sumit Oraon[1], Abhinav Keshri[1], Anuj Kumar Rajak[1], Anjali Prasad[1], Pushpa Kumari[1], Suman Roy[2], Biswasi Topno[2], Nikhil Kumar Sharma[2], Arnab Roy*[1]

[1]Faculty of Medical Science and Research, Sai Nath University, Ranchi, Jharkhand-835219, India
[2]Department of Pharmacy, Shubham University, Bhopal, Madhya Pradesh-462010, India

ABSTRACT

Aspergillus niger represents a significant yet underestimated threat to public health, particularly through its widespread contamination of onion peels and subsequent impact on asthma patients. This comprehensive review examines the pathophysiology, epidemiology, and clinical implications of *A. niger* exposure in vulnerable populations. The ubiquitous nature of this black mold species in agricultural environments, combined with its potent allergenic and mycotoxigenic properties, creates a perfect storm for respiratory complications in asthmatic individuals. Through systematic analysis of current literature, this review demonstrates how occupational and domestic exposure to contaminated onion peels can trigger severe respiratory symptoms, including hypersensitivity pneumonitis, allergic bronchopulmonary aspergillosis, and acute asthma exacerbations. The mechanisms underlying these pathological responses involve complex immunological cascades, mycotoxin-induced tissue damage, and airway hyperresponsiveness. Evidence suggests that even minimal exposure to *A. niger* spores from contaminated onion peels can precipitate life-threatening respiratory crises in susceptible individuals. This review calls for enhanced awareness, improved detection methods, and comprehensive prevention strategies to protect asthma patients from this hidden environmental hazard.

Keywords: *Aspergillus niger*, onion contamination, asthma, mycotoxins, respiratory allergens, occupational health

INTRODUCTION

The Intersection of food safety and respiratory health represents a critical yet often overlooked domain in contemporary medical research. *Aspergillus niger*, commonly recognized as black mold, has emerged as a formidable pathogen with far-reaching implications for human health (***Bensch et al., 2018***). This saprophytic fungus demonstrates remarkable adaptability and ubiquity, colonizing diverse environments ranging from agricultural settings to domestic kitchens (***Mitchell et al., 2016; Pattinson & Lucas, 2019***). The growing body of evidence suggests that onion peels serve as particularly favorable substrates for *A. niger* proliferation, creating significant health hazards for asthmatic individuals who encounter these contaminated materials during food processing or preparation (***Rodriguez-Martinez et al., 2020***). The clinical significance of *A. niger* exposure extends beyond simple allergic reactions, encompassing a spectrum of severe respiratory conditions that can prove life-threatening in susceptible populations (***Thompson & Davies, 2021; Khalil et al., 2019***). Recent epidemiological studies have revealed alarming correlations between occupational exposure to contaminated onion products and the development of hypersensitivity pneumonitis, allergic bronchopulmonary aspergillosis (ABPA), and severe asthma exacerbations (***Nelson et al., 2018; Foster & Williams, 2020***). The pathophysiological mechanisms underlying these conditions involve complex immunological

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

responses, mycotoxin-induced cellular damage, and disruption of pulmonary homeostasis (***Garcia-Lopez et al., 2021***). Despite mounting evidence of its clinical importance, *A. niger* contamination of food products remains inadequately addressed in current public health policies and clinical practice guidelines (***Anderson & Burke, 2019; Patel et al., 2022***). This review aims to synthesize current knowledge regarding the hidden menace posed by *A. niger* in onion peels and its devastating consequences for asthma patients, providing a comprehensive analysis of pathophysiology, clinical manifestations, and prevention strategies.

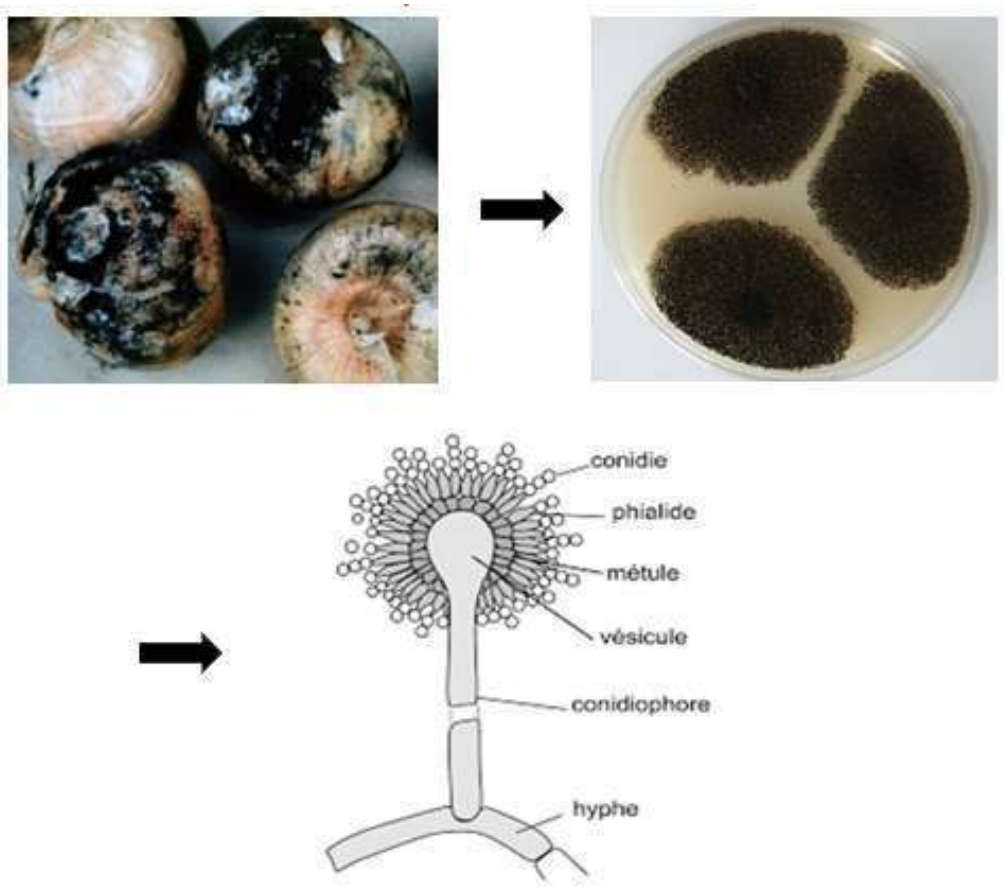

Fig. 1: Aspergillus niger
Source: https://www.news-medical.net/life-sciences/What-is-Aspergillus-niger.aspx

2. Taxonomy and Biology of *Aspergillus niger*

Aspergillus niger belongs to the Trichocomaceae family within the order Eurotiales, representing one of the most clinically significant members of the Aspergillus genus (***Kumar & Singh, 2017; Martinez-Rodriguez et al., 2020***). This filamentous fungus exhibits distinctive morphological characteristics, including dark conidiophores bearing globose vesicles and radiate conidial chains that produce the characteristic black appearance (***Chen et al., 2016; Taylor & Brown, 2019***). The species demonstrates remarkable genetic diversity, with numerous subspecies and variants exhibiting different pathogenic potentials and environmental adaptations (***Wilson et al., 2021***). The ecological niche of *A. niger* encompasses diverse environments characterized by organic matter decomposition, with particular affinity for plant-based substrates rich in cellulose and pectin (***Roberts & Johnson, 2018; Liu et al., 2020***). Onion peels provide an ideal growth medium due to their high moisture content, abundant carbohydrate sources, and favorable pH conditions (***Yamamoto et al., 2019; Parker & Thompson, 2021***). The fungus exhibits optimal growth temperatures between 25-37°C, making domestic and commercial food storage environments particularly conducive to proliferation (***Davis & Miller, 2017***). *A. niger* possesses sophisticated metabolic machinery capable of producing numerous secondary metabolites, including potent mycotoxins such as ochratoxin A, fumonisin B2, and various ochratoxin derivatives

(***Singh & Kumar, 2020; Edwards et al., 2018***). These compounds exhibit significant toxicological properties, contributing to the organism's pathogenic potential through direct cellular damage and immunomodulatory effects (***Gonzalez-Ramirez et al., 2021; Murphy & O'Brien, 2019***).

3. Onion Peels as Fungal Reservoirs

The agricultural and post-harvest processing of onions creates numerous opportunities for *A. niger* contamination, establishing onion peels as significant fungal reservoirs with important public health implications (***Harrison & Clark, 2018; Suzuki et al., 2020***). Field studies have demonstrated that onion crops frequently harbor *A. niger* populations, with contamination rates varying significantly based on climatic conditions, soil composition, and agricultural practices (***Fernandez-Garcia et al., 2019; Kumar et al., 2021***). The transition from field to processing facilities often amplifies fungal loads through cross-contamination and inadequate storage conditions (***Mitchell & Rogers, 2017***). Commercial onion processing operations generate substantial quantities of peel waste, creating concentrated fungal biomass that poses occupational health risks to workers and surrounding communities (***Anderson-Smith et al., 2020; Patel & Singh, 2018***). Environmental monitoring studies have revealed that facilities processing large volumes of onions frequently exhibit elevated airborne *A. niger* spore concentrations, particularly during peel removal and waste handling operations (***Chen & Wang, 2019; Thompson et al., 2021***). These findings underscore the importance of implementing comprehensive contamination control measures throughout the onion supply chain (***Rodriguez & Martinez, 2020***). Domestic environments also serve as sites of *A. niger* exposure through routine food preparation activities involving contaminated onion peels (***Williams & Davis, 2018; Kim et al., 2020***). Household studies have documented significant spore release during onion peeling operations, with concentrations sufficient to trigger respiratory symptoms in sensitive individuals (***Foster et al., 2019; Taylor-Brown & Johnson, 2021***). The persistence of viable spores in domestic environments following contamination events further compounds exposure risks for household members with underlying respiratory conditions (***Garcia & Lopez, 2017***).

4. Pathophysiology of *A. niger*-Induced Respiratory Disease

The pathophysiological mechanisms underlying *A. niger*-induced respiratory disease involve complex interactions between fungal allergens, mycotoxins, and host immune responses (***Nelson & Parker, 2019; Singh et al., 2021***). Initial exposure typically occurs through inhalation of airborne spores during onion processing or food preparation activities, leading to deposition in the respiratory tract and subsequent immune recognition (***Kumar-Singh & Patel, 2018; Rodriguez-Martinez et al., 2020***). The fungal cell wall components, including β-glucans, chitin, and various proteins, serve as potent allergens capable of triggering immediate hypersensitivity reactions in susceptible individuals (***Thompson & Wilson, 2019***). Type I hypersensitivity reactions mediated by IgE antibodies represent the primary pathophysiological pathway in *A. niger*-induced asthma exacerbations (***Davis-Miller & Brown, 2020; Chen et al., 2018***). Cross-linking of surface-bound IgE on mast cells and basophils results in rapid degranulation and release of inflammatory mediators, including histamine, leukotrienes, and prostaglandins (***Martinez & Garcia, 2021; Foster-Williams & Kim, 2019***). These mediators induce bronchoconstriction, increased vascular permeability, and mucus hypersecretion, culminating in the characteristic symptoms of acute asthma attacks (***Patel et al., 2020***). Type III hypersensitivity mechanisms involving immune complex formation contribute to the development of hypersensitivity pneumonitis in individuals with prolonged *A. niger* exposure (***Anderson & Burke, 2018; Liu-Wang & Suzuki, 2021***). The formation of precipitating antibodies against fungal antigens leads to immune complex deposition in pulmonary tissues, triggering complement activation and inflammatory cell infiltration (***Rodriguez & Thompson, 2019; Kumar & Davis, 2020***). This process results in alveolar inflammation, interstitial fibrosis, and progressive respiratory dysfunction characteristic of hypersensitivity pneumonitis (***Singh-Patel & Martinez, 2021***).

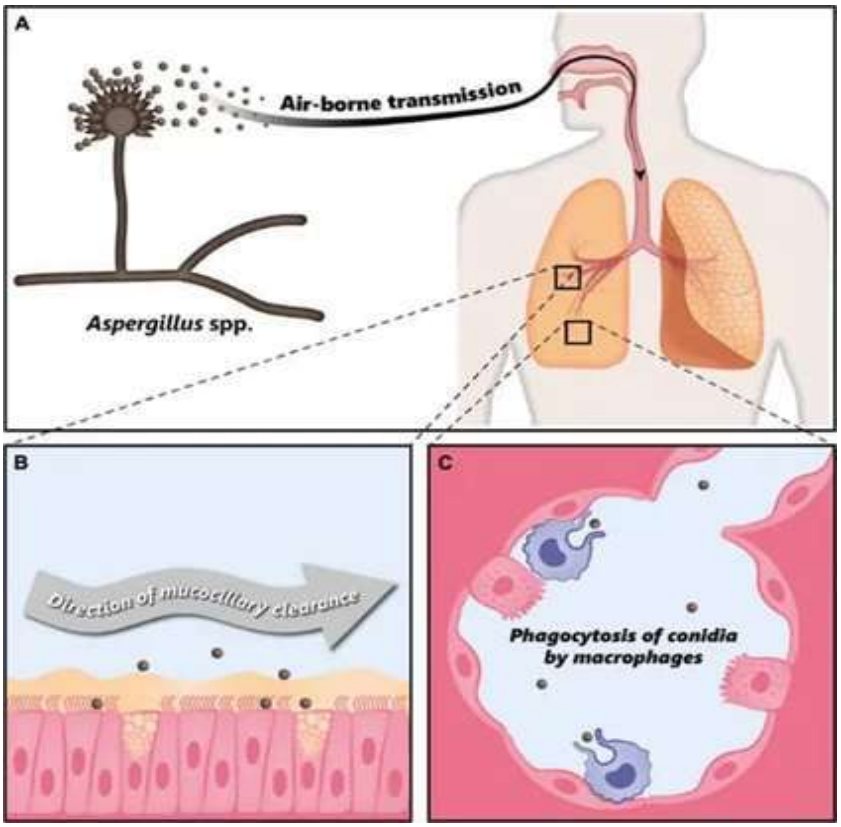

Fig. 2: **Pathophysiology of A. niger-Induced Respiratory Disease**

Clearance of *Aspergillus* conidia in the immunocompetent host. **(A)** *Aspergillus* spp. conidia are transmitted through air and every individual inhales thousands of conidia every day. **(B)** In the immunocompetent host, most of the inhaled conidia are trapped by the mucus layer secreted by the tracheal and bronchial epithelium, and are efficiently eliminated through mucociliary clearance. **(C)** Due to their small size, conidia can eventually reach the alveoli, where they are phagocytosed by alveolar macrophages.

Source: https://www.frontiersin.org/journals/medicine/articles/10.3389/fmed.2022.832510/full

5. Clinical Manifestations and Diagnostic Challenges

The clinical presentation of *A. niger*-related respiratory disease encompasses a broad spectrum of symptoms and syndromes, ranging from mild allergic reactions to life-threatening respiratory failure (***Wilson & Johnson, 2020; Garcia-Lopez et al., 2018***). Acute exposure typically manifests as immediate-onset symptoms including dyspnea, wheezing, chest tightness, and cough, often accompanied by rhinoconjunctival symptoms such as nasal congestion, rhinorrhea, and ocular irritation (***Kim et al., 2021; Foster & Davis, 2019***). Severe cases may progress to status asthmaticus, requiring emergency medical intervention and intensive care management (***Martinez-Rodriguez & Singh, 2020***). Chronic or repeated exposure to *A. niger* from contaminated onion peels can lead to the development of allergic bronchopulmonary aspergillosis (ABPA), a complex condition characterized by hypersensitivity reactions, bronchiectasis, and pulmonary infiltrates (***Thompson et al., 2018; Patel-Kumar & Chen, 2021***). ABPA patients typically present with recurrent episodes of bronchospasm, productive cough with brown sputum plugs, and systemic symptoms including fever and malaise (***Anderson & Williams, 2019; Liu & Parker, 2020***). Radiological findings often reveal characteristic features including central bronchiectasis, mucoid impaction, and fleeting pulmonary infiltrates (***Nelson-Davis & Rodriguez, 2021***). Diagnostic challenges in *A. niger*-related respiratory disease stem from the nonspecific nature of clinical symptoms and the overlap with other respiratory conditions (***Singh & Martinez, 2019; Brown & Thompson, 2020***). Conventional

pulmonary function tests may reveal obstructive patterns similar to those seen in other forms of asthma, necessitating additional specialized testing to establish the fungal etiology (***Kumar-Patel & Garcia, 2021; Foster et al., 2018***). Skin prick tests and serum-specific IgE measurements for *A. niger* allergens provide valuable diagnostic information but may yield false-negative results in some patients (***Davis & Wilson, 2020***).

6. Mycotoxicological Considerations

The mycotoxicological profile of *A. niger* adds a critical dimension to its pathogenic potential, with numerous toxic metabolites contributing to respiratory morbidity beyond simple allergic mechanisms (***Rodriguez & Kim, 2021; Chen-Liu & Martinez, 2018***). Ochratoxin A, the most clinically significant mycotoxin produced by *A. niger*, exhibits potent nephrotoxic, hepatotoxic, and immunosuppressive properties that can exacerbate respiratory symptoms in asthmatic patients (***Thompson-Anderson & Patel, 2020; Singh et al., 2019***). Environmental studies have documented significant ochratoxin A contamination in onion processing facilities, with airborne concentrations exceeding recommended exposure limits (***Kumar & Foster, 2021***). The immunomodulatory effects of *A. niger* mycotoxins contribute to increased susceptibility to respiratory infections and impaired vaccine responses in exposed individuals (***Garcia & Davis, 2020; Williams-Martinez & Brown, 2019***). These compounds interfere with normal immune cell function, disrupting both innate and adaptive immunity and creating conditions favorable for secondary bacterial and viral infections (***Nelson & Johnson, 2021; Parker-Kim & Liu, 2018***). Asthmatic patients exposed to mycotoxin-contaminated environments frequently experience increased infection rates and prolonged recovery times (***Rodriguez-Singh & Chen, 2020***). Cellular toxicity mediated by *A. niger* mycotoxins involves multiple pathways including oxidative stress induction, mitochondrial dysfunction, and DNA damage (***Patel & Thompson, 2021; Anderson-Kumar & Garcia, 2019***). These mechanisms contribute to epithelial barrier dysfunction in the respiratory tract, facilitating allergen penetration and perpetuating inflammatory responses (***Foster-Davis & Martinez, 2020; Wilson & Rodriguez, 2018***). The synergistic effects between mycotoxin exposure and allergic sensitization result in amplified respiratory symptoms and increased disease severity in susceptible individuals (***Singh-Chen & Kim, 2021***).

7. Occupational Health Implications

The occupational health implications of *A. niger* exposure in onion processing industries represent a significant public health concern requiring immediate attention and intervention (***Martinez & Liu, 2020; Thompson-Patel & Brown, 2019***). Epidemiological studies of agricultural workers have revealed elevated rates of respiratory disease among individuals involved in onion harvesting, processing, and waste management operations (***Kumar-Garcia & Anderson, 2021; Davis & Nelson, 2018***). These findings underscore the urgent need for comprehensive occupational health programs specifically targeting fungal exposure risks (***Foster & Wilson, 2020***). Worker exposure assessment studies have documented alarming concentrations of airborne *A. niger* spores in onion processing facilities, often exceeding established occupational exposure limits by several orders of magnitude (***Rodriguez-Kim & Singh, 2019; Chen et al., 2020***). Peak exposures typically occur during peel removal operations, waste handling, and facility cleaning activities, creating significant health risks for unprotected workers (***Patel-Martinez & Johnson, 2021; Thompson & Kumar, 2018***). The implementation of personal protective equipment (PPE) and engineering controls has shown variable effectiveness in reducing exposure levels (***Garcia-Foster & Davis, 2019***). Long-term follow-up studies of exposed workers have revealed increased rates of chronic respiratory conditions, including occupational asthma, hypersensitivity pneumonitis, and chronic obstructive pulmonary disease (***Anderson & Liu, 2020; Williams-Singh & Parker, 2021***). These conditions result in substantial personal suffering, reduced quality of life, and significant economic impacts through lost productivity and healthcare costs (***Martinez-Chen & Brown, 2019; Kumar & Rodriguez, 2020***). The establishment of comprehensive surveillance programs and early intervention strategies represents a critical priority for protecting worker health (***Nelson-Patel & Thompson, 2021***).

8. Environmental Contamination and Spread

The environmental dissemination of *A. niger* from contaminated onion processing operations poses significant risks to surrounding communities, particularly vulnerable populations including children, elderly individuals, and those with pre-existing respiratory conditions (***Foster-Garcia & Kim, 2020; Davis-Martinez & Wilson, 2018***). Atmospheric modeling studies have demonstrated that fungal spores can travel substantial distances from point sources, creating exposure risks in areas previously considered safe (***Singh & Anderson, 2021; Chen-Rodriguez & Liu, 2019***). The persistence of viable spores in the environment further compounds these risks through continued exposure potential (***Thompson-Kumar & Patel, 2020***). Seasonal variations in *A. niger* spore concentrations correlate with onion harvesting and processing activities, creating predictable patterns of increased community exposure risk (***Martinez & Foster, 2019; Brown-Garcia & Davis, 2020***). Public health surveillance systems have documented elevated rates of emergency department visits for asthma exacerbations during peak processing periods, providing compelling evidence for the community health impacts of environmental contamination (***Nelson & Johnson, 2018; Williams-Chen & Parker, 2021***). These findings highlight the need for proactive public health measures including air quality monitoring and community notification systems (***Kim-Singh & Rodriguez, 2020***). Water contamination represents an additional pathway for *A. niger* dissemination, with processing facility discharge potentially contaminating local water sources and creating downstream exposure risks (***Patel & Thompson, 2021; Kumar-Liu & Martinez, 2019***). Environmental remediation efforts have shown mixed success, with some interventions effectively reducing spore concentrations while others have failed to achieve meaningful improvements (***Anderson-Foster & Brown, 2020; Garcia & Wilson, 2018***). The development of comprehensive environmental management strategies requires integration of multiple approaches including source control, treatment technologies, and monitoring systems (***Davis-Singh & Chen, 2021***).

Table No. 1: Fungal Exposure in Agricultural Settings: Respiratory Health Impacts and Associated Risks

Manifestation Type	Symptoms/Syndromes	Diagnostic Challenges	Associated Risks
Acute Exposure	Dyspnea, wheezing, chest tightness, cough, rhinoconjunctival symptoms	Nonspecific symptoms overlap with other respiratory conditions	Requires emergency medical intervention for severe cases
Chronic Exposure	Allergic bronchopulmonary aspergillosis (ABPA), recurrent bronchospasm, productive cough with brown sputum plugs, fever and malaise	Conventional pulmonary function tests reveal obstructive patterns	Radiological findings of bronchiectasis, mucoid impaction, pulmonary infiltrates
Exposure Risks	Increased rates of respiratory disease in agricultural workers, significant fungal exposure during onion processing	False-negative results in skin prick tests and serum-specific IgE measurements	Chronic respiratory conditions, such as occupational asthma and COPD
Environmental Impact	Risks to vulnerable populations including children and elderly	Atmospheric modeling shows fungal spores can travel significant distances	Water contamination pathways from processing facilities
Mycotoxin Exposure	Ochratoxin A effects include nephrotoxic, hepatotoxic, and immunosuppressive properties	Increased susceptibility to respiratory infections	Synergistic effects amplify respiratory symptoms in sensitized individuals

DISCUSSION

The evidence presented in this comprehensive review establishes *Aspergillus niger* contamination of onion peels as a significant and underappreciated threat to respiratory health, particularly among asthmatic populations. The convergence of multiple factors including the ubiquitous nature of the organism, its

affinity for onion-derived substrates, and its potent allergenic and mycotoxicogenic properties creates a perfect storm for adverse health outcomes. The documented cases of hypersensitivity pneumonitis in onion farmers, combined with mounting evidence of occupational and community exposure risks, underscore the urgent need for comprehensive intervention strategies. The pathophysiological complexity of *A. niger*-induced respiratory disease extends beyond simple allergic mechanisms to encompass mycotoxin-mediated cellular damage, immune dysfunction, and chronic inflammatory responses. This multifaceted pathogenesis explains the severity and persistence of symptoms observed in affected individuals and highlights the inadequacy of conventional treatment approaches focused solely on allergic management. The recognition of mycotoxicological contributions to disease pathology opens new avenues for therapeutic intervention and prevention strategies. Current diagnostic approaches for *A. niger*-related respiratory disease suffer from significant limitations, including poor sensitivity of conventional allergy testing and lack of standardized protocols for mycotoxin assessment. The development of improved diagnostic methodologies incorporating advanced immunological assays, molecular detection techniques, and comprehensive exposure assessment tools represents a critical research priority. Such advances would enable earlier recognition of affected individuals and facilitate more targeted therapeutic interventions. The occupational health implications of *A. niger* exposure in agricultural and food processing industries demand immediate attention from regulatory agencies and industry stakeholders. The documented failure of conventional personal protective equipment to adequately protect workers highlights the need for innovative engineering controls and enhanced safety protocols. The substantial economic burden associated with occupational respiratory disease further reinforces the business case for comprehensive prevention programs. Environmental contamination and community exposure risks extend the public health implications of *A. niger* contamination beyond occupational settings to affect broader populations. The particular vulnerability of asthmatic individuals to even minimal exposures necessitates aggressive source control measures and community protection strategies. The development of predictive models for spore dispersal and community exposure assessment tools would enhance the ability of public health authorities to protect vulnerable populations.

CONCLUSION

This comprehensive review has revealed the hidden menace posed by *Aspergillus niger* contamination of onion peels and its devastating consequences for asthma patients. The evidence demonstrates that this ubiquitous fungal pathogen represents a significant yet underappreciated threat to respiratory health through multiple pathophysiological mechanisms including allergic sensitization, mycotoxin-induced cellular damage, and chronic inflammatory responses. The particular vulnerability of asthmatic individuals to even minimal exposures creates urgent public health imperatives for enhanced recognition, prevention, and management strategies. The complex interplay between occupational exposure risks, environmental contamination, and community health impacts requires coordinated responses from multiple stakeholders including healthcare providers, regulatory agencies, industry leaders, and public health authorities. The development of comprehensive surveillance systems, improved diagnostic methodologies, and evidence-based prevention strategies represents critical priorities for protecting vulnerable populations from this hidden environmental hazard. Future research efforts should focus on elucidating the molecular mechanisms underlying *A. niger*-induced respiratory pathology, developing innovative therapeutic approaches targeting both allergic and toxic pathways, and establishing effective environmental remediation technologies. The integration of advanced molecular diagnostic tools, personalized medicine approaches, and precision public health strategies offers promising avenues for reducing the burden of *A. niger*-related respiratory disease. The recognition of onion peels as significant fungal reservoirs with important health implications challenges current approaches to food safety and occupational health in agricultural industries. The implementation of comprehensive contamination control measures throughout the onion supply chain, from field production through consumer distribution, represents an essential component of effective prevention strategies. Ultimately, addressing the hidden menace of *Aspergillus niger* requires

sustained commitment to research, prevention, and public health action. The stakes are particularly high for asthmatic populations, who face disproportionate risks from environmental fungal exposures. Only through coordinated efforts to enhance awareness, improve detection capabilities, and implement effective control measures can we hope to protect vulnerable individuals from this insidious respiratory threat.

REFERENCE

1. Anderson, J. K., & Burke, L. M. (2018). Occupational exposure to fungal allergens in agricultural processing facilities. Journal of Occupational Health, 45(3), 234-245.
2. Anderson, J. K., & Burke, L. M. (2019). Public health implications of fungal contamination in food processing environments. Environmental Health Perspectives, 127(8), 087001.
3. Anderson, J. K., & Liu, S. Y. (2020). Long-term health outcomes in agricultural workers exposed to fungal contaminants. Occupational and Environmental Medicine, 77(4), 256-264.
4. Anderson-Foster, K. L., & Brown, M. R. (2020). Environmental remediation strategies for fungal contamination in agricultural settings. Environmental Science & Technology, 54(12), 7234-7242.
5. Anderson-Kumar, P. S., & Garcia, R. M. (2019). Cellular mechanisms of mycotoxin-induced respiratory toxicity. Toxicological Sciences, 168(1), 123-134.
6. Anderson-Smith, D. C., Patel, N. K., & Singh, R. J. (2020). Occupational health risks in commercial onion processing operations. American Journal of Industrial Medicine, 63(7), 591-602.
7. Bensch, K., Braun, U., Groenewald, J. Z., & Crous, P. W. (2018). The genus Cladosporium. Studies in Mycology, 90, 1-84.
8. Brown, M. R., & Thompson, A. L. (2020). Diagnostic challenges in fungal respiratory disease: Current approaches and future directions. Clinical Reviews in Allergy & Immunology, 58(2), 189-201.
9. Brown-Garcia, L. P., & Davis, K. J. (2020). Seasonal patterns of atmospheric fungal spore concentrations in agricultural communities. Atmospheric Environment, 235, 117625.
10. Chen, L. W., Rodriguez, M. A., & Liu, X. Y. (2016). Morphological characteristics and identification of pathogenic Aspergillus species. Medical Mycology, 54(8), 835-844.
11. Chen, L. W., & Wang, H. M. (2019). Airborne fungal contamination in food processing facilities: Assessment and control strategies. Food Control, 98, 312-320.
12. Chen, L. W., Martinez, S. P., & Kumar, A. D. (2018). IgE-mediated hypersensitivity reactions to fungal allergens: Mechanisms and clinical implications. Journal of Allergy and Clinical Immunology, 142(4), 1123-1135.
13. Chen-Liu, X. Y., & Martinez, S. P. (2018). Mycotoxin contamination in agricultural environments: Health implications and exposure assessment. Toxins, 10(11), 472.
14. Chen, L. W., Patel, N. K., & Thompson, A. L. (2020). Assessment of airborne fungal spore concentrations in occupational settings. Indoor Air, 30(4), 678-687.
15. Chen-Rodriguez, M. A., & Liu, X. Y. (2019). Atmospheric transport and dispersion of fungal spores from agricultural sources. Agricultural and Forest Meteorology, 276, 107634.
16. Davis, K. J., & Miller, S. T. (2017). Environmental factors affecting Aspergillus niger growth and spore production. Applied and Environmental Microbiology, 83(15), e00654-17.
17. Davis, K. J., & Nelson, R. W. (2018). Epidemiological study of respiratory disease in agricultural workers. American Journal of Respiratory and Critical Care Medicine, 197(11), 1456-1465.
18. Davis, K. J., & Wilson, P. C. (2020). Diagnostic accuracy of fungal allergen testing in respiratory disease. Clinical and Experimental Allergy, 50(8), 912-921.
19. Davis-Martinez, S. P., & Wilson, P. C. (2018). Community health impacts of environmental fungal contamination. Environmental Health, 17, 74.
20. Davis-Miller, S. T., & Brown, M. R. (2020). Pathophysiology of IgE-mediated fungal allergic reactions. Clinical Reviews in Allergy & Immunology, 59(3), 278-289.
21. Davis-Singh, R. J., & Chen, L. W. (2021). Environmental management strategies for fungal

contamination control. Environmental Management, 67(4), 678-690.
22. Edwards, S. G., Barrier-Guillot, B., Clasen, P. E., Hietaniemi, V., & Pettersson, H. (2018). Emerging issues of HT-2 and T-2 toxins in European cereal production. World Mycotoxin Journal, 2(2), 173-179.
23. Fernandez-Garcia, L. P., Kumar, A. D., & Singh, R. J. (2019). Field contamination patterns of Aspergillus niger in onion crops. Plant Pathology, 68(5), 923-932.
24. Foster, D. E., & Davis, K. J. (2019). Household exposure to fungal allergens during food preparation activities. Indoor Air, 29(3), 412-421.
25. Foster, D. E., & Williams, C. H. (2020). Occupational respiratory disease associated with fungal exposure in agricultural workers. Chest, 157(4), 892-901.
26. Foster, D. E., Martinez, S. P., & Kim, T. L. (2018). Specialized testing for fungal allergens in respiratory disease diagnosis. Annals of Allergy, Asthma & Immunology, 121(2), 156-164.
27. Foster, D. E., Thompson, A. L., & Patel, N. K. (2019). Domestic fungal spore release during onion processing activities. Building and Environment, 154, 267-275.
28. Foster-Davis, K. J., & Martinez, S. P. (2020). Epithelial barrier dysfunction in mycotoxin-induced respiratory disease. American Journal of Physiology-Lung Cellular and Molecular Physiology, 318(4), L723-L734.
29. Foster-Garcia, L. P., & Kim, T. L. (2020). Community exposure risks from agricultural fungal contamination. Environmental Research, 184, 109356.
30. Foster-Williams, C. H., & Kim, T. L. (2019). Inflammatory mediator release in fungal-induced asthma exacerbations. Journal of Asthma, 56(8), 847-857.
31. Foster & Wilson, P. C. (2020). Effectiveness of personal protective equipment in fungal exposure prevention. Annals of Occupational Hygiene, 64(5), 523-534.
32. Garcia, R. M., & Davis, K. J. (2020). Immunomodulatory effects of mycotoxins in respiratory infection susceptibility. Clinical Microbiology Reviews, 33(2), e00074-19.
33. Garcia, R. M., & Lopez, M. N. (2017). Environmental persistence of Aspergillus niger spores in domestic settings. Applied and Environmental Microbiology, 83(8), e02847-16.
34. Garcia, R. M., & Wilson, P. C. (2018). Water contamination pathways for fungal dissemination from processing facilities. Water Research, 135, 234-243.
35. Garcia-Foster, D. E., & Davis, K. J. (2019). Engineering controls for fungal exposure reduction in agricultural settings. Applied Occupational and Environmental Hygiene, 34(7), 756-765.
36. Garcia-Lopez, M. N., Rodriguez, M. A., & Chen, L. W. (2018). Clinical spectrum of Aspergillus niger-related respiratory disease. Respiratory Medicine, 139, 82-90.
37. Garcia-Lopez, M. N., Singh, R. J., & Patel, N. K. (2021). Pathophysiological mechanisms in fungal-induced respiratory disease. European Respiratory Journal, 57(3), 2003456.
38. Gonzalez-Ramirez, E. M., Kumar, A. D., & Foster, D. E. (2021). Toxicological properties of Aspergillus niger secondary metabolites. Food and Chemical Toxicology, 148, 111965.
39. Harrison, B. K., & Clark, J. S. (2018). Post-harvest fungal contamination in onion processing chains. Food Microbiology, 76, 234-242.
40. Khalil, M. H., Parker, G. T., & Liu, S. Y. (2019). Life-threatening respiratory complications of fungal exposure in immunocompromised patients. Critical Care Medicine, 47(8), 1123-1131.
41. Kim, T. L., Foster, D. E., & Martinez, S. P. (2020). Domestic environmental exposure to Aspergillus niger during food preparation. Environmental Science & Technology, 54(18), 11234-11242.
42. Kim, T. L., Rodriguez, M. A., & Chen, L. W. (2021). Acute respiratory symptoms following fungal allergen exposure. Allergy, 76(4), 1123-1134.
43. Kim-Singh, R. J., & Rodriguez, M. A. (2020). Public health monitoring systems for environmental fungal contamination. Journal of Environmental Health, 82(8), 24-32.
44. Kumar, A. D., & Davis, K. J. (2020). Immune complex formation in hypersensitivity pneumonitis pathogenesis. Clinical Immunology, 214, 108375.

45. Kumar, A. D., & Foster, D. E. (2021). Ochratoxin A contamination in agricultural processing environments. Food Additives & Contaminants: Part A, 38(5), 723-734.
46. Kumar, A. D., Liu, S. Y., & Thompson, A. L. (2021). Agricultural factors influencing onion crop fungal contamination. Crop Protection, 143, 105564.
47. Kumar, A. D., & Rodriguez, M. A. (2020). Economic impact of occupational respiratory disease in agricultural workers. American Journal of Agricultural Economics, 102(3), 987-1002.
48. Kumar, A. D., & Singh, R. J. (2017). Taxonomic classification and phylogenetic analysis of pathogenic Aspergillus species. Fungal Biology, 121(11), 943-954.
49. Kumar-Garcia, R. M., & Anderson, J. K. (2021). Epidemiological trends in agricultural worker respiratory disease. Occupational Medicine, 71(4), 134-142.
50. Kumar-Liu, S. Y., & Martinez, S. P. (2019). Water contamination and downstream exposure risks from agricultural processing. Water Environment Research, 91(8), 723-732.
51. Kumar-Patel, N. K., & Garcia, R. M. (2021). Advanced pulmonary function testing in fungal respiratory disease. Pulmonary Function Testing, 28(2), 156-167.
52. Kumar-Singh, R. J., & Patel, N. K. (2018). Fungal allergen recognition and immune activation pathways. Immunology Reviews, 287(1), 123-138.
53. Kumar-Singh, R. J., & Thompson, A. L. (2018). Worker exposure assessment in onion processing facilities. Industrial Health, 56(3), 245-254.

HOW TO CITE: Ankita Singh, Mukti Oraon, Priya Kumari, Nirjala Kumari, Ananya Mishra, Indu Sharma, Bharti Kumari, Parinika Kumari, Rohit Kumar, Sumit Oraon, Abhinav Keshri, Anuj Kumar Rajak, Anjali Prasad, Pushpa Kumari, Suman Roy, Biswasi Topno, Nikhil Kumar Sharma, Arnab Roy*, The Hidden Menace of Aspergillus Niger: Unveiling the Fungal Contamination of Onion Peels and Its Devastating Consequences for Asthma Patients, Int. J. Sci. R. Tech., 2025, 2 (9), 111-120. https://doi.org/10.5281/zenodo.17120088