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**Presence of *Spongospora subterranea* in Soils of Potato Production Area
in Gilgit and Hunza Valleys of Pakistan**

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Abstract: Powdery scab of potato was first reported in Pakistan in 1986 on the basis of tuber symptoms. However, the presence of pathogen was confirmed only from Astak valley in Northern Area in 1994 on the basis of serology, electron microscopy and bioassay. As the disease is both seed and soil-borne and seed potatoes are brought from Northern Areas to other potato growing areas, therefore, from quarantine point of view, it is necessary to probe different potato growing soils in Northern Areas for the presence of *Spongospora subterranea*. Probing of the soils of sixteen locations of potato growing areas in Gilgit and Hunza valley was done through bioassay by using tomato bait plants. Soils of eleven locations including Sust, Morkhun, Galapan, Gulmit, Shishcut, Aliabad, Nasirabad, Nagar, Thol, Naltre Bala and Naltre Paen gave root infection score for the presence of zoosporangia in a bioassay test.

Key words: *Spongospora subterranea*, soil probing, powdery scab and potato.

Introduction

In Pakistan, powdery scab was first reported in 1986 by Turkensteen from isolated pockets of Attock, Okara, Faisalabad and later in 1987 from certain parts of Kalat division in Baluchistan on basis of tuber symptoms (Turkensteen, 1987, 1988). *Spongospora subterranea* f.sp. *subterranea* the casual agent of powdery scab of potato is both seed and soil-borne. It survives in soil for many years, as once its resting spores are introduced in the soil, it is difficult to eradicate and with passage of time inoculum builds up. First time, the pathogen was confirmed on the basis of microscopy, serology and bioassay in 1996 from Astak valley in Skardu region of Northern Areas of Pakistan (Ahmad *et al.*, 1996). Northern Areas constitutes a major potato seed production area. Therefore, it necessitated the probing of soil in potato growing areas of suitable climate for this pathogen to curtail its spread and for effective management of the disease. This paper reports the results of soil probing for the presence of *S. subterranea* through solution culture test (bioassay) (Merz, 1989) in Gilgit and Hunza valley of Northern Areas of Pakistan.

Materials and Methods

Soil sampling: Soils were sampled during 1997 from potato fields of Northern Areas. Two to three sub-samples were taken diagonally from each field (3 cm-layer was always removed to avoid possible solarization effect). The sub-samples were mixed together and then 1 kg sample per field was taken and air dried at room temperature and then stored at 15°C for further use where required.

Soil testing

Bioassay test: Three weeks old tomato bait plants were prepared by growing them in sterilized sand and irrigated with 3-fold dilution of nutrient solution (Merz, 1989). Roots were trimmed and seedlings were transferred to plastic trays containing nutrient solution and kept for 1 week in growth room with 15 hr. of light (12,000 lux, cool white florescent tubes) at 18°C and 9 hr. dark period at 16°C. After one-week plantlets were transferred to a baiting solution containing 100 g. homogenized soil sample per liter nutrient solution and kept for ten days in the growth room with the same conditions as described above. After 10 days of baiting period roots of plantlets were washed and cultivated in fresh nutrient solution for another 7 days. Then roots were harvested cleared and stained as described by Merz (1989). The whole root system was observed under stereomicroscope for the

presence of zoosporangia. Scoring was done on 0-4 scale (0 = no sporangia, 1 = only a few sporangia, 2 = several roots with sporangia, 3 = sporangia regularly present or moderate infection and 4 = heavy infection) (Merz, 1989).

Results and Discussion

Out of sixteen locations, eleven locations showed infestation with *S. subterranea* and gave root infection score, ranging from 0.12 to 1.56 on 0-4 scale (Table 1) in solution culture test system by using tomato bait plants. Turkensteen (1986) conducted a survey of potato diseases in this area but did not reported powdery scab. Later, presence of powdery scab was reported on the basis of visual and light microscopic observations by Soomro *et al.* (1994). This study is the first authentic report on the presence of

Table 1: Soil probing of potato growing areas of Gilgit and Hunza valley in Northern Areas of Pakistan through bioassay test

Locations	No. of samples	Samples infested with <i>S. subterranea</i>	Average bioassay score on 0-4 scale
Sust	1	1	0.3
Morkhon	1	1	0.25
Galapan	1	1	0.58
Khyber	1	-	-
Passu	1	-	-
Gulmit	2	1	0.12
Shishkat	2	2	0.23
Karimabad	2	-	-
Aliabad	2	2	0.55
Murtazabad	1	-	-
Nasirabad	3	3	0.53
Nagar	1	1	1.56
Thol	1	1	0.75
Naltar Bala	3	2	0.33
Naltar Paen	3	1	0.3
Nomal	2	-	-

S. subterranea in soil of potato fields of Gilgit and Hunza valley, where confirmation was done through a sensitive technique of bioassay. Farmers of this area were not familiar with the scab symptoms. However few complained that they had received scabby potato seed from various seed supplying agencies (Soomro *et al.*, 1994). The possibility of introduction of inoculum

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of powdery scab in the area with the healthy tubers can not be ruled out as tubers with no visible infection can be contaminated with spore balls of *S. subterranea* and give rise to severe disease (Burnett, 1991). On the other hand the chance of introduction of initial inoculum through infected seed is also there. Once the disease is introduced either by former or later way at inconspicuous level of incidence and severity, gradual build up of its inoculum in soil would take place and eventually lead to level which produce severe disease.

Cool and wet climatic conditions favour powdery scab development. However, climate of Gilgit and Hunza valley being cool and very dry is not suitable for the development of disease. But dry conditions necessitate rather a large number of irrigations for the proper growth of the crop that would provide favorable conditions for disease development. Farmers in the area give 8-10 irrigations to potato which may also help in powdery scab establishment (Soomro *et al.*, 1994). The presence of *S. subterranea* in the soils of potato growing areas of Northern Areas is alarming as this area is being used for disease free certified seed production. Further work on probing of soils of other valleys is continued.

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