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Characterization and pathogenicity of *Fusarium* spp. associated with tuber rot and wilt of potato (*Solanum tuberosum* L.) in three local government areas of plateau State, Nigeria

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Abstract

Fusarium is one of the most important genera of phytopathogenic fungi, causing potato wilt in the field and potato tuber dry rot in storage. The objectives of this study was to isolate, identify and characterize *Fusarium* species associated with potato wilt and rot in different potato growing areas in Plateau State (Mangu, Jos North and Barkin Ladi Local Government Areas), and to assess their pathogenicity. Soil samples were collected from farms known to cultivate potato for at least three farming seasons consecutively. Two species of *Fusarium* were identified (*Fusarium solani* and *Fusarium falciforme*). Among these species isolated, they showed varying pathogenicity and wilting on four potato varieties (Caruso, Connect, Jelly and Marabel). *Fusarium solani* were identified for Mangu and Jos-North while *Fusarium falciforme* was identified in Barkin-Ladi soil. The *In vitro* potato tuber pathogenicity showed that *F. solani* was more aggressive while *F. falciforme* showed resistance. However, contrasting experience was observed in field (*In vivo*). The Barkin-Ladi isolate (*F. falciforme*) was more aggressive in the field than *F. solani*. This implies that *Fusarium* is responsible for wilting of potato in field and rot in storage and that the spores of this organism persist in the soil hence, the need to carry out preventive measures such as, solarization, crop rotation, planting resistant varieties and the likes rather than imploring curative measures.

Keywords: *Fusarium*, *Solanum tuberosum*, Wilt, Rot

Introduction

Potato (*Solanum tuberosum* L.) is a herbaceous crop belonging to the family Solanaceae, planted in a wide range globally (Damte, 2018). It is the fourth most important crop in production after rice, wheat and corn. Potato (*Solanum tuberosum* L.) is an important crop plant with potential to meet food demand of the fast growing human population (Nadia *et al.*, 2021) ^[16] planted in 18.2 million hectares globally (FAO, 2010) ^[10]. The production of potatoes worldwide is estimated at over 377 million tons, led by China with over 26% of the world total followed by India, Russia, Ukraine and the United States as major producers (FAOSTAT, 2013) ^[10]. Nigeria is the fourth in Sub-Saharan Africa. In Nigeria, inadequate supply of good quality seeds, lack storage facilities, poor diseases and pest management, resulting in an average yield of 3.1 tons/hectare, which is the lowest in Sub-Saharan Africa (<https://www.potatopro.com/potato-markets/nigeria>).

Potato is prone to many diseases that can destroy the crop before and after harvest. Pathogenic fungi cause economic losses in the field, during storage, transport and commercialization (Eken *et al.* 2000) ^[6]. Potato dry rot is known to affect tubers in storage and seed tuber in the field (Nadia *et al.*, 2021) ^[16]. Symptoms of dry rot on tuber appear after one month of storage as small brown lesions that enlarge in all directions. The periderm sinks as a result of inner tissue desiccation which probably leads to the formation of concentric rings of wrinkled skin (Stevenson *et al.*, 2001) ^[24]. Infected seed tuber can be a source of inoculum (Nadia *et al.*, 2021) ^[16]. Infested soil can be another source of infection. *Fusarium* spp. can survive for many years as fungal propagules in the soil, as colonizers of living plants or crop debris, as saprophytes, endophytes or facultative pathogens (Nadia *et al.*, 2021) ^[16].

Fusarium dry rot of potato tubers can cause Up to 60% of yield lost (Secor and Salas, 2001) ^[19].

Fusarium is one of the most important genera of phytopathogenic fungi, causing potato wilt in the field and potato tuber dry rot during storage. *Fusarium* is a ubiquitous genus in nature with representatives found in the soil and in various other substrates (in decomposing organic matter), in pathogenic or non-pathogenic associations (with animals, plants and other organisms). Due to the importance of these fungi as plant pathogens and mycotoxin producers historically, studies over more than 200 years have focused on isolates obtained from economically **important** diseased plants in commercial agricultural setting. *Fusarium* (fungus) wilt of potato, has become in recent years, one of the most serious pathogen affecting root crops like potato and yam (Srinivas *et al.*, 2019) ^[22]. *Fusarium* wilt of potato is a vascular disease caused by different *Fusarium* species, including, *F. solani*, *F. oxysporum* f. sp. *tuberosi* and *F. sambucinum* (Nadia *et al.*, 2021) ^[16]. This pathogen infects potato through roots, then colonizes xylem vessels of stems resulting in necrosis at lower leaves and unilateral leaf yellowing, chlorosis, vascular discoloration, stunting, wilt and eventual death (Nadia *et al.*, 2021) ^[16].

For instance, *Fusarium* dry rot is distributed worldwide and occurs wherever potatoes are grown (Nadia *et al.*, 2021) ^[16]. Nadia *et al.* (2021) ^[16] reported that 13 *Fusarium* species are responsible for *Fusarium* dry rot in potatoes globally but the species composition depends on the geographic location and the season. Farmers depend on chemical pesticides for management of pest and diseases because of their availability and effectiveness.

Fusarium is a serious pathogen that has been given less attention unlike its counterpart *Phytophthora infestans* and it affects potato both in field and during storage. For every potato farmer, diseases are mostly managed using synthetic fungicides despite its detrimental effects (Van de Mortel *et al.*, 2009; Soylu *et al.*, 2006) ^[27, 21].

Year 2020 was declared as International Year of Plant Health by the United Nations hence, food production is estimated to increase by 60% to feed estimated 10 billion people expected to be on earth by 2050 (FAO, 2021) ^[9]. Global losses due to crop pests and diseases on food crops are large ranging by means from 8.1 to 21% in potato (FAO, 2021) ^[9]. Pre-harvest losses due to diseases with nearly 50% for potato farmers has reported for South America (FAO, 2021) ^[9].

Additionally, economic losses caused by *Fusarium* spp. are as a result of production of mycotoxins that contaminate potato tuber which are toxic to humans and animals (Nadia *et al.*, 2021) ^[16]. Mycotoxins can lead to an immune suppressive effect due to their multiple inhibitory properties on eukaryotic cells, including suppressing synthesis of protein, DNA and RNA, restraining of mitochondrial function and affecting cell division and membrane function (Rocha *et al.* 2005). Most *Fusarium* species are able to produce one or more mycotoxins with various degrees of toxicity (Nadia *et al.*, 2021) ^[16].

Fusarium dry rot control measures include cultural practices (crop rotation, use of disease free seed, avoiding tuber injuries during harvesting, and ensuring wound healing before storage). The zones that have scar forms more or less rapidly depending on the temperature. Simultaneously, the superficial cells dehydrate. Biological control agents, ultraviolet radiation, as well as chemical control are also used to control the disease (Nadia *et al.*, 2021) ^[16].

The objectives of this research were to: (i) identify *Fusarium* species associated with potato dry rot and wilt in Plateau State

and to evaluate their pathogenicity both *In vitro* and *in vivo*.

Materials and Methods

Description of the study area

Plateau State is the twelfth largest state in Nigeria. It is located at the central part of the country and it is geographically unique due to its boundaries of elevated hills surrounding the Jos plateau. The State lies in Nigeria's middle belt, has an area of 26,899 km², with an estimated population of about three million people. It lies between latitude 08° 24' N and longitude 008° 32' and 010° 38' east. The state is named after the pictures of Jos plateau, a mountainous area in the north of the state with captivating rock formation. Bare rocks are scattered across the grassland, the altitude ranges from around 1, 200 metres (3,900ft) to a peak of 1,829metres (6,001Ft) above sea level in the Shere Hills range near Jos. Many years of tin and columbite mining have left the area strewn with deep gorges and lakes (Anon., 2018) ^[2].

Plateau State is situated in the tropics at higher altitude having a temperate climate averaging between 13 and 22°C. Harmattan winds cause the coldest weather between December and February and the warmest temperature usually occurs in the dry season during the months of March and April. The mean annual rainfall varies between 52 m in the southern part to 57 m on the Plateau the highest rainfall recorded during the wet months of July and August (Anon., 2018) ^[2].

Soil Samples Collection

Soil samples used in this study were collected in sterile polythene bags with low density from farms known to have been used to cultivate potatoes for three farming seasons and the locations included: Barkin-Ladi, Jos-North and Mangu Local Government Areas. The samples were taken to the Post-Graduate Laboratory, Department of Plant Science and Biotechnology, University of Jos, Nigeria, where they were stored in the refrigerator at 11°C until required for experimentation.

Preparation of Medium

Potato Dextrose Agar (PDA) was prepared according to manufacturer's instructions. This was achieved by dissolving 19.5 g of the powder into 500 ml of distilled water in a conical flask. The mixture was tightly corked using cotton-wool, folded in aluminum foil paper and brought to boil on a hot plate (for proper dissolution of the powder and emulsification). The heated medium was further autoclaved at 121°C for 15 min and allowed to cool to 45°C. This was supplemented with gentamycin (2 ml /80 mg) to suppress bacterial growth. Potato Dextrose Broth (PDB) was prepared by dissolving 9.75 g of powder in 250 ml McCartney bottles covered and autoclaved at 121°C for 5 min.

Isolation and identification of *fusarium* species.

A stock solution of each soil sample was made by weighing 1 g of each soil sample into 9 ml of sterile distilled water. This was followed by serial dilutions of each stock solution. One milliliter of each solution was transferred onto the surface of sterile PDA plates prepared. The plates were allowed to stand on the work bench until properly absorbed. This was followed by incubation of the plates at (25±2°C) for 3-4 days. The growth was subculture on fresh sterile PDA plates after 4 days and re-incubated to obtain pure isolates. Mycelia growth that varied from white cottony to pinkish in appearance were picked and subcultured on sterile PDA plates, incubated at room temperature of 25±2°C for 4 days.

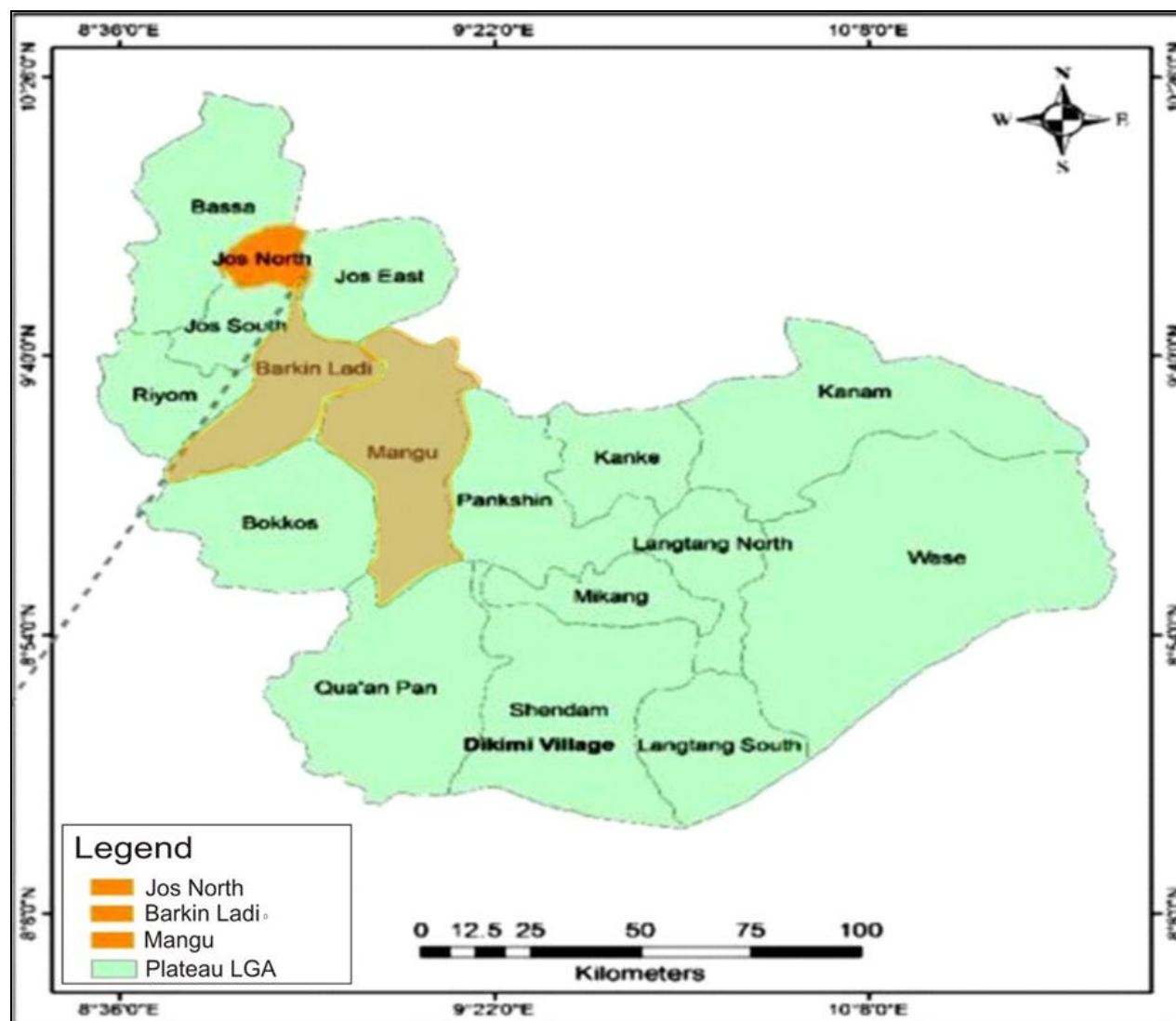


Plate 1: Map of Plateau State of Nigeria showing locations of inoculum source

Identification of *Fusarium* under Light Microscope

Identification of *Fusarium* species was based on microscopic characteristics. The compendium for fungal identification was used as guide for the descriptive morphology which was authenticated based on micrographs to confirm *Fusarium* species (Monica cheesebrough, 2000) ^[15]. This was done by preparing slide on clean, grease-free glass slide, swabbed with 70% ethanol and passed through flame three times and allowed to cool. A drop of lactophenol cotton blue was placed on the slide using a 1 ml dropper pipette. With the aid of a sterile needle, the mycelia growth were aseptically picked and teased over the lactophenol blue until well-spread. The smear was carefully covered with a sterile cover slip by placing the edge of the cover slip to avoid bubble formation. Same procedure was followed to prepare clear smear using sterile distilled water in place of lactophenol cotton blue. The prepared slides were viewed under the microscope using x4, x10 and x40 objectives.

Sub-Culturing on Slant

The isolates were aseptically sub-cultured on PDA slant and in the PD broth, previously prepared and cooled to 45°C (15 ml of the PDA) slanted on McCartney bottles which were loosely closed and slanted on a laboratory tray and allowed to solidify. On the solidified slanted medium mycelia of isolates of *Fusarium* were point inoculated and incubated at 25±2°C. The isolates were also inoculated into PD broth, mycelium were

inoculated too.

Sub-culturing of *Fusarium* Species for Spore Development

Isolates of *Fusarium* species were inoculated onto PDA as previously described. It was inoculated for spore development at 25±2°C for 14 days. The spores were harvested and by cutting a 5 mm disc of isolates from lawn cultures of *Fusarium* on PDA plates (Monica Cheesebrough, 2000) ^[15].

DNA Extraction Using ZR Fungal/Bacterial DNA Miniprep (Manufactured by Zymo Research)

Two millilitres of fungal cells broth culture was added to a ZR Bashing™ Lysis Tube which was followed by adding 750 µL Lysis Solution to the tube. Bead fitted with 2 ml was secured using tube holder assembly and the process was set at maximum speed for > 5 minutes. The ZR Bashing Bead™ Lysis Tube was centrifuged in a microcentrifuge at > 10,000 x g for 1 minute. Approximately 400 µl supernatant was added to a Zymo-Spin™ IV Spin Filter (orange top) in a Collection Tube and centrifuged at 7,000 x g for 1 minute. One-thousand two hundred (1,200) µl of Fungal/Bacterial DNA Binding Buffer was added to the filtrate in the Collection Tube from Step 4. Eight hundred (800) microlitre of the mixture was transferred from Step 5 to a Zymo-Spin™ IIC Column in a Collection Tube and centrifuged at 10,000 x g for 1 minute. The flow through from the Collection Tube was discarded and Step 6 was

repeated. DNA Pre-Wash Buffer was added (200µL) to the Zymo-Spin™ IIC Column in new Collection Tube and centrifuged at 10,000 x g for 1 minute. Five hundred (500) µL Fungal/Bacterial DNA Wash Buffer was added to the Zymo-Spin™ IIC Column and centrifuged at 10,000 x g for 1 minute. The Zymo-Spin™ IIC Column was transferred to a clean 1.5 ml micro centrifuge tube and 100µL (35 µL minimum) DNA Elution Buffer was added directly to the column matrix. The mixture was centrifuged at 10,000 x g for 30 seconds to elute the DNA.

Preparation of Agarose Gel

One (1) gram agarose was measured for DNA and 2 g of agarose for PCR. The agarose powder was mixed with 100 mL 1xTAE in a microwavable flask. The mixture was microwaved for 1-3 min until the agarose was completely dissolved (but was not allowed to over boil, as some of the buffer would evaporate, thus alter the final percentage of agarose in the gel). Agarose solution was allowed to cool down to 50°C for 5 mins. Ten (10) microlitre EZ vision DNA stain was added. The agarose was poured into a gel tray with the well comb in place. The newly poured gel at 4° C for 10-15 minutes was allowed to sit at room temperature for 20-30 minutes until it had completely solidified.

Agarose Gel Electrophoresis of extracted DNA

Loading buffer was added to each DNA samples. Once solidified, the agarose gel was placed into the gel box (electrophoresis unit). Gel box was filled with 1xTAE (or TBE) until the gel was covered. A molecular weight ladder was carefully loaded into the first lane of the gel. Samples were carefully loaded into the additional wells of the gel. The gel was run at 80-150 V for about 1-1.5 hours. Power was turned off, the electrodes were disconnected from the power source, and the gel was carefully removed from the gel box. DNA fragments were carefully visualized under UV transilluminator (Eva *et al.*, 2010) [7].

Polymerase Chain Reaction of Internal Transcribed Spacer (ITS) gene of the Fungal Isolates

The PCR mix was made up of 12.5 µL Taq 2X Master Mix from New England Biolabs (M0270); 1 µL each of 10 µM forward (ITS 1: TCC GTA GGT GAA CCT GCG G) and reverse primer (ITS4 TCCTCCGCTTATTGATATGS); 2 µL of DNA templates were used and then made up with 8.5 µL Nuclease free water (Eva *et al.*, 2010) [7].

Cycling Conditions for the Internal Transcribed Spacer (ITS) gene

Initial denaturation was done at 94°C for 5 mins, followed by 36 cycles of denaturation at 94°C for 30 sec, annealing at 50°C for 30 secs and elongation at 72°C for 45 seconds. Followed by a final elongation step at 72°C for 7 minutes and was held at 10°C forever.

Sequencing

The amplified fragments were sequenced using a Genetic Analyzer 3130 x 1 sequencer from Applied Biosystems using manufacturer's manual while the sequencing kit used was that of BigDye terminator v3.1 cycle sequencing kit. Bio-Edit software and MEGA X were used for all genetic analyses.

Pathogenicity Test

In vitro pathogenicity test on potato tubers

In a three by three by 3 treatment combination (3 X 3 X 3), tubers of each variety of *S. tuberosum* were used after washing

and surface sterilized by immersion in 5% v/v sodium hypochlorite solution for 15 minutes, then rinsed three times in sterile distilled water and air-dried. Using a sterile glass rod, two diametrically opposed wounds, 5 mm diameter and 5mm deep, were made on each tuber. A 5-mm-diameter agar plug, from the margin of a 4 day old-culture on PDA, was placed into the wounds but a sterile plug on the control tubers. Tubers were placed in sterile plastic beakers with water-soaked paper covering the bottom of the beakers followed by incubation at 25 °C in the dark for 30 days. Five replicates were made and including those of the sterile control. After incubation, the tubers were cut across the two inoculation points for assessment/ observations.

For the tuber pathogenicity trial, differences between the means of each treatment were evaluated using one-way ANOVA. Data were analyzed using SPSS setting the confidence interval at 5%.

In vivo pathogenicity test

For each isolate (Mangu, Barkin-Ladi and Jos-North), pathogenicity of *Fusarium* were determined by inoculation of the isolate into the soil growing potato seedling. Conidial suspension of the organism was obtained from two weeks old cultures. A mycelia plug from sub-cultured monoculture of the isolate was transferred to potato dextrose broth and incubated at 25±2 °C. After 7 days mycelia with spores and broth were filtered through four layer of sterilized gauze to trap the hyphae. The spore were sub-sequently concentrated and adjusted to approximately 10 conidial mL⁻¹ using haemocytometer. Selected potato seedling planted were inoculated during the cotyledon and three-true leaf stages. A ditch was made in the soil about 3 cm created near the seedling. Near each seedling, 10 mL of the fungal spore suspension was poured into the soil. This was replicated for each variety and water was used as negative control. Symptoms on each seedling were looked out for and monitored up to day 30. The cotyledon disease symptoms were graded along a four point disease severity scale by Clive *et al.*, (2010) [3]. Disease severity index were calculated, analysis of variance (ANOVA) was used to determine the overall effects of the isolate and interaction between the host and organism.

Symptoms on each seedling were looked out for and monitored for 30 days as described by Clive *et al.* (2010) [3]. Root and cotyledon disease symptoms were graded along a four-point disease severity scale: 0 = no symptoms, 1 = <10% fibrous root browning with the over ground part having no symptoms and with slight cotyledon wilt, 2 = taproot browning or 11-50% fibrous root browning with heavier cotyledon wilt, 3 = >50% taproot browning with wilt of the entire cotyledon, and 4 = browning of most of the taproot browning, plant emergence death, and damping-off. The disease severity index (DSI) was calculated as follows: $\sum (\text{disease severity scale points} \times \text{number of plants at each scale point}) / (\text{total number of seeds surveyed} \times \text{disease severity scale of the highest scale point observed}) \times 100$.

Analysis of variance (ANOVA) was conducted on the DSI data to determine the overall effects of the isolate and the interactions between the host and strains ($p < 0.01$).

Isolation of *Fusarium* species from Infected Plant (Koch's Postulate)

The stem of infected field trial were aseptically collected and washed in running tap water and surface sterilized in 70% ethyl alcohol for 1 minute and it dried on sterile paper. The stem were aseptically cut into pieces (1-2 mm thick) and placed on previously prepared PDA for 2-3 days. Plates were sub-cultured

onto PDA amended with gentamycin as previously described. Isolate were purified and pure culture obtained and identified using morphological features on plates and under light microscope. Identification was made based on feature compare with isolation procedure previously described.

Results

Identification of *Fusarium* species

The colonial appearance of *Fusarium* species is as presented in Plates 2, 3, and 4. These plates represent isolates from the three Local Government Areas of Mangu, Jos-North and Barkin-Ladi respectively. These plates represent seven days old culture of *Fusarium* isolates on Potato Dextrose Agar (PDA). The mycelia vary from white (Plate 2 and 4) to pink in colour (Plate 3). They are cottony in appearance (Plate 2). The sources of inocula were obtained from soil samples from Barkin-Ladi, Jos-North and Mangu LGAs. The macroconidia of the fungi are slightly curved (tapered) or straight with septation while the microconidia which are elliptical to cylindrical without septation are presented in Plate 6 and 7 respectively. Plate 4 shows hyphae of the isolate appearing clear and distinct with the microconidia. These

appearances of septation were visible after 5-7 days of culturing.

Molecular Characterization of *Fusarium* Isolates

The PCR Gel electrophoresis shows high molecular weight DNA isolated from the organism with the band shown in shown on Plate 7. The gel image shows the amplification of the Internal Transcribed Spacer (ITS) of isolates on Lane M using 50 bp DNA ladders where, the band of the isolates appeared at 650 bp as shown on Plate 8.

Isolates obtained from soils of Mangu, Jos North and B/Ladi revealed the presence of *Fusarium solani*, *Fusarium solani* and *Fusarium falciforme* respectively with the bases as obtained from NCBI bank. The sequencing revealed that *Fusarium* isolated from Mangu soil sample had 99.43% pairwise similarity with *Fusarium solani* strain Y1 with NCBI accession number MH383176.1 (Mangu isolate A), the inoculum from soil of Jos North has 98.59% pairwise similarity with *Fusarium solani* strain CBS 1400079 while Barkin-Ladi isolate had 99.8% pairwise similarity with *Fusarium falciforme* strain DTO 422-H8 which has NCBI accession number MT251175.1 (Barkin-Ladi Isolate B).



Plate 2: Colonial Appearance of *Fusarium solani* isolated from mangu soil

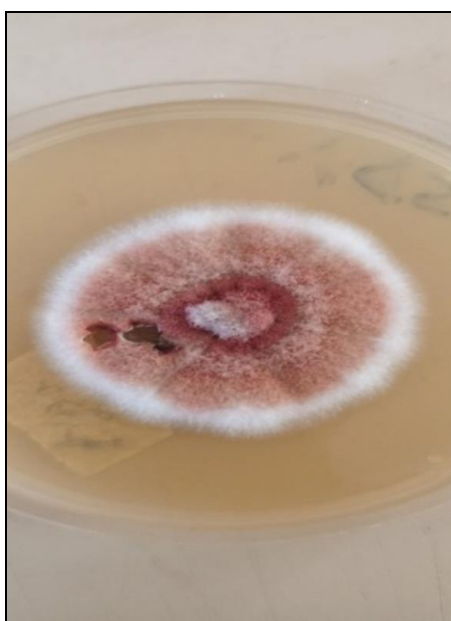


Plate 3: Colonial appearance of *Fusarium* sp isolated from Jos-North



Plate 4: Colonial appearance of *Fusarium falciforme* Isolated from B/Ladi Soil

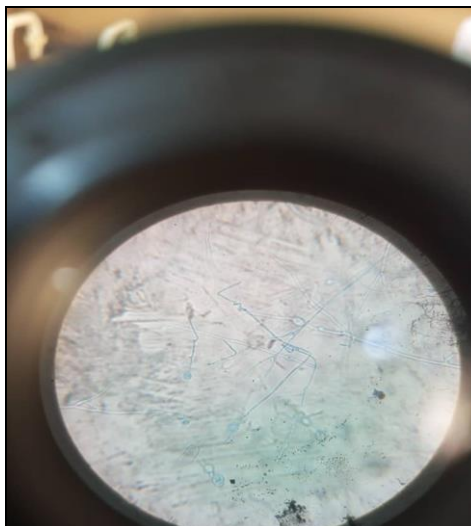


Plate 5: Macroconidia of *Fusarium* sp

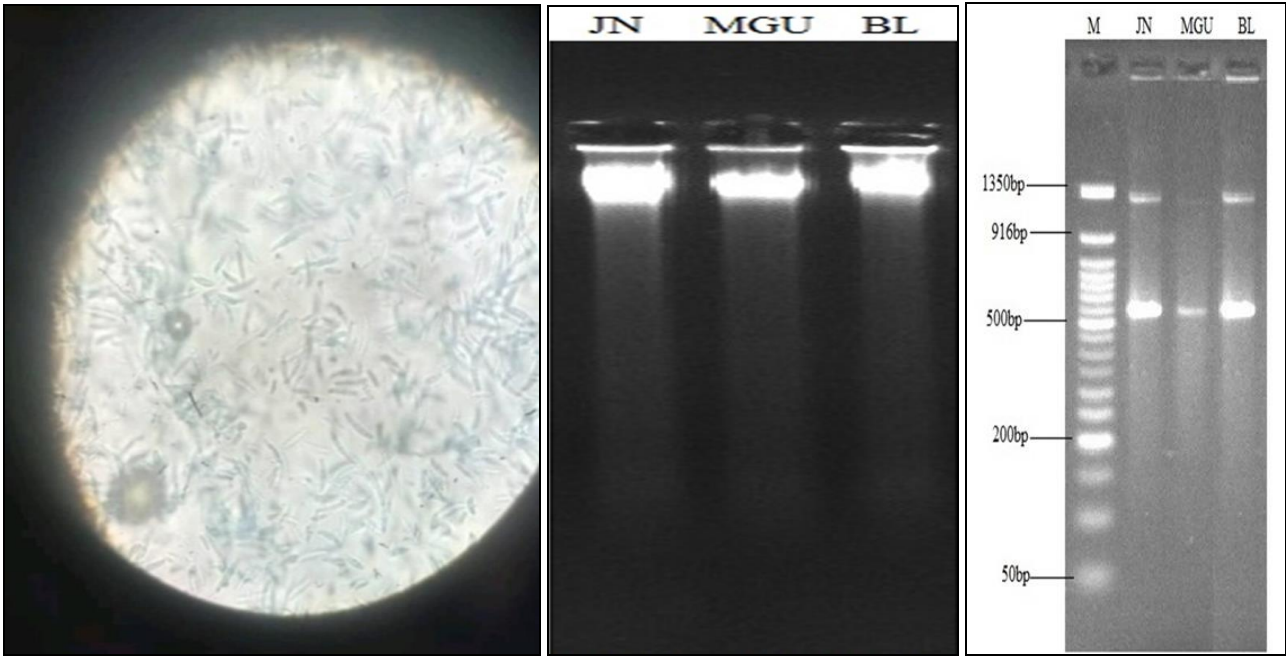


Plate 6: Microconidia of *Fusarium* sp **Plate 7:** High molecular weight DNA band of **Plate 8:** Gel Image Showing Amplification PCR gel image from the *Fusarium* spp Isolates of the Internal Transcribe Spacer (ITS) of the *Fusarium* spp isolates. Lane M is a 50 bp DNA ladder

Table 1: Blast output for the nucleotide sequences of the genes of isolates from Mangu, Jos-North and Barkin-Ladi

Isolate	GenBank organism	Identity	Accession number
<i>Fusarium solani</i> Mangu	<i>Fusarium solani</i> Y1	99.43%	MH383176.1
<i>Fusarium falciforme</i> Barkin-Ladi	<i>Fusarium falciforme</i> DTO	99.8%	MT251175.1
<i>Fusarium</i> Jos-North	<i>Fusarium solani</i> CBS	98.59%	NR163531

Discussion

Fusarium species are ubiquitous in nature as other species and several strains are pathogenic to plants and animals. *Fusarium* species are known to produce white, to pink mycelial colonies on potato dextrose agar (PDA). The fungi were identified in this study microscopically having macroconidial shapes which appeared to be slightly curved or sickle-shaped. Some of the macroconida were slightly curved or straight with septation, while the microconidia were elliptical to cylindrical in shape without septation. The *Fusarium* isolates obtained in this study exhibited the aforementioned criteria which are evident in their association with potato and all the effects exerted on the host plant. These findings were similar to the description of *Fusarium* by Narayan, Pralay, Rajan, Suvranil, Smriti, Animesh and Surendra (2023) which conformed to the reports of Liu *et al.* (2018). According to the reports of Nadia *et al.* (2021) ^[16], *Fusarium solani* species complex has been moved to genus Neocosmospora. The ability to isolate *Fusarium* from soil and plant leaves may be due to their abundance in the soil and the phyllosphere. They are known to exhibit remarkable biodiversity which ranges from morphological, physiological and ecological attributes, which gives it the opportunity to take advantage of its ubiquity. Pathogenicity of *Fusarium* to the potato samples *in vitro* agreed with the reports of Nadia *et al.* (2021) ^[16] that isolated three *Fusarium* species from potato and were exclusively responsible for dry rot of the produce *in vitro*. The *Fusarium* isolates identified in the potato samples studied were *F. solani*, *F. falciform* and *Fusarium solani* (respectively from Mangu, Barkin-Ladi and Jos-North) indicating that *Fusarium* species vary with location and differences in the species might be

responsible for its pathogenicity. The field (*in vivo*) pathogenicity test of these organisms revealed that the plants wilted between 13-30 days of planting under green house conditions. The signs and symptoms of the disease started with yellowing of stem to wilting of the potato leaves. This is similar with the reports of Gherbawy *et al.* (2019) whose reports agreed with the reports of Nadia *et al.* (2017), Stefańczyk, *et al.* (2016) and Du *et al.* (2012). As a result of early manifestation of wilting during the field pilot trial, it necessitated delay of introducing the *Fusarium* isolates to the potato seedlings during the main trial *in vitro* until the sixth week after planting. Suman *et al.* (2017) suggested that reduction in mechanical injury would reduce surface rot. The *in vitro* pathogenicity test of the organisms (*Fusarium* isolates) revealed that they were pathogenic on the four potato varieties sampled. The fungi were highly pathogenic to Caruso and Marabel. This could be due to the high moisture content of these varieties; Jelly and Connect were less susceptible to infection *in vitro* which might be due to their peels resistance to the pathogens penetration. Based on location, Barkin-Ladi (*Fusarium falciforme*) isolates were least pathogenic to the potato samples unlike the isolates obtained from Jos-North and Mangu Local Government Areas. In the present study, a diversity of fungal species isolated from soils of potato farming areas were collected. However, the list of the *Fusarium* spp. associated with potato in this region is likely still incomplete because few farms were visited. The results can be useful for other studies such as epidemiology of *Fusarium* spp in potato planting regions of plateau State or the prevalence of *Fusarium* wilt and rot of potato, the search for resistance against the dominant species associated with wilt and rot, storage methods to prevent rot by extending the shelf life of

potato and the likes.

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