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Ecuador, 1991 potato germplasm collecting expedition: taxonomy and new germplasm resources

David M. Spooner,[1] Raúl Castillo T.[1,2] & Luis López J.[3]
[1] *Vegetable Crops Research Unit, Agricultural Research Service, USDA, Department of Horticulture, University of Wisconsin, 1575 Linden Drive, Madison, WI 53706, USA;* [2] *Departamento Nacional de Recursos Fitogenéticos, Instituto Nacional de Investigaciones Agropecuarias (INIAP), Estación Experimental Santa Catalina, Quito, Ecuador;* [3] *International Board for Plant Genetic Resources, Office for South America, c/o CIAT, Apt. Aereo 6713, Cali, Colombia*

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Summary

We conducted a joint Ecuador/Colombia/United States wild potato (*Solanum* sect. *Petota*) germplasm collecting expedition in Ecuador from April 13–July 1, 1991. The goals of the expedition were to collect germplasm and study the species boundaries of all of the 25 Ecuadorian taxa accepted by current taxonomists. We made 126 collections of 24 of these 25 taxa, 113 as germplasm samples, 13 only as herbarium collections. We synonymize six of these 25 names (*S. baezense* Ochoa, *S. cyanophyllum* Correll, *S. pichinchense* Bitter & Sodiro, *S. serratoris* Ochoa, *S. suffrutescens* Correll as synonyms of *S. andreanum* Baker; *S. correllii* Ochoa as a synonym of *S. regularifolium* Correll). Four other names (*S. chomatophilum* f. *angustifoliolum* Correll, *S. moscopanum* Hawkes, *S. solisii* Hawkes, *S. tundalomense* Ochoa) could not be consistently distinguished from *S. colombianum* Dunal in the field. We are currently investigating them to determine their species status.

Introduction

Solanum sect. *Petota*, the potato and its wild relatives, is a highly diverse group distributed from Nebraska to southern Chile. The latest taxonomic interpretation by Hawkes (1990) recognizes 232 species and 22 subspecies. Seven of these species are cultivated and the rest are wild. These taxa have tremendous proven and potential use to improve the disease resistances, environmental tolerances, and agronomic traits of the world's cultivars (Ross, 1986; Hanneman, 1989; Plaisted & Hoopes, 1989; Hawkes & Hjerting, 1989). Much effort has been placed into the world-wide collection, preservation, taxonomy, and evaluation of these taxa (Hawkes, 1990; Spooner & Bamberg, 1991).

Ecuador was targeted by the Technical Advisory Committee of the Inter-Regional Potato Introduction Project (IR-1) as a high priority area for collection because of its large number of wild potato taxa, combined with its low number of germplasm holdings. The goals of the expedition were to collect germplasm and study the species boundaries of all of the Ecuadorian taxa accepted by current taxonomists.

Materials and methods

We documented 25 taxa accepted for Ecuador by Correll (1962); modified by Ochoa (1963; 1981a, b, c, d; 1982, 1983, 1990), or Hawkes (1990). Prior to the expedition, we assembled locality data from Correll (1962), the original description literature, germplasm records, and inspection of herbarium vouchers at the Instituto de Ciencias Naturales, Universidad Central, Quito (Q); the Departamento de Biologia, Pontifica Universidad Católica del Ecuador, Quito (QCA); and the Museo Nacional de Ciencias Naturales, Quito (QCNE), the Inter-Regional Potato Introduction Project (here designated as PTIS), and the University of Wisconsin-Madison Department of Botany (WIS; herbarium vouchers follow Holmgren et al., 1990). We also obtained locality data from Carlos Ochoa (CIP) and Jack Hawkes (University of Birmingham, England). These species, and prior germplasm holdings at IR-1 are listed in Table 1.

We found localities with the following geographic references: Paynter & Traylor (1977); the 1:50,000 scale topographic maps from the Ecuador Instituto Geográfico Militar (anonymous, dates vary by map); the Ecuador Instituto Geográfico Militar 'Indice Toponimico de la República del Ecuador' (anonymous, undated), Tomo I (A-B), Tomo II (C), Tomo III (CH-D), Tomo IV (E-F), Tomo V (G-K), Tomo VI (L), Tomo VII (M-O), Tomo VIII (P-Q) (the others are not yet published); and United States Department of Interior, Gazetteer of Ecuador (anonymous, undated). Insofar as the locality data permitted, we visited the type localities of all taxa with type localities in Ecuador (*S. albornozii, S. baezense, S. burtonii, S. calacalinum, S. chilliasense, S. chomatophilum* f. *angustifoliolum, S. correllii, S. cyanophyllum, S. minutifoliolum, S. pichinchense, S. regularifolium,*

Table 1. Germplasm holdings at IR-1 prior to the 1991 expedition of the *Solanum* sect. *Petota* taxa accepted by Correll (1962); modified by Ochoa (1963; 1981a, b, c; 1982; 1983; 1990) or Hawkes (1990)

Taxon	Ecuadorian accessions	Total
Solanum albornozii Correll	1	1
S. andreanum Baker	0	2
S. baezense Ochoa	0	0
S. burtonii Ochoa	0	0
S. calacalinum Ochoa	0	0
S. chilliasense Ochoa	0	0
S. chomatophilum f. *angustifoliolum* Correll	0	0
S. colombianum Dunal	1	11
S. correllii Ochoa	0	0
S. cyanophyllum Correll	0	0
S. flahaultii Bitter	0	0
S. juglandifolium Dunal	0	1
S. minutifoliolum Correll	0	0
S. moscopanum Hawkes	1	6
S. ochranthum Dunal	2	4
S. paucijugum Bitter	0	0
S. phureja Juz. & Buk. (cultivated)	2	127
S. pichinchense Bitter & Sodiro	0	0
S. regularifolium Correll	0	0
S. serratoris Ochoa	0	0
S. solisii Hawkes	1	1
S. suffrutescens Correll	0	0
S. tuberosum ssp. *andigena* Hawkes (cultivated)	7	698
S. tundalomense Ochoa	5	5
S. tuquerrense Hawkes	1	2

S. serratoris, S. solisii, S. suffrutescens, S. tundalomense).

We collected on many passable roads throughout Ecuador by jeep, or in other areas on horseback or on foot. We located many new populations by asking the advice of local residents about sites of 'sacha papa' (wild potato), 'papa del monte' (potato growing among the bushes) or 'papa silvestre' (wild potato). We visited all Ecuadorian type localities to the precision of the locality data, using data from the 1 : 50,000 scale topographic maps available from the Instituto Geográfico Militar. We dried herbarium vouchers at QCA, and deposited sets of vouchers there, at the Departamento Nacional de Recursos Fitogenéticos, INIAP, Santa Catalina Station; the Inter-Regional Potato Introduction Station, Sturgeon Bay, Wisconsin (IR-1); the International Potato Center in Lima, Peru (CIP); QCA; US; and WIS. We extracted seed at INIAP. Detailed field trip reports are on file at INIAP, IR-1, the United States Germplasm Services Laboratory in Beltsville, Maryland, CIP (both the Quito, Ecuador office and La Molina, Peru office), and the International Board of Plant Genetic Resources (both the Latin America office in Cali, Colombia, and the main headquarters in Rome, Italy). In addition, all locality data are available on-line from the United States, USDA GRIN (Germplasm Resources Information Network) system.

Results and discussion

Taxonomy. We had many problems identifying our collections. Although Hawkes (1990) provides a recent taxonomic interpretation of *Solanum* sect. *Petota*, there remains continuing disagreement as to species boundaries and placement of species into series (Spooner & Sytsma, 1992). These problems have arisen from errors in the association of a type with the proper taxon, the use of type specimens lacking fruits for new species descriptions, or lack of documentation of intrapopulational variation within taxa (Spooner et al., in press). Figure 1, Table 2 provides our decisions as to synonymy (solid lines) and unresolved taxonomic questions (dotted lines) concerning the Ecuadorian taxa. This treatment is to be regarded as conservative in that future study may show additional species variability in the species we accept in this report. The discussion below follows the order listed in Table 2.

Non-tuber-bearing species. Hawkes (1989) designates *Solanum* subsection *Estolonifera* Hawkes to include species in *Solanum ser. Etuberosa* Juz. and ser. *Juglandifolia* (Rydb.) Hawkes. Subsection *Estolonifera* includes all non-tuber-bearing species, and Hawkes (1990) includes these, and the tuber-bearing species (subsection *Potatoe* [G. Don] D'Arcy), together in sect. *Petota* Dunal. Chloroplast DNA data (Spooner et al., 1990) suggests that subsection *Estolonifera* is paraphyletic, with ser. *Etuberosa* the sister taxon of subsection *Potatoe*, and species within ser. *Juglandifolia* as a sister taxon to *Lycopersicon*. As a result, we do not use subsection *Estolonifera* in Table 2. Child (1990) also treats taxa within ser. *Juglandifolia* (sensu Hawkes, 1990) outside of sect. *Petota*.

Solanum juglandifolium and *S. ochranthum* are very similar morphologically. Both are climbing vines that can reach 4 m or more in length and are easily found in the field because of their large size, bright masses of yellow flowers, and growth in open disturbed habitats along roads. Although they frequently are confused on herbarium sheets, they are easily distinguished in the field by the texture of the leaves (scabrous in *S. juglandifolium*, soft and tomentose in *S. ochranthum*) and size of the mature fruits (up to 3 cm in diameter in *S. juglandifolium*, up to 6 cm in diameter in *S. ochranthum*). Successful sexual crosses never have been made with the tuber-bearing species, but *S. lycopersicoides* Dunal, another member of ser. *Juglandifolia* (sensu Hawkes, 1990), has been crossed with *Lycopersicon* (Rick, 1988).

Tuber-bearing species. Although the Ecuadorian species have been placed into six separate series (Fig. 1), we make no series designations here because of the many unresolved issues as to affiliations of species to series (Spooner & Sytsma, 1992).

Solanum acaule. Our collection *5070* represents the first record of this species from Ecuador.

Table 2. Summary of collections of *Solanum* sect. *Petota* from the 1991 expedition to Ecuador, and germplasm holdings at IR-1

Species	Ecuadorian collections							Total at IR-1	
	Geographical areas[1]	Total[2]	Seeds	Tubers	Green-house	Herb Spec.	Elevations	Ecuador[3]	Total[4]
Non-tuber-bearing *species*[5]									
Solanum juglandifolium	1,8,10,17,18(2), 20,27,30,44(2)	11	11			11	1750–2740	11	12
S. ochranthum	2,5(2),8,11,12, 41(2),42	9	9			9	2400–3000	10	12
Tuber-bearing *species*[6]									
S. acaule	32	1	1			1	3750	1	344
S. albornozii	42(3),43	4	4			4	2350–2750	5	5
S. andreanum[7]	3(2),8(2),15(2),16, 17,24(7),30(4),31	22	13	5	1	15	1950–3140	18	20
S. burtonii	28	1		1		1	3000	1	1
S. chilliasense	40(2)	2	2			2	3200–3275	2	2
S. colombianum[8]	5,7(3),9,11,14(3), 20(2),23(3),27(2), 29(2),33,35(4), 36(4),38(3),39(4),40,41	35	24	5	3	33	2720–3720	33	43
S. paucijugum[9]	19(7),25,26(2), 28,29(4),35	16	9	1	2	15	3350–3770	15	15
S. minutifoliolum	23(3)	3	2			3	2470–2970	2	2
S. phureja	1,37	2		2			3260	4	127
S. regularifolium[10]	34	1	1			1	2950–3000	1	1
S. tuberosum ssp. *andigena*	37	1		1			2700	8	699
S. tuquerrense	1(3),2,4(3),5,6(2), 11(4),13,14,19	17	8	5		16	3230–4000	14	16
'unidentified'[11]	12,26	2		2				2	

[1] Refers to map locations.

[2] Designates total number of 1991 Ecuador collections. Seeds were the preferred germplasm source, followed by tubers and lastly living plants or in-vitro stocks currently maintained at INIAP (Santa Catalina Station).

[3] Includes germplasm collections from this trip and previous IR-1 accessions from Ecuador.

[4] Includes IR-1 accessions from all countries.

[5] Hawkes (1990) designates *Solanum* subsection *Estolonifera* Hawkes (non-tuber-bearing species) and subsection *Potatoe* G. Don (tuber-bearing species). Spooner et al. (1990) indicate that subsection *Estolonifera* is paraphyletic and this taxon is therefore not used here.

[6] Because of the confusion over series designations, species are not designated as to series.

[7] Included here are *S. baezense, S. cyanophyllum, S. pichinchense, S. serratoris,* and *S. suffrutescens.*

[8] Provisionally included here are: *Solanum chomatophilum* f. *angustifolium*, all the varieties of *S. colombianum, S. moscopanum*, and *S. solisii.* These may be good species, but we currently are unable to reliably distinguish all of these taxa.

[9] Included are accessions that may later prove to be *S. flahaultii.*

[10] Includes *S. correllii.*

[11] Only tubers were located.

Hypotheses of Species Boundaries and Series Relationships of the Equadorian Species of *Solanum* sect. *Petota*

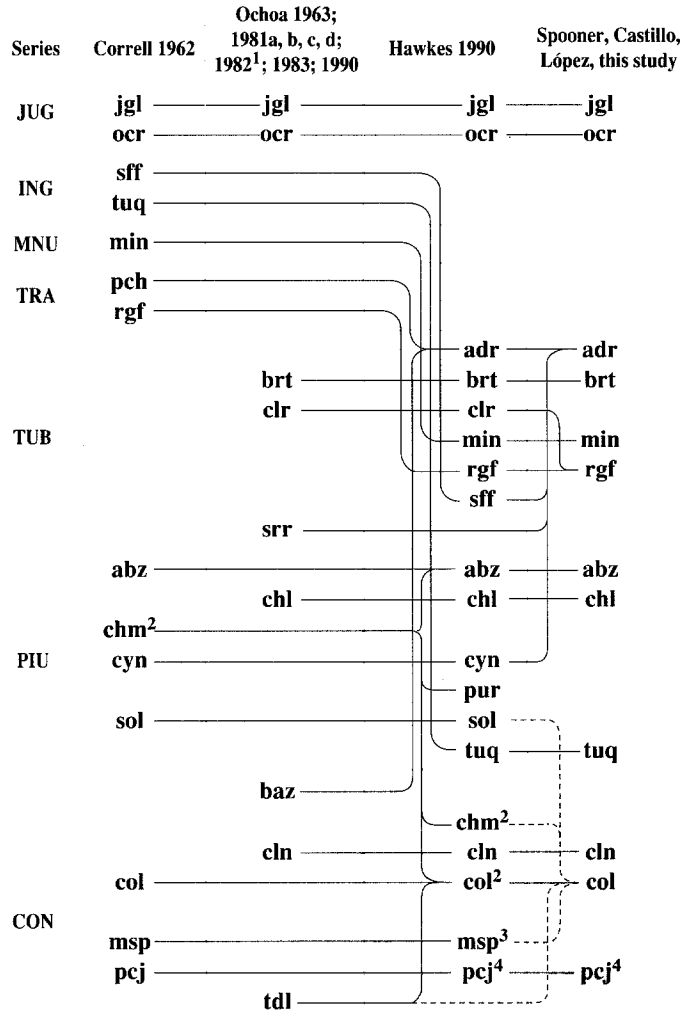

Fig. 1. Chronological history of the hypotheses of species boundaries and series relationships in the Ecuadorian wild taxa of *Solanum sect. Petota* by Correll (1962), Ochoa (1963; 1981a, b, c, d; 1982; 1983; 1990), Hawkes (1990), and this study. Solid lines in the last column represent our designations of synonymy. Dotted lines indicate our current inability to distinguish individual taxa that may, with later study, prove to be good species. Hawkes (1990) considers *S. chomatophilum* (chm) and *S. piurae* (pur) to be restricted to Perú but we include the species here to trace synonymy. Abbreviations of series (CAPS) and species (lower case) follows Hawkes (1990) or Huamán and Ross (1986) or Simmonds (1963) if not included there: abz *Solanum albornozii* Correll, adr *S. andreanum* Baker, baz *S. baezense* Ochoa, brt *S. burtonii* Ochoa, chl *S. chilliasense* Ochoa, chm *S. chomatophilum* Bitter, cln *S. calacalinum* Ochoa, col *S. colombianum* Dunal, crl *S. correllii* Ochoa, cyn *S. cyanophyllum* Correll, flh *S. flahaultii* Bitter, ING *Solanum* ser. *Ingifolia* Ochoa, jgl *S. juglandifolium* Dunal, JUG ser. *Juglandifolia* (Rydb.) Hawkes, min *S. minutifoliolum* Correll, MNU ser. *Minutifoliola* Correll, msp *S. moscopanum* Hawkes, ocr *S. ochranthum* Dunal, pcj *S. paucijugum* Bitter, pch *S. pichinchense* Bitter, pur *S. piurae* Bitter, rgf *S. regularifolium* Correll, sff *S. suffrutescens* Correll, sol *S. solisii* Hawkes, srr *S. serratoris* Ochoa, tdl *S. tundalomense* Ochoa, TRA ser. *Transaequatorialia* Buk., TUB ser. *Tuberosa* (Rydb.) Hawkes, tuq *S. tuquerrense* Hawkes.

[1] Ochoa (1982) also here accepts *S. albornozii, S. cyanophyllum, S. minutifoliolum, S. paucijugum, S. pichinchense, S. regularifolium, S. solisii*, and *S. suffrutescens* for Ecuador but does not provide series designations and they are not included in this table. [2] Correll (1962) divides *S. chomatophilum* into three forms: *S. chomatophilum* f. *chomatophilum* (as an autonym) distributed in Ecuador and Perú, f. *angustifoliolum* distributed in Ecuador and Perú, and f. *pilosum* distributed in Colombia and Perú. Hawkes (1990) partitions the subspecies of *S. chomatophilum* into four species placed into two series (Fig. 1). His synonymy of f. *angustifoliolum* under both *S. albornozii* and *S. colombianum* is invalid and effectively synonymizes these two species he accepts. [3] Neither Correll (1962), Ochoa (1982), nor Hawkes (1990) list *S. moscopanum* for Ecuador, but it is included here because of our current inability to distinguish it from *S. colombianum* and because it is listed for Ecuador by Hanneman and Bamberg (1986; *Ochoa 2104,* Ochoa provided no locality beyond Ecuador). [4] Hawkes (1990) suggests that *S. flahaultii* Bitter may be synonymous with *S. paucijugum.*

Hawkes (1990) divides *S. acaule* into three subspecies: ssp. *acaule* (4x, distributed from southern Peru to northern Argentina), ssp. *punae* (Juz.) Hawkes & Hjert. (4x, distributed from central Peru to northern Argentina), and ssp. *aemulans* (Bitter & Wittm.) Hawkes & Hjert. (4x, confined to northern Argentina). Brücher (1959), Correll (1962), and Ochoa (1990) combine *S. acaule* ssp. acaule and ssp. *punae*, a decision supported by evidence from single-copy nuclear DNA (Hosaka & Spooner, in press). Although we make no taxonomic judgement here regarding the validity of these latter two subspecies, our collection combines the characters of flat rosettes (ssp. *punae*) and short hairs (ssp. *acaule*) that Hawkes (1990) uses to separate these subspecies. This record is more than 1000 km (by air) north of the known range of *S. acaule* in central Peru.

Solanum albornozii. The narrow leaves and ovoid fruits make this a distinctive species within Ecuador. All collections to date are from areas just west of the town of Loja.

Solanum andreanum. We discovered extensive synonymy in this species. We synonymize the following under *S. andreanum*: *S. pichinchense* Bitter & Sodiro, *S. cyanophyllum* Correll, *S. suffrutescens* Correll, *S. baezense* Ochoa, and *S. serratoris* Ochoa. Correll (1962) Ochoa (1981d, 1983, 1990) or Hawkes (1990) classified these taxa into five separate series: ser. *Conicibaccata, Ingifolia, Piurana, Transaequatorialia*, and *Tuberosa*. We present a fuller discussion of this synonymy elsewhere (Spooner et al., in press).

Solanum burtonii. We found *S. burtonii* (*5086*) on the southern slopes of Volcán Tungurahua, south of Baños, at or near the type locality. The locality data, 'Montes de Nahuasú, between Monte Negro and Salado' uses local place names, not present on any maps or gazetteers available to us. The rugose leaves and large yellow tubers of this species give it an overall appearance similar to the cultivated diploid species, *S. phureja*. We make no taxonomic conclusions about the relationships of *S. burtonii* to *S. phureja*, but point to the fact that Hawkes (1990) makes analogous conclusions with respect to other species by including *S. hygrothermicum* Ochoa and *S. estradae* L. López as subspecies of *S. phureja*. Local residents at the collection area said that this species is locally common in the area, and occasionally is collected for food, but when they accompanied us to look for this species, it was very rare. We found round but immature fruits on our collection on May 17. The species could not be found on our revisit to the site on June 14.

Solanum calacalinum. This was the only species we could not locate on this trip. The type locality, 'Cerro La Sirena, various km north of Calacalí' is ambiguous, but C.M. Ochoa (by letter) said that the type was collected on the path from Calacalí to Mount Tablón, and at Sillacunga and at La Rinconada at Tilingón. 'Cerro La Sirena', 'Mt. Tablón', 'Sillacunga', 'La Rinconada', and 'Hacienda Tilingón' are not on our locality references, but are all local place names in the area of Calacalí, north of Quito.

Solanum chilliasense. We made two collections (*5057, 5058*) at or near the type locality. The enlarged terminal leaflet and ovoid fruits of this species distinguish it from any other species we have seen in Ecuador.

Solanum colombianum. We currently are unable to distinguish consistently the following taxa: *S. chomatophilum* f. *angustifoliolum* and f. *chomatophilum, S. colombianum, S. moscopanum, S. solisii*, and *S. tundalomense*. Correll (1962) recognizes three forms for *S. chomatophilum*: f. *chomatophilum*, distributed in Ecuador and Peru (type locality in Peru), f. *angustifoliolum*, distributed in Ecuador and Peru (type locality in Ecuador), and f. *pilosum* distributed in Colombia and Peru (type locality in Peru). Correll (1962) distinguishes these forms by differences of leaflet width and overall pubescence of the plant. Hawkes (1990) partitions these three forms into four species and two series: f. *chomatophilum* into *S. chomatophilum*, restricted to Peru (ser. *Conicibaccata*), f. *angustifoliolum* into *S. colombianum* (ser. *Conicibaccata*) and into *S. albornozii* (ser. *Piurana*), and f. *pilosum* into *S. piurae* (ser. *Piurana*; see Fig. 1).

Correll (1962) recognizes four varieties of *S. colombianum*: var. *colombianum*, occurring in Venezuela, Colombia, and Ecuador (type locality in Colombia), var. *meridionale* Hawkes, occurring in

Venezuela and Ecuador (type locality in Ecuador), var. *trianae* Bitter, occurring in Venezuela and Colombia (type locality in Colombia), and var. *zipaquiranum* Hawkes occurring in Colombia. He distinguished them by characters of presence/absence of interstitial leaflets, length of lateral leaflet petioles, lateral leaflet decurrency, leaf size, and corolla color. Hawkes (1990) synonymizes all four varieties under *S. colombianum*.

Correll (1962), Ochoa (1981d), and Hawkes (1990) recognize *S. moscopanum*. Hanneman & Bamberg (1986) include one accession of *S. moscopanum* from Ecuador (*Ochoa 2104*). Correll (1962) and Hawkes (1990) distinguish *S. moscopanum* from *S. colombianum* by corolla color and shape; pubescence of calyx, corolla, and filaments; and ploidy level (4x in *S. colombianum*, 6x in *S. moscopanum*). We currently are unable to distinguish *S. colombianum* from *S. moscopanum* by the morphological characters mentioned in the literature, and therefore do not identify any collections as *S. moscopanum* in this report.

Correll (1962), Ochoa (1982), and Hawkes (1990) recognize *S. solisii,* distinguished by Correll (1962) or Hawkes (1990) by shiny, one-two-jugate leaves; a 15-lobed, pleated corolla; and round to ovate fruits (although the type and all subsequent collections lack fruits).

We collected at or near the type localities of *S. chomatophilum* f. *angustifoliolum* (*5053*), *S. colombianum* var. *meridionale* and *S. solisii*, with type localities near each other (*5062, 5063*), and a syntype locality of *S. tundalomense* in Cotopaxi Province (*5089, 5090*; see Ochoa, 1963). These collections, and many other collections of *S. colombianum,* have much intrapopulational variation in plant height; leaf size, shape, pubescence, and shininess; and corolla color, size and shape. Collections *5062* and *5063* are the same population, differing only by corolla color (white vs. blue) and grew at or near the type localities of *S. colombianum* var. *meridionale* and *S. solisii*. Different plants within this one population are highly variable in leaf shape (two-jugate with an enlarged terminal leaflet and no interjected leaflets to four-jugate with many interjected leaflets), corolla color (white, blue), and corolla shape (rotate-pentagonal to rotate with interpetalar ridges giving the corolla a 15-lobed appearance. These variants appear to cover the range of morphological characters distinguishing *S. colombianum* from *S. solisii*.

Until we complete further studies on these collections, we will tentatively group all of them under *S. colombianum*. We will investigate chloroplast and nuclear DNA similarities and differences, intra- and interpopulational patterns of variation, the association of these with ecological or geographical factors, document mature fruit shape, and the association of ploidy level with morphological traits.

Solanum paucijugum. Correll (1962), Ochoa (1981d), and Hawkes (1990) recognize *S. paucijugum* as distinct from *S. flahaultii*. They use the following combination of features to distinguish *S. paucijugum* from *S. flahualtii*: 1. leaves short-pilose adaxially/leaves long-pilose adaxially, 2. 3–7 leaflet pairs/5–7 leaflet pairs, 3. interstitial leaflets common/interstitial leaflets rare, 4. pedicels articulate near the middle/pedicels articulate near the calyx, 5. corolla lobes large, acumens large/corolla lobes flat, acumens small, 6. distribution in Ecuador/ distribution in Venezuela, Colombia and Ecuador. Hawkes (1990) suggests that *S. paucijugum* and *S. flahaultii* Bitter may be synonymous, but Ochoa (1981d) accepts both as species. Our collections exhibited much intra-populational variation in the above traits, and we tentatively group all under *S. paucijugum* at this time.

Solanum minutifoliolum. This is one of the most distinctive potato species in Ecuador and unlikely to be confused with any other. Our three collections are all in the region of the type collection, and the species apparently is restricted in its distribution. Hawkes's (1990) listing of the elevation of the species as 1200–1500 m is in error. The lowest record of this species (Correll, 1962 – 'South of Baños, 1500 m, *Y. Mexia 6997*') lists an elevation that is too low, because Baños is at 1900 m and areas to the south ascend Mt. Tungurahua. Our collections (Table 2) and those of previous collections (Correll, 1962) document an elevational range of 2470–2970 m.

Solanum regularifolium/S. correllii. Correll's (1961) description of *S. regularifolium* lacks elevational data. His listing of the type in Correll (1962)

also lacks elevational data, unlike all of the other collections he made on his expedition to Ecuador in 1950 (see Correll, 1962, p. 574, list of Ecuador itineraries), although he lists 2150 m for *S. regularifolium* in the text. The type locality data indicates that this species was collected near a river just south of Guasuntos. Guasuntos is at 2530 m, and Rio Guasuntos just south of this town is at 2500 m, higher than the 2150 m listed in Correll (1962). This area is extremely dry and eroded, but C.M. Ochoa (pers. comm.) says he has collected this species there but it is now extirpated.

Ochoa (1981b) described *S. correllii* from an area about 22 km (by air) southwest of Guasuntos along Rio Angas. Our collections at the type locality of *S. correllii* shows a range of leaf morphology from leaves with or without interjected leaflets, and corolla colors ranging from white to lilac. No significant pubescence characters distinguish *S. correllii* from *S. regularifoliolum*. The fruits are round to oval. These features are very similar to *S. andreanum*, but we maintain the species as separate at this time because *S. regularifolium* begins to fruit in late June, later that *S. andreanum*. Ochoa (1981b) did not mention *andreanum* or *S. regularifolium* in his description of *S. correllii*. Our formal synonymy follows:

Solanum regularifolium Correll, Wrightia 2: 194. 1961. – TYPE: ECUADOR. Chimborazo: on brushy slope near river, just south of Guasuntos, 13 Mar 1958, *D.S. Correll & G. Albornoz P. E335* (holotype: LL!; isotypes S, US!).

Solanum correllii Ochoa, Amer. Potato J. 58: 223. 1981. – TYPE: ECUADOR. Chimborazo: near the Angas River, 2700 m, Jun 1979, *C.M. Ochoa 13369* (holotype: private herbarium of C.M. Ochoa; isotype: herbarium of the International Potato Center, Lima, Peru, SI, US!).

Additional specimen examined: ECUADOR. Chimborazo-Cañar border: along both sides of lower and upper banks of Río Angas, and along slopes of Quebrada Angas along feeder streams into this river, beginning about 500 m E of railroad tracks in Quebrada Angas and running for 500 m E, 2°23' S, 78°57'W, 2950–3000 m, 10 May 1991, *D.M. Spooner, R. Castillo & L. López 5067* (herbaria of the Ecuador National Plant Genetic Resources Program, INIAP, Santa Catalina Station; the Inter-Regional Potato Introduction Station, Sturgeon Bay, Wisconsin; The International Potato Center, Lima, Peru; US; WIS).

Solanum tuquerrense. All of our collections were made above 3200 m in northern Ecuador. The species is unlikely to be confused with any other in Ecuador.

Cultivated species. We collected two specimens of *S. phureja* and one specimen of *S. tuberosum* ssp. *tuberosum*. Our collection of *S. tuberosum* from Cañar Province (*5051*) was from a cornfield where it has been a persistent weed for more than 50 years.

New Germplasm Resources. This expedition resulted in 126 collections of all Ecuadorian taxa except *S. calacalinum*. One-hundred thirteen of these are germplasm collections and 13 are represented only by herbarium vouchers (Table 2). Eighty-four of the germplasm collections were as [true] seed, 23 as tubers, and six as living plants or in vitro stocks maintained at INIAP.

The expedition collected from northern Carchi Province near the border with Colombia (0°44'N), south to central Loja Province (4°00'S), at elevations ranging from 1750–4000 m (Fig. 2, Table 2). This expedition produced the first available germplasm collections of *S. burtonii, S. chilliasense, S. minutifoliolum, S. paucijugum,* and *S. regularifolium*, and possibly the tentative taxa (see taxonomy) here grouped under *S. colombianum* (*S. chomatophilum* f. *angustifoliolum, S. solisii*). We collected the first available Ecuadorian accessions of *S. acaule* and *S. andreanum*. Except the living plants at INIAP, we divided the germplasm equally between Ecuador and the United States. The germplasm will be increased and distributed at IR-1 after passage through United States quarantine. Expected dates of germplasm availability from IR-1 are late in 1993 for the germplasm collected as seed, and late in 1994 for the tuber collections. The tuber collections take longer to prepare for distribution because of the longer time needed for disease screening in United States quarantine and the long-

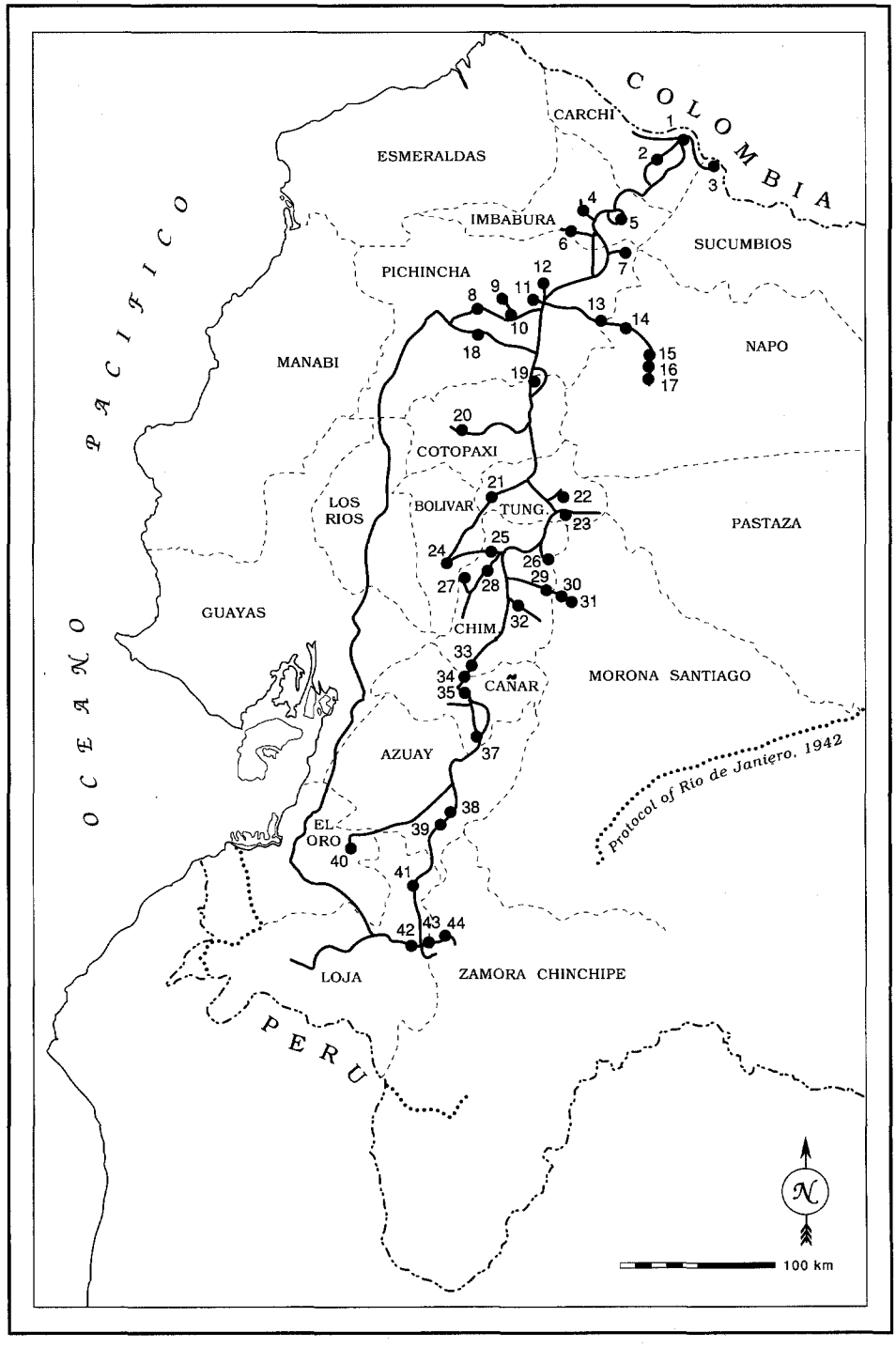

Fig. 2. Routes of the 1991 Ecuador expedition. The numbers refer to generalized collection sites (see Table 2).

er time needed at IR-1 to convert the tubers to true seed. Because we collected some tubers while young, it is possible that some may not survive. INIAP is maintaining some collections made exclusively as tubers or shoot tips as greenhouse plants or in vitro stocks, and is attempting to convert them to true seed or tuber stocks.

Ideas for future collecting in Ecuador. The focus of this expedition was to collect taxa for which no known germplasm existed in any genebank. Because of this, we concentrated on areas with known localities, and had to pass up many promising sites. Also, more extensive collecting could be done in some sites that we visited on this trip. Following is a list of promising areas for future collecting based on our preliminary visits or examination of topographic maps. *Azuay:* 1. Cajas Reserve, 2. Girón-San Fernando Rd., 3. mountains southwest of Cuenca on road to Girón. *Azuay/Morona Santiago:* 1. road from Gualaceo-Macas (*Solanum paucijugum*). *Cañar:* 1. road from Zhud-Cañar (*S. solisii*), 2. road from Azoguez-Rivera (*S. solisii*). *Carchi/Sucumbios:* 1. old road from Julio Andrade to La Bonita. *Chimborazo:* 1. Parque Nacional Sangay, along the old closed road beginning near the park headquarters, west of Pungalá, east to La Esperanza. Horses are required here, and the trip would take at least two days each way. We found *S. paucijugum* at the western entrance to the park, but visited too early for fruits. *Solanum andreanum* may occur on the eastern slopes of the mountains. *El Oro:* 1. mountains above Chilla. *Loja:* 1. Parque Nacional Podocarpus, 2. areas about Celica (we were told that wild potatoes grew there, and there are no records from this area), 3. uplands east of Amaluza, 4. areas near Saraguro. *Loja/Zamora Chinchipe:* 1. road from Loja-Zamora. *Napo:* 1. Cordillera de los Huacamayos (*S. andreanum*). *Pinchinca:* 1. areas about Calacalí, Tanlahua, and Volcán Reventador (collecting in February-April to look for *S. calacalinum*). *Cotopaxi:* 1. Cordillera Los Llanganates (*S. andreanum*).

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