

MICROORGANISMS ASSOCIATED WITH POST-HARVEST ROT OF FRAFRA  
POTATOES [*Solenostemon rotundifolius* (Poir.)] IN BONGO-SOE, UPPER  
EAST REGION, GHANA.

**Abstract**

Investigations into the microorganisms associated with the postharvest rot of *Solenostemon rotundifolius* (Frafra potato) was investigated. Four hundred (400) tubers each of black and brown cultivar of *Solenostemon rotundifolius* tubers were used for the experiment. The findings of this study showed that the microorganisms responsible for rot in *Solenostemon rotundifolius* tubers were six in number though in varying proportions. *Colletotrichum gloeosporioides* was identified to be responsible for 30.76% of rots, *Aspergillus niger*, 23.07%, *Curvularia lunata*, 19.23%, *Aspergillus flavus*, 11.54%, *Trichoderma sp* and *Penicillium sp* both recorded 7.70% of rots observed. The activities of the damaging microorganisms can be reduced by controlling mechanical injury during harvesting, transportation and storage of *Solenostemon rotundifolius* tubers should be prevented or reduced because they pave way for tuber infection by the rot causing microorganisms.

**1.0 Introduction**

*Solenostemon rotundifolius* (Frafra potato) belongs to the family Labiatae (Lamiaceae) (Tindall, 1983). Frafra potatoes are herbaceous perennials normally cultivated as annuals (National Research Council, NRC, 2006). In Ghana, the crop is mainly cultivated in the Guinea and Sudan savannah agro-ecological zones (Opoku-Agyeman *et al.*, 2004). The areas of cultivation mainly cover the Upper East and Upper West regions of Ghana. However, the crop can also be cultivated in the moist semi deciduous forest ecology of Ghana (Opoku-Agyeman *et al.*, 2004). *Solenostemon rotundifolius* is an important food security crop (Burkill, 1995 and National Research Council, 2006). Apart from cultivation of frafra

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potatoes for consumption, the crop also has medicinal, industrial and sociocultural importance in areas of its cultivation in Ghana (Abapol 1997 and Tetteh *et al.* 1997).

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In spite of its importance, frafra potato cultivation appears to be declining in Ghana due to numerous problems encountered by farmers during cultivation. These include post-harvest loss during storage (Tindal, 1983) which contributes to the immensely to spoilage (rotting) of tubers in storage (Tetteh *et al.* 1997) Postharvest spoilage (rot) is a major contributor to losses of all root and tuber crops via microbial infestation of healthy tubers which reduces the table quality of such tubers and render them unappealing to consumers (Amusa, 1999).

Roots and tubers have been subjected to several diseases by several post-harvest rot causing organisms including viruses, fungi, bacteria, nematodes etc. For instance in yam (*Dioscoreae Sp*), the microorganisms commonly associated with storage rots include: *Sclerotium rolfsii*, *Colletotrichum gloeosporioides*, *Aspergillus spp*, *Botryoidplodia theobromea*, *Curvularia verruculosa*, *Rhizoctonia solani*, *Penicillium spp* and *Fusarium moniliforme* (Nwankiti and Okpala, 1981; Green, 1994). Also in Sweet potatoes (*Ipomoea batatas* ), pathogens commonly associated with storage rots include: *Ceratocystis fimbriata* (a fungus that causes Black rot), *Fusarium* (a fungus that causes Fusarium surface rot and Fusarium root rot), *Rhizopus stolonifer* (a fungus that causes Rhizopus soft), *Diplodia gossypina* (a fungus that causes Java black rot), *Erwinia chrysanthemi* (a bacteria that causes Bacterial soft rot, also known as bacterial stem and root rot), *Monilochaetes infuscans* (a fungus that causes scurf, also known as soil-stain), *Macrophomina phaseoli* (a fungus that causes Charcoal rot) (Sikora *et al.*,1995). However, for *Solenostemon rotundifolius*, no published research work has been cited on the microorganisms associated with post-harvest rot until recently. Mohammed *et al.*, (2013) indicated that the following microorganisms are associated with post-harvest rot of *Solenostemon rotundifolius* in Nigeria; *Aspergillus niger*, *Fusarium oxysporum*, *Penicillium expansum* and *Rhizopus stolonifer*. However, no research work has been cited on the

microorganisms associated with post-harvest rot of *Solenostemon rotundifolius* in Ghana. This research work therefore has the overall objective of identifying the microorganisms associated with post-harvest rot of frafra potatoes in Bongo-soe, Upper east region of Ghana.

## 2.0 Materials and methods

### 2.1 Geographical location of the Experimental Site

The research work was carried out at the laboratory of the Department of Horticulture and the Pathology laboratory of the Faculty of Agriculture, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana.

The *Solenostemon rotundifolius* tubers were stored at the Horticulture Department laboratory while rot identification was carried out at the Pathology laboratory of the Faculty of Agriculture. **2.2 Procurement of Frafra potato (*Solenostemon rotundifolius*) tubers and Preparation**

The black and brown cultivars of frafra potato tubers used for this research were all obtained from a single farm in Bongo-soe, in the Bongo district of the Upper East region of Ghana. The farm was monitored from planting to harvest, fresh tubers were subsequently obtained on the day of harvest for experimentations. A total of eight hundred samples of frafra potato tubers were used for the studies. This was made up of four hundred black cultivars and four hundred brown cultivars of wounded and non-wounded tubers, the samples were visually inspected for any sign of rot and defective samples were discarded. The tubers were stored in sixteen medium sized plastic bowls which contained fifty tubers each.

### 2.3 Identification of rot pathogens

The Tubers were stored for ..... from 2<sup>nd</sup> November, 2012 to 22<sup>nd</sup> March 2013.

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Tubers showing visible signs of rot during the storage period (2<sup>nd</sup> November, 2012 to 22<sup>nd</sup> March 2013) were taken to the Pathology laboratory of the Faculty of Agriculture for identification of the possible microorganisms responsible for the rot. This was done

fortnightly. The procedure involved taking pieces of diseased tissues (2-5 mm square) from the margin of the necrotic lesion using a sterile scapel blade and surface sterilizing of the necrotic tissue segments done by immersing the tissue segments in 10% commercial bleach solution in a beaker for one minute. Tissue segments were taken out of the sterilant solution in intervals of 10 seconds and blotted dry with a clean paper towel. This ensured that at least some of the segments were exposed to the sterilant for the appropriate period of time. The surface sterilized tissue segments were then plated on Potato Dextrose Agar (PDA) medium, using a pair of forceps which was flamed sterilized periodically. The plates were sealed with a sellotape to prevent desiccation and contamination and incubated at room temperature until growth occurred. The plates were then observed daily for fungal growth from the tissues. The characteristics of the spore and mycelium were studied using a compound microscope (MAKE, MODEL AND SPECIFICATION),. The characteristics observed were used in identifying the rot organisms according to standards described by Mathur and Kongsdal (2003) and Barnett and Hunter (1972).

**Comment [Clement4]:** The proximate composition would have also been determined as the tubers ages in storage chamber

This test will determine the effect of the microorganisms on nutritional composition of the tubers

### **3.0 Results and Discussions**

Five genera of microorganisms were identified to be associated with post-harvest rot of stored frafra potato tubers. These are: *Curvularia sp.*, *Colletotrichum sp.*, *Aspergillus sp.*, *Penicillium sp.* and *Trichoderma sp.* The microorganisms identified to be responsible for causing Post-harvest rot in *Solenostemon rotundifolius* tubers were six in number. *Colletotrichum gloeosporioides* was responsible for 30.76% of rots observed, *Aspergillus niger*, 23.07%; *Curvularia lunata*, 19.23%; *Aspergillus flavus*, 11.54%; *Trichoderma sp* and *Penicillium sp* both recorded 7.70 % of rots observed.

The percentage incidence of *Aspergillus niger* (15.38%), *Curvularia lunata* (11.54%) and *Aspergillus flavus* (7.69%) was higher in the black cultivar as compared with the brown cultivar which had percentage incidence of 7.69, 7.69 and 3.85% respectively. Also, the

percentage incidence of *Colletotrichum gloeosporioides* (15.38%) and *Penicillium sp* (3.85%) was the same in both the black and brown cultivars of *Solenostemon rotundifolius* tubers used in this study. *Trichoderma sp* caused rot in only tubers of the brown cultivar with percentage incidence of 7.07%. In all, tubers of the black cultivar had more incidence of rot causing microorganisms (53.84%) compared with tubers of the brown cultivar which had a total incidence of 46.16%.

The identification of *Aspergillus niger* and *Penicillium sp.* confirmed the observations made by Mohammed *et al.* (2013). According to available literature, this is the first time *Colletotrichum gloeosporioides*, *Curvularia lunata*, *Aspergillus flavus*, and *Trichoderma sp* have been found to cause post-harvest rot in *Solenostemon rotundifolius* tubers. *Curvularia lunata*, *Colletotrichum gloeosporioides*, *Aspergillus niger*, *Aspergillus flavus*, *Penicillium sp* and *Trichoderma sp.* have been found to be associated with rot in other roots and tuber crops like ..... (Nwankiti and Okpala, 1981);..... (Green, 1994), ..... (Rees *et al.*, 2003), ..... (Messiga *et al.* 2004). These microorganisms identified are wound pathogens that infect mechanically injured tubers and have been found to infect tubers in the field and later manifest in storage (Rees *et al.*, 2003, Okigbo *et al.*, 2010). These microorganisms can also infect tubers through diseased foliage, mother tubers or roots (Nmeke *et al.*, 2005). The skin of *Solenostemon rotundifolius* tubers is easily damaged (Mohammed *et al.*, 2013) and farmers make matters worse with poor practices that encourage mechanical injury on tubers during harvesting, transportation and even storage. This therefore explain the presence of these microorganisms in the *Solenostemon rotundifolius* (frafra potatoes) tubers used in this study.

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**Table 1:** Isolated microorganisms identified to be associated with Post-harvest rot in black and brown cultivars of frafra potato (*Solenostemon rotundifolius*) tubers.

Organism identified	Black cultivar	Brown cultivar	Total percentage
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	Percentage incidence (%)	Percentage incidence (%)	incidence (%)
<i>Colletotrichum gloeosporioides</i>	15.38	15.38	30.76
<i>Aspergillus niger</i>	15.38	7.69	23.07
<i>Curvularia lunata</i>	11.54	7.69	19.23
<i>Aspergillus flavus</i>	7.69	3.85	11.54
<i>Trichoderma sp</i>	0.00	7.70	7.70
<i>Penicillium sp</i>	3.85	3.85	7.70
<b>Total percentage incidence (%)</b>	<b>53.84</b>	<b>46.16</b>	<b>100</b>

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#### 4.0 Conclusion

The findings of this study have shown that *Colletotrichum gloeosporioides*, *Aspergillus flavus*, *Aspergillus niger*, *Curvularia lunata*, *Penicillium sp* and *Trichoderma sp* are responsible for the post-harvest rot of *Solenostemon rotundifolius* tubers in Bongo-soe, Upper East Region of Ghana.

#### 5.0 Recommendation

Mechanical injury during harvesting, transportation and storage of *Solenostemon rotundifolius* tubers should be prevented or reduced since mechanical injuries can pave the way for tuber infection by the rot causing microorganisms identified in this study.

#### References

**Comment [Clement7]:** All these references are outdated, the most recent being 2010..... please get recent literatures to upgrade this work

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Comment [Clement8]: YOU HAVE THIS AS ABAPOL IN THE BODY OF THE MANUSCRIPT... CHECK???????

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**Comment [Clement9]:** YOU HAVE AS Nmeka et al. 2005 in the body, since they are two authors, it should be Nmeka and Okigbo (2005)



