DECAPITATION AND GENETIC MARKERS AS RELATED TO HAPLOIDY IN SOLANUM TUBEROSUM

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INTRODUCTION

Haploids (2n = 24) of the common potato (2n = 48) offer exciting potential for genetic study and breeding (HOUGAS and PELOQUIN, 1958). Stockpiles of haploids, derived from a wide range of Solanum tuberosum germ plasm, are the initial prerequisite for the exploitation of this potential.

Interspecific matings (S. tuberosum ♀ - S. diploid ♂), utilizing suitable genetic markers, have proved effective in obtaining haploids of the common potato (HOUGAS, PELOQUIN and Ross, 1958). This paper is concerned with the problem of increasing the efficiency of obtaining haploids from interspecific matings by use of 1. a decapitation technique and 2. effective genetic markers.

DECAPITATION TECHNIQUE

Decapitation of the pistillate S. tuberosum parent and culture of the “decapitant” in tap-water or nutrient solution is an effective means for increasing seed set in certain difficult intraspecific matings (McLEAN and STEVENSON, 1952) and in certain interspecific matings (PELOQUIN and HOUGAS, 1958). This technique has proved very useful in the search for Solanum haploids conducted at the Potato Introduction Station, Sturgeon Bay, Wisconsin. A brief description of the method follows. The “decapitants” (8-10 inches of the apical stem including leaves and inflorescence) are collected from the field in water-filled containers when the first flowers of the inflorescence begin to open. The “decapitants” are transported to an air-conditioned (about 24 °C) greenhouse and placed in quart containers filled with tap-water (FIG. 1). It is advisable to add a bactericide, such as 5-10 ppm streptomycin sulphate, to the water for control of soft-rot infection. All open flowers are then removed and discarded. As the buds reach the “petal-color” stage the pollen-fertile parents are emasculated.

Pollen is collected in gelatin capsules from the “pollinator” plants by use of a mechanical vibrator. The pollen may be used directly or stored under refrigeration in

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moisture-free containers (Fig. 2). *Solanum* pollen remains viable for several months when properly stored at sub-zero temperatures (Beamish, 1954; Howard, 1958; King, 1955). The pollen may be applied 1. by inserting the stigma and style in the capsule or 2. by first transferring the pollen from the capsule to an ordinary 1 · 3 inch microscope slide (Fig. 1). Four to six flowers of each inflorescence are pollinated. The remaining young buds are removed and discarded. The "decapitants" are moved from the air-conditioned house 4–6 days after pollination to allow for the next cycle of emasculations and pollinations.

The decapitation technique has several advantages. First, it results in a significant increase of fruit and seeds per pollination in difficult matings (*S. tuberosum* ♂ – *S. diploid species* ♂) (Pelquin and Hougas, 1958). Second, the technique is readily adapted to large-scale operations (more than 75,000 pollinations were made during the summer of 1958 at the Potato Introduction Station, Sturgeon Bay, Wisconsin). Third, matings can be easily conducted under various controlled environments (temperature, light, day length and nutrients).

The frequency of haploids per 100 pollinations, measured from preliminary data, ranged from 0–4.2 in field pollinations and from 0–5.6 in decapitation-technique pollinations. These preliminary data also indicate that the choice of both the *S. tuberosum* parent and the diploid "pollinator" appears to have a marked influence on haploid frequency.

*Fig. 1. Decapitants of *S. tuberosum* in the greenhouse*

*Fig. 1. Décapitées de *S. tuberosum* en serre*

*ABB. I. Dekapitanten von *S. tuberosum* im Gewächshaus*