

Crossing of Potato in Tajikistan

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Introduction

Potato tubers are valuable food products for most people in the world, and in many regions are considered a “second bread”. The agricultural environment of mountainous areas of Tajikistan situated at an altitude of more than 1800 meters above sea level, make it possible to grow good and quality harvest of potato. Under these cool mountainous conditions, potato plants are of little affection, have intensive bloom, and form a lot of berries and botanic seeds.

During the researches made in different soil and climatic conditions a number of scientists (Carli et al., 2008; Kiru, 2007) have ascertained the significance of breeding pair selection and locality of crossbreeding, so as to get good results of potato hybridization.

According to (Luthra et al., 2006; Mumindjanov, 2003; Partoev et al., 2008) from India, success of selective and genetic work aimed at nurture of new perspective grades, depend to a large extent on pollen grain fertility and vitality when conducting different crossing between grades and species of potato.

Thus, on basis of above researchers work analysis and our experience on potato crossbreeding obtained in India this year, for the first time in the highland of Tajikistan we have begun to research the rate of pollen grain fertility and to cross different grades and hybrids of potato and the results of this researchers brining in this brochure.

Materials and Methods

To determine the viability? vitality of potato pollen grains, the following types of work should be prepared and carried out:

- To make acetocarmine solution, dropping bottle, forceps and needle ready for potato pollen release.
- To remove flower pistil using forceps.
- To pour out the pollen on the slide in the acetocarmine drop by shaking the stamen filament of the flower.
- To cover the acetocarmine and pollen mixture with a glass sheet.

- The ready preparation is to be examined through the microscope in 3-5 minutes.
- The quantity of acetocarmine coloured pollen grains (both fertile – vital pollen grains and yellow pollen grains – sterile or unviable grains) should be counted in three or five microscopic fields.
- The counted quantity of coloured and uncoloured pollen grains is to be recorded into the log book.

Pollen vitality was analyzed in three terms: on July, 20 (the beginning of blooming period), on August, 1 (mass blooming period) and on August, 10 (the end of blooming period). In each term the pollen of five plants of each sample was taken, 15 plants in total. Fertile (vital) and sterile (unviable) pollen grains were counted in three microscope fields with increasing of 8x7 on the microscopes MBC-9 and MBC-10 and with increasing of 20x7 on the microscope MBU- 4A. As a material for research, 62 clones and varieties of potato from the International Potato Center (CIP) in the network of plant gene pool investigation in the republics of Central Asia and the Caucasus. Also the collection of potato samples obtained from the Institute of Botany, Plant Physiology and Genetics of the National Academy Sciences of Tajikistan. Planting was carried out on May at an altitude of 2700 meters above sea level, in the research field station, situated in the Jirgital region, Sari-Kendja village, Muksu jamoat, Republic of Tajikistan.

Also straight and back crosses of different potato grades and species were carried out in order to obtain first generation hybrids. For conducting potato grades crossbreeding after 3 p.m. emasculation of maternal plant flowers (removal of flower stamen filament with forceps) was made. After 4 p.m. we plucked paternal plant flowers, removed their pistils and kept them in a Petri dish at the room temperature from 4 p.m. to 9 a.m. of the next day.

In the morning, inside the room we shook stamen filaments with anthers using forceps and needle and picked the pollen into the

glass Petri dishes of small size. The picked pollen was used for pollination of emasculated flowers by touching the pistil head with the picked pollen of paternal flowers. After pollination we attached a paper label indicating hybrid combination (maternal form x paternal form) and the date of crossbreeding written in pencil to the stem. The number of pollinated flowers was recorded into the potato crossbreeding log book in compliance with the dates of pollination. All statistical dates (X, S, Sx, V, %, LSD 05) processing, according on (Dospekhov, 1985).

Results and Discussion

Investigations concerning identification of potato pollen grain fertility have been conducted in Jirgital region at an altitude of 2700 meters above sea level where an experimental plot of the Institute of Botany, Plant Physiology and Genetics of the National Academy Sciences of Tajikistan. Fertile (vital) potato pollen grains placed in the acetocarmine drop are coloured and turned red. As to sterile pollen grains, they are not coloured and will have yellow coloring. Their number can be easily counted through the microscope.

Pollen grain fertility of potato clones and grades in highland environment of our republic is genotypically specific. Most of the examined clones and grades have more than 80-97% of fertile (vital) pollen grains. At the same time it is necessary to note that pollen grain fertility of some potato grades makes only 5-10%. Among potato varieties cultivated in the mountainous

area, Ccardinal grade had the lowest percentage of fertile pollen grains with an average of 26,5%, while the new perspective Dusti grade had the highest (95,2%). This grade was raised by the scientists of the Institute of Botany, Plant Physiology and Genetics of the National Academy Sciences of Tajikistan and the International Potato Centre (CIP). It should be noted that some clones sampled individually from hybrid swarm F1 and propagated from one plant by culture method (in-vitro plants), had stamen filaments of different shapes. For example, clones 43, 48, and 54 had different morphological attributes of stamen filaments (Fig.).

Clone 43 had plants with two types of stamen filament shape. One part of the plant had a regular stamen filament; the other part of the plant had a modified stamen filament when stamen filaments are not pressed to the pistil stem as it is with regular plants. They are detached from it and look friable.

Thus, according to the stamen filament shape among these new potato clones, we can observe definite variation. It should be noted that the rest of the morphological traits (plant and flower color, leaf shape, evolution phenological stage and tuber color of the examined clones) remained stable. In addition, the our researches indicated that the plants with modified shape remained stable. In addition, the our researches indicated that the plants with modified shape of the stamen filament have weak yellow color of the stamen filament and low fertility of pollen grains compared to regular plants.



Figure : Different shapes of flowers, stamen filaments and pistils of potato clones.

Plants with modified shape of stamen filament have considerably less fertile pollen grains compared to those with regular stamen (Table). The sign of cytoplasmic male sterility is greatly detected with clone 48 where pollen grain fertility was only 5, 4%. Along with it, we have ascertained that although many potato clones have regular stamen filament shape and bright yellow coloring of the stamen filament and anther, their index of fertility is very low. They are clones 2, 3, 7, 15, 50, 58, 64, 65, and 67 that have only 5, 1 – 9, 7% of fertile pollen grains. These clones can serve as a good base line for potato breeding through straight crossing (without anther removal), and for obtaining botanic seeds without flower emasculation. Thus, specific potato clones with male sterility sign have been defined. As a result of potato hybridization carried out in Jirgital region from July to August regular were obtained berries F1.

№	Varieties of potato	Analysis implementation dates:			Mean
		Jul. 20	Aug. 1	Aug. 10	
1	Clone 43 (plants with regular stamen filament)	83.5	84.8	75.6	81.3
2	Clone 43 (plants with modified shape of stamen filament)	45.7	50.1	47.5	47.8
3	Clone 48 (plants with modified shape of stamen filament)	5.7	4.8	5.6	5.4

Table: Pollen grain fertility (%) in potato clones with different shape of the flower stamen filament.

Conclusions

For the first time, study of pollen grain fertility and hybridization of potato varieties have been carried out in the mountainous area of Tajikistan.

The degree of pollen grain fertility and the variability of this genetic trait among 62 potato samples have been determined (5-97%).

Some potato clones have great variability based on the flower and anther color as well as on the shape of the stamen filament. Ten potato clones were selected based on the low quantity of fertile pollen grains (5, 1-9, 7%).

Potato variety Cardinal grade showed the lowest percentage (26, 5) of fertile pollen grains, while Dusti grade showed the highest (95, 2%).

Six kg of hybrid berries were obtained from crosses of potato varieties and hybrids.

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