Page 225 to 229

Volume 1 • Issue 6 • 2017

Scientia Ricerca

Editorial

Clinical Biotechnology and Microbiology

ISSN: 2575-4750

Occurrence and Distribution of Early Blight Disease in Gilgit-Baltistan (GB) Pakistan

Aqleem Abbas[1]*, Altaf Hussain[2] and Anam Moosa[3]

[1]Department of Plant Pathology, the University of Agriculture, Peshawar Pakistan

[2]Department of Plant Protection Guangxi University Nanning, Guangxi Province China

[3]Department of Plant Pathology, University of Agriculture, Faisalabad Pakistan

***Corresponding Author:** Aqleem Abbas, Department of Plant Pathology, the University of Agriculture, Peshawar Pakistan.

Received: November 11, 2017; **Published:** December 09, 2017

Abstract

Recently early blight disease of potatoes, causes major yield losses in Gilgit-Baltistan (GB) Pakistan. Characteristic dark brown to black lesions with the concentric rings are observed on potato plants. Here we report recent situation of early blight disease on potatoes in GB.

Keywords: *Alternaria spp; Early blight; Potatoes; Gilgit-Baltistan (GB)*

Volume 1 Issue 6 December 2017

Introduction

Gilgit Baltistan (GB; Formerly Northern Areas until 2009) is dry and less humid region of Pakistan (Weightman, 2005). In the recent years a survey about the powdery mildew of cucumbers was conducted in the Nomal valley, District Gilgit. During this survey, whitish colonies of powdery mildew were observed in open fields of cucumber plants (Abbas, 2017). Among the fruits, grapes are severely infected by Grey mold disease caused by *Botrytis cinerea* (Abbas, 2017).

The berries due to infection of Grey mold become unmarketable and inconsumable. Likewise Potatoes (*Solanum tuberosum* L.) are one of the most important, valuable, nutritious and major cash crop of Gilgit-Baltistan Pakistan (Ahmad Bakhtiar, 2003). Recently early blight disease pose a serious threat to potato production in GB. As above mentioned the region is dry and less humid therefore the early blight should not be a problem. However in the recent decade enormous rainfall and frequent wetting of the leaves of potatoes favor the development of this disease.

Similarly non-availability of disease free high quality potato seed tubers and years of single cropping have also increased the incidence of early blight. Early blight not only cause disease in potatoes but other hosts of the family Solanum have also become infected. These hosts are tomato (*Solanum lycopersicum* L.), eggplant (*S. melongena* L.), bell pepper and hot pepper (*Capsicum* spp.) The production of potato crop in 2017 was approximately 20 bags (Each bag was of 70-80 Kg) per Kanal area. However to estimate total annual potato

production of GB is difficult to do accurately due to the fact that the region is highly mountainous. Moreover there are diverse range of vegetation, ecological zones and diverse climatic conditions of GB.

The symptoms of early blight on potatoes appear as small 2-3 mm brownish or blackish spots especially on older leaves of Potatoes. The spots then became enlarge in size and somehow surrounded by yellowish color termed as yellow halo. The diameter of these spots was approximately 9-10 mm often have brown or dark concentric rings seem like bullseye. As the disease progress these spots increased in size and the whole leaves became chlorotic and finally defoliated. Similarly the spots also appeared on stem, however the spots had oval shape with a greyish or light center and often seem depressed.

Potato tubers were also found to be infected with the disease. The symptoms were sunken and asymmetric shape which are often surrounded by a pink or purple line. The subsurface of lesions were found leathery and shriveled with a darkish appearance. The spots soon became dry therefore in contrast to other diseases no bad smell was observed. This indicates that there would have been no further invasion by secondary organisms. The strong winds of GB also cause the potato plants to sway excessively and create injuries. These injuries are entry points for early blight to infect the potato crop severely.

Early blight disease is caused by a large-spored fungus called *Alternaria solani. Alternaria solani* is asexual stage however there is no known sexual stage. Therefore this fungus has been placed in class Deuteromycete. However the other species of genus *Alternaria* which is called small-spored *Alternaria alternate* is also considered a serious threat to potato cultivation (Landschoot., *et al*. 2016). Alternaria solani usually contaminate the cultures of other fungi in the molecular plant pathology laboratories. Therefore nowadays it is considered as contaminant. It can easily be grown in Potato Dextrose Agar (PDA) and Potato Dextrose Broth (PDB) where it forms a grayish or blackish type of colony.

The asexual conidia are normally formed 9-11 transverse septae. There is also variations in morphology and pathogenic abilities of the isolates of the fungus (Grum-Grzhimaylo., *et al*. 2016). Recently it has been revealed that not only Alternaria solani cause early blight disease of potatoes but more than one Alternaria spp. can cause early blight. Those species identified based on morphological and molecular characteristics are *A. tomatophila, A. grandis, A. tenuissima, Alternaria interrupta, Alternaria infectoria, Alternaria dumosa, Alternaria arbusti* and *A. alternate* (Ardestani., *et al*. 2010; Orina., *et al*. 2012; Zheng., *et al*. 2013; Zheng., *et al*. 2015; Meng., *et al*. 2015).

These *Alternaria* spp. overwinters primarily on infected debris of potato crops. The mycelium of these fungi are actually dark due to presence of pigments and resistant to lysis therefore persist in the soil for several years. Sometime these fungi produce hard resistant structures called chlamydospores. Potato traders of GB usually prefer big size potato tubers and the small size potatoes tubers were left in the fields. These small size tubers act as volunteer potatoes on which the pathogen survive till the next growing season. Climate conditions vary widely across GB, ranging from the monsoon-influenced regions, moist temperate zones, arid and semi-arid cold deserts.

Moreover the region is regarded as altitude based region based on amount of rainfall. The region can be divided into low and high areas based on the amount of rainfall. In the low areas the amount of rainfall is 200 millimeters annually. However, in the high areas the amount of rainfall is 2,000 millimeters per year. However in May and June the weather become warm and temperature range (25-30°C) (Khan., *et al*. 2014). The dew or free moisture on the foliage of potato plants can cause conidia of Alternaria spp. to germinate within 30-40 minutes. The germ tube arises from the conidia penetrate the leaf epidermis directly or enter through the micro-pores such as stomata.

The wounds or injuries are entry point for the pathogen. The pest also cause injuries particularly for feeding on tubers and as a result pathogen enter and cause disease. Post harvests losses also occurred due to wounds on tuber skin during harvest. The alternating wet and dry periods of GB also favor the sporulation of the fungi. If the nights are wet, conidiophores are produced and the following day light spores emerge on the conidiophores. These conidia are then dispersed to the adjacent potato fields primarily by high winds and rarely by sprinkle irrigation or splashing rains. These conidia are infecting and re-infecting during the same growing season. Therefore the early blight is considered as polycyclic diseases (Figure 1).

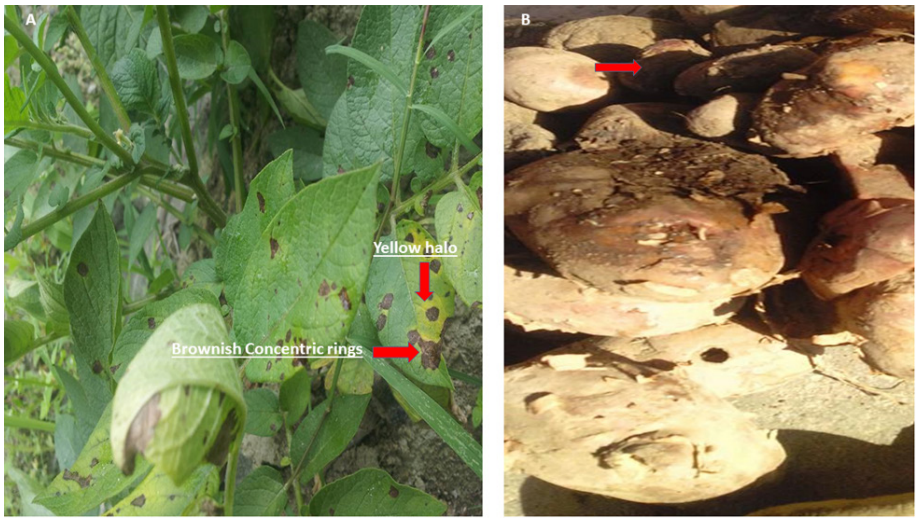

Figure 1: *Potato leaflets and tubers infected by early blight disease in GB*

A. *Typical symptoms (Yellow halo and concentric rings) on leaflets*

B. *Shriveled and darkish potatoes*

Early blight can be managed by proper tillage, crop rotation, certified potato seeds, well-drained irrigation, plow under plant debris and volunteer potatoes, eradication of weeds and application of ash may also reduce the intensity of the disease. The wild species of potatoes exhibited a high degree of resistance however replaced by newly developed varieties. Newly introduced varieties such as Desiree, Cardinal and Diamont don't have complete resistance against early blight disease. These varieties have been introduced from the other provinces of Pakistan.

Along with these germplasm several viral and fungal diseases have also been introduced. The fungicides such as mancozeb and chlorothalonil can be used as protectant (Campo Arana., *et al*. 2007; Rodriguez., *et al*. 2006). The curative fungicides such as Quinone Outside Inhibitors (QoI) (azoxystrobin, pyraclostrobin, trifloxystrobin, fenamidone and famoxidone) can also be used which can stop infection by inhibiting spore germinations of early blight disease (Pasche and Gudmestad 2008).

However the aforementioned fungicides are not eco-friendly. The disease can also be managed by application of biological agents however the commercial application and grower acceptance of biological control is negligible in GB due to the fact that biological agents are costly and are not easily available. Moreover their efficacy vary under the range of environmental conditions occur in the fields.

Conclusion and Future Perspectives

The recent heavy rainfalls due to climate change, absence of crop rotations as well increasing soil compaction favor fungal diseases in Gilgit Baltistan (GB). Crop rotations, good soil structure, timely and well balance applications of fertilizers, changing the sowing dates and growing resistant varieties may limit the early blight disease. Moreover there is need to establish plant breeding and genetics department in GB and Department of Plant Pathology for breeding of resistant potato cultivars and timely management of plant diseases respectively.

Moreover the green house and field experiments should be conducted to know the level of genetic variation of Alternaria spp and also other potato diseases. There is also need to know about the role played by non-solanaceous crops and alternative hosts in the perpetuation of early blight disease. The introduction of potato germplasm from other areas of Pakistan largely contribute to the dissemination of diseases and to some extent early blight disease of potato crop. Hence concerted efforts are required to enforce quarantines regulations in GB to prevent dissemination of early blight as well as other fungal diseases of potato crop.

Early blight disease is considered as foliar disease however the spores are also carried by infected potato germplasm. Moreover there is need to establish molecular assays (PCR etc) Labs at ports of GB for detecting diseases in the potato germplasm. Furthermore there is also need to build and improve capabilities of plant pathologists in the region to address these diseases.

Acknowledgments

The present report, is dedicated to the Prof. Dr. Muhammad Arif for his contributions to research on various potato viruses in Pakistan. We thank Scientia Ricerca for reviewing the report.

References

1. Abbas Aqleem. "A Report of Powdery Mildews on Cucumbers in Village Nomal, Gilgit Baltistan (GB) – Pakistan". *Clinical Biotechnology and Microbiology* 1.3 (2017): 99-104.
2. Ahmed Bakhtiar. "Sustainable Tourism and Cultural Heritage IUCN, 2003". *Agricorner* (2012):
3. Abbas Aqleem. "A Report of Grey Mold Disease on Grapes Caused by Botrytis cinerea in Gilgit-Baltistan, Pakistan". *Clinical Biotechnology and Microbiology* 1.3 (2017): 117-119.
4. Ardestani ST., *et al*. "New Alternaria species associated with potato leaf spot in various potato growing regions of Iran". *Iranian Journal of Plant Pathology* 45 (2010): 83e86.
5. Campo Arana RO., *et al*. "Potato early blight epidemics and comparison of methods to determine its initial symptoms in a potato field". *Revista Facultad Nacional de Agronomía, Medellín* 60.2 (2007): 3877-3890.
6. Chaerani R and RE Voorrips. "Tomato early blight (Alternaria solani): the pathogen, genetics, and breeding for resistance". *Journal of General Plant Pathology* 72.6 (2006): 335-347.
7. Grum-Grzhimaylo AA., *et al*. "On the diversity of fungi from soda soils". *Fungal Diversity* 76.1 (2016): 27-74.
8. Khan MZ. "Agro biodiversity in Gilgit-Baltistan on the verge of extinction". *Karakurm knowledge highways* (2014): 9-18.
9. Landschoot Sofie., *et al*. "Identification of A. arborescens, A. grandis, and A. protentaas new members of the European Alternaria population on potato". *Fungal biology* 121.2 (2016): 172-188.
10. Meng J-W., *et al*. "Population genetic analysis reveals cryptic sex in the phytopathogenic fungus Alternaria alternata". *Scientific Reports* 5 (2015): 18250.
11. Olanya OM., *et al*. "The effect of cropping systems and irrigation management on development of potato early blight". *Journal of General Plant Pathology* 75.4 (2009): 267-275.
12. Vloutoglou I and SN Kalogerakis. "Effects of inoculum concentration, wetness duration and plant age on development of early blight (Alternaria solani) and on shedding of leaves in tomato plants". *Plant Pathology* 49.3 (2000): 339-345.
13. Orina AS., *et al*. Alternaria Species on Potatoes on Russia Presentation Euro blight Workshop, St. Petersburg. (2012):
14. Pandey KK., *et al*. "Resistance to early blight of tomato with respect to various parameters of disease epidemics". *Journal of General Plant Pathology* 69.6 (2003): 364–371.
15. Pasche JS and NC Gudmestad. "Prevalence, competitive fitness and impact of the F129L mutation in Alternaria solani from the United States". *Crop Protection* 27.3-5 (2008): 427-435.
16. Rodriguez MAD., *et al*. "Components of resistance to early blight in four potato cultivars: Effect of leaf position". *Journal of Phytopathology* 154.4 (2006): 230-235.
17. Vakalounakis DJ. "Evaluation of tomato cultivars for resistance to Alternaria blight". *Annals of Applied Biology* 102 (1983): 138–139.
18. Weightman and Barbara A. "Dragons and Tigers: A Geography of South, East, and Southeast Asia (2nd Ed.)". *John Wiley & Sons* (2005): 193.
19. Zheng HH and Wu XH. "First report of Alternaria blight of potato caused by Alternaria tenuissima in China". *Plant Disease* 97.9 (2013): 1246.
20. Zheng HH., *et al*. "Characterization of Alternaria species associated with potato foliar diseases in China". *Plant Pathology* 64.2 (2015): 425-433.