

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: - www.journalijar.com</p> <h2>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p>Article DOI:10.21474/IJAR01/4935 DOI URL: http://dx.doi.org/10.21474/IJAR01/4935</p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal Homepage: http://www.journalijar.com Journal DOI:10.21474/IJAR01</p>
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RESEARCH ARTICLE

FUNGI ASSOCIATED WITH PEELED-FRESH FRUITS SOLD BY STREET VENDORS IN PORT HARCOURT TOWN, RIVERS STATE.

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Manuscript Info

Manuscript History

Received: 23 May 2017

Final Accepted: 25 June 2017

Published: July 2017

Key words:-

fungi, fresh fruits, blotter-method, pure cultures.

Abstract

Peeled fruits each of Watermelon (*Citrulluslunatus*), Pawpaw (*Carica papaya*), and Pineapple (*Ananascomosus*) were bought from street vendors in Creek Road Market, Mile 1 Market, Mile 3 Market, Borokiri and Lagos Bus Stop all in Port Harcourt Town, Rivers State to investigate the fungi associated with these fruits and the possible implications associated with their consumption using the Standard Blotter Method and the Acidified Potato Dextrose Agar Method. Four major species were isolated from these fruits. They include-*Rhizopusstolonifer*, *Aspergillusniger*, *Aspergillusflavus*, *Fusariumsp* and *Penicilliumoxalicum*. The fruits bought from Creek Road Market revealed the highest % incidence occurrence while those in Mile 1 Market had a lower % incidence occurrence. *Aspergillusniger* was observed to have had the highest percentage incidence in all the areas sampled and all the fruits used, followed by *Rhizopusstolonifer* and *Fusarium sp.* *Penicilliumoxalicum* was only observed in Pineapple (*Ananascomosus*) in all the sampled locations while *Aspergillusflavus* was only observed in Pawpaw (*Carica papaya*) and it had the least percentage incidence occurrence in all the sampled locations. The inherent hazards associated with the consumption of fruits on display at these markets are discussed and suggestions on how to prevent the likelihood of fruit-borne infections, including improved sanitary conditions in the markets are discussed.

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Introduction:-

Fresh-peeled fruits are fruits that have been physically altered from its original form but remains in a fresh state (IFPA, 2001). Fresh-peeled fruits offer consumers ready-to-eat produce that is one of several convenient, nutritious, and fresh-like tasting, and are a rapidly growing category of value-added products that are minimally or lightly processed.

Fruits are good sources of nutrients for growth, repair and control of body processes as most of them contain sugar, vitamins, mineral elements and small quantities of protein and oil (Duckworth, 1996). For their nutritional values, man has been utilizing fresh fruits for the production of consumable items like jam, juices, flavoring agents, marmalade, beverages and wine (Hobbs, 1998). Over the years, there has been a significant increase in the consumption of sliced produce because they are easily accessible, convenient, nutritious and, most especially,

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cheaper than the whole fruits or vegetables. The commonly consumed peeled-fresh hawked in Port Harcourt Town are Pawpaw (*Carica papaya*), Pineapple (*Ananascomosus*), and Watermelon (*Citrulluslanatus*)

This increase in the consumption of sliced fruit has been linked with a parallel increase in food-borne illness (Mensah et al., 2002). Due to their high nutritional contents, particularly sugar, and low pH, fruits and their products serve as breeding substrates for microorganisms whose activities constitute the most important causes of spoilage. Microorganisms from many sources such as agricultural environment, the vegetation as well as dead decaying materials, can contaminate fruits. Duckworth (1966) reported that tree-borne fruits like orange and pawpaw are contaminated more readily with spores from the infections on surrounding vegetation. Contamination or cross-contamination of street foods especially peeled fresh fruits and vegetables are increased by unsanitary processing and preservation methods. The use of dirty utensils, as well as the open display of fresh-peeled produce encourages sporadic visits by flies, cockroaches, rodents and dusts (Bryan et al., 1992). Also, some of these fresh-peeled fruits are contaminated through harvesting materials and contact with processing equipment. Another major source of contamination of fresh fruits and vegetables sold by street vendors is the washing water. Poorly processed street vended produce has been identified as an important cause of death in developing countries (Mensah et al., 2002). Maryrose and Umechuruba (2004) had earlier reported that *Fusariumsolani*, *Phomacarica-papaya* *Aspergillusflavus*, *Aspergillusniger*, *Botryodiplodiatheobromae*, *Cladosporiumherbarum*, *Colletotrichumdematium*, *Fusariummoniliforme*, *Phomopsiscarica-papaya*, *Penicillium sp.*, and *Rhizopusstolonifer* were responsible for post harvest spoilage of pawpaw in mile 3 market, Port Harcourt. Some other genera of fungi were reported to be responsible for fresh-peeled pineapple fruit which include *aspergillusflavus*, *Penicilliumsp*, *Botridioplodiatheobromae*, *Fusariummoniliforme* and *Rhizopusstolonifer*.

The objective of this work is to identify the fungi associated with fresh-peeled fruits sold by street vendors in Port Harcourt Town. Thus, making useful suggestions on how the sale of contaminated fruits and their consumption could be minimized.

Materials and Methods:-

Experimental Site:-

The study was conducted at the Department of Plant Science and Biotechnology Mycology Laboratory, University of Port Harcourt, Port Harcourt, Nigeria at Latitude 4⁰ 00N and 5⁰ 00N and Longitude 6⁰ E and 7⁰ E.

Sampling procedure:-

Five different samples of packaged fresh-peeled fruits for each of watermelon, pawpaw and pineapple were purchased from Mile 1 Market, Creek Road Market, Mile 3 Market, Borokiri and Lagos Bus stop all in Port Harcourt Town, Rivers State. The samples were immediately transported in a polyethylene bag to the laboratory for analysis. The standard blotter method highlighted by Zad (1987) was used followed by the acidified potato dextrose agar (PDA) method to isolate pure cultures of the fungi observed (Schaad 1989). Pure cultures of the isolated fungi were prepared by using a sterile wire loop to pick the fungi from the cultured fruits into the Petri-dishes containing solidified APDA medium (Schaad and Donaldson 1980). Each of the fungus was placed at the center of the Petri-dishes. The name of each fungus was labeled on the plates. They were then inoculated at room temperature (28±2°C) for seven days for the fungus to grow. Ten Petri-dishes were plated for each fungus.

Percentage Incidence Occurrence of Fungi Isolated:-

The percentage incidence occurrence of each of the fungi observed was taken for each of the plated fruits using the formula below:

$$\% \text{ incidence occurrence} = \frac{\text{Total no. of particular fungi} \times 100}{\text{Total no. of plated sample}} \quad 1$$

Results:-

Creek Road Market:-

The results showed that *Aspergillusniger* was the most prevalent in Creek road Market with the highest percentage incidence occurrence in pawpaw. *Aspergillusflavus* was only observed in pawpaw, while *Rhizopusstolonifer* was found in watermelon and *Penicilliumoxalicum* was observed only in pineapple. The result is as shown in Figure 1.

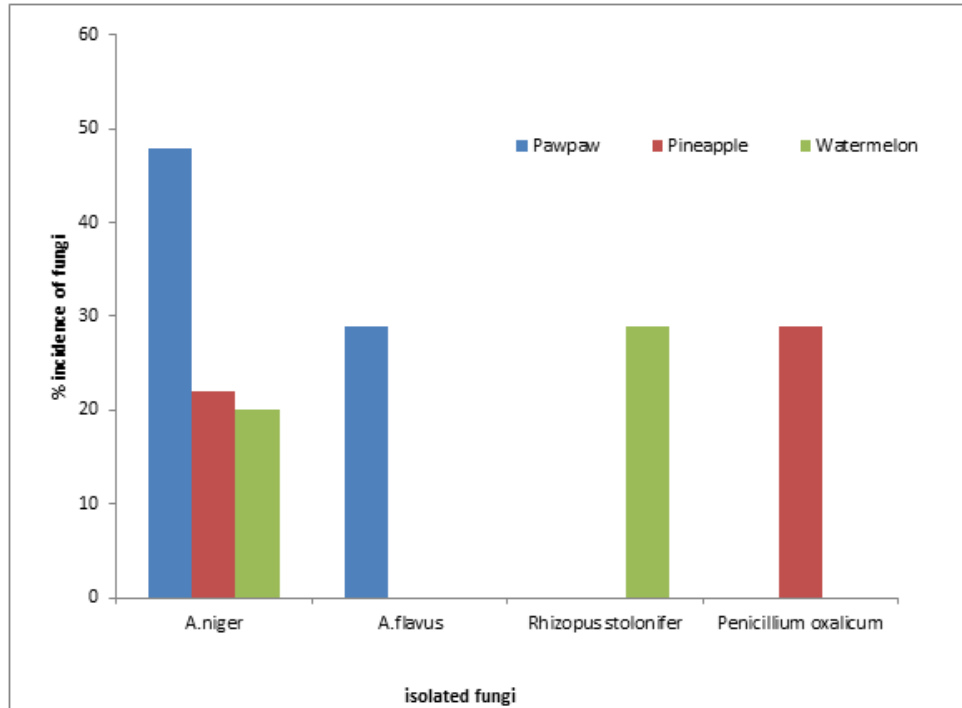


Fig 1:- Percentage Incidence of Fungal Isolates from peeled-fresh fruits obtained from Creek Road Market.

Mile 1 Market:-

The fruits obtained in Mile 1 Market showed that *Aspergillusniger* was most prevalent in this sampled location, appearing in the three fruits studied, followed by *Rhizopusstolonifer*. *Aspergillusflavus* only occurred in pawpaw while *Penicilliumoxalium* was only observed in pineapple. Fig 2

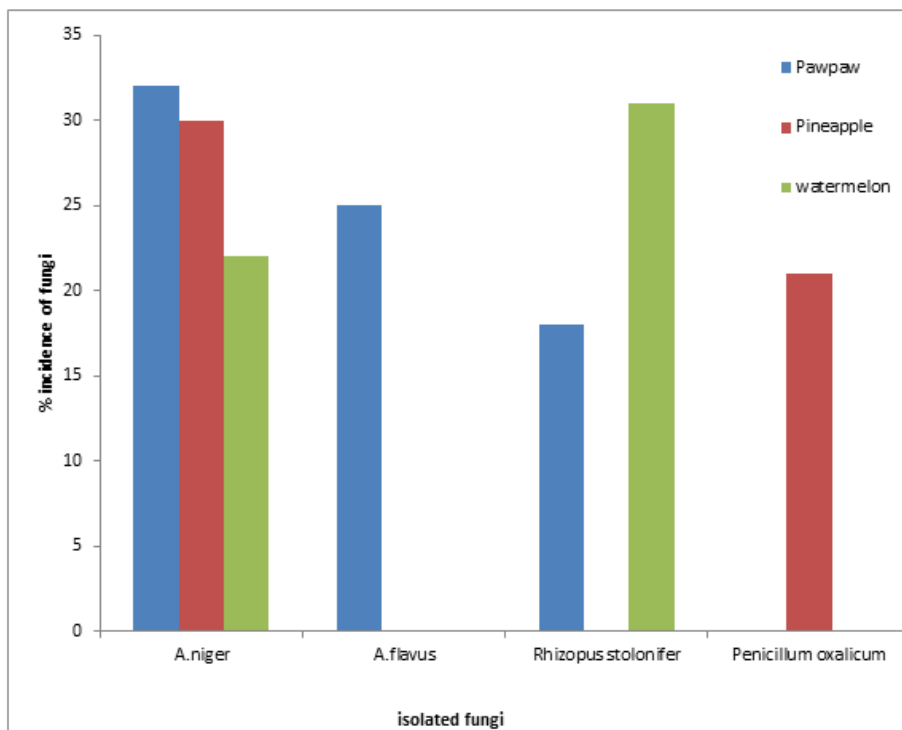


Fig 2:- Percentage Incidence of Fungal Isolates from peeled-fresh fruits obtained from Mile 1 Market.

Lagos Bus-stop:-

Figure 3 showed the percentage incidence occurrence of the fungal isolated from fruits obtained in Lagos Bus Stop. The results showed that *Aspergillusniger* was seen in all the fruits sampled, followed by *Rhizopusstolonifer*. *Penicilliumoxalicum* was only observed in pineapple, while *Aspergillusflavus* was only observed in pawpaw.

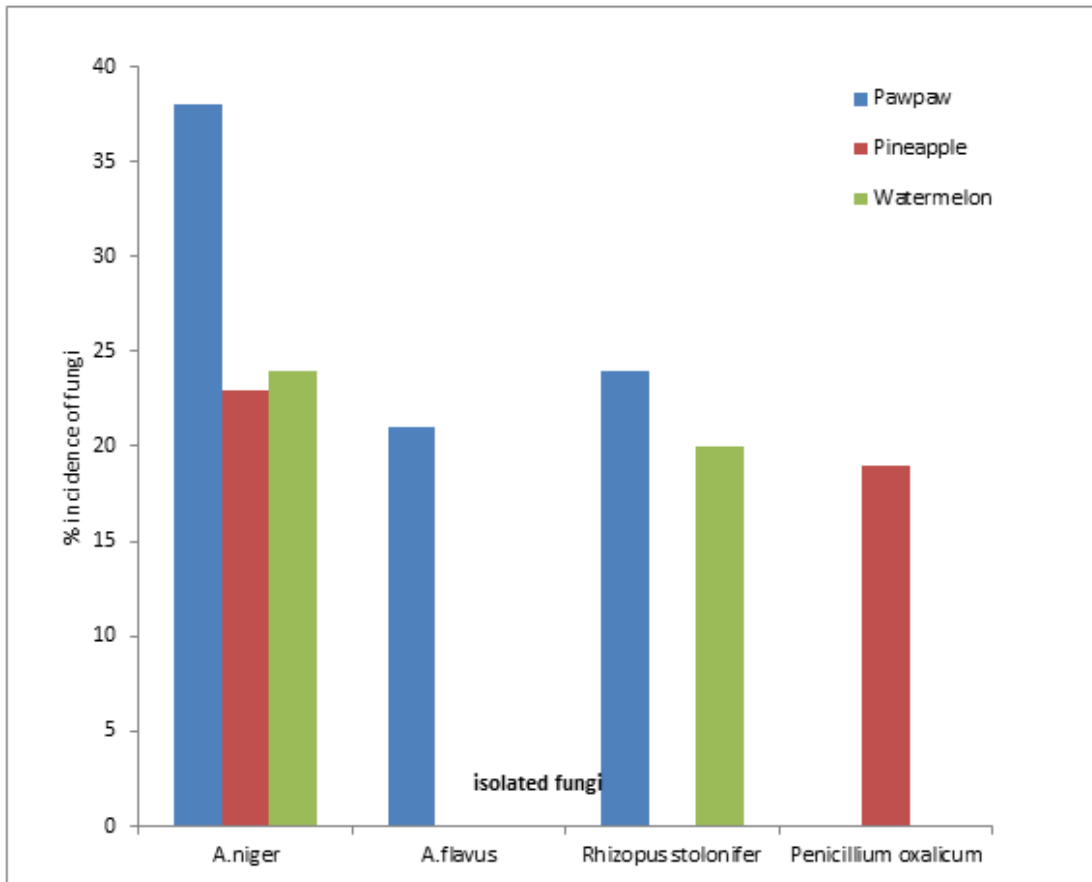


Fig 3:- Percentage Incidence of Fungal Isolates from peeled-fresh fruits obtained from Lagos Bus Stop

Mile 3 Market:-

Figure 4 showed the percentage incidence occurrence of the fungal isolated from fruits obtained in Mile 3 Market. *Aspergillusniger* and *Fusariumsp* were observed to occur in all the fruits used, followed by *Rhizopusstolonifer*. *Penicilliumoxalicum* was only observed in pineapple while *Aspergillusflavus* was only isolated from pawpaw.

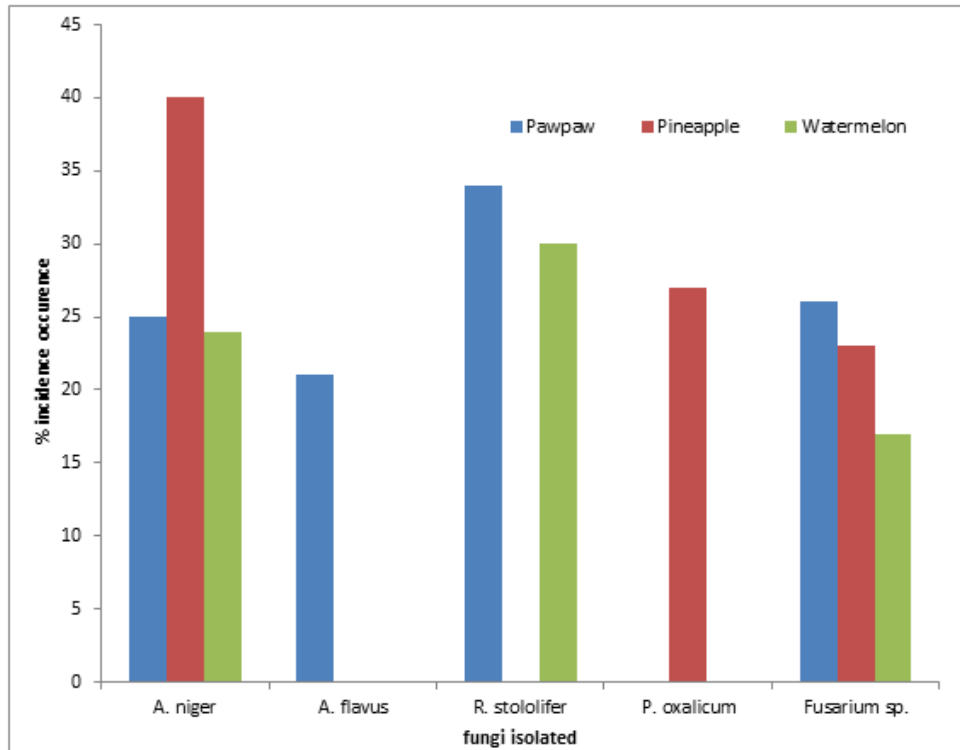


Fig 4:- Percentage Incidence of Fungal Isolates from peeled-fresh fruits obtained from Mile 3 Market

Borokiri Market:-

The results from the fruit samples obtained at Borokiri Market showed that *Aspergillusniger*, and *Fusariumsp*were the most prevalent because they occurred in all the sampled fruits. *Rhizopusstolonifer*was isolated from watermelon and pawpaw, while *Aspergillusflavus*was isolated from pineapple and pawpaw and *Penicilliumoxalicum*was isolated from pineapple alone. The results are as shown in Fig 5.

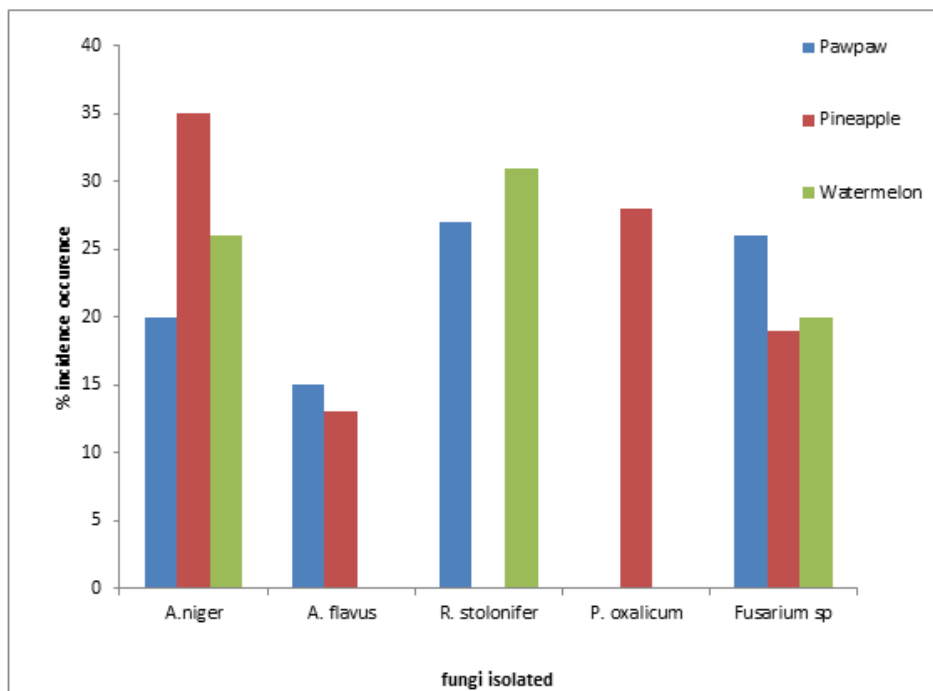


Fig 5:- Percentage Incidence of Fungal Isolates from peeled-fresh fruits obtained from Borokiri Market

Discussion:-

Visits to the markets revealed that these fruits were displayed in the open markets on wheelbarrows, trays and on tables close to the open gutters and dirty drainages. This situation was pronounced in virtually all the markets. The environments in the market were generally unhygienic with open clogged gutters, and refuse dumps with pieces of dirt's littering virtually every available space. Hence, these fungi may have been introduced into fruits from package materials, soil contaminated materials used during processing of sliced fruits. Also, this filthy and unhealthy situation at the markets could have provide an adequate environment for breeding of dangerous micro-organisms that are easily transmitted by flies, thereby contaminating these fruits and other items that are exposed in the market. Most fruit sellers had no specific spaces allocated for the display of their goods rather they squeeze themselves together in available spaces and extending to roadsides at the edge of dirty drainages as it is in Lagos Bus Stop. The presence of fungi such as *Aspergillusniger*, *Aspergillusflavus* and *Fusariumsp* may lead to food poisoning, since many of these fungi are toxin-producing organisms that are carcinogenic especially species of *Aspergillus* that produce the toxin aflatoxin (Marasas, and Paul, 1987). Ingestion of aflatoxin in moldy foods has been implicated in the development of liver cancer (Nester et al., 2004). The occurrence of *Aspergilliuspp* and *Rhizopusstolonifer* in fruits may be due to the fact that they are spore formers (John, and Rippon, 1981) and are common environmental contaminants because they are quite abundant in the air irrespective of the atmospheric humidity (Burge, 1985). The presence of *Rhizopusstolonifer* and *Penicilliumoxalicumis* in agreement with the report of Splittstroesser (1987) who implicated fungi as contaminants of fresh fruits especially in the presence of injuries like slicing. Water and the environment may have played major roles in fungal contamination of the samples especially during washing of the fruits (Rajasekar and Balasubramanian, 2011).

Conclusion and Recommendation:-

All fruits in the three markets contained fungi most of which are dangerous to human health. These microbes become even more dangerous because the fruits concerned are normally consumed raw without any conscious attempt made to sterilize them before consumption. In order to minimize the contamination levels of fresh-peeled fruits sold by street vendors such as Pawpaw, pineapple and Watermelon), good hygiene and proper sanitary conditions must be practiced by food vendors. Finally, farmer on their part should adopt modern methods of harvesting the fruits, packaging them on well ventilated wooden boxes for eventual transportation to the markets. The marketers should then display these fruits in transparent high density polyethylene bags or in glass containers. The fresh fruits should be handled with care at all points of contact with man in order to avoid injuries that would serve as primary points of attack by fungi.

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Appendix 2:-

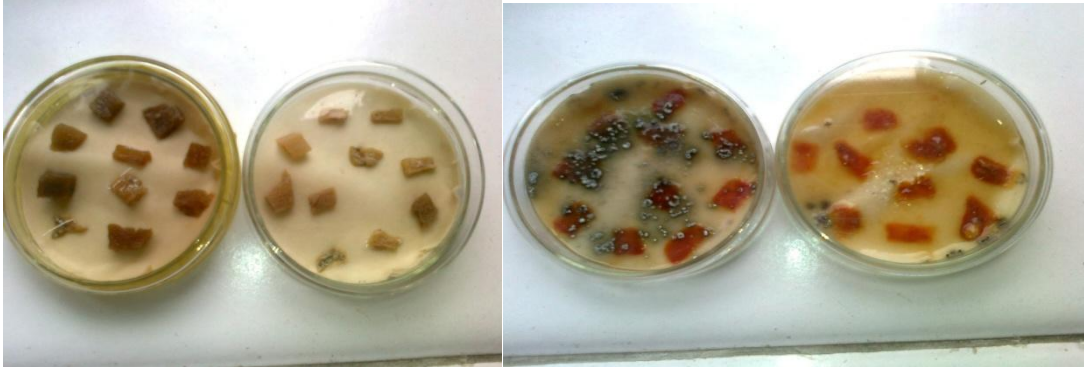


Plate 1:- fungal growth on pineapple and watermelon fruits after 7 days of incubation.

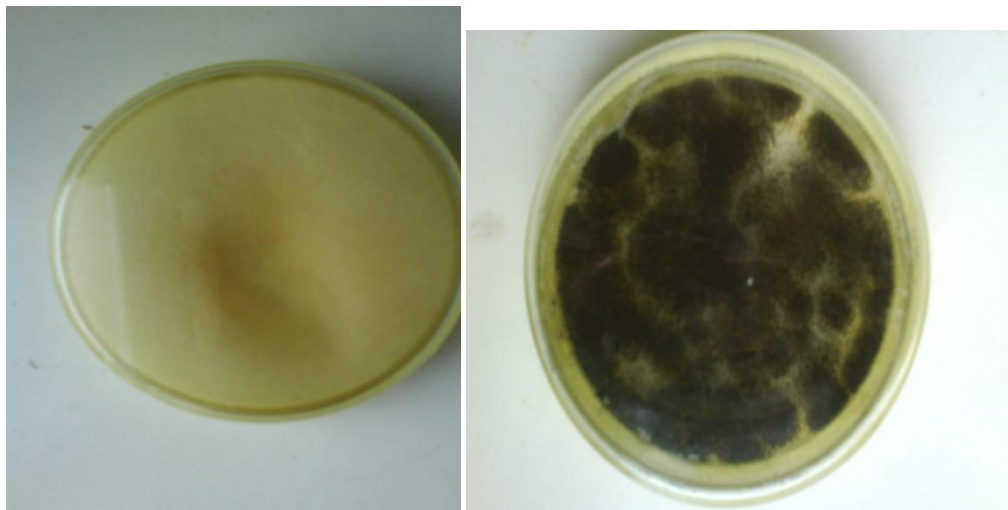


Plate 4:- Pure cultures of *Rhizopusstolonifer* **Plate 5:-** Pure cultures of *A. niger*,