FROST RESISTANT POTATO HYBRIDS VIA SOLANUM ACAULE, BITT. DIPOID-TETRAPLOID CROSSES

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Abstract

Solanum juzepczukii Buk. and Solanum curtilobum Juz. et Buk. are two important primitive cultivated species of potato which are planted in the highlands of Peru and Bolivia. Little natural variation exists within these species. Crosses were made to artificially recreate these species using tetraploid cultivated potatoes as female parents and triploids derived from acaule-diploid crosses as males. The new hybrids were tetraploid (2n = 48) with a high degree of heterosis and variability, and several potential cultivated clones possessing valuable characters such as yield, earliness, frost tolerance and good tuber type were selected.

Resumen

Solanum juzepczukii Buk. y Solanum curtilobum Juz. et Buk. son dos especies primitivas cultivadas que se siembran actualmente en las regiones altas de Perú y Bolivia. Existe poca variación natural dentro de estas especies por lo cual se hicieron intentos para obtener artificialmente numerosos clones, aumentar su variabilidad y dar la oportunidad de seleccionar nuevos fenotipos con mejores características. Los cruzamientos empleando papas cultivadas tetraploides como progenitores femeninos y triploides derivados de híbridos acaule-diploide como masculino dieron como resultado nuevos híbridos con 2n = 48 que tuvieron un alto grado de heterosis y variabilidad. Esto dio la oportunidad para seleccionar clones con características valiosas tales como alta producción, precocidad, tolerancia a heladas y buen tipo de tubérculos.

Introduction

In the tropical highlands, especially in the Andes of South America, potatoes are grown as one of the major staple foods, but crop yields are low since frost damage is very frequent during the growing period. In potato growing areas of Peru and Bolivia, from 3,600 to 4,000 m. above sea level, cold stress is predominant. Farmers cultivate more than 20,000 hectares of hybrids which have been directly derived from the wild, frost-resistant species Solanum acaule, Bitt. These include the triploid S. × juzepczukii Buk. (2n = 36) and the pentaploid S. × curtilobum Juz. et Buk.

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These hybridogenic species were produced in nature probably by crosses between the wild tuber-bearing species *S. acaule* and the primitive cultivated potatoes *S. stenotomum* Juz. et Buk. (2n = 24) and *S. andigena* Juz. et Buk. (2n = 48).

These hybrid potato species have a high content of glycoalkaloids and they are commonly known as bitter potatoes. To make these potatoes edible pre-Columbian Indians developed, according to Spanish reports by Cieza de León and Garcilaso de la Vega, from the 16th and 17th centuries (Christiansen, 1977), a processing method consisting of freezing, drying and washing. The dried potatoes obtained by this method were called “chuño” and could be stored from one year to another or longer (Fig. 2).

According to Hawkes (1962), *S. juzepczukii* was formed by crosses between *S. acaule* and *S. stenotomum*. *S. curtilobum* was formed by crosses between *S. juzepczukii* and *S. andigena*. Schmiediche (1977) found that electrophoretically all known accessions of *S. curtilobum* were identical. He concluded that this species was only formed once and that all accessions of *S. curtilobum* that exist today have originated from a single and unique cross. So far, nobody has obtained artificially and maintained experimentally a reasonable number of *S. curtilobum* clones to observe their potential for potato breeding.

**FIG. 1.** a) *Solanum acaule*, a wild potato species with high resistance to frost.