

Research Article



Black Scurf of Potato Disease Prevalence in the Markets of Federal Capital Territory, Pakistan

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Abstract | Potato (*Solanum tuberosum* L.) belongs to *solanaceae* family and is categorized as tuberous crop. Potato is ranked 4th all over the world after rice, wheat and maize. Nutritionally potato is rich in vitamins (B1, B2 and B6), minerals (potassium, phosphorus and magnesium), pantothenic acid and riboflavin. Major potato producing districts in Punjab are Okara, Sahiwal, Kasur, Sialkot, Sheikhpura, Narowal, Lahore, Pakpattan, Jhang, Tobe Tek Singh and Gujranwala. Potato is attacked by a number of diseases including early blight of potato, black scurf disease of potato, stem canker and powdery scab of potato. Among various fungal diseases in potato crop, the black scurf disease of potato caused by *Rhizoctonia solani*, affects the quality of potato and lowers its market value. A preliminary study was designed to see the prevalence, incidence and severity of black scurf disease in the markets of Federal Territories of Islamabad to estimate the intensity of the disease by calculating the disease index. Maximum disease index was observed in Abpara and F-10 markets i.e. 21.11% with varying disease incidence and severity percentage. However, the presence of black scurf disease in the market shows that in Pakistan the consumers do not consider it as a threat, because it remains in potato peel only.

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Introduction

Potato (*Solanum tuberosum* L.) belongs to *solanaceae* family and is categorized as tuberous crop. Potato is ranked 4th all over the world after rice, wheat and maize (Ahmed et al., 1995). In Pakistan, it is the most prominent vegetable possessing 16-22% starch that is used in multiple combinations with meat, rice and mutton (Ahmed et al., 1995).

Potato tubers comprise of 79% moisture contents and 21% dry matter, while about 60-80% is starch. Nutritionally, potato is rich in vitamins (B1, B2 and B6), minerals (potassium, phosphorus and

magnesium), pantothenic acid and riboflavin. Soluble and insoluble fibers present in potato help in curing constipation and colon cancer. This also decreases absorption of dietary cholesterol which leads to lower plasma LDL cholesterol. Oil drilling firms make use of potato starch for washing the boreholes. Tubers may contain toxic alkaloids as solanine and chaconine. Formation of solanine in tubers is indicated by greenish discoloration with sprouts on potato skin (Memon, 2017).

The total world potato production is estimated at 388,191,000 tonnes in 2017 (FAOSTAT, 2019). In Pakistan, potato is cultivated on an area of 194003

hectares with the production of 4447776 tonnes. Among provinces, the Punjab has highest area of potato under cultivation i.e. 180478 hectares and maximum production of 4402582 (GoP, 2018).

Major potato producing districts in Punjab are Okara, Sahiwal, Kasur, Sialkot, Sheikhpura, Narowal, Lahore, Pakpattan, Jhang, Toba Tek Singh and Gujranwala (Memon, 2017). Potato is mostly found as either red skin varieties e.g. desiree, cardinal, raja, symphonia and barna or white skinned e.g. santana, santé, and diamond (Khan et al., 2010).

Potato is attacked by a number of diseases including early blight of potato, black scurf disease of potato, stem canker and powdery scab of potato (Rauf et al., 2007; Majeed et al., 2014). Among various fungal diseases, the black scurf disease caused by *Rhizoctonia solani* is a serious threat to potato crop. The characteristic symptoms of black scurf include; dark brown to black colored hard masses of sclerotia, irregularly shaped and superficial, varying from small, flat, barely detectable blotches to large and raised lumps adhering tightly to the skin) on tubers and stem canker are the result of *Rhizoctonia* disease complex in potato (Tsrer, 2010).

The potato black scurf and stem canker on potato crop is economically important disease. It is often referred as *Rhizoctonia* disease complex and is common in most of the potato cultivating areas around the world (Powelson et al., 1993; Jeger et al., 1996). The disease gets severe when infected tubers are used as seeds and become sources of inoculum for future potato crops. The fungus survives hard conditions in the form of black sclerotia which germinate under cold and wet soil conditions. The stem arising from such tubers is characterized by brown and black sunken lesion on young and under-developed tissues (Larkin et al., 2006).

Black scurf disease affects the quality of potato and lowers its market value. A preliminary study was designed to see the prevalence, incidence and severity of black scurf disease in the markets of Federal Territory of Islamabad to estimate the intensity of the disease by calculating the disease index.

Materials and Methods

A survey was done in the markets of Federal Capital

Territory of Islamabad Pakistan. These markets included G-11, Aabpara, G-10, G-9, Sabzi Mandi, Chattha Bakhtawar, F-10, Near Metro mall and F-11. The samples were randomly taken from the markets containing 3 Potatoes in a sample. The samples were taken in the paper envelop and labeled the location, sample type and date (Figure 1).

The samples were brought to Plant Pathology Laboratory of Crop Diseases Research Institute, NARC Islamabad and the observations for the following parameters were recorded.



Figure 1: Potatoes samples taken from the markets of Federal Capital territory, Islamabad.

Prevalence

Prevalence is defined as the presence of disease in the market. The disease was either present or not present in the markets.

Disease incidence (%)

The incidence was defined as the percentage of number of infected tubers among the sample population taken.

$$\text{Disease Incidence (\%)} = \frac{\text{No. of infected tubers}}{\text{No. of tubers in a sample}} \times 100 \text{ Total}$$

Mean disease incidence percentage was calculated from the sub locations surveyed in the market.

Disease severity

The disease severity was defined as the percentage of infected area of tubers with spots clusters. The severity was based on the following rating scale (0-5):

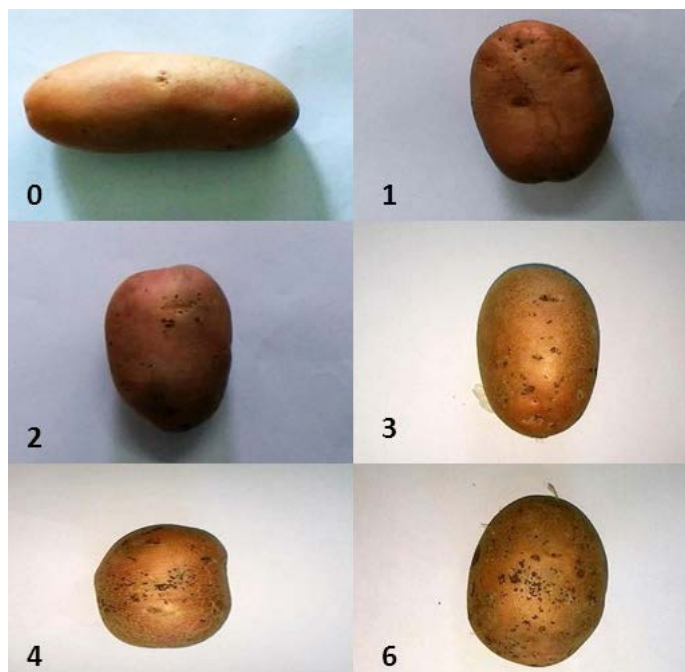


Figure 2: *Potato black scurf visual rating scale (0-5). Where; 0 means No disease; 1 means 1-10% disease; 2 means 11-20% disease; 3 means 21-30% disease; 4 means 31-49% disease; 5 means 50% or more disease.*

Mean disease severity rating (0-5) was calculated from the sub locations surveyed in the market.

Disease index (%)

Disease Index (%) is the actual disease scenario which is calculated by combining disease incidence and disease severity. Following is the formula of disease index (%):

$$\text{Disease Index (\%)} = \frac{n1 (0) + n2 (1) + n3 (2) + n4 (3) + n5 (4) + n6 (5)}{N} \times 100$$

Where;

n1= No. of Plants having no disease 0; n2= No. of Plants with disease rating 1; n3= No. of Plants with disease rating 2; n4= No. of plants with disease rating 3; n5= No. of plants with disease rating 4; n6= No. of plants with disease rating 5.

Results and Discussion

Prevalence of black scurf disease

The samples taken from various markets of Federal Capital Territory Islamabad showed that the prevalence of disease was 100% in all markets of G-11, Aabpara,

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G-10, G-9, Sabzi Mandi, Chattha Bakhtawar, F-10, Near Metro mall and F-11 (Table 1) (Figure 2).

Table 1: *Mean prevalence (%), mean disease incidence (%) and mean disease severity of black scurf disease in the markets of federal capital territory.*

Location	Mean prevalence (%)	Mean incidence (%)	Mean severity
G-11	100	52.78	1.03
Aabpara	100	44.44	0.67
G-10	100	44.44	1.06
G-9	100	55.56	0.56
Sabzi Mandi	100	50.00	0.61
Chattha Bakhtawar	100	75.00	2.58
F-10	100	47.22	1.06
Near Metro mall	100	66.67	0.89
F-11	100	44.44	0.78

Mean disease incidence (%)

Mean disease incidence percentage 75% in Chattha Bakhtawar followed 66.67 in the market near Metro Mall, 55.56% in G-9, 52.78% in G-11, 50% in Sabzi Mandi, and 47.22% in F-10 market. Minimum mean disease incidence 44.44% was found in the markets of Aabpara, G-10 and F-11. (Table 1).

Mean disease severity (0-5)

Maximum mean disease severity rating 2.58 was found in Chattha Bakhtawar followed by 1.06 in G-10 and F-10 and 1.03 in G-11 market. In markets of near Metro Mall, Aabpara and SabziMandi the mean disease severity was 0.89, 0.67 and 0.61 respectively. However, minimum disease severity 0.56 was found in G-9 (Table 1).

Mean disease index (%)

The maximum mean disease index was observed in 21.11% in both G-10 and F-10 followed by 20.56% in G-11, 17.78% in near Metro Mall, 17.22% in Chattha Bakhtawar, 15.56% in F-11, 13.33% in Aabpara and 12.22 in Sabzi Mandi. Minimum 11.11% mean disease index was found in G-9 market (Table 2).

The above results show that the potato black scurf infested potato tubers are randomly distributed in the market. No matter how sophisticated communities are around markets. This is because the potato tubers are mostly covered with soil at the time of purchase and hence the disease does not appear clearly on tubers. Therefore, buyers are least concerned for the disease. Many consumers even don't know that black scurf

is a disease or a fungal fruiting body. The maximum disease index was found in F-10 and G-10 which are very high standard markets of Federal Capital Territory.

Table 2: Mean disease index (%) in the markets of federal capital territory.

No.	Location	Mean disease index (%)
1	G-11	20.56
2	Aabpara	13.33
3	G-10	21.11
4	G-9	11.11
5	Sabzi mandi	12.22
6	Chattha Bakhtawar	17.22
7	F-10	21.11
8	Near Metro mall	17.78
9	F-11	15.56

This also shows that potato black scurf can be a threat when potato is in the form of plant and no tubers are produced because it causes shortening, girdling and bunching of stem (Ahmed et al., 1995). This study also indicates that the black scurf free potatoes are hard to be found in the markets. Similarly, disease is prevailing in the maximum potato growing areas of Pakistan as potato is brought from different parts and regions of the country to the Federal territory.

Author's Contribution

Muhammad Abu Bakar Siddique: Abstract and Methodology.

Faisal Sohail Fateh: Idea conceived and technical input.

Zia-Ur-Rehman: Conclusions.

Humayun Saleem: Collection of data.

Conflict of interest

The authors have declared no conflict of interest.

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