

Identification of fungi associated with storage rots of Irish Potato (*Solanum Tuberosum* L.) tubers in Sokoto Metropolis

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ABSTRACT

Fungi associated with storage rot of Irish potato tubers in Sokoto, northwestern, Nigeria were investigated. Irish potato tubers showing symptoms of rots were obtained from five different markets; Tsohuwar Kasuwa, Sokoto Central Market, Gawon nama, Mabera and Nagarta markets located in Sokoto metropolis. The following fungi; *Rhizopus stolonifer*, *Aspergillus niger*, *Aspergillus flavus*, *Penicillium* species, *Mucor racemosus*, *Fusarium oxysporum* and *Alternaria alternata* were isolated from rotted tubers. *Rhizopus stolonifer* has the highest percentage frequency of occurrence followed by *Aspergillus niger* and *Alternaria alternata* has the least percentage frequency. The pathogenicity test revealed that *R. stolonifer* is the most virulent followed by *F. oxysporum* and *M. racemosus* is the least virulent fungus. The use of good storage facilities, adequate control measures and improved Irish potato varieties should be encouraged in order to reduce storage rot of Irish potato tubers.

Keywords: Potato tubers, fungi, storage, rots, markets.

INTRODUCTION

Irish potato (*Solanum tuberosum* L.) is an annual herbaceous, dicotyledonous plant belonging to the family *Solanaceae*. It is a perennial that grows about 60cm high depending on variety [10]. Irish potato originated from the Andes highlands of South America, Bolivia and Peru. It later spread to Europe in the 16th century. It was brought to Africa in the 19th century [11]. Irish potato was introduced into Nigeria in the later part of the 19th century and early 20th century by Europeans notably the tin miners in Jos Plateau. Most important potato producing areas in Nigeria are Jos Plateau, Kano, Zaria, Mambila, Biu and Obudu highlands [6]. About 95% of the total production comes from Jos Plateau. The current Irish potato production in Nigeria is 800,000 tonnes per annum [14].

Irish potato is ranked fourth in importance after rice, wheat and maize. Potatoes are eaten boiled, fried and in stews [4]. It is also grown for livestock feed and industrial purposes [16]. It has high nutritive value and the tubers contain carbohydrate 14.2%, protein 4.7%, ash 5%, fat 0.7%, fibre 0.8%, vitamin 69%, calcium 1%, iron 14%, magnesium 6%, phosphorus 8%, potassium 9%, and sodium 6% [17; 16].

Storage rot constitutes a major constraint to Irish potato production in Nigeria. The storage rot is caused by fungi, bacteria and viruses [19]. Several fungi have been isolated from rotten Irish potato tubers. [8] In their research findings reported that *Alternaria solani*, *Phytophthora infestans* and *Rhizopus stolonifer* caused post harvest rot of Irish potato tubers in Egypt. The following fungi *Rhizoctonia bataticola*, *Butrydiplodia theobromae*, *Fusarium redolens*, *F. oxysporum*, *Penicillium* species and *Rhizopus oryzae* were associated with post harvest rot of Irish potato tubers in south-east and southwestern Nigeria [1; 19].

The present study was carried out to isolate and identify fungi associated with storage rot of irish potato tubers in Sokoto and recommend some management strategies.

MATERIALS AND METHODS

The study area

The study was conducted in the Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto. Sokoto state is located in the Northwestern Nigeria at longitude 3-9⁰ east and latitude 10-14⁰ North. The area has an average annual rainfall of 550mm. It is characterized by long dry season (October to April) and short rainy season (May to September). The average monthly temperature ranges from 21 to 39⁰C and is lowest in December and January. Heat is more severe in March and April [13].

Collection of Sample

Irish potato tubers of nicola variety showing symptoms of rotting were randomly selected from five different markets; Sokoto central market, Gawon Nama, Tsohuwar Kasuwa, Mabera and Nagarta located in Sokoto metropolis. The tubers were put singly into sterile polythene bags and brought to mycology laboratory of Usmanu Danfodiyo University, Sokoto for microbial analysis.

Isolation and Identification of Associated Fungi

The diseased tubers of irish potato were washed with tap water and wiped with cotton wool soaked in 70% alcohol. The tubers were cut through by means of sterile knife. Slicing were done starting from the healthy portions. Pieces of 5 x 5mm were cut and plated on sabonraud dextrose agar (SDA) and incubated at room temperature for 24 to 35 hours.

Representative colony types were purified by subculturing on fresh SDA plates. Pure cultures were transferred to slants of SDA. Pure cultures of the isolates were grown singly on SDA for identification. The isolated fungi were identified based on the isolates colonial characteristics on culture plates and microscopic features in slide cultures. Using a sterile inoculating needle portion of each mycelia colony was aseptically taken and placed on a clean microscope slide and tease in a drop of lacto phenol cotton blue. The isolates were identified by reference to [9].

Pathogenicity test

Fresh and healthy tubers of irish potato were washed with tap water and surface sterilized with 70% ethanol. Cylindrical cores were removed from the tubers with help of 5mm cork borer. Four millimeter (4mm) agar discs containing 7days old cultures of the isolates were introduced into the holes and sealed with the sterile vaseline. Controls were set up as described except that the inocula consist of uninoculated sabouraud agar blocks. All the treated tubers were put singly into sterile polythene bags and incubated at 28 + 2⁰C for 10 days. The tubers were cut through and examine for rot at the end of the incubation period.

RESULTS

Isolation of fungi from rotten irish potato tubers

A total of 7 storage fungi were recovered from rotten irish potato tubers. The result indicated that *Rhizopusstolonifer*, *Aspergillus niger*, *A. flavus*, *Fusarium oxysporum*, *Penicilliumspecies*, *Mucor racemosus* and *Alternaria alternata* were responsible for storage rot of irish potato tubers in Sokoto. *Rhizopus stolonifer* has the highest frequency of occurrence followed by *Aspergillus niger* and *Alternaria alternata* has the least percentage frequency of occurrence. The results are presented in Table 1:

Table 1: Fungi isolated from rotten irish potato tubers

Fungi	Frequency of Occurrence(%)
<i>Rhizopus stolonifer</i>	30.9
<i>Aspergillus niger</i>	23.1
<i>Aspergillus flavus</i>	18.6
<i>Fusarium oxysparum</i>	6.2
<i>Penicillium species</i>	7.1
<i>Mucor racemosus</i>	9.7
<i>Alternaria alternata</i>	4.4

Pathogenicity test

The pathogenicity test revealed that all the fungal isolates were pathogenic on irish potato tubers. *Rhizopus stolonifer* is the most virulent fungus followed by *F. oxysporum* and *M.racemosus* is the least virulent fungus. The results of pathogenicity test are shown in Table 2.

Table 2: Pathogenicity of the isolates on irish potato tubers

Fungi	Diameter of Rot (mm)
<i>Rhizopus stolonifer</i>	52
<i>Aspergillus niger</i>	30
<i>Aspergillus flavus</i>	35
<i>Fusarium oxysporum</i>	46
<i>Penicillium species</i>	33
<i>Mucor racemosus</i>	24
<i>Alternaria alternata</i>	34

DISCUSSION

The fungi associated with storage rot of irish potato tubers in Sokoto were *R. stolonifer*, *Aspergillus niger*, *A. flavus*, *F. oxysporum*, *Penicillium species*, *M. racemosus* and *Alternaria alternata*. This is similar to the findings of [19] who identified *Rhizopus oryzae*, *Fusarium redolens*, *Butryodiplodia theobromae*, *Fusarium oxysporum* and *Penicillium species* were responsible for postharvest rot of irish potato tubers. The results of this study are in agreement with the findings of other researchers [13; 7] that fungi constitute a menace in storage rot of many agricultural commodities. It was observed that *R. stolonifer* is the most frequently isolated fungus from rotten irish potato tubers in Sokoto. But [19] discovered that *F. oxysporum* is the most frequently isolated fungus from rotted irish potato tubers in southwestern, Nigeria. It has been reported by [2] that *R. stolonifer* is the most frequently isolated fungus from rotten sweet potato tubers. This could be attributed to its ability to produce numerous spores [5].

The results of pathogenicity test indicate that fungi induce different level of decay with *R. stolonifer* as the most virulent fungus. [19] Reported *R. oryzae* as the most virulent among the fungi associated with storage rot of Irish potato tubers in southwestern, Nigeria. The variations of the fungal isolates to cause different level of decay may be due to differences in their ability to utilize tuber components as food for growth [15]. Postharvest rot of irish potato tubers may be due to its low pH, moisture content and nutritional compositions which make it susceptible to infection by fungi. The high incidence of storage rot of irish potato encountered in Sokoto could be related to prevailing climatic factors and storage conditions. It could also be attributed to handling procedures during harvest, transit, marketing and storage places. Postharvest loss of root and tubers has been of serious problem to farmers and warring against food security [18]. This study has shown that fungal rot is the greatest cause of rot of irish potato in storage. Colonization of the tubers by fungi will lead to reduction in consumption materials, market value and production of mycotoxins. Consumption of excess amount of mycotoxins can cause illness or death [12]. The pathogenic fungi can cause allergies in susceptible individuals.

CONCLUSION

This study has shown that many fungi have been found to cause storage rot of irish potato in Sokoto. These pathogens lead to enormous loss of irish potato tubers despite its economic and nutritive value. The disease is of great economic importance to this country. Some of these fungi are capable of producing mycotoxins which are hazardous to the health of consumers. As such urgent attention is required to safe the menace and increase the economic yield of the produce. This will ensure substantial contribution of the irish potato to food supply and national economy.

Recommendations

The following measures are recommended in order to reduce the incidence of storage rot of irish potato tubers :-

1. There is need to devise good storage facilities to prolong the shelf life of irish potato after harvest.
2. Employ adequate control measures especially biological measures which are safe and environmentally friendly. Such as the use of organisms that are parasites or antagonistic to the pathogens.
3. Physical damage to the tubers should be avoided since they serve as major points of entry of pathogens into the tubers

4. Contact between healthy and rotten tubers should be avoided to prevent infection
5. Measures should be taken to prevent the tubers from getting contact with soil to avoid re-infection. This include the use storage clamps , raised platforms, concrete floor etc.
6. Healthy and undamaged tubers should be place in a dried and well ventilated stores.
7. Tubers should be surface sterilize before storage in order to prolong their storage life
8. Farmers should use improved irish potato varieties such as ajax and patista.
9. Consumption of infected tubers should be discouraged because they may contain mycotoxins produced by the fungal pathogens.
10. Use of hot watertreatment at different temperatures.

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