Reprint **ISSN 1991-3036 (Web Version)**

International Journal of Sustainable Crop Production (IJSCP)

(*Int. J. Sustain. Crop Prod.*)

Volume: 13 **Issue: 1** **August 2018**

Int. J. Sustain. Crop Prod. 13(1): 1-4 (August 2018)

SCREENING OF POTATO VARIETIES AND GERMPLASM AGAINST LATE BLIGHT DISEASE

M.M.H. TIPU, F.S. SHIKHA, M. YASMIN, P.R. SARKER AND R. SULTANA

An International Scientific Research Publisher

Green Global Foundation©

Web address: http://ggfjournals.com/e-journals archive

E-mails: editor@ggfjournals.com and editor.int.correspondence@ggfjournals.com

ISSN-1991-3036 (Online)
Int. J. Sustain. Crop Prod. 13(1):1-4(August 2018)

SCREENING OF POTATO VARIETIES AND GERMPLASM AGAINST LATE BLIGHT DISEASE

M.M.H. TIPU[1*], F.S. SHIKHA[2], M. YASMIN[2], P.R. SARKER[3] AND R. SULTANA[4]

[1]Plant Pathology Division, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jamalpur-2000, Bangladesh; [2]Soil Science Division, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jamalpur-2000, Bangladesh; [3]Tuber Crops Research Centre, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jamalpur-2000, Bangladesh; [4]Horticulture Research Centre, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jamalpur-2000, Bangladesh.

*Corresponding author & address: Mohammad Monirul Hasan Tipu, E-mail: tipubari2013@yahoo.com
Accepted for publication on 14 July 2018

ABSTRACT

Tipu MMH, Shikha FS, Yasmin M, Sarker PR, Sultana R (2018) Screening of potato varieties and germplasm against late blight disease. *Int. J. Sustain. Crop Prod.* 13(1), 1-4.

The study was conducted at Regional Agricultural Research Station, Jamalpur during 2014-2015 to find out resistant or tolerant cultivars against late blight of potato caused by *Phytopthora infestans*. Seeds of a total 56 cultivars were sown under natural epiphytotic condition. Out of fifty six germplasm 16 germplasm were found highly susceptible and thirty two germplasm were susceptible against *P. infestans*. Four varieties were moderately resistant. The variety LB-6 was found resistant to late blight. Germplasm Sarpo Mira, Bionica and LB-7 were found highly resistant against *P. infestans* that can be used in breeding programme for the development of late blight resistant potato variety.

Key words: *potato, late blight, phytophthora infestans, resistance*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is an important vegetable cash crop grown all over the world and ranks fourth after wheat (*Triticum aestivum* L.), maize (*Zea mays* L.) and rice (*Oryza sativa* L.) (Ewing 1997). It produces approximately twice as many calories per hectare as rice and wheat (Poehlman and Slepper, 1995). In Bangladesh demand of potato is increasing day by day. It has become popular with the producers as a winter crop. So, a large portion of total cultivable lands is being used under potato cultivation. With the increase of potato cultivation, incidence and severity of many diseases are simultaneously increasing. Potato crop faces several constraints of fungal, bacterial and viral origin (Bhutta *et al.* 2004) due to unavailability of disease free seed and lack of knowledge of integrated disease management (IDM) (Bhutta and Hussain, 2002; Bhutta *et al.* 2005). Among the diseases, late blight of potato caused by *Phytophthora infestans* (Mont.) De Barry is the most devastating and causing 50-70% potato yield loss and can cause epidemic within a few days under favorable environmental conditions (Haq *et al.* 2008; Rahman *et al.* 2008). *P. infestans* produces sporangia on sporangiophores released from infected plants are known to be capable of wind borne migration for over several kilometers. The disease is of common occurrence in Bangladesh for over 30 years (Dey *et al.* 2010). None of the commercial varieties is found resistant to *P. infestans*. Research on this disease is going on at Tuber Crops Research Centre (TCRC), BARI over several years.

Screening of potato germplasm against late blight of potato is necessary in order to identify the resistant sources because cultivation of resistant varieties seems to be the only viable and environment friendly approach for managing this disease. Varietal resistance can also allow significant reduction in fungicides application while maintaining the yield and quality of the produce (Inglis *et al.* 1996). Hence, aim of the study was to find out sources of resistance against *P. infestans* in germplasm presently available in Bangladesh.

MATERIALS AND METHODS

Disease screening nursery comprising of 56 varieties/advanced lines was established in the research area of Regional Agricultural Research Station, Jamalpur during 2014-2015. Seeds were collected from Tuber Crop Research Centre, BARI, Joydebpur, Gazipur and Breeder Seed Production Centre, Debigonj, Panchagarh. Each variety/line was sown in two rows of three meter length with 25 cm plant to plant and 60 cm row to row distance on November 27, 2014. Standard crop management practices were followed without using any measure to control late blight. The screening was done under natural epiphytotic conditions. Disease inoculum collected from diseased plants were suspended with water and sprayed over the experimental plot on January 01, 2015. Disease data were recorded just from the onset of the disease and mean while environmental data *viz.* temperature, moisture and rainfall was also recorded. Weather characteristics of this region are listed in Table 1.

Table 1. Weather data of Jamalpur recorded during winter season in 2014-2015

Month	Temperature (mean)		Relative Humidity (mean)		Total Rainfall (mm)
	Max.	Min.	Max.	Min.	
November'14	29.30	17.27	73.13	61.23	0.0
December'14	24.94	13.52	89.20	72.41	0.0
January'15	24.09	12.25	86.19	65.31	22.50
February'15	27.74	14.69	82.58	58.88	61.00
March'15	31.13	16.13	64.91	59.56	10.00

The disease severity was recorded at four days interval and the area under the disease progress curve (AUDPC) was calculated in accordance to Forbes *et al*. (2014). Based on the AUDPC values, the germplasm were classified as highly resistant (< 250), resistant (251-350), moderately resistant (351-650), susceptible (651-1200) and highly susceptible (>1200) as per Gopal and Singh (2003).

RESULTS AND DISCUSSION

Results of the study revealed that potato germplasm showed different levels of resistance against *P. infestans* (Table 2). Most of the potato varieties showed susceptibility to *P. infestans* because the weather conditions during the crop season were conducive for the disease development. Among the germplasm 16 germplasm were found highly susceptible to late blight having AUDPC value more than 1200. Thirty two germplasm showed AUDPC ranging from 728 to 1182 were susceptible for *P. infestans*. Four varieties i.e. CIP 395195.7, Connect, CIP 391846.5 and CIP-1 were moderately resistant to late blight with AUDPC value between 518 and 580. The cultivar LB-6 was found resistant to late blight having AUDPC value 264. Three germplasm namely Sarpo Mira, LB-7 and Bionica found to be highly resistant against *P. infestans* and their AUDPC value ranged from 30 to 64.

Table 2. Response of 56 potato varieties/germplasms against late blight of potato during 2014-15

Germplasm	AUDPC	Response	Germplasm	AUDPC	Response
Barcelona	1084	S	9.91	828	S
Provento	1104	S	Rosagold	1034	S
Caruso	728	S	Destiny	1002	S
Cumbica	1002	S	Verdi	1122	S
CIP 395195.7	518	MR	Challenger	1182	S
Bionica	64	HR	Pamela	1442	HS
Georgina	1284	HS	Kufri Jyoti	1032	S
Lady Rosetta	1430	HS	Dolly	1384	HS
9.112	904	S	Rumba	1058	S
CIP 397073.7	982	S	Figaro	1072	S
Flamenco	1242	HS	Alger	1462	HS
Safrana	1094	S	Monte Carlo	1242	HS
LB-7	52	HR	Endeavor	1402	HS
YP-04-80	992	S	Cardinal	1020	S
9.125	1078	S	Kufri Pukhraj	992	S
Granola	1304	HS	Agila	1008	S
CIP 391846.5	548	MR	Royal	1162	S
Tomensa	1282	HS	Sagita	1282	HS
Defender	1384	HS	Hanna	1322	HS
Yukon Gem	862	S	CIP-1	580	MR
Connect	524	MR	Diamant	1052	S
9.35	944	S	YP-04-108	836	S
Forza	1404	HS	LB-6	264	R
Atlantic	1042	S	Sarpo Mira	30	HR
Laura	1122	S	El Mundo	1322	HS
Flova	1284	HS	Modoc	948	S
BARI TPS-1	992	S	Raja	1170	S
Asterix	1114	S	CIP-11	1068	S

Horizontal resistance to late blight is considered to be the major crop protection trait needed in new varieties to face the increasing threat of a re-emergent potato disease (Landeo *et al.* 2000). Major genes for resistance are highly effective in absence of compatible race, but have historically been unstable due to continuous changes in the pathogen (Van der Plank, 1968; Fry and Goodwin, 1997). Presence of R genes can also interfere with the recognition of true horizontal resistance (Landeo and Turkensteen, 1989). Horizontal resistance to late blight is considered more durable and effective against all variants of the pathogen (Turkensteen 1993; Haynes *et al.* 1998). However, the expression of quantitative resistance can be affected by environmental conditions (Umaerus and Umaerus, 1994), which brings into question its stability across different testing or production conditions.

In a separate study, Dey *et al*. (2010) observed that the population structure of the Bangladeshi isolates of *P. infestans* has changed considerably in recent years towards more aggressive types. At present, complex races (metalaxyl resistant strain of *P. infestans*) are predominant in the northern part of the country (where winter sets early and continues for longer period and metalaxyl fungicides used indiscriminately over years) compared to other regions of the country.

The presence of an aggressive, variable population of the pathogen may affect the durability of partial resistance (Latin *et al.* 1981) due to accelerated adaptation of aggressive forms of the pathogen with higher levels of parasitic fitness (Nelson 1979). A shift towards more aggressive populations of *P. infestans* will cause an overall decrease in resistance of potato cultivars. In addition, differential changes in ranking of partially resistant cultivars after exposure to different genotypes of the pathogen may occur (Leonard and Moll, 1979). This may be the reason for the breakdown of disease resistance of the germplasm. Since both partial and race-specific resistance can collapse following the appearance and spread of more aggressive pathogen strains, it is furthermore useful to assess potato resistance to late blight using isolates from the most aggressive populations. Although yields of resistant varieties are not always higher than susceptible varieties, they would decrease the source of inoculum significantly.

CONCLUSION

From the present study, it can be concluded that the germplasm Sarpo Mira, LB-7, Bionica and LB-6 showed stable resistance against late blight of potato. Among these, Sarpo Mira, LB-7 and Bionica can directly be utilized as parents for transferring stable late blight resistance in varietal improvement programme.

ACKNOWLEDGEMENT

Authors are grateful to Director, Tuber Crops Research Centre, Bangladesh Agricultural Research Institute (BARI) for providing necessary fund.

REFERENCES

Bhutta AR, Hussain JI (2002) Production of healthy seed potato in Pakistan. *Science Technology and Development* 21(3), 1-9.

Bhutta AR, Malik MH, Muhammad J (2005) Seed Potato Crop Management in Northern Areas, DOA, Nas, Gilgit and FSC & RD, GOP, Islamabad. P.166.

Bhutta AR, Muhammad MQ, Hussain JI (2004) Pathological survey of potato crop in Northern areas, 2003. FSC & RD / AKRSP, DOA, Islamabad. 109p.

Dey TK, Hossain M, Kadian MS, Hossain S, Bonierbale M, Mahmud AA (2010) Prevalence, epidemiology and management of potato late blight in Bangladesh. *Potato J.* 37(3-4), 99-102.

Ewing EE (1997) Potato: The physiology of vegetable crops. CAB Intern. UK. pp. 295-344.

Forbes G, Pérez W, Andrade Piedra J (2014) Field assessment of resistance in potato to *Phytophthora infestans*. Lima (Peru). International Potato Center (CIP). 35p.

Fry WE, Goodwin SB (1997) Resurgence of the Irish potato famine fungus. *Bioscience* 47: 363-371.

Gopal J, Singh BP (2003) Screening potatoes for resistance to late blight (*Phytophthora infestans*) under field conditions. *Potato Res* 46: 47-56.

Haq I, Rashid A, Khan SA (2008) Relative efficacy of various fungicides, chemicals and biochemicals against late blight of potato. *Pak. J. Phytopathol.* 21(1), 129-133.

Haynes KG, Lambert DH, Christ BJ, Weingartner DP, Douches DS, Backlund JE, Secor G, Fry WE, Stevenson W (1998) Phenotypic stability of resistance to late blight in potato clones evaluated at eight sites in the United States. *Am. J. Potato Res.* 75: 211-217.

Inglis DA, Johnson DA, Legard DE, Fry WE, Hamm PB (1996) Relative resistances of potato clones in response to new and old populations of *Phytophthora infestans*. *Plant Dis* 80: 575-578.

Landeo JA, Gastelo M, Roncal E, Mendoza A (2000) Phenotypic stability for horizontal resistance to potato late blight in population B. *Am. J. Potato Res.* 77: 406.

Landeo JA, Turkensteen L (1989) Assessment of partial resistance to late blight (*Phytophthora infestans*) of major genes in potato. *Am. Potato J.* 66: 530.

Latin RX, MacKenzie DR, Cole H (1981) The influence of host and pathogen genotypes on the apparent infection rates of potato late blight epidemics. *Phytopathology* 71: 82-85.

Leonard KJ, Moll RH (1979) Durability of general resistance: evaluation of cultivar isolates interactions. In, Proceedings of Symposia, 9th International Congress of Plant Protection, Washington DC, USA: 190–193.

Nelson RR (1979) The evolution of parasitic fitness. In, Plant Disease: An Advanced Treatise. Horsfall JB and Cowling EB (ed), Academic Press, New York, USA: 23-46.

Poehlman JM, Slepper DA (1995) Breeding Field Crops. 4th Ed. Lowa State Univ. Press / Ames. 419-433, Pyongchang, Ganwon, Korea. Nat. Alpine Agric. Experi. Station, RDA, Pyongchang, Korea. 2001. Pp. 16-21.

Rahman MM, Dey TK, Ali MA, Khalequzzaman KM, Hussain MA (2008) Control of late blight disease of potato by using new fungicides. *Int. J. Sustain. Cr. Prod.* 3(2), 121-127.

Turkensteen LJ (1993) Durable resistance of potatoes against *Phytophthora infestans*. In, Durability of disease resistance. Jacobs T and Parlevliet JE (ed), Kluwer Academic Publishers, Dordrecht, Netherlands: 115-124.

Umaerus V, Umaerus M (1994) Inheritance of resistance to late blight. In, Potato Genetics. Bradshaw JE and Mackay GR (ed), CAB International, Wallingford, UK: 365-402.

Van der Plank JE (1968) Disease resistance in plants. Academic Press, NY, USA: 206p.