

2013-14

Title of Proposal: Developing an effective screen for powdery scab resistance in potato germplasm smooth-skin and russet-skin type cultivars

Most relevant funding source: CCPGA

Investigator names and department:

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Summary of Problem

Powdery scab disease caused by *Spongospora subterranea f. sp. subterranea* is one of the major concerns for potato producers in production regions throughout the world. This is a soil borne pathogen that infects root hairs, stolon epidermal cells, lenticels, eyes and wounds of developing tubers. Infected tubers and roots may have white gall-like growths, which later develop into brown powdery scab tuber lesions as they mature (Harrison et al. 1997). Christ (1993) observed that potato cultivars with smooth or light skin (i.e whites and reds) are more susceptible; whereas russet-skinned cultivars are less prone to powdery scab, although root galls are common. There are reports on partial russeting in some cultivars such as Rio Grande Russet. Partial russeting and irregular skin set can lead to disease, loss of water and susceptibility to skin bruise, effecting tuber quality (Lulai EC, 2002).

Nature, scope, objectives of proposed research and preliminary results

Powdery scab symptoms cause significant economic losses in both fresh and seed markets. Depending on the severity of symptoms, tubers could become non-marketable or grade quality may be reduced in fresh and seed markets. Seed lots infected with powdery scab may or may not pass inspection depending on the regulations of the certifying agency and the degree of infection. Infected tubers are also more susceptible to secondary infections, such as fusarium dry rot, bacterial soft rot and other pathogens during storage. We are proposing to identify markers for powdery scab susceptibility to help breeders in the cultivar selection and breeding process.

Potato genotypes that are being identified with tuber-powdery scab tolerance are usually turned out to be russet skin types (Houser and Davidson 2010; Nitzan et al. 2010). In spite of this finding act, there has not been substantial amount of research effort to understand genetics and biochemistry of powdery scab disease tolerance in russet skinned potatoes. It is important to understand the functional genes and related biochemical pathways to confirm disease tolerance in these potatoes. As mentioned above, certain storage proteins such as LOXs and patatins have a role in certain disease tolerance mechanism to certain diseases. Our recent report suggests that the storage protein levels of various potato genotypes are significantly different (Perla et al. 2012). In this context, the objective of this study was to understand the role of LOX and patatin and other protease inhibitor proteins, in the powdery scab tolerance in of russet skinned tubers.

Table 1. Kendall's tau correlation between tuber DSI, unmarketable tubers, total protein, LOX protein and patatin-lipase levels of tubers

Variables	Unmarketable Tubers	Total Protein	LOX (PB)	LOX (DB)	Patatin-L (PB)	Patatin-L (DB)	Tuber Skin ^a
DSI	0.688**	-0.045	-0.225	-0.494*	0.180	0.000	-0.691*
Unmarketable tubers		-0.076	-0.076	-0.328	0.227	-0.025	-0.553
Total protein			0.156	0.022	0.200	0.644***	0.163
LOX (PB)				0.600**	0.244	0.333	0.683*
LOX (DB)					-0.067	-0.067	0.618*
Patatin-L (PB)						0.556**	0.163
Patatin-L (DB)							0.358

^aGenotypes were ranked on the basis of the roughness of tuber skin, where 1 = smooth and 2 = rough (russet skin).

DSI = Disease severity index of tubers. PB = Protein basis. DB = Dry weight basis. Patatin-L = Patatin-lipase. Values in bold are significantly different from zero.

Timeline and expected short term (1 yr) and longer term (3-5 yrs) outcomes.

1st years: Screening number of target enzymes

2nd year: Conforming laboratory results with green house and field trails.

Detailed annual budget (personnel, materials and supplies, travel, equipment, services) and a budget justification.

Total budget	45,000 (for two years)
Requested funding for 2013-14:	22,500.00
Research Associate (50%)	10,000.00
Equipment	5,000.00
Chemicals	3,000.00
Travel	1,500.00