Becoming wild: investigating the putative origin, feral capacity and ethnobotany of Araq potatoes

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Introduction
The so-called Araq potato is a folk taxon with considerable intraspecific diversity that is characterized by its weediness or wild state while also being collected and consumed by Andean farmers. These wild potatoes are widely spread throughout the Andean center of potato origin and diversity all the way from Bolivia to Venezuela. They are known by a variety of different vernacular names: Araq Papa (central and southern Peru), Papa Gentil (central Peru), Papa Curao (central and northern Peru), Chayka Papa (Yauyos, Peru), Tipono (Venezuela), and Lelekkoya (Bolivia). Ochoa (1990) has suggested that the Araq potato is tetraploid and belongs to Solanum tuberosum subspecies andigena. This would correspond to the S. tuberosum tetraploid Andigenum Group according to a recent taxonomic treatment by Spooner et al. (2007). If it is true that the Araq potatoes belong to a domesticated or cultivated species, then why do they grow in the wild? They commonly grow as a weed in agricultural systems, particularly in maize or faba-bean fields. But are they an intermediate product of the domestication process that had originally led up to the cultivated Andigena or have they become feral through a return to the wild? What are the farmer recognized and quantitative morphological differences between cultivated Andigena and Araq potatoes? These questions are relevant from an evolutionary and biosafety perspective.

Objectives, materials and methods
The objectives of the ongoing research are: (i) to try and unravel the putative origin of the Araq potatoes and to identify characters contributing to its fitness as a weed, (ii) to understand farmer perceptions about the origin and usefulness of the Araq potatoes. A series of complementary trials and methods were applied: (i) molecular (SSR marker) and morphological characterization of 17 Araq accessions from 5 departments of Peru, (ii) flow cytometry to determine their ploidy, (iii) a population dynamics trial with 9 Araq accessions in 3 contrasting environments to evaluate fitness, (iv) a trial for root-stolon system and tuber-skin-thickness comparison involving 6 Araq accessions, 11 cultivated Andigena landraces and 1 out-group species (S. Juzepczukii) to understand differentiation, (v) a semi-structured farmer survey in 3 regions of the central Peruvian Andes to characterize local notions of the Araq potatoes.

Preliminary results
A dissimilarity tree (dendrogram) built with SSR marker data from the 17 Araq accessions and a CIP composite genotype set using the Unweighted Neighbor Joining (NJ) clustering method for a dissimilarity matrix calculated with the Jaccard’s coefficient using DARwin 4.0 confirms that all the Araq accessions cluster in the clade of the cultivated S. tuberosum tetraploid Andigenum Group (Fig 1). This in combination with the clear identification of all 17 accessions as tetraploids confirms that they are indeed Andigena’s. The fact that the Araq accessions are widely scattered within the subtree of the cultivated S. tuberosum tetraploid Andigenum Group and do not cluster together
indicates that they have originated from different events: likely as sexual hybrids resulting from geneflow and successful establishment. Initial results from the population dynamics trial show positive survival rates 18 months after the trial was established under conditions of direct competition with native weedy floras. Average overall survival rates for the 3 contrasting environments were 1.9 (eastern Andes), 4.8 (central Andes) and 15.5 (western Andes) respectively. The highest survival rates are observed in the driest environment. Farmer typically report that Araq potatoes have long stolons and thick tuber skin. Under conditions at CIP's experimental station in Huancayo these longer stolons were not clearly expressed as compared to cultivated Andigena landraces. Tuber thickness has yet to be measured and compared (second half of June 2012). Initial analysis of the survey data confirms that an extensive farmer knowledge system exists in relation to the Araq potatoes with regular consumption taking place because of preference or food security rationales. Selected components of the research still have to be completed or analyzed as this abstract is written, but full results will be presented at the 2012 ALAP meeting.

Conclusions

- Taxonomically the Araq potatoes belong to the S. tuberosum tetraploid Andigenum Group and a comparative dissimilarity analysis suggest multiple events of origin. It seems likely that this particular group of potatoes has become wild originating from cultivated Andigena.

- Araq potatoes are well adapted to survive as an agricultural weed. A comparison of Araq versus cultivated Andigena genotypes in a single experimental environment did not clearly identify stolon length as a key trait providing fitness. Other fitness traits may include: tuber skin thickness, dormancy, early tuberization and/or resistance to Phytophthora infestans.

- An extensive farmer knowledge system is associated to the Araq potatoes, including folk taxonomy and importance in rural food systems as a wild collected food.

Figure 1: Dissimilarity tree comparing 17 Araq accessions with a composite genotype set

| a: Full tree with Araq accessions (orange) and cultivated Andigena genotypes (blue) |
| b: Zoom-in: clade with Araq accessions (orange) and cultivated Andigena genotypes (blue) |

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References
