

Wild potato (*Solanum* sect. *Petota*) germplasm collecting expedition to Mexico in 1993, with special reference to *Solanum bulbocastanum* Dunal and *S. cardiophyllum* Lindley

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Summary

A joint Mexico/United States expedition collected wild potato (*Solanum* sect. *Petota*) germplasm in Mexico between August 1–31, 1993. The purpose of the expedition was to expand germplasm and herbarium collections of *S. bulbocastanum* and *S. cardiophyllum*. Collections were made from west-central to southern Mexico, and comprised 19 true seed and 37 tuber collections (45 collections in total) of 9 species and two putative natural hybrids.

Introduction

Mexico has been the focus of many germplasm collecting expeditions, but some Mexican species are still underrepresented in the world's genebanks relative to taxonomic and geographic coverage (Spooner et al., 1991). The latest taxonomic treatment of sect. *Petota* (Hawkes, 1990) recognizes three subspecies in *S. bulbocastanum* Dunal (ssp. *bulbocastanum*, ssp. *dolichophyllum* (Bitter) Hawkes, ssp. *partitum* (Correll) Hawkes), and three subspecies in *S. cardiophyllum* Lindley (ssp. *cardiophyllum*, ssp. *ehrenbergii* Bitter, ssp. *lanceolatum* (P. Berthault) Bitter).

A recent chloroplast DNA study (Spooner & Sytsma, 1992) revealed unexpected maternal relationships between *S. bulbocastanum* and *S. cardiophyllum* (placed by Hawkes, 1990, in ser. *Bulbocastana* (Rydberg) Hawkes and ser. *Pinnatisecta* (Rydberg) Hawkes respectively). Similarly, these species showed similarities in light sprout morphology (van den Berg, 1993). We wished to further investigate these surprising results with additional accessions, molecular markers, and morphological studies. The purpose of this expedition was to increase the geographic and taxonomic representation of *S. bulbocastanum* and *S. cardiophyllum* necessary for these studies, and to collect germplasm of any other members of sect. *Petota* encountered.

Table 1. Summary of collections of *Solanum* sect. *Petota* from the 1993 Mexico expedition.

Taxa	Seeds	Tubers	Total collections	Map locations
<i>Solanum brachistotrichum</i>	0	1	1	3
<i>S. bulbocastanum</i>	6	7	9	1,4,11,12,15
<i>S. cardiophyllum</i>	4	14	17	2,5,6,7,8,9,10,12,13,14
<i>S. cardiophyllum</i> x <i>S. bulbocastanum</i>	0	1	1	2
<i>S. pinnatisectum</i>	2	2	3	6,9
<i>S. polyadenium</i>	0	1	1	10
<i>S. polytrichon</i>	4	4	5	9,10
<i>S. x sambucinum</i>	1	2	2	8,9
<i>S. stenophyllum</i>	0	1	1	3
<i>S. stoloniferum</i>	2	2	3	11,15
<i>S. tuberosum</i>	0	2	2	2,13

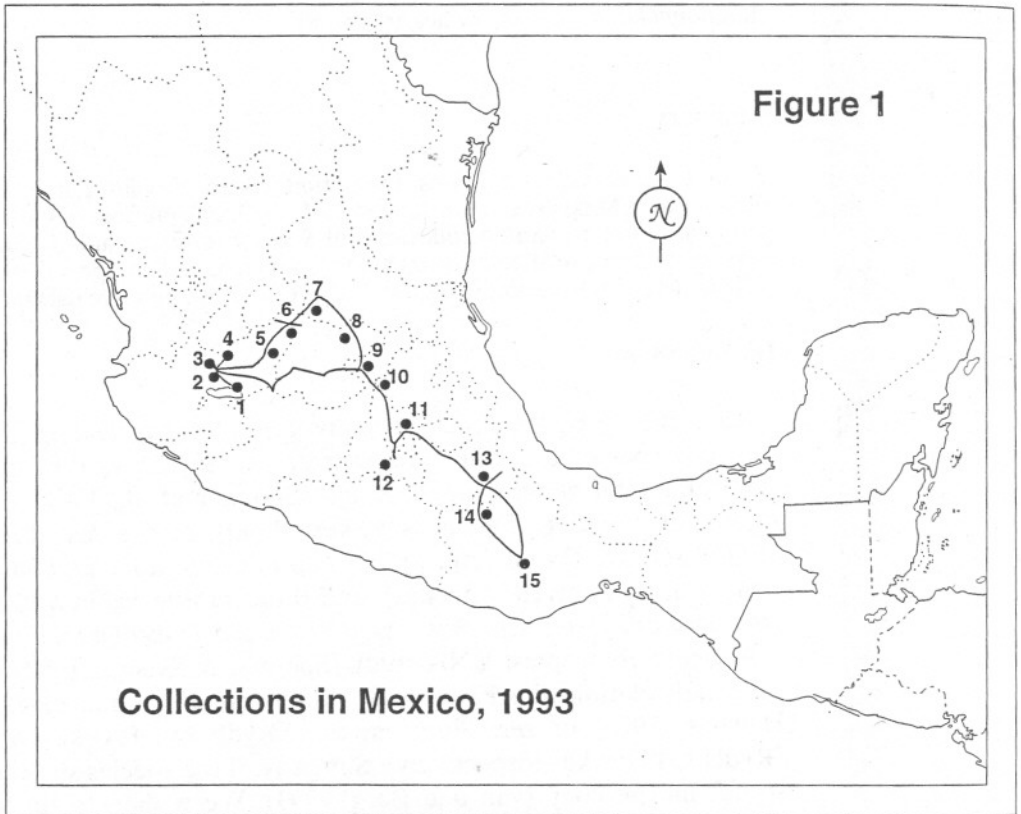


Fig. 1. Map of routes of the 1993 Mexico expedition. The numbers refer to generalized collecting sites (see Table 1).

Materials and methods

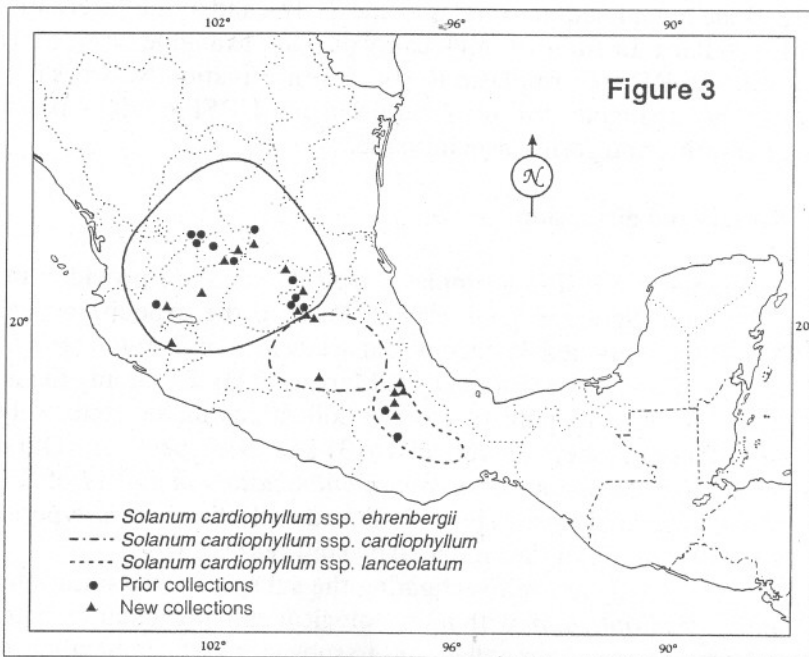
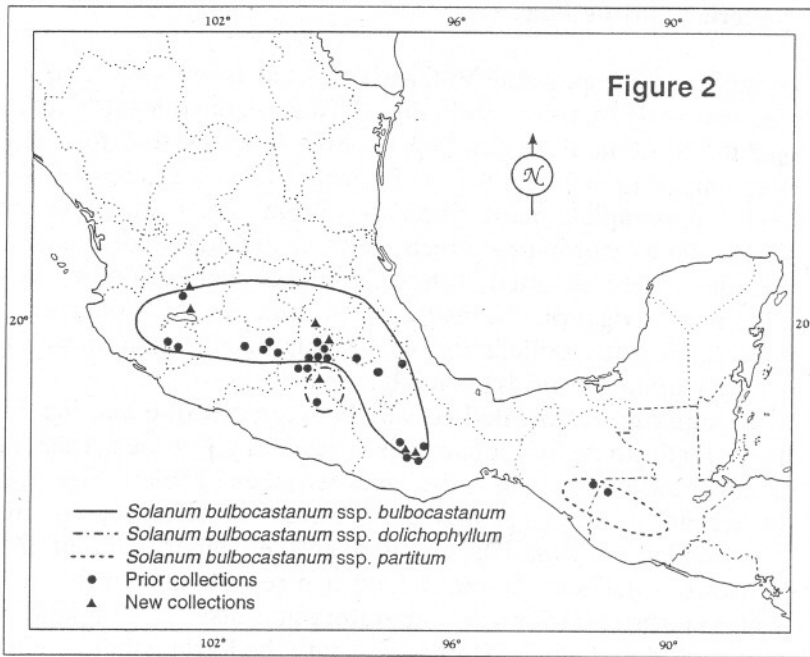
Rodríguez, Vargas, and Villegas collected from west central to southern Mexico between August 1–31, 1993 (Fig. 1). We obtained locality data from Correll (1962) and the National Research Support Project-6 (NRSP-6; formerly known as the Inter-Regional Potato Introduction Project, IR-1). We mapped localities on 1:250,000-scale topographic maps purchased from the Instituto Nacional de Estadística Geografía e Informática. Precise latitude and longitude data (to a precision of a 300 m radius) were obtained in the field by a Global Positioning System "Trans-Pak II™" (Trimble Navigation, Sunnydale, California, USA). Collections consisted of 19 true seed and 37 tuber collections (45 germplasm collections in total) of 9 species and two putative natural hybrids (Table 1).

Germplasm was divided equally between NRSP-6 and the Programa Nacional de Papa, Instituto de Investigaciones Forestales y Agropecuarias. Twenty-seven of these are of *S. bulbocastanum* and *S. cardiophyllum* (Table 1; Figs. 2, 3). We deposited sets of herbarium vouchers at the herbarium of NRSP-6, the Instituto de Botánica, Universidad de Guadalajara, and at the Department of Botany, University of Wisconsin-Madison. Detailed field trip reports are on file at NRSP-6, the United States Germplasm Services Laboratory in Beltsville, Maryland, and the International Board of Plant Genetic Resources (both the Latin America office in Cali, Colombia, and the main headquarters in Rome, Italy), and at the International Potato Center in Lima, Peru. In addition, all locality data are available on-line from the United States, USDA GRIN (Germplasm Resources Information Network) system. All collections will be available for distribution from NRSP-6 after passage through USDA quarantine and germplasm increase.

Results and discussion

Accounts of NRSP-6 germplasm from Mexico are provided in Bamberg & Martin (1993) and Spooner et al. (1991). Prior to the expedition described in this paper, NRSP-6 maintained 45 germplasm accessions of *S. bulbocastanum* and 28 accessions of *S. cardiophyllum* (Bamberg & Martin, 1993). Excluding the intraaccession hybrids made in the genebank to convert collections made exclusively as tubers into true seed, these numbers are reduced to 31 and 29, respectively. Our new collections add 9 germplasm accessions of *Solanum bulbocastanum* and 17 of *S. cardiophyllum*. They fill in geographic gaps (Figs. 2, 3) and collections from type localities (Table 2) of these two species as last mapped by Hawkes (1966).

We currently are reinvestigating the subspecies classification of *S. bulbocastanum* and *S. cardiophyllum* with morphological and molecular techniques. We will provide determinations of our collections to subspecies when our studies are completed.



Figs. 2, 3. Distributions of NRSP-6 germplasm holdings of *S. bulbocastanum* and *S. cardiophyllum*, mapped over the distribution of the subspecies (Hawkes, 1966). Some distribution points have more than one accession per area. We make no decision here regarding identity of collections to subspecies.

Table 2. Type localities of *Solanum bulbocastanum* Dunal and *S. cardiophyllum* Lindley, grouped under the synonymy of Hawkes (1990), indicating new collections made on the 1993 collecting expedition to Mexico.

Taxon	Type locality	Prior collections	New collections
<i>Solanum bulbocastanum</i> Dunal spp. <i>bulbocastanum</i>	Mexico ¹		
<i>S. bulbocastanum</i> var. <i>latifrons</i> Bitter	Mexico ¹		
<i>S. bulbocastanum</i> var. <i>glabrum</i> Correll	Mexico. Oaxaca: upper slopes of Cerro San Felipe	Yes	Yes
<i>S. bulbocastanum</i> ssp. <i>dolichophyllum</i> (Bitter) Hawkes	Mexico. Morelos: moist hillsides near Cuernavaca	No	Yes
<i>S. longistylum</i> Correll	Mexico. Morelos: El Parque	Yes	Yes
<i>S. bulbocastanum</i> ssp. <i>partitum</i> (Correll) Hawkes	Guatemala. Baja Verapaz	No	No
<i>S. cardiophyllum</i> Lindley ssp. <i>cardiophyllum</i>	Mexico ¹		
<i>S. cardiophyllum</i> var. <i>oligozygum</i> Bitter	Mexico ¹		
<i>S. cardiophyllum</i> var. <i>pliozygum</i> Bitter	Mexico. D.F.: Cerro de Guadalupe, Valley of Mexico	No	No
<i>S. coyoacanum</i> Bukasov ex Rybin	Mexico. D.F.: near Coyoacan	No	No
<i>S. cardiophyllum</i> ssp. <i>ehrenbergii</i> Bitter	Mexico		
<i>S. cardiophyllum</i> var. <i>ehrenbergii</i> Correll	Mexico. Queretato: near Queretaro	Yes	Yes
<i>S. cardiophyllum</i> ssp. <i>lanceolatum</i> (P. Berthault) Bitter	Mexico. Puebla: calcareous hill near Tehuacan*	No	Yes

¹Inspecific locality.

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Names are necessary to report factually and available data; however, the USDA neither guarantees nor warrants the standard of the product, and the use of the name by USDA implies no approval of the product to the exclusion of others that may also be suitable.

References

- Bamberg, J.B. & M.W. Martin, 1993. Inventory of tuber-bearing *Solanum* species: Catalog of potato germplasm - 1993. Potato Introduction Station, NRSP-6, Sturgeon Bay, Wisconsin. 104 pp.
- Berg, R.G. van den, 1993. Light sprout morphology of wild tuberiferous *Solanum* species. *Acta Botanica Neerlandica* 42: 37-49.
- Correll, D.S., 1962. The potato and its wild relatives. *Contributions from the Texas Research Foundation, Botanical Studies* 4: 606 pp.
- Hawkes, J.G., 1966. Modern taxonomic work on the *Solanum* species of Mexico and adjacent countries. *American Potato Journal* 43: 81-103.
- Hawkes, J.G., 1990. The potato: evolution, biodiversity and genetic resources. Belhaven Press, Oxford, England/Smithsonian Institution Press, Washington, D.C., 259 pp.
- Spooner, D.M., J. Bamberg, J.P. Hjerting & J. Gómez, 1991. Mexico, 1988 potato germplasm collecting expedition and utility of the Mexican potato species. *American Potato Journal* 68: 29-43.
- Spooner, D.M. & K.J. Sytsma, 1992. Reexamination of series relationships of Mexican and Central American wild potatoes (*Solanum* sect. *Petota*): evidence from chloroplast DNA restriction site variation. *Systematic Botany* 17: 432-448.