



Isolation and Identification of Pathogenic Fungi from Infected Chilli Plant for Sustainable Food Production and Disease Management

¹Aliyu Magaji, ² Bello Mohammed Dakingari and ³ Aati Rilwanu

^{1 2 3}Department of Sciences, Kebbi State Polytechnic Dakingari

Corresponding Author¹

ABSTRACT

Chilli production today is one of the most lucrative commercial farming businesses in Augie local Government north western part of Nigeria. The most important limiting factor affecting the production of chilli in the area is frequent outbreak of diseases which infect the plant at almost all the growing stages. The aim of the research is to isolate and identify fungal species associated with chilli plants in the area. The isolation and identification of different fungi was conducted from four major chilli producing Villages namely, Mera, Mallamawa, Tiggi and Gidan koni. Chilli plants Samples showing typical symptoms of diseases were collected leaf, stem, fruit and roots were collected from fields and then fungi were isolated and identified at biology laboratory using standard procedures. A total of 8 fungal species were isolated and identified from growing chilli plant in the area to includes *Fusarium oxysporum*, *Fusarium solani*, *Pythium* Spp, *Aspergillus flavus*, *Collectriticum pormoides*, *Rhizoctonia solani*, *Trichoderma harzianum* and *Pythoptera capsici*. It was concluded the fungal species identified are the major cause of chilli diseases in the area.

KEYWORDS: Isolation, Identification, Fungi, Chilli,

Received 01 Feb., 2024; Revised 08 Feb., 2024; Accepted 10 Feb., 2024 © The author(s) 2024.

Published with open access at www.questjournals.org

I. INTRODUCTION

Vegetable farming such as chilli production is one of the most important lucrative commercial farmin in Nigeria. In a country made up of over 100 million people of different tribes and ethnicities, whose major common denominator is the use of vegetables in preparing their food, vegetable farming in Nigeria is indeed very profitable. Many people in Nigeria are involved in chilli production serving as a source of livelihood either as farmers, transporters, processors or marketers of the crop. Chilli (*Capsicum annum* L.) is considered one of the most important spices and condiment in the world. Chilli is consumed daily by a quarter of world population and its consumption is growing (Bediola, *et al*, 2015). *Capsicum annum* is called by different names such as pepper, chilli, or chilli pepper depending upon the nature of the fruits and place (Khalid *et al.*, 2021).

Chilli is extensively cultivated in Augie local government area. It is highly produced in towns like Bubuche, Bayawa, Mallamawa, Yola, Gidan koni, Mera and Dukke. Its production in Augie area is mainly in the hands of resource poor farmers, who grow it as single crop on average farm size of 0.5 ha—1 ha. These farmers consider its production as a source of livelihood. Despite its numerous importance, pathogenic fungi have been identified as a major challenge affecting chilli production in the area. It is a major constraint but yet the neglected area of concern in chilli production. According to Iram *et al.*, (2020) fungi are the most devastating pathogen in a biotic factor that can cause yield reduction in chilli. Thangjam *et al.*, (2020) has identified phytophthora leaf blight, anthracnose, Damping off, *Cercospora* leaf spot and Powdery mildew as major fungi diseases affecting chilli. Pathogenic fungi affect chilli crop at any growing stage; at seedling stage, flowering stage and at maturity stage. Pathogenic fungi can affect every part of the crop; the roots, stem, fruit and flowers. According to Thilagam *et al.*, (2018) fungi pathogens are able to infect various plant parts such as roots, stems, leaves, flowers, and fruits, inducing characteristic visible symptoms like spots, blights, anthracnose, wilts, rots etc

The problem of pathogenic fungi is often aggravated by the fact that many resource poor farmers have poor knowledge about the identity of the fungi diseases affecting chilli making the treatment of the diseases

difficult. The aim of this research is to isolate and identify pathogenic fungi in growing chilli plant in Augie, kebbi Stae, Nigeria for sustainable chilli production and diseases management.

II. MATERIALS AND METHOD

Sample Collection

Growing chilli plant parts leaf stem fruit and root showing diseased symptoms wre collected from four different fields from each of the selected villages namely, Mera, Mallamawa, Tiggi and Gidan koni. All samples collected were transported in a separate polythene bags to the biology laboratory of Kebbi State Polytechnic Dakingari, Nigeria for fungal isolation.

Isolation of Fungal

The media used for isolation of fungal species from diseased plant part was Potato Dextrose Agar (PDA), which was prepared according to the manufacturer’s instruction. Appropriate quantity of the media was dissolve and autoclave before pouring into sterile Petri dishes. The samples were cut in to small sizes and surfaced sterilized by dipping them in a concentration of 70% ethanol solution for 1 minute. The samples were later removed and rinsed severally in a sterile distilled water and later allow to dry on sterile paper towels. About 20ml PDA was dispensed into each of the sterile petri-dish containing a small portion of the sample and allowed to solidify. After solidification all sample were incubated in a room temperature. Fungal growth was observed after 48 hours. Fungal subcultures were made from 5 day growing hyphae.



Identification of Fungal Isolates







Fungal isolates were identified morphologically by using colony appearance and microscopic characteristics observed under a light microscope. Lactophenol cotton blue was used to make microscopic slide smear of isolate for visualization of fungal features for proper identification on the microscope. These structural features were matched with standards in as reported by reported by Akinyemi *et al*, (2018).



III. RESULTS AND DISCUSSION

The table below show the sample of chilli plant collected from different chilli farms from the study area. Based on the appearance of diseased plant 11 categories were observed. This was made by observing the difference from each diseased appearance. Leaf, stem, roots, flower and fruits show the appearance of the diseases. The most affected part of the plant is the leaves which immediately show discoloration from brownish, black to shiny black and yellowish. Flowers turn brown and later fall. The root show signs of rotten, elongation, lesion and stunting. Drying and weak stem is also common appearance of the diseased plant studied. These appearances surely represent the presence of the pathogenic fungi. Muhammad *et al* 2024 also studied the population dynamics and aggressiveness of pathogenic fungi associated with root rot in chilli plant using the appearance of the diseases.

Table1 characteristics diseases symptoms identified on growing chilli plants in the area

Affected plant part	Plant Appearances
	Leaf ad stem turn dark brown in color Leaf curl and start fall Flower fall
	Leaf burns, curl The stem turn dark no flower is observed Root appeared to be heathy

	<p>Some branches of burns and the entire plant show signs of dying Flower turn small and brownish and later die up</p>
	<p>Leaf completely removed from some portion of the plant Stem show signs of drzing Fruit turns very small</p>
	<p>The plant leafs became very tiny Flower turn brown</p>
	<p>The entire plant become dusted with dark brown and black powdered like substances</p>
	<p>Part of the whole plant dries out Some portion of the root show signs of decay</p>
	<p>The whole plant was dusted black shiny substance The whole farm is affected Fruit and flower were also affected</p>

	Plant show stunted growth, elongated stem and signs of drying Roots are tiny
	The plant leaves turns yellow Stems turn brownish
	Leaf completely absent Some portions of the entire stem turns brown and dries out

Isolated fungal colonies from growing chilli plants showing disease symptoms





plates1: Photo of the fungal isolate

Table2 Identification of fungal species from infected growing chilli plants

SN	Fungal species	Affected plant part
1	<i>Fusarium oxysporum</i>	The whole plant, roots
2	<i>Fusarium solani</i>	The whole plant
3	<i>Pythium Spp</i>	Root and stem
4	<i>Aspergillus flavus</i>	Leaf and stem
5	<i>Collectriticum pormoides</i>	Fruit
6	<i>Rhizoctonia solani</i>	Leaf, stem
7	<i>Trichoderma Spp</i>	Leaf
8	<i>Pythoptera capsici</i>	Fruit

Table2: Fungal species identified from growing chilli plants showing diseases symptoms

The table shows that eight fungal species were identified from the isolated fungal colonies. The fungal species identified includes *Fusarium oxysporum*, *Fusarium solani*, *Pythium Spp*, *Aspergillus flavus*, *Collectriticum pormoides*, *Rhizoctonia solani*, *Trichoderma harzianum* and *Pythoptera capsici*. The identified species may be responsible for diseases symptoms on chilli plants in the area. The fungal isolates identified were among the fungal species identified from the previous study in the area by Magaji *et al* 2023. These species were identified from different type of soil where chillies are grown in the area. The abundance and diversity of these fungal species in the vegetable cultivated farms in the study area may responsible for their occurrence in the area. Akinyemi *et al* 2018 isolated and identified Pathogenic fungi from infected chilli plants such as *Alternaria*, *Aspergillus*, *Fusarium*, *Mucor*, *Penicillium*, *Rhizopus*, and *Trichoderma* which include most of the species recorded in this study.

Soil and soil, organic matter remained the reservoir of most fungal organism which later developed in the soil and infect the growing plant especially vegetable crops. Magaji *et al* 2023 studied fungal pathogenic soil borne fungi associated with vegetable cultivated soil in the area and identified seventeen fungal species to include all the species recorded in this current study. Muhammad *et al* 2024 also attributed the incidence and severity of fungal pathogen in growing chilli farm to the soil inoculums density. He also revealed that temperature play a great role in the fungal growth and development in the area. Poor knowledge of the disease and causes of the fungal pathogen by local farmers is one of the factors favoring the development of the disease. The management of all the diseases in the area is achieved only by application of insecticides against fungal species which may only favor the growth.

Kechi-Nwogu *et al* 2021 identified *Aspergillus flavus*, *Penicillium corylophilum*, *Aspergillus fumigatus*, *Aspergillus niger*, *Rhizopus stolonifer* and *Verticillium spp.* as the major caused various chilli diseases such as, damping off, wilting, powdery-mildew, soft rot and general spoilage in pepper and other plant species. The characteristics symptoms of the diseases such as wilting, damping off and powdery mildew were

also among the diseased symptoms identified Kechi–Nwogu *et al* 2021 are similar to what was observe in this study. Chili pepper plants have been found to be susceptible to fungal pathogens causing diseases. Pahnwa *et al* 2023 studied different Fungal Species from Major Kharif Vegetables of Sindh Province, Pakistan such as chilli, eggplant and tomato and revealed the occurrence of different fungal species with leaf spot and fruit rot disease that may cause severe losses to vegetables. Most of these symptoms were identified with different growing chilli plant parts in the area. Shuaibu *et al* 2023 conducted pathological assessment of fungal pathogens associated with tomato and pepper plant revealed about seven fungal pathogens (i.e *Cercospora capsici*, *Botrytis cineria*, *Alternaria solani*, *Collectotrichum capsici*, *Aspergillus niger*, *Rhizoctonia solani*) were pathogenic to pepper showing a typical symptom on the foliage and stem. Most diseases symptoms appear on foliage leaves and stem which are the major parts of the growing chilli or most vegetable plant. But Muhammad *et al* isolated and identified as *Phytophthora capsici*, *Pythium aphanidermatum*, *Pythium debaryanum*, *Pythium myriotylum*, *Ceratobasidium sp.*, *Rhizoctonia solani*, *Verticillium dahlia*, *Macrophomina phaseolina*, *Fusarium oxysporum*, *Fusarium solani*, *Alternaria spp.*, *Aspergillus flavus*, *Aspergillus niger*, *Penicillium spp.*, and *Rhizopus spp.* from which *Phytophthora capsici*, *Rhizoctonia solani*, and *Pythium aphanidermatum* which are among the ones isolated and identified in this study.

IV. CONCLUSION

The research findings revealed most of the diseased appearance in chilli plants in the area may be as a result of pathogenic fungal species. *Fusarium oxysporum*, *Fusarium solani*, *Pythium Spp*, *Aspergillus flavus*, *Collectotrichum pormoides*, *Rhizoctonia solani*, *Trichoderma harzianum* and *Pythoptera capsici* are the most common fungal species affecting the production of chilli in the area. It was therefore concluded for sustainable chilli production in the area the should be effective management of pathogenic fungi couple with better knowledge of diseases cause by fungal organisms

REFERENCES

- [1]. Akinyemi B. K. and Liamngee K. (2018), Isolation and Identification of Fungi Causing Decay, Asian Journal of Research in Crop Science 1(2): 1-6,
- [2]. Chandra S.C., Jain SC, Kiran C., Sunita K., Jat SK, Choudhary RN. (2022), Identification and isolation of different Colletotrichum spp. along with other fungi associated with chilli seeds collected from infected fruits. Pharma Innovation Journal 11(11):391-397.
- [3]. Chandini KC. and Rajeshwari N. (2017), Isolation and identification of soil fungi in Mattavara forest, Chikamagalur, Karnataka: Journal of Pharmacognosy and Phytochemistry; 6(5): 721-726
- [4]. Daniel R., Simone P. (2021). Encyclopedia of Virology (Fourth Edition)
- [5]. Fatma F. M. (2003), Distribution of Fungi in the Sandy Soil of Egyptian Beaches. Pakistan Journal of Biological Sciences, 6: 860-866.
- [6]. Gaddeyya G., Shiny N.P., Bharathi P. and Ratna Kumar P. K. (2012) Isolation and identification of soil mycoflora in different crop fields at Salur Mandal, Advances in Applied Science Research, 3 (4):20-26
- [7]. Gupta N., Kumar R., Maurya S. K., Singh H. and S. Kuma (2017), Isolation and identification of soil mycoflora in cropfield (C. Borivillianum) of bareilly district, uttar Pradesh
- [8]. Jim C. (2007). Fungal plant pathogens and symptomology: master gardener. Wsu county extension, sjc
- [9]. Jufri S. W., Larekeng S. H. and Arif A. (2007), Isolation and identification of fungi associated with natural forest land and post-mining areas of PT. Vale Indonesia:Preliminary study
- [10]. Jadhav S. Y. and Shinde P. P. (2017), Isolation and Identification of Soil Fungi from Kadegaon Tehsil, Sangli District, Maharashtra, India. International Journal of Scientific and Research Publications, Volume 7, Issue 12: pp 616-621
- [11]. Koika S.T, Subbarao K.V., Davis M.R. and Turini T.A. (2003), Vegetable diseases caused by soil borne fungi: Commercial Greenhouse publication 21575, University of California
- [12]. Ikechi–nwogu, GC; Odogwu, AB; Ukomadu, J; Usiakponebro, EP J. (2021), Isolation and Identification of Fungi Associated with Habanero Pepper (*Capsicum chinense jacq*) Using Basic Molecular Techniques, Apply Science Environ. Manage Vol. 25 (7) 1121-1125
- [13]. Iram K. , Hadeeqa R, Jamshaid K., Tariq A, Amjad A., Muhammad Ubair A. (2021), Isolation, Identification And Management Of Fungal Pathogen Responsible For Chilli Leaf Spot Disease, Life Science Journal 18(11)
- [14]. Jufri S.W, Iswanto J, (2021) Isolation and identification of fungi associated with natural forest land and post-mining areas of PT. Vale Indonesia: Preliminary study, Earth Environ. Sci. : 807
- [15]. Liamngee K, Iheanacho A. C. and Kortse P. A. (2018), Isolation, Identification and Pathogenicity of Fungal Organisms Causing Postharvest Spoilage of Tomato Fruits during Storage, Annual Research & Review in Biology, 26(6): 1-7
- [16]. Magaji A. and Muhammad B.D (2023), Isolation and Identification of Pathogenic Soil Borne Fungi Associated with Vegetable Farm
- [17]. Magaji A. and Muhammad B.D (2023), Diversity and abundance of mycoflora Associated with Sandy Soil from Vegetable Cultivated Farms in Selected Production Areas of Augie, Kebbi, Nigeria.
- [18]. Muhammad U.A, Nasir A. A, Muhammad A. Rana M. A and Sharifa G.C (2024) Population Dynamics And Aggressiveness Of Fungal Pathogens Associated With Chilli Root, Pak. J. Bot.
- [19]. Wong K.Y, Nur Elia N.M , Asmadi, N.F, Ibrahimand A.F (2020), Identification of fungal isolates associated with Anthracnose disease on chilli and its pathogenic level, Terengganu Journal of Undergraduate Research, 2:351-56