

REPORT OF EXPEDITION
TO COLLECT WILD SPECIES OF POTATO
IN COSTA RICA

November 25- December 23, 1996

Collectors and Authors of Report:

David M. Spooner
USDA, ARS
Department of Horticulture
University of Wisconsin-Madison
1575 Linden Drive
Madison, WI, 53706, USA
Tel: (1) 608-262-0159; FAX: (1) 608-262-4743
email: dspooner@facstaff.wisc.edu

Roel Hoekstra
Centre for Plant Breeding and Reproduction Research
(CPRO-DLO)
Centre for Genetic Resources The Netherlands (CGN)
Droevendaalsesteeg 1, P.O. Box 16, 6700 AA Wageningen
The Netherlands
Tel: (31) 317-477077; FAX: (31) 317-418094
email: r.hoekstra@cpo.dlo.nl

Braulio Vilchez
Departamento de Biología
Instituto Tecnológico de Costa Rica
P.O. Box 159-7050
Cartago, Costa Rica
Tel: (506) 551-5333; FAX: (506) 551-5348

Funding provided by the United States Department of Agriculture, Agricultural Research Service, and the Centre for Genetic Resources The Netherlands of the Centre for Plant Breeding and Reproduction Research (CPRO-DLO/CGN).

Seed collections from the expedition sent to: CGN (CPRO-DLO) and the United States National Research Support Project-6 (NRSP-6). Because there is no public genetic resources system to store and increase seeds of wild crop relatives in Costa Rica, none were left there, but seeds will be made freely available upon request to all parties after passage through quarantine and seed increase. Herbarium specimens deposited at the Herbario Nacional, Museo Nacional de Costa Rica (CR), the herbarium of the Instituto Nacional de Biodiversidad (INB), the Herbarium of NRSP-6 (PTIS), and at the Department of Plant Taxonomy, Wageningen Agricultural University (WAG). This report was mailed to those individuals listed in Appendix 7 on page 40 on June 23, 1997.

TABLE OF CONTENTS

| | |
|---|----|
| Cover..... | 1 |
| Table of contents..... | 2 |
| Acknowledgments..... | 3 |
| Summary..... | 3 |
| Purpose of this expedition..... | 3 |
| Trip planning..... | 4 |
| Obtaining permission to collect..... | 4 |
| Gathering the locality data..... | 4 |
| Mapping the locality data..... | 4 |
| Conducting the expedition..... | 4 |
| Figure 1. Route of the 1996 expedition and distribution of Costa Rican wild potatoes..... | 5 |
| Taxonomy of Costa Rican wild potatoes..... | 6 |
| Figure 2. Comparison of taxonomic treatments of Correll (1962) and Hawkes (1990)..... | 7 |
| Figure 3. Distribution of the Mexican and Central American species of <i>Solanum</i> sect. <i>Petota</i> | 8 |
| Table 1. Distribution of Costa Rican wild potato species gathered before the expedition..... | 9 |
| Table 2. List of new collections..... | 17 |
| Daily itinerary..... | 21 |
| References..... | 34 |
| Appendices: | |
| Appendix 1. Letter from Msc. Silvia Alverenga and B.B. Sonia Hernandez to Spooner..... | 35 |
| Appendix 2. General collecting permit for collecting on protected areas in Costa Rica..... | 36 |
| Appendix 3. INBio export permit application..... | 37 |
| Appendix 4. Export permit..... | 38 |
| Appendix 5. Monteverde Cloud Forest Reserve Research form..... | 39 |
| Appendix 6. Map of Monteverde Cloud Forest Reserve, with site of <i>S. longiconicum</i> | 40 |
| Appendix 7. Distribution of this report..... | 41 |

ACKNOWLEDGMENTS

We thank Ing. Walter Quirós of the Comisión de Recursos Fitogenéticos for permission to collect in Costa Rica; Carlos Mario Rodríguez Solís, Nelson Zamora and Quirico Jiménez Madrigal of INBio for help in obtaining collecting and export permits, use of facilities to dry and deposit herbarium specimens, and help in providing release time of INBio taxonomists to help collect in the field; José González and Renaldo Aguillar (INBio) for help in collecting; Luis Rojas Badilla, park guard of the Reserva Biosfera La Amistad, Estacion Altamira, for use of facilities to collect; German Cruz Villanueva, Reserva Biológica Dúrika, for use of facilities to collect and field help; Robert Carlson, Biológica Bosque Nuboso Monteverde for permission to explore there; Henry Shands and Karen Williams of the USDA, Agricultural Research Service, and Jaap Hardon of the Center for Genetic Resources, The Netherlands, for collecting funds; Alan Stoner of the USDA, Agricultural Research Service, for importing herbarium and germplasm collections into the United States; and John Bamberg, USDA, Agricultural Research Service (NRSP-6), for increasing germplasm after passage through United States quarantine.

SUMMARY

We conducted a collaborative Costa Rica and The Netherlands and United States wild potato (*Solanum* sect. *Petota*) germplasm collecting expedition in Costa Rica from November 24 to December 23, 1996. The goals of the expedition were to collect wild potato germplasm and gather field data for taxonomic studies of the group. We made collections at 13 sites, 10 of these with mature fruits. Later germplasm collections by our collaborators are planned to collect mature fruits at the three sites without them, and at a 14th new site. These collections considerably extend the numbers and geographic range of the germplasm available from Costa Rica, previously known from two sites. We provide a complete list of localities of sect. *Petota* in Costa Rica and map them, distinguishing those sites represented by germplasm accessions. We provide comments on the taxonomy of wild potatoes in Costa Rica and recommend areas for future collecting. The identity of wild potatoes in Costa Rica is unresolved, and various authors have suggested that they be identified as *S. longiconicum*, *S. oxycarpum*, and *S. woodsonii*. Until we can help resolve this problem with study of our new collections, we tentatively identify all Costa Rican collections as *S. longiconicum*, the latest accepted name for wild potatoes for Costa Rica (Hawkes, 1990).

PURPOSE OF THIS EXPEDITION

Costa Rica had only two germplasm collections of wild potatoes available worldwide, and there are unresolved taxonomic problems there. This country, therefore, formed a priority for collecting by the Centre for Genetic Resources The Netherlands (CGN) and the National Research Support Program-6, United States (NRSP-6). This report details the results of a collaborative germplasm collecting expedition in Costa Rica by these genebanks, and the Instituto Tecnológico de Costa Rica, from November 24 to December 23, 1996. The goals of the expedition were to collect wild species germplasm, to increase them quickly and make them freely available internationally, and to gather data to help resolve the taxonomic problems of these collections.

TRIP PLANNING

Obtaining Permission to Collect

This expedition was initiated by letters to the Instituto Nacional de Biodiversidad (INBio) and the Comisión de Recursos Fitogenéticos. We were directed by Ing. Walter Quirós, Comisión de Recursos Fitogenéticos, to collaborate with Silvia Alvanenga, Instituto Tecnológico de Costa Rica, who indicated that Braulio Vilchez of that institution would be our collaborator in the field (Appendix 1). We obtained a general collecting permit, needed for collecting in National Protected areas (Appendices 2, 3) and an export permit (Appendix 4) with the help of personnel at INBio. We obtained a separate permit (Appendix 5) to collect on the privately owned Monteverde Cloud Forest Reserve.

Gathering the locality data

Prior to the expedition, we compiled locality data from: 1) database files backing up germplasm records from CGN (Hoekstra, 1996) and NRSP-6 (Bamberg et al., 1996); 2) literature records from Correll (1962), who obtained these from herbarium material in F, G, GH, K, LL, MICH, MSC, NY, S, US, Z; and 3) our own inspection of CR, F, INB, PTIS, USJ, WAG, WIS. A summary of these records is listed in Table 1. Herbarium codes follow Holmgren et al., 1990 [8th ed.]; INB and PTIS will appear in the 9th edition.

Mapping the locality data

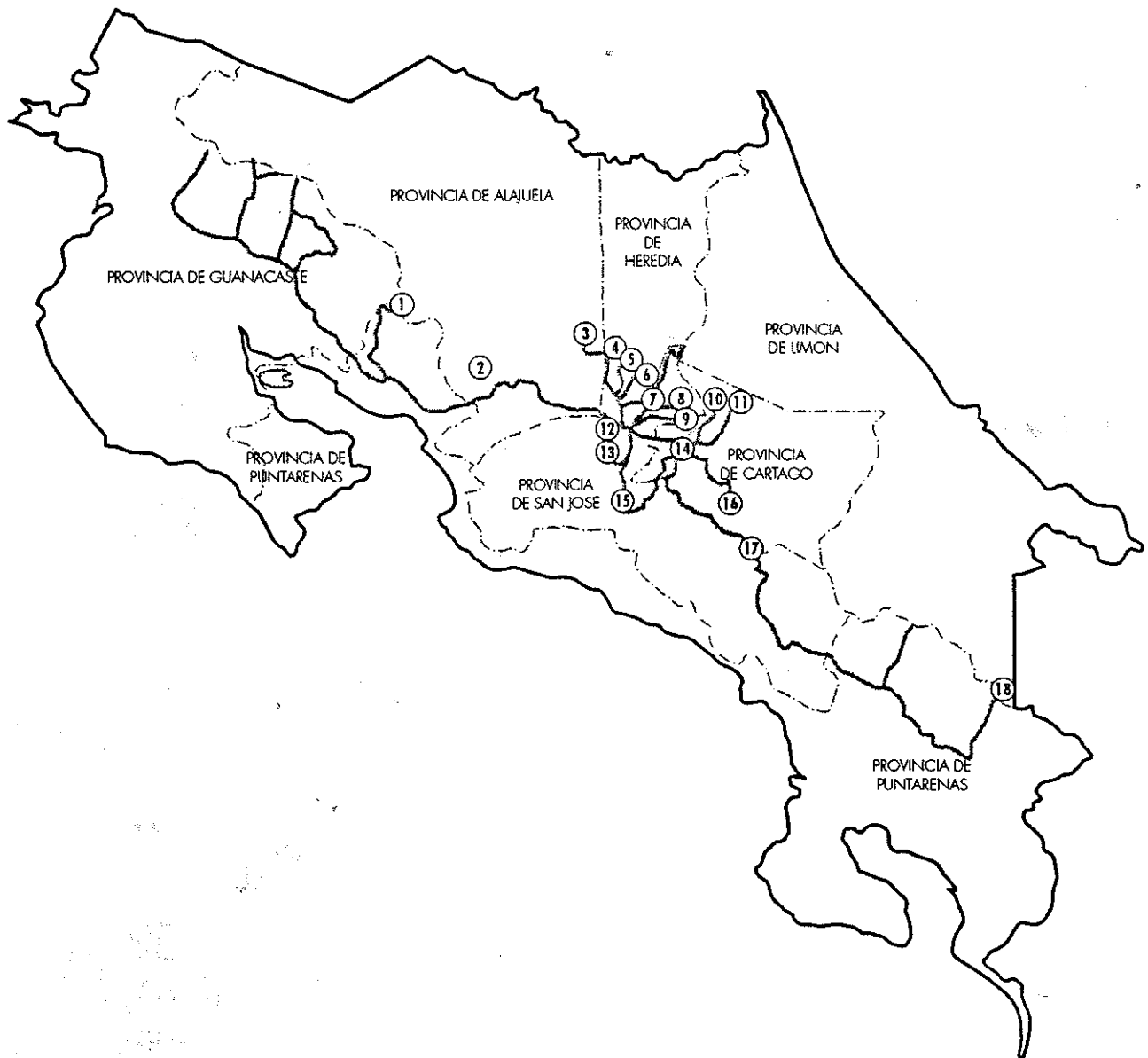
Geographic references were found with the aid of 1) Gazetteer of Costa Rica published on the internet by the Missouri Botanical Gardens (<http://www.mobot.org/MOBOT/Research/gazette2.html>); 2) Tribunal Supremo de Elecciones (1993), 3) United States Department of the Interior (1986), 4) the 1:50,000-scale topographic maps (137 sheets), and the 1:200,000-scale topographic maps (13 sheets) from the Instituto Geográfico Nacional, Costa Rica; 5) Chinchilla (1987). These geographic resources, and comparable resources from recent expeditions to Mexico, Guatemala, Venezuela, Colombia, Ecuador, Bolivia, Argentina, and Chile, are a growing and valuable component to the PTIS library (Bamberg and Spooner, 1994).

Conducting the expedition

We rented a jeep for the entire expedition, needed for many of the unpaved roads in Costa Rica. Local residents provided advice on the location of some populations. Longitude and latitude data were obtained by a global positioning system. We dried herbarium vouchers at INBio, and herbarium vouchers were deposited at CR, INB, PTIS, and WAG. A map of our entire route is presented in Fig. 1. New collections are listed in Table 2, and are mapped, with the old collections, on Fig. 1. Because there is no public genetic resources system to store and increase seeds of wild crop relatives in Costa Rica, none were left there, but seeds will be made freely available upon request to all parties after passage through quarantine and seed increase.

Costa Rican 1996 wild potato collecting expedition 5

Fig. 1. Route of the 1996 expedition to Costa Rica, and distribution of wild potatoes as grouped by the generalized areas as in Table 1.



TAXONOMY OF COSTA RICAN WILD POTATOES

Solanum L. sect. *Petota* Dumort., the potato and its relatives, occurs from the southwestern United States to southern Chile. It consists of seven cultivated and 225 wild species, according to the latest comprehensive taxonomic treatment of Hawkes (1990). However, nine of these species are members of separate clades and are best treated in sect. *Etuberosum* (Buk. & Kamez) A. Child, sect. *Lycopersicum* (Mill.) Wettst., or sect. *Juglandifolium* (Rydb.) A. Child (Child, 1990; Spooner et al., 1993).

The identity of wild potatoes in Costa Rica is unresolved. Correll (1962) and Hawkes (1990) have suggested that they be identified as *S. longiconicum*, *S. oxycarpum*, and *S. woodsonii* (Fig. 2). All of these species are morphologically very similar, and have been grouped by all authors in series *Conicibaccata* Bitter, a series characterized partly by conical fruits. This series has diploids, tetraploids, and hexaploids, but germplasm identified as *S. longiconicum* and *S. oxycarpum* have all been determined to be tetraploid ($2n = 2x = 48$; Correll, 1962; Hawkes 1990; Bamberg et al., 1996), providing no aid in separating them.

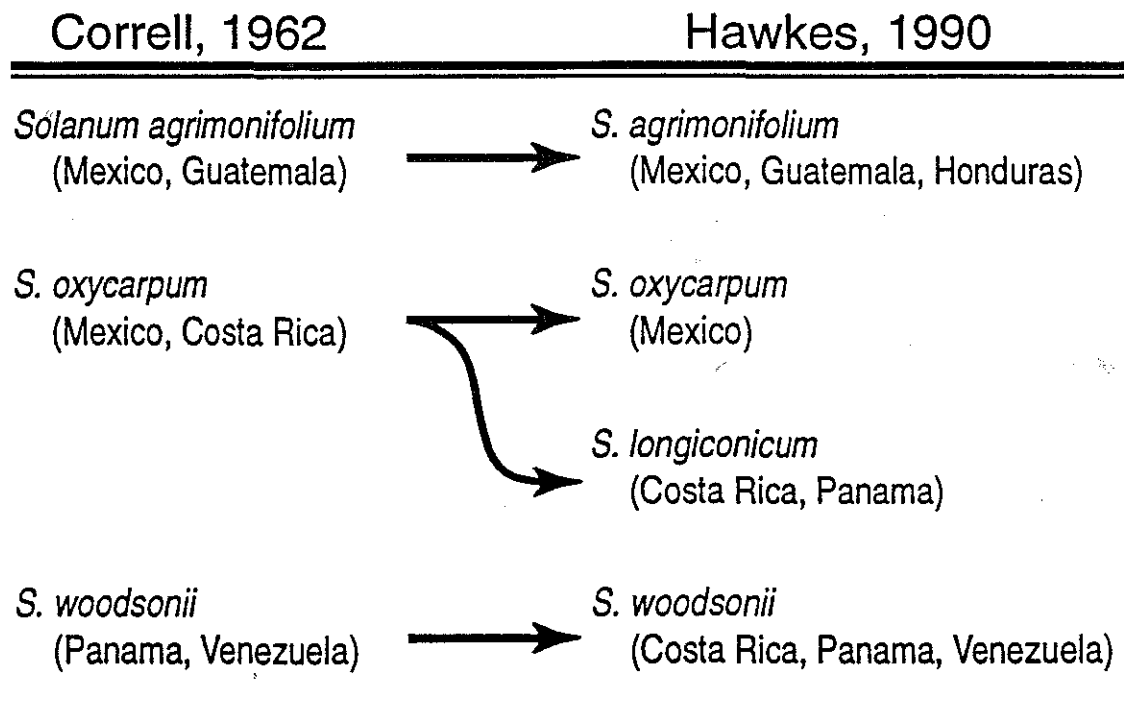
The morphological distinctions of *S. longiconicum*, *S. oxycarpum*, and *S. woodsonii* by Correll (1962) and Hawkes (1990) are based on slight differences in leaf pubescence, leaf shape, numbers of lateral and interjected leaflets, and corolla shape. Correll (1962) identified all Costa Rican collections as *S. oxycarpum* (including *S. longiconicum*), and distinguished these from *S. woodsonii* (from Panama) by 3 or more pairs of lateral leaflets, corollas with prominent acumens, and unlobed anthers, in contrast to *S. woodsonii* with 2 or 3 pairs of lateral leaflets, corollas with inconspicuous acumens, and anthers lobed at the base.

Hawkes (1990), on the other hand, considered *S. oxycarpum* to be a species confined to Mexico, and to be distinguished from *S. longiconicum* (Costa Rica and Panama) by the former with glabrous leaves (no hairs), and the latter with subglabrous leaves (only slightly hairy). He also considered *S. woodsonii* to occur in Costa Rica, but unlike Correll (1962) cited no specimens. He distinguished *S. woodsonii* from *S. longiconicum* by its yet slightly hairier leaves, with fewer lateral leaflets, and with anthers with a lobe at the base (*S. longiconicum* unlobed).

Castillo and Spooner (1997) showed that most of the diploid ($2n = 2x = 24$) members of the series were distinguishable from the polyploids (composed of tetraploids [$2n = 4x = 48$] and hexaploids [$2n = 6x = 72$]) based on both morphology and chloroplast DNA. There were rare exceptions, however. Only two accessions of Costa Rican ser. *Conicibaccata* were examined for chloroplast DNA (as *S. longiconicum*, PI 186568, PI 208780), and one of these for morphology (PI 186568). Surprisingly, these two accessions were very different based on chloroplast DNA, with PI 186568 grouping with the polyploids, and 208780 grouping with the diploids. Accession PI 186568 grouped morphologically with the diploids, providing ambiguous results regarding these Costa Rican collections.

Our new collections showed a range of variability, some that by traditional taxonomic criteria could be identified as *S. agrimonifolium*. This latter species is thought to be distributed from southern Mexico to Honduras (Fig. 3; Correll, 1962; Hawkes, 1990). It differs from *S. longiconicum* and *S. oxycarpum* by its greater number of interjected and lateral leaflets (7-9 lateral leaflets, up to 20 interjected leaflets, *S. agrimonifolium*; 3-5 lateral leaflets, *S. longiconicum*, few" interjected leaflets). Until we can help resolve this problem with study of our new collections, we tentatively identify all Costa Rican collections as *S. longiconicum*, the latest accepted name for Costa Rica (Hawkes, 1990). To explore a geographic component to the distribution of these species, we map them based on literature records and our herbarium records, based on the taxonomy of Hawkes (1990).

Fig. 2. Comparison of the alternative hypotheses by Correll (1962) and Hawkes (1990) regarding the species boundaries and distribution of Costa Rican wild potatoes. *Solanum agrimonifolium* is included because we collected biotypes in Costa Rica that may be identified as this species.



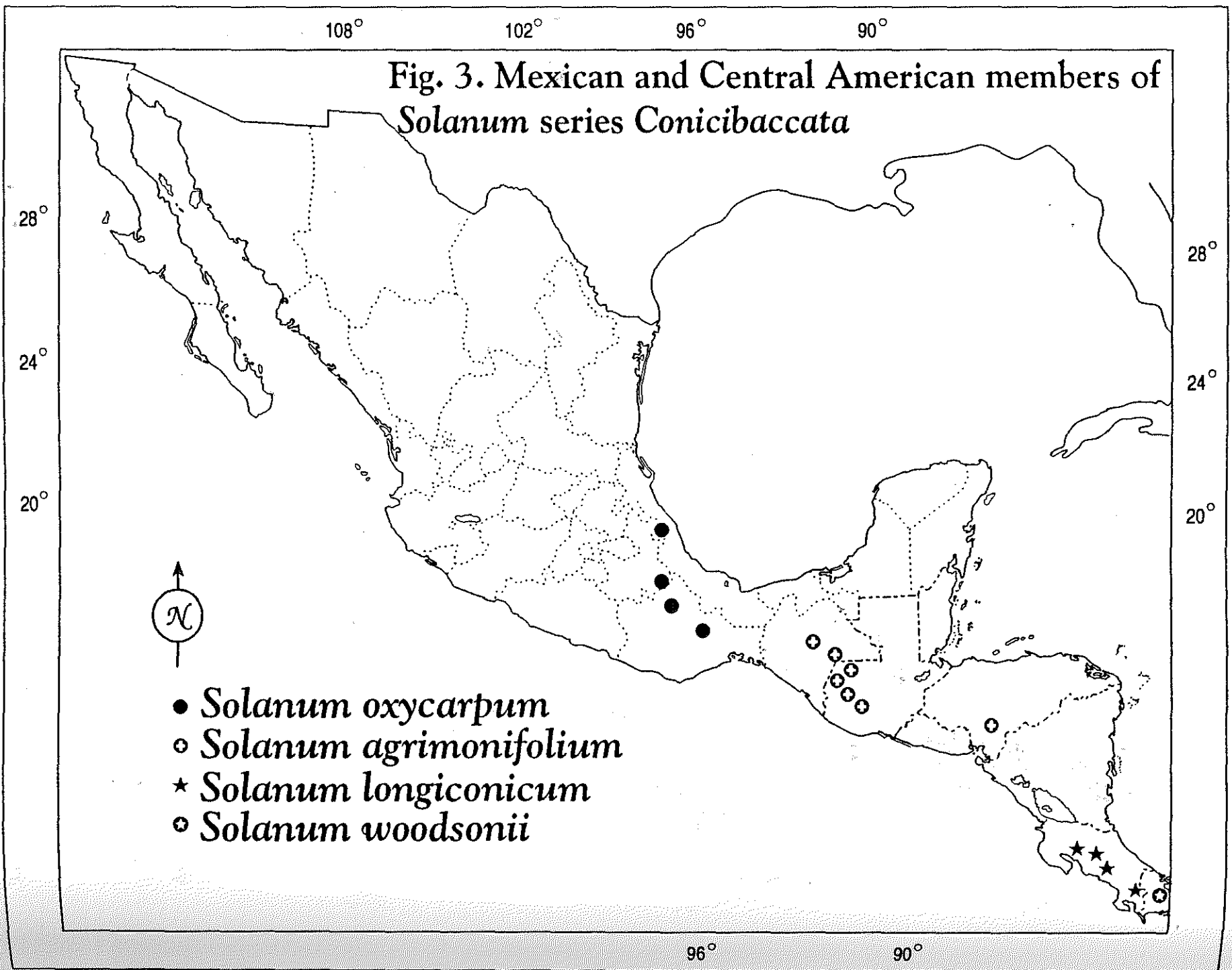


Table 1. Distribution of Costa Rican wild potato species gathered before the expedition (data from Correll [1962], NRSP-6 locality data; and herbaria of the Field Museum of Natural History [F]; U.S. Potato Introduction Station Herbarium [PTIS] Herbario Nacional, Museo Nacional de Costa Rica [CR]; Herbario, Escuela de Biología, Universidad de Costa Rica [USJ]; and Instituto Nacional de Biodiversidad, Costa Rica [INB]). Herbarium codes at the end of the records follow Holmgren et al. (1990). Area codes correspond to those of Fig. 1.

Area 1: Monteverde; Provinces Alajuela, Guanacaste, Puntarenas

1. Alajuela, Guanacaste, Puntarenas: Reserva Biológica Monte Verde, Trayecto de La Torre a Río Negro, división entre Alajuela, Puntarenas y Guanacaste, entre las vertientes Pacífica y Norte, 10°21'N, 84°48'W, 1600-1700 m, in a grazed field, flower blue, January 21, 1988, *W. Haber & E. Bello 8029* (CR).
2. Alajuela, Guanacaste, Puntarenas: High ridge N of television relay tower above Monteverde and bordering Monteverde Cloud Forest Nature Reserve, 10°19'N, 83°48'W, 1750-1800 m, elfin forest on steep slopes and ridges with taller cloud forest in protected sites, herb 0.3-1 m tall, bluish purple flowers, fruits peridulous and conical, February 27, 1977, *J.L. Gentry 3819* (CR, F).
3. Alajuela, Guanacaste, Puntarenas: Cerro Amigos, E side, 1750-1800 m, purple flowers, *V.T. Dryer 1150* (F).
4. Puntarenas: Reserva Biológica de Monteverde, path to Chomogo, purple flowers, March 9, 1976, *J. Gómez Laurito, S. Salas, U. Bermúdez & M. Madriz GL-1388* (USJ).
5. Puntarenas: ca. 2 km SE of Monteverde in the Pacific watershed, on ridge along trail, 10°18'N, 84°48'W, 1,500 m, pastures, forest edges and montane evergreen cloud forest (lower montane wet forest and lower montane rain forest zones), herb of 0.5 m tall, corolla purple, the limb spreading, March 18-21, 1973, *J.L. Gentry Jr & W.C. Burger 2712* (CR, F).

Area 2: Socorro; Province Alajuela

6. Alajuela: between Socorro and San Ramón, path to San Antonio, August 25, 1926, *A.M. Brenner s.n.* (CR).

Area 3: Volcán Poás; Province Alajuela

7. Alajuela: Road between large meadow of Volcán Poás and Poasito, at edge of road, plant 75 cm tall, white flowers, August 19, 1961, *A. Jiménez M. 174* (F).
8. Alajuela: Volcán Poás, Clairieres de l'Achiote, 2200 m, November, 1896, *A. Tonduz 10801* (US).
9. Alajuela: Parque Nacional Volcán Poás del portón, 400 m S of main road, 2,500 m, plant herbaceous, leaves yellowish-green, mature fruits yellowish-green, flowers white, May 1, 1993, *M. Valerio 657* (CR).

10. Alajuela: Volcán Poás, on SE shoulder of volcano, 2,135 m, in small clearing in rain forest, only 1 small tuber found, March 26, 1947, *C. Horn* 1 (LL, NA).
11. Alajuela: Volcán Poás, 2678, January 30, 1922, *J.M. Greenman & M.T. Greenman* 5374 (GH, MO).

Area 4: Varablanca; Provinces Alajuela, Heredia

12. Alajuela: Isla Bonita (note: Isla Bonita is located on the road north of Varablanca, at 10°14'N, 84°10'W, on 1:50,000-scale topographic map 3346 I, at about 1,050 m) *Hope*, s.n. (PTIS - one of the two preexisting germplasm collections).
13. Heredia: between Los Cartagos and Varablanca, 1,830 m, grows in protected place for the wind in the entrance of a cave, purple flowers, June 22, 1963, *A. Jiménez* M. 762 (CR, F).
14. Heredia: Central Cordillera, N slope, between Poás and Barba volcanoes, Varablanca de Serapiquí, 1,920 m, on bare exposed soil, February, 1938, *A.F. Skutch* 3580 (MO, NY, S, US).
15. Heredia: Between Poás and Barba volcanoes, Verablanca, 1,600-1,700 m, in brushy potrero, weedlike, July 22, 1923, *W.R. Maxon & A.D. Harvey* 8274 (BM, US).

Area 5: Volcán Barva (=Barba as a variant spelling); Province Heredia

16. Heredia: Finca la Selva, San Rafael de Vera Blanca, slopes N of Volcán Barba, 1,700 m, in grazed field, purple flowers, terrestrial decumbent plant with lower parts of the stem and some leaves purple, some tubers 2 cm long, June 23, 1963, *A. Jiménez* 801 (F, CR).
17. Heredia: Volcán Barba, 2,900 m, a la orilla del trillo, en la matorral de la cumbre, white flowers, dark green leaves, February 17, 1962, *R. Lucas Rodríguez* C. 839 (CR).
18. Heredia: Río Uvertas (upper Río Patria) on the E slope of Volcán Barba at the Caribbean side of the Continental divide, 10°06'N, 84°04'W, 1900 m, wet secondary forest 15 m high with many epiphytes and with frequent rain and wind from the Caribbean, herb 30 cm tall, corolla white, fruiting peduncle straight and fruits pendulous, April 1 & 3, 1973, *J.L. Gentry Jr & W.C. Burger* 2869 (F).
19. Heredia: Volcán Barva, SW slopes, above Sacramento, 10°07'N, 84°07'W, 2200-2300 m, (record also lists 10°08'N, 84°08'W), in evergreen mountain rain forest formations, along road side in partial shade, flowers blue-purple, leaves tinged with purple below, February 3, 1982, *W.C. Burger, K. Barringer & J. Gomez-L.* 11432 (F).
20. Heredia: Volcán Barba, *A. Roesl* 630 (LL-photo, type locality of *S. manoteranthum*, LL, M).
21. Heredia: Rancho Flores [on Volcán Barva according to INBIO gazetteer], 2,043 m, forest, February 22, 1890, *A. Tonduz* 2181 (BR).

22. Heredia: Around lake of Volcán Barva, 2,900 m, white flowers, 'en un paredón', January 25, 1979, *J. Gómez Laurito GL-4387* (USJ).
23. Heredia: Volcán Barba, E slopes, between Río Nuevo (upper Río Patria), 10°06'N, 84°03'W, 2,000 m, lower montane rain forest and upper wet pastures with frequent wind & rain from Caribbean, on a tree stump in partial shade, pendulous white flowers, October 25, 1975, *W.C. Burger & R. Baker 9486* (F).
24. Heredia: Volcán Barba, E slope, Río Uvertas (upper Río Patria) near the continental divide, 10°06'N, 84°04'W, 2,000 m, wet secondary forest, about 15 cm high with many epiphytes with frequent wind and rain from Caribbean, in cut-over field strewn with cut trees, in open area, petals white, November 22-24, 1969, *W.C. Burger & R.L. Liesner 6419* (F)
25. Heredia: Parque Nac. Braulio Carillo, Estacion Barva, 10°07'2"N, 84°07'2"W, 2,500 m, found in primary forest and fields, plant 0.4 m, flower lila, fruit green, June 30, 1990, *G. Varela 83* (INB).
26. Heredia: Cerro Gallito [note: the village of Gallito is at ca. 2,100 m, on the lower south-facing slopes of Volcán Barva, as seen on the 1:50,000-scale 3346 II topographic map [Barva] at 10°06'N, 84°06'W; but Correll [1962] maps this record in San José Province), 2,000 m, February 3, 1935, *J. Valerio 1048* (F).

Area 6: Cerro Chompipe; Province Cartago

- 27, 28, 29. Heredia: Alto de Roblé, 2,000 m, May, 1888, *H. Pittier 18, 34, 215* (G, collections 18, 34; BR, collection 215).
30. Heredia: Cerro Chompipe, San Rafael, 10°05'13"N, 84°05'23"W, 2,100 m, shrub, 1.5 m tall, white flowers, stamens yellow, green fruits, December 16, 1993, *G. Vargas, A. Cascante & A. Ruiz Boyer 1617a* (CR).

Area 7: Cerro Zurquí; Provinces Heredia, San José

31. Heredia: forest at base of Cerro Zurquí, 10°03'N, 84°02'W, 1,650 m, in stream bed, flowers white, leaves dark above, *R.W. Lent 3569* (CR, F).
- 32, 33, 34. Heredia: NE of San Isidro, Yerba Buena (note: Yerba Buena is located at 10°02'N, 84°00'W, according to the U.S. gazetteer), 2,000 m, wet forest, February 22-28, 1926, *P.C. Standley & J. Valerio 49948/49973/49982* (US).
35. Heredia: Along the Río Vara Blanca (Pacific drainage), Cerros Zurquí, 10°03'N, 84°01'W, 1,600-1,800 m, open pasture on steep mountain side, on dead tree trunk, remnants of lower montain rain forest formations on ridges and steep slopes, corolla lobes white, February 7, 1977, *J. Gentry s.n.* (CR).
36. Heredia: Cerro de Las Lajas, N of San Isidro, 2,000-2,400 m, wet forest, March 7, 1926, *P.C. Standley & J. Valerio 51583* (F, US).

37. San José: high above Río Hondura, 10°03'N, 83°59'W, 1,400 m, roadside, herb of 60 cm, light violet flowers, propagates by runners, tubers present, March 10, 1973, *R.W. Lent* 3227 (F).

Area 8: Las Nubes; Province San José

- 38, 39, 40. San José: Las Nubes, 1500-1900 m, March 20-22, 1924, *P.C. Standley* 38614/38666/38818 (US).

Area 9: Rancho Redondo; Province San José

41. San José: Potrereros of Rancho Redondo, 2,220-2,600 m, October 9-18, 1929, *C.W. Dodge & W.S. Thomas* 4926 (F, MO).

Area 10: Volcán Irazú; Province Cartago, San José

42. Cartago: road up Volcán Irazú, near bridge over Río Birris, 2,900 m, in damp places near river, white flowers but veins petal green inside and purple outside. sepals purple, February 24, 1965, *R.W. Lent* 387 (F)
43. Cartago: Volcán Irazú, slopes, 2,745 m, June 28, 1920, bank of a stream, *W. Popenoe* 1015 (NA, NY, US).
44. Cartago: Volcán Irazú, 1948, *E.G. Casseres* 1 (CR).
45. Cartago: Moist bank by the road from Cartago to Volcán Irazú, August 23, 1940, *M.A. Chrysler* 5552 (F).
46. Cartago: Volcán Irazú, S slope, Río Birris, wet thicket, February 23, 1924, *P.C. Standley* 35400 (US).
47. Cartago: North of Irazú, 3,050 m, in oak forest, March 28, 1928, *H.E. Stork* 1281 (F).
48. Cartago: Irazú, massif de Irazú, defrichements du Roblé, 2,000 m, July 10, 1891, *A. Tonduz* 4235 (LL-photo, Z: BR, CR, G, LL, US, Z).
49. Cartago: La Palma del Volcán Irazú, 1,800 m, *C. Wrecklé* 65 [Type locality of *S. longiconicum*] (B, destroyed, photos: F, GH, LL, NY, US).
- 50, 51. Cartago or San José: Valley of Archángelos, massif of the Irazú, May 24, 1888, *H. Pittier* 260 p.p, 261 p.p (BR).
52. San José: Irazú on road to Roblé, 3,050 m, May 16, 1928, *H.E. Stork* 1999 (F).

Area 11: Volcán Turrialba; Province Cartago

- 53. Cartago: Between Lecheria and base of Volcán Turrialba, 3,000 m, November 1, 1948, *Oviedo 524* (CPC).
- 54. Cartago: road to crater of Volcán Turrialba, humid shady place, June 17, 1976, *J. Gómez Laurito GL-1680* (USJ).
- 55. Cartago: Volcán Turrialba, S slope, near the Finca del Volcán Turrialba, 2,000-2,400 m, wet forest, February 22, 1924, *P.C. Standley 34993* (US).

Area 12: Escazú City; Province San José

- 56. San José: Interamerican Highway, Km. 29, section 4, Jaboncillos (Jaboncillo=9°56'N, 84°09'W, a small village just west of Escazú just west of San José), 2,900 m, June, 1944, *R. Mesén 501* (CPC).

Area 13: Cerro Escazú; Province San José

- 57. San José: Cantón de Aserri, Zona Protegida Cerros de Escazú, Cerros Escazú, La Carputerá, El Cedral, Alto Hierbabuena: robledales alterados en la folda NE, 10°09.3'N, 84°06.4'W, 2,150 m, corolla blanco lila, estombres amarillos, November 6, 1993, *J.F. Morales 1964* (INB). (Note: Spooner and Hoekstra looked for potatoes at Zona Protegida Cerros de Escazú without success (see itinerary of December 15). They later spoke with the collector at INBio, and he indicated the plant was collected on the road to Zona Protegida Cerros de Escazú, but outside of the protected area proper. The correct latitude and longitude is approximately 9°50.6'N, 84°07.4'W).

Area 14: Cartago; Province Cartago

- 58. Cartago: Cartago, 1,400 m, 'papa-ciruela', the fruit is eaten, September, 1908, *C. Wercklé 17296* (GH).

Area 15: Cristóbal; Province San José

- 59. San Cristóbal, *C. Wercklé s.n.* (US).
- 60. San José: San Cristóbal Road, 2,440 m, in deep forest, weak herb, only small tubers of 5 mm and 1 cm long, May 27, 1928, *H.E. Stork 2213* (F).

Area 16: Tapantí; Province Cartago

- 61. Cartago: S of Tapantí along the new road on the E slope above the Rio Grande de Orosi, 09°42'N, 83°47'W, 1,400-1,600 m, climbing near the ground above brook, white flowers marked with lavender, anthers yellow, green fruits, June 10-24, 1968, *W.C. Burger & R.G. Stolze 5723* (CR, F).

62. Cartago: ca. 15 km S of Tapantí along the new road on E slope above Río Grandé de Orosi near the concrete bridge, 09°42'N, 83°47'W, 1,500 m, in open secondary growth on steep bank above road at edge of forest with many epiphytes, herb 30 cm tall, corolla white, the limb spreading, stems purplish, April 13/14, 1973, *J.L. Gentry Jr & W.C. Burger s.n.* (F).

Area 17: Cerro de la Muerte; Province Cartago

63. Cartago: Pan American Highway, Km. 11, section 4, between Madreselva and Cañon, 2,510 m, June, 1944, *R. Mesén 505* (CPC).
64. Cartago: Interamerican Highway, 60 km S of Cartago, 2,850 m, recently cut woodland, November 7, 1949, *J.G. Hawkes 1130* (CPC, PTIS - one of the two preexisting germplasm collections).
65. Cartago: 28 km S of Empalme, January 11, 1975, *R.A. Ocampo & C. Otorola 960* (CR).
66. Cartago: Interamerican Highway, 35 km S of Cartago, 2,520 m, November 7, 1949, *J.G. Hawkes & R. Mesén 1126* (CPC).
67. Cartago: La Trinidad, SE of Empalme, 2,500 m, grows submerged in a ditch, white flowers with pale tinted violet, *A. Jiménez M. 2197* (F).
68. Cartago: 10 km SE of Empalme along Interamerican Highway, 2,000 m, wet soil, pale violet flowers, February 8, 1971, *W.T. Gillis & T.C. Plowman 10037* (F).
69. Cartago: Interamerican Highway, 52 km S of Cartago, 2,850 m, November 7, 1949, *J.G. Hawkes 1128* (CPC).
70. Cartago: Interamerican Highway, Km.21, section 4, near Río Humo (note: Río Humo is N of Tres de Junio at 9°41'N, 83°50'W), 2,790 m, June, 1944, *R. Mesén 506* (CPC).
71. Cartago: Interamerican Highway, 50 km S of Cartago, 2,700 m, November 7, 1949, recently cleared woodland, common, *J.G. Hawkes 1127* (CPC).
- 72, 73. Cartago: Interamerican Highway, Cerro de la Muerte, 2,660 m, June, 1944, *R. Mesén 498/500* (CPC).
74. Cartago: Reserva Biológica de Tres de Junio, purple flowers, green fruits, August 21, 1975, *J. Gómez Laurito, R. Soto, D.I. Rivera, E. Alán GL-1, 200* (USJ).
75. Cartago: 9 km from Millsville to Cartago, 3,000 m, disturbed cloud forest, common, July 22, 1949, *R.W. Holm & H.H. Iltis 517* (G, MO).
76. Cartago: Cordillera de Talamanca, Cerro de la Muerte, Interamerican Highway between Km 60 & 77, La Trinidad, 3,140 m, cloud forest, steep bank, flowers lavender, February 26, 1966, *A. Molina R, W.C. Burger & B. Wallenta 17888* (F).

77. Cartago, San José: Cordillera de Talamanca, near and below Cerro de la Muerte, 3,200 m, cloud forest area, road side weed, lilac flowers, *L.O. Williams, A. Molina R, T.P. Williams & D.N. Gibson 28304* (F).
78. Cartago, San José: Interamerican Highway, Km.37, section 4, Cerro de la Muerte, 3,150 m, June, 1944, *R. Mesén 509* (CPC).
79. Cartago, San José: near Division, Cerro de la Muerte, 3,000 m, growing in weedy area, plants 0.6 m tall, petal lavender, anther yellow, October 6, 1978, *T. Antonio 667* (CR, F).
80. Cartago, San José: 20 km SE from Empalme along Interamerican Highway, Km 72, El Trinidad, 09°40'N, 83°53'W, 2,600 m, steep slopes with open forest and bamboo thickets, May 25 & June 19, 1968, *W.C. Burger & R.G. Stolze s.n.* (F).
81. Cartago, San José: 22 km SE of Empalme, along Interamerican Highway, 09°40'N, 83°50'W, 2,500-2,600 m, montane forest formation with open landslides and road cuts and small swamps, climbing in low shrubs (50 cm) of a *Blechnum* bog, corolla lavender, pendulous green mature fruits, November 27, 1969, *W.C. Burger & R.L. Liesner 6466* (CR, F).
82. Cartago, San José: Interamerican Highway near Trinidad and km.72, ca 20 km SE of Empalme, 09°40'N, 83°53'W, 2,600-2,800 m, steep slopes with forest remnants, open areas with bog-like vegetation, February 5, 1982, *W.M. Burger & K. Barringer 11479* (F, CR).
83. Cartago, San José: 22 km SE of Empalme, along Interamerican Highway, 2,500-2600 m, montane forest formation with open landslides and road cuts and small swamps, terrestrial in forest with slender branches, grows over other shrubs, flower pale lavender, fruits green and pendulous, August 9, 1921, *W.C. Burger 7961* (F).
- 84, 85, 86, 87. San José: Cerro de Las Vueltas (note: Cerro de Las Vueltas at 09°37.4'N, 83°51.5' W on 1:50,000-scale topographic map 3444 V) 2,700-3,000 m, wet forest, Dec. 29-Jan. 1, 1925/6, *P.C. Standley & J. Valerio 43591/43661/43759/43913* (US).
88. San José: Dos Amigos (note: Dos Amigos at 09°37.4'N, 83°50.7' W on 1:50,000-scale topographic map 3444 V), Southern Pan American Highway, September, 1943, *O. Jimenez s.n.* (CR).
89. San José: New road from La Estrella to Copey, 2,450 m, February 15, 1935, *J. Valerio 1050* (F).

Area 18: Valle Silencio; Province Limon

90. Limon: Cordillera de Talamanca, Atlantic slope, Valle de Silencio, area just N of Cerro Hoffman, 4 1/2 airborne km W of the Panama border, 09°08'N, 82°58'W, 2,350-2,450 m, gently sloping valley dominated by oak forest, terrestrial, corolla violet, yellow anthers, infructescence deflexed, green fruits, September 8, 1984, *G. Davidse, G. Herrera & M.H. Grayum 28690* (CR).

Localities unknown

91. Monté Sin fé, February 6, 1967, *L.D. Gómez* 27 (CR)
92. Ferralos?, or Feualos?, January 23, 1913, *J. León* 1115 (CR)
93. Cerro del Fugles, December 24, 1931, *W. Kupper* 173 (M)

Table 2 List of new collection

Costa Rican 1996 wild potato collecting expedition 17

Solanum longiconicum Bitter

Costa Rica. Cartago: 9.3 km S of Empalme at Km 66 of the Interamerican Highway; Lat: 09°40.2'N, Long: 83°51.8'W, 2500 m elev; growing along the road; corolla white to light blue. Fruits from 3 plants, fruit size (w x l) 7x23 - 11x32 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7101
November 28, 1996

Solanum longiconicum Bitter

Costa Rica. Cartago: 13.5 km S of Empalme at the Interamerican Highway; Lat: 09°37.9'N, Long: 83°50.4'W, 2770 m elev; along the road, common; corolla light blue to dark blue, fruit size (w x l) 6x20 - 11x30 mm.

Duplicates at: INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7103
November 28, 1996

Solanum longiconicum Bitter

Costa Rica. Cartago: 20.3 km S of Empalme along Interamerican Highway; Lat: 09°36.4'N, Long: 83°45.8'W, 3020 m elev; along the road; corolla light blue with white nerves, fruit size (w x l) 10x29 - 15x35 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7104
November 28, 1996

Solanum longiconicum Bitter

Costa Rica. Heredia: Volcán Barva, 500 m after entrance of park, 100 m NW towards viewpoint; Lat: 10°07.2'N, Long: 84°07.5'W, 2570 m elev; under a tall tree; corolla white, fruit size (w x l) 7x22 - 8x28 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7105
November 29, 1996

Solanum longiconicum Bitter

Costa Rica. Heredia: Volcán Barva, above Laguna Barva on the path to Laguna Copey; Lat: 10°08'N, Long: 84°06.5'W, 2780 m elev; along path in cloud forest; corolla light blue, fruit size (w x l) 12x23 - 11x26 mm.

Duplicates at: INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7107
November 29, 1996

Solanum longiconicum Bitter

Costa Rica. Heredia: Volcán Barva, along path above Laguna Copey; Lat: 10°09'N, Long: 84°06'W, 2500 m elev; along path in cloud forest; corolla white to light blue, fruit size (w x l) (11x23 mm).

Duplicates at: INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7108
November 29, 1996

Solanum longiconicum Bitter

Costa Rica. Alajuela/Puntarenas/Guanacaste: Monteverde Cloud Forest Preserve, division point of provinces A, P and G, top of Cerro Amigos, around television tower (channel 13); Lat: 10°19.0'N, Long: 84°47.7'W, 1830 m elev; growing in garbage heap and in cleared areas; corolla violet, fruit size (w x l) 11x24 - 15x33 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & J. Gonzalez 7109
November 30, 1996

Solanum longiconicum Bitter

Costa Rica. Limón: Cordilla de la Talamanca, Parque Internacional de la Amistad, N of Cerro Hoffman, 700 m S and 500 m N of open place along trail which begins at park station Altamira; Lat: 09°06.5'N, Long: 82°57.7'W, 2320 m elev; in humid places; corolla white, fruit size (w x l) immature.

Duplicates at: INB, PTIS, WAG

D. Spooner, R. Hoekstra, B. Vilchez & R. Aguillar 7116
December 5, 1996

Solanum longiconicum Bitter

Costa Rica. Alajuela: Volcán Poás, 8.5 km from Poasito, 400 m before large meadow in the Parque nacional; Lat: 10°10.7'N, Long: 84°14.3'W, 2560 m elev; along the road in humid places; corolla blue or white, fruits from 3 plants, fruit size (w x l) 14x26 - 20x35 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7122
December 9, 1996

Solanum longiconicum Bitter

Costa Rica. Heredia: Parque Nacional Braulio Carillo sector Cerro Chompipes, 6.3 km N of San Rafael, along recently cleared path to the top for new road; Lat: 10°05.1'N, Long: 84°04.4'W, 2200 m elev; in wet cloud forest; corolla white or light blue, fruit size (w x l) (10x24 mm).

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7123
December 10, 1996

Solanum longiconicum Bitter

Costa Rica. Cartago: Parque Nacional Tapanti, 9.2 km from entrance of park, from concrete bridge till end of the road at electricity station; Lat: 09°41.2'N, Long: 83°45.5'W, 1740 m elev; along road on wet mountain slopes; corolla white or light violet with white nerves, fruit size (w x l) immature.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7129
December 11, 1996

Solanum longiconicum Bitter

Costa Rica. Cartago: Volcán Turrialba, 9.5 km on road towards volcano; Lat: 10°00.7'N, Long: 83°45.4'W, 2910 m elev; along road at base of steep mountain side; corolla white or white with lila nerves, all fruits from 1 plant only, fruit size (w x l) 11x29 - 15x33 mm.

Duplicates at: CR, INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7133
December 12, 1996

Costa Rican 1996 wild potato collecting expedition 20

Solanum longiconicum Bitter

Costa Rica. Cartago: Volcán Irazú, 2.9 km N of Potrero Cerrado, at Km 25, under bridge over Río Birris; Lat: 09° 57.6'N, Long: 83° 50.5'W, 2900 m elev; ; corolla purple, 1 fruit, fruit size (w x l) immature.

Duplicates at: INB, PTIS, WAG

D. Spooner, R. Hoekstra & B. Vilchez 7136
December 13, 1996

DAILY ITINERARY

November 24, 1996 (Sunday)

Roel Hoekstra arrived in San José at 6:00 PM, and waited at the airport to meet David Spooner who arrived at 6:45 PM. Stayed in Quality Hotel Centro Colón, Costado Norte Centro Colón, (Tel: 506-257-2850).

November 25

We took a taxi to Cartago, to meet Ing. Braulio Vilchez. Vilchez was recommended to us as our collaborator in this expedition by Sonia Alvarenga. We discussed the purpose and details of our expedition, and agreed to work together until December 13.

We all went to the Herbario, Escuela de Biología, Ciudad Universitaria Rodrigo Faio, Universidad de Costa Rica, San José (herbarium code USJ) (Tel: 506-255555, ext. 432). We obtained four new herbarium records of *S. longiconicum* for Costa Rica (Table 1).

We then went to the Centro Científico Tropical Apartado Postal 8-3870, San José, Tel: 506-225-2649. We purchased a complete set (nine sheets) of Zonas de Vida de Costa Rica (1:200,000-scale, by Rafael Bolaños M. and Vicente Watson C., 1993) maps. These maps outline the vegetation zones of Costa Rica. We were interested in the vegetation zones where *S. longiconicum* grew, and to see if we could use this map to predict new sites of occurrence.

We then went to the Instituto Geográfico Nacional, Plantel Central Ministerio de Obras Públicas y Transportes, Plaza González Víquez, San José, Tel: 608-257-7798, ext. 2625. We purchased one set of 1:200,000-scale topographic maps for mapping the localities, to be used in the field. Spooner and Hoekstra also purchased a set for their institutions. Spooner also purchased a complete set of 1:50,000-scale topographic maps for his institution.

We then went to the Herbario Nacional, Museo Nacional de Costa Rica, Avenida O and Calle 4, San José. We obtained 21 records of *S. longiconicum* (12 new records regarding our previous survey of Correll, 1962, and the Field Museum of Natural History).

We then went to the Instituto Nacional de Biodiversidad (INBio). The purpose of our visit to check their herbarium and to get help in obtaining a collecting permit for the protected areas of Costa Rica. They had no herbarium specimens of *Solanum* sect. *Petota* there. We were informed that to obtain a collecting permit we needed to present photocopies of our passports, a copy of our collecting proposal, and submit a fee of \$60.00.

We went to the bank to cash travelers checks. Spooner and Hoekstra returned to their hotel in San José, and Vilchez drove his car home to Cartago.

November 26.

Vilchez needed to work another day at his institution to finish giving exams to his students. Spooner and Hoekstra entered all locality data in a d-BASE file, and sorted it by Provinces. In total, there were 93 locality records. We were able to map to a specific or somewhat general point all but three of them. These 90 records extended from an area beginning at the junction of Guanacaste, Puntarenas and Alajuela Provinces, south of Laguna de Arenal, at about 10°17'N,

84°46'W, to near the border with Panama at 9°08'N, 82°58'W. Record 90 (Table 1) is extremely significant, because it extends the distribution of *S. longiconicum* ca. 100 km by air southeast in Costa Rica. The prior southeastern-most records were six records at or about at Cerro de la Muerte in Cartago and San José Provinces. The record at the border with Panama is the only one in Limon Province. In total, all 90 mapped records occurred in the 1:200,000-scale maps named San José, Talamanca, and Quepos. Spooner rented a jeep (Suzuki Sidekick) from the Hertz rental place around the corner from the hotel.

November 27.

Vilchez took a bus from his home in Cartago and met Spooner and Hoekstra at their hotel in San José. We discussed the results of our locality mapping exercise. We drove to downtown San José and obtained passport-type photos needed for our collecting permit. We returned to INBio and gave Quirico Jiménez our materials needed for the permit. Because we could not yet collect on protected lands in Costa Rica, we decided to drive north to Varablanca, on the way to Volcán Poás, where there were records collected before the National Park, to check records for area 4 (Table 1). It was raining and blowing heavily above about 1,500 m. We searched in vain for potatoes up until 2,000 m, when we turned back because it was raining too hard to efficiently search. Spooner and Hoekstra returned to their hotel and Vilchez drove the jeep to his home. Spooner and Hoekstra walked downtown to purchase road maps and then returned to the hotel to work on the report.

November 28

We drove to Cartago and slowly ascended the west end of the Cordillera de Talamanca, continued south to Empalme, past Cerro de la Muerte, south of Villa Mills, and then began to descend the Cordillera de Talamanca. Today's goal was to search for records of area 17. We found our first record of *S. longiconicum* 9.3 km south of Empalme, and two more later on the road (7101, 7103, 7104). The habitat was under shaded roadside cloud forest vegetation in moist organic soil. It rained most of the day with a strong wind. The plants were very young to the point of dropping fruits. The populations had corollas varying in color from pure white to medium purple but appeared to be the same species, suggesting to us that this color difference we noted on herbarium sheets did not suggest there were two species in Costa Rica. When we began to descend the Cordillera southeast of Villa Mills, the habitat became drier, and we found no more potato populations. We turned back, and began to look for potatoes northwest of Empalme, to see if we could locate some of the records that appeared to be collected there, but we found none. It was clear that these 27 records (for the 90 that had locality data good enough to map at least to a general area) were in a relatively localized area along this stretch of road on the Cordillera, and that we accounted for 30% of all the known records of wild potatoes in Costa Rica on this one day. We returned to San José for the evening.

November 29

We first drove to INBio where we met Nelson Zamora and Quirico Jiménez, who helped us plan collections beginning tomorrow in Monte Verde Reserve and other uplands northeast Costa Rica. They arranged for us to work with the INBio employee José Gonzalez for the next few days while Vilchez remained in Cartago where he had to attend a meeting at his work. Gonzalez had a collecting permit and could legally collect with us. We drove to Volcán Barva (as spelled on our topographic map, but in the herbarium and literature records as Volcán

Barba), to search for records of area 5. One of them (record 18 above Sacramento) appeared to be eliminated by development of housing along the road, but the others in the protected area of Parque Nacional Braulio Carrillo were still there. The park protects a mature cloud forest with moist organic soils ideal for wild potatoes, and we easily collected three populations this day (7105, 7107, 7108). As the day before, the populations varied with corollas white to blue. Also, the populations varied in maturity from young non-flowering plants to yellowing plants with mature fruits. We returned to San José where we spent the night.

November 30

We met José Gonzalez at our hotel and drove northwest to the town of Monteverde. We met Dr. William Haber, a botanist working in the area for the Missouri Botanical Gardens. He told us how to reach his collection site of record 1. He told us it was the same general site as records 2 and 3. We hiked up the steep road used to service the many television antennas on this hill (Cerro Amigos), and found collection number 7109. The population consisted of about 20 plants, growing in a sunny area next to a building for the television towers, in moist organic soils. The plants were about 1 m tall, and in full flower and with many fully mature fruits. It reminded us of the larger plants of *S. agrimonifolium* we had collected in Guatemala the year before. We spent the night in Hotel Belmar in Monteverde.

December 1

We left our hotel and drove to the entrance to Reserva Biológica Bosque Nuboso Monteverde (Monteverde Cloud Forest Biological Reserve). We met Bob Carlson, the Park Manager, and asked for permission to collect *S. longiconicum* there. A separate permission is needed than the government general collecting permit because the Monteverde Reserve is privately owned. We were lucky to meet Mr. Carlson, because it was his day off, and he told us that without a permit authorized by him, we could not collect, but he kindly issued us one when we filled out the form and indicated the nature of our collecting trip. For reference, a permit can be obtained by providing information contained in a collecting or research application contained in Appendix 5. These can be obtained by sending an email message to Mr. Carlson at montever@sol.racsa.co.cr or by sending a FAX to (506) 645 5034. The office telephone is (506) 645 5122.

We hiked up the trail to Chomogo (record 4) and found a few small non-flowering plants just over the highest point on the trail on the ridge separating the Atlantic and Pacific watersheds, but found no flowering or fruiting plants and made no collection. For reference, a map to the Monteverde Cloud Forest Biological Reserve showing the path to Chomogo and the site of collection 4 is included (Appendix 6). This site is very shaded in this protected reserve, and it is possible that the difference in the flowering and fruiting nature of the population we collected yesterday, and the non-flowering nature of the population here, is caused by less light. Soon after finding this site, the trail descended to the junction of Sendero Río and Sendero Pantanoso. We decided to split up to maximize our effectiveness, with Spooner hiking along Sendero Pantanoso, Vilchez hiking along Sendero Río, and Hoekstra hiking back up Sendero Chomogo. We were not able to find any more wild potatoes and met at the entrance to the park and drove northwest to Liberia where we spent the night at Hotel El Sitio.

December 2

The goal for this day was to search in an upland site more northeast than any records of *S. longiconicum* in Costa Rica, and chose the Volcano at Rincon de La Vieja as the northernmost site with an elevation we thought may harbor this species (1,895 m). We drove from Liberia to the entrance to Rincon de la Vieja National Park. This entrance begins 3 km northwest of the traffic light in Liberia along the Pan American Highway. The entrance to the park is 19 km from the Pan American Highway. We hiked from the trail's beginning at the park entrance at 670 m, to the end of the woods at about 1,300 m. The woods had many shaded spots with deep organic soil that appeared to be suitable for *S. longiconicum*, but we found none. We continued hiking to 1420 m, beyond the tree line, to 10°49.2'N, 85°20.8'W. It was extremely windy with dense sulfurous smelling clouds blowing over the volcano top, and the park ranger advised us not to hike beyond the tree line for danger of being blown over a ridge and losing our way in the dense clouds. The soil was exposed lava with short bushes, a habitat unlikely to harbor *S. longiconicum*. Before returning to the woods, we hiked down a steep valley with a stream and vegetation in the deepest parts of the valley, but found no potatoes. We returned to our jeep and drove back to San José, where we took Gonzalez back to his home. Spooner and Hoekstra went back to Hotel Colón.

December 3

Spoooner went to the American Embassy to pick up an expedition check sent from the USDA, cleaned clothes, went to the Organization of Tropical Studies to purchase a copy of "Costa Rican Natural History, ed. Daniel H. Jansen, Univ. Chicago Press, 1983," went to American Airlines to change the return ticket to the morning of December 23, and went with Vilchez to INBio. We met there with Nelson Zamora (Coordinator of Botany). We reviewed a FAX Spooner received today from Garrett Davidse through Harvey Ballard, providing some details on how to collect record 90. We decided that Vilchez would pick up Renaldo Aguillar in the jeep and meet Hoekstra and Spooner at their hotel at 5:00 AM the next morning to depart for record 90 and an additional site more to the northwest. Hoekstra also changed his ticket (to depart the evening of December 22), and input locality data on the dBASE file. Spooner and Hoekstra worked on financial accounting, finished writing the report to this day, and purchased food and equipment for the next week's expedition southeast.

December 4

We met Vilchez and Aguillar (an INBio taxonomist) at 5:00 AM and departed south along the Pan American Highway. Aguillar had a collecting permit and could legally collect with us. We first drove to Buenos Aires and met a contact of Aguillar who called by telephone the Reserva Biológica Dúrika to see if we could arrive there in a few days to collect in the Talamanca Mountains north of there (see December 7).

We then drove south to Paso Real, crossed the Río General, drove southeast to Vueltas and Nabillo, and then drove north through Alto Sábalo, to Altamira, to the Altamira Station of the Reserva Biosfera La Amistad. Our goal was to collect germplasm at record 90, significant because it was the farthest record east in Costa Rica. The Altamira Station is located at 1,200 m, at 9°01.8'N, 83°00.5'W.

The address of the Altamira Station is:

Reserva La Biosfera
Estacion Altamira
Parque Internacional La Amistad (PILA)
A.C.L.A.P.
Penez Zeledón
San José, Costa Rica

We met the park guard, Luis Rojas Badilla, who offered to let us sleep in his work station, and helped us locate two guides for our planned hike in the reserve the next day. They were:

Gerardo Sanchez Villalobes, and
Vianney Villalobes Rodríguez (cousins)
200 m E, Centro Salon Comunal
Colorado de Billey
Buenos Aires, Puntarenas
Costa Rica

They agreed to meet us the next morning at 5:30 AM to hike to record 90, located north of Cerro Hoffman. Two years ago they were hired by the park to construct a trail in the park, and knew the area very well.

December 5

We met our guides at the station and departed north up the Talamanca Mountains at 6:00 AM. We carried a 4-person tent, sufficient food for three days, a plant press, cameras and a GPS machine. The bottom part of the preserve was a cattle ranch, and it has many open grassy areas intermixed with old growth trees with spider monkeys living in the woods. Along the trail the guides showed us recent tracks of large wild cats (puma, leopard) that lived in the area, but indicated that there were no records of attacks on humans there. The path reached mature oak forest at about 2,000 m, and this was the dominant tree throughout our hike to the top and north of Cerro Hoffman. The path traverses a ridge the entire way, with some flat areas and some descents. We reached near the top of Cerro Hoffman (the top at 2,575 m) at about 3:00 PM, and descended to a cleared camp, reaching it at about 4:00 PM. On hiking downhill north of Cerro Hoffman and to our camp, we found two small populations of *S. longiconicum*, one with flowers with white corollas, the other lacking flowers but with some pedicels with fallen flowers or fruits. There were only two to three plants in each population. Soon after setting up camp, we hiked for about 45 minutes farther northeast along a stream called Río Terbi, and found some plants of *S. longiconicum*.

December 6

We awoke the following morning and it had frozen the previous night. Those who left their clothes out of the tent had to thaw them before departing. We hiked from 7:30 AM until 11:00 AM, northeast of our campsite and returning, following Río Terbi and having to walk through it a couple of times. Our farthest walk was at the end of the path in an open tree fern forest, at 9°08.0'N, 82°57.5'W, at 2,400 m. This is about 1 km west of the border with Panama. We saw four populations of *S. longiconicum* along this route, but all were small, containing only two to five plants. All populations were in very wet soil in sunny areas. Only one population

had small (1-1.5 cm long) fruits, and we collected a single fruit along this route. The age of the plants ranged from very small non-flowering ones to yellowing and apparently mature plants that dropped their fruits. The plants were at the most 1 m tall. Like in the Monteverde Cloud Forest Reserve (December 8), we suspect that our difficulty finding many (and larger) plants in these mountains may be caused by the lack of sunny openings needed for development of fruits. The virgin forest status of this area leaves few large open sites to be found, with most of them by streamsides, paths, or tree falls. We broke camp and had lunch from 11:00-11:30 AM, and reached the Altamira station just before dark at 5:30 PM. We spent the night there.

December 7

We left the Altamira Station of the Reserva Biosfera La Amistad and drove to Buenos Aires. Our goal was to collect a new site for wild potatoes in the Talamanca Mountains, that would connect the sites between the records southeast of Empalme (Cartago and San José Provinces) the record north of Altamira (Limon Province). Aguillar had previously worked at the Reserva Biológica Dúrika, north of Buenos Aires at the foothills of the Talamanca Mountains. He knew that the people, location, and facilities there were suitable for searching the mountains. We called the Reserve (they are connected by a radio telephone) at 7300657 and made arrangements to be met by representatives of the Reserve at a path departing from the Buenos Aires-Holam road, 14 km north of the town square of Buenos Aires. We were met by two people with horses, and they packed our equipment for the 45 minute walk to the preserve.

The Reserva Biológica Dúrika is a private reserve, started by German Cruz Villanueva, a former resident of Buenos Aires who is working to preserve the mountain habitats in the foothills of the Talamanca Mountains above Buenos Aires. The reserve contains 27 people in seven families, who live a mostly self-sufficient communal existence, with one of their goals being the expanding protection of the foothill mountain habitats there. There is clear cutting and burning about the preserve for expanding cattle operations, and the reserve is buying additional land partly by the income from tourism gained by renting their cabins (\$35/person/night). Cruz Villanueva has spent much time in the mountains, and knew a site for *S. longiconicum* on the Atlantic slope of the Talamanca Mountains. He had commitments the following day, but we made an agreement to walk there on a two or three day expedition beginning on Monday, and would stay at the reserve on Sunday.

December 8

We met Cruz Villanueva, and we noted the heavy rains in the Talamanca mountains. We listened to a weather report and a cold front was approaching from the Caribbean that indicated very windy and rainy weather in the mountains for some days. We decided to postpone our collecting trip in the Talamanca Mountains until after we finished doing our collecting around San José and Cartago. We made plans to call in about a week hence and drove back to San José where we spent the night.

December 9

Our collecting goal for today were records of area 3 on Volcán Poás. On the way to these records we stopped at INBio to apply for export permits, to gain data on geographic references, and to dry plants. After collecting on Volcán Poás we went to downtown San José to look for two geographic references 1) Tribunal Supremo de Elecciones [1985], 2) Chinchilla

[1987]). We found out that both were out of print but were available in the public library. The second reference had 90 color maps for sale by the publisher for 60 colones each. Spooner made arrangements with the hotel personnel to purchase the maps and photocopy the books for use in final field planning and for deposit in the NRSP-6 geographic library (see Materials and Methods).

Regarding collecting on Volcán Poás, the predicted rain from the Caribbean materialized, and it was raining very heavily above about 2,000 m. However, we were easily able to locate *S. longiconicum* as soon as we entered the park boundary, as it was abundant along the roadsides there. This population was extremely variable and showed a range of leaf morphotypes that seemed on first inspection to interconnect the variability in *S. agrimonifolium*, *S. longiconicum*, and *S. woodsonii*, and the corolla colors varied from pure white to purple. We made six herbarium specimens to document the variability, and a separate herbarium specimen of four leaf types from different plants in the population for possible use in a publication. After collecting in the park we drove east, past Poasito, to Varablanca and north along the road to San Rafael, to search for records of area 4, descending to about 1,600 m. This area was almost completely converted to pasture land, but had some roadside habitats and areas in valleys with a woods border that could possibly harbor wild potatoes. It was raining so heavily that it was difficult to search effectively, and we decided to use the rest of the day to look for geographic references (above). We spent the night in San José.

December 10

Our goal today was to search records of area 6, found on Cerro Chompipe, north of San Rafael. Three of these records, 27, 28, and 29, are listed Alto de Róble. This locality is at or on Cerro Chompipe, according to Chinchilla (1987), Canton San Rafael map (pg. 223).

We drove into Parque Nacional Braulio Carillo, sector Chompipe, and hiked along an established path, continuously going down hill, for about two hours. There were hundreds of plants along this path, some in flower, but none in fruit. We returned to our car and hiked up a new road under construction beginning about 1-2 km into the park entrance. This very steep road was paved on the bottom portion, but only the trees were knocked down farther up hill, ascending the upper parts of Cerro Chompipe. We found flowering and fruiting plants in the newly deforested area (7123).

We then drove east, to look for records of area 7. These records were all about the north and east-facing lower portions of Cerro Zurqui. Route 32 descends the Río Hondura river valley, passing the east-facing slopes of Cerro Zurqui and Cerro Hondura, and from 1,900-1,400 m contains extremely wet habitats with *Gunnera* and other mesic vegetation associated with *S. longiconicum*. We found no wild potatoes in this valley, and returned to San José for the night.

December 11

Our goal today was to search for records of area 16, located in Parque Nacional Tapantí, about a one hour drive southeast of Cartago. Both records were at very low elevations (1,400 and 1,500 m, respectively), and would represent the lowest collections we made in Costa Rica. There is a single road through the park, and it ends at an electrical generating station, except for one side road that runs for about 3 km and ends in a tunnel into a cliff face that serves some function for the electrical station a few km down the road. We found about 50 plants of

S. longiconicum (7129) near the end of the road about 1/4-1/2 km before the electrical generating complex, on a slope by the road, and about a slope by a building just above the complex. About five plants were in flower, one had very young fruits and flowers, and the rest had not yet produced flowers. We decided that because this population and perhaps others might need to be recollected because of young fruits, we would ask Vilchez and/or Aguillar to revisit and collect mature fruits of some populations in February or March. We returned to San José for the evening and worked on the report.

December 12

Our goal today was to search for records of area 11, collected at the base of or on upper elevations of Volcán Turrialba (collections from 2000-3000 m). The top of the volcano is at 3329 m. We drove from San José to north of Cartago on Rt. 2, then on Rt. 230 through Oratorio, Pacayas, Capellades, then north on a road that goes to the entrance to the volcano on a very poor rock and dirt road that goes north up the volcano. It was raining all day, and the road was deeply rutted and slippery and we were only able to ascend to about 2,800 m. In doing so we tore our muffler away from the exit pipe and had to have it fixed later in the day. The entire volcano around this dirt road that ascends the volcano (beginning at about 2,400 m) and the area below this road, is devoted to grazing lands, and here is little chance of potatoes growing in this disturbed area. Record 53 was confusing, because it indicated a collection site "between the Lecheria and base of Volcán Turrialba." A lecheria is a place to sell milk, not a place name, and there are many such places on this volcano.

We located *S. longiconicum* (7133) at 2910 m, in a very wet site in the shade by the roadside, where there was one large plant growing 2.5 m long, and with mature fruits to 33 mm long. This plant was tall like collection 7122 on Volcán Poás, and with very large fruits like collection 7122 and collection 7109 at Monteverde. All three of these collections were of large plants that reminded us of plants of "*S. agrimonifolium*" we collected the prior year in Guatemala. Unlike collections 7109 and 7122, however, very few plants of collection 7133 had interjected leaflets, that have been used to distinguish *S. agrimonifolium* from *S. longiconicum*. After collecting 7133, we continued to hike up the volcano road, reaching 3,180 m at 10°01.0'N, 83°45.6'W. The vegetation from about 3,000 m and above was of smaller bushes, not of taller trees with shade where we normally collected *S. longiconicum*, and we returned to leave the volcano and return to San José.

December 13

Our main goal today was to search for records of area 10, all collected on Volcán Irazú. Records 48, 52 are listed as being on Volcán Irazú, with the additional locality of "Roble." This is different than "Alto de Roble," found by Cerro Chompipe (see December 10). Record 47 is listed as being collected north of Volcán Irazú, but a major eruption in 1963 likely destroyed this population.

The base of Volcán Irazú is completely converted to farming, with much cattle and horse grazing lands. Although the habitats above about 2,400 m have moist organic soils with some remaining large trees that appeared to have been ideal habitats for *S. longiconicum*, the area is so converted to farming that it would be very difficult to locate this species here except in the most protected of sites kept away from the plow and grazing animals. We located *S. longiconicum* (7136) in one such site, in the steep ravine of Río Burris (record 42). We located

a single fruit from this population consisting two very large sprawling plants. This fruit was perhaps not yet mature and we are unsure of the success of this germplasm collection. The banks of Río Burris likely is protected from humans by its very steep slopes and additionally its unpleasant smell, as the river is heavily polluted with sewage. Potatoes are a major crop here, and found escapes of cultivated potatoes to be common on the volcano. The habitat changes dramatically at about 3,100 m, to shrubs rather than trees, and thinner soils. We searched for *S. longiconicum* to 3,200 m, and then turned back.

We drove south and then west to Rancho Redondo to search for record 41 (area 9). This area is also heavily converted to agriculture, and we could find no wild potatoes here. We continued to Llano Grande, and also on a road from just east of Rancho Redondo going northeast to near the headwaters of Río Cajón, also failing to find wild potatoes (areas all heavily converted to farming).

We drove to INBio to drop off our herbarium specimens for drying, check on the status of our herbarium specimen export permit (INBio was kindly helping us obtain one), and to speak to Msc. Carlos Mario Rodríguez Solís (Coordinador Inventario Nacional de Biodiversidad, INBio) about the possibility of hiring Renaldo Aguillar to revisit collection 7116 to see if he could collect mature fruits. We tried to extract seeds from this collection, and at the most we may have two seeds. Sr. Rodríguez Solís kindly agreed to allow Aguillar to revisit this site in February. We returned to San José.

December 14

We spent the day in San José working on this report, with specific attention to rechecking all locality records against the distribution map (Fig. 2). We planned collecting for the next day.

December 15

Our main goal today was to search for record 57 (area 13) collected November 1993 in the "Zona Protegida Cerros de Escazú". We drove from San José via Escazú to San Antonio and searched for a road upwards the NE facing slopes of Cerro de Escazú. We found a trail along a stream and hiked along that stream and later on a steep mountain to the altitude of 1750 meters at 9°52.1' N and 84°08.2' W. That mountain was heavily grazed and the chance to find potatoes was low. We decided to go back to the car (9°53.5' N, 84°07.8' W) and find another way upwards the Cerro to the Zona Protegida. The road map showed a road at the SW side of the Cerro starting at Jorco. We drove to Jorco and found out that the road is in a bad shape and shut off by a locked gate. A much better road would be found at Tarbaca, a village we already drove through on our way to Jorco, southeast of the Cerro. Showing the collecting permit we got entrance to the Zona Protegida Cerros de Escazú. We drove up to the house of the park guard and were allowed to look for potatoes. It was already getting late when we drove further up till the entrance to the Zona Protegida which was closed with a gate. We hiked up to the top of the Cerro El Cedral (2530 m, 9°50.9' N, 84°08.3' W). The habitat appeared perfect for potatoes, but we did not find a single plant of them. We hiked back to the car and drove back to San José. More detailed information from the collector of the INBio herbarium specimen is needed before we will undertake another attempt to find this record.

December 16

Spooner traveled by bus from San José to Buenos Aires, and by taxi on the road north to Utyum, stopping at the place (no houses there) called Los Limones, where he walked uphill the one-hour walk to the Dúrika community. The goal was to try again to collect *S. longiconicum* in the Cordillera de Talamanca (see December 7). He met German Cruz Villanueva and made plans to leave the next day at daybreak.

Hoekstra drove to Cerro de Zurqui to look for records of area 7. The smaller roads and trails are not included on the normal road map and therefore the much more detailed IFAM map on the canton San Isidro of the province Heredia (page 227) was used. The targeted road to drive up to the Cerro as far as possible is the division of the districts Concepcion and San José of this canton. Near the end of the road the car got stuck in a pool of mud and could only be freed with the help of six Costa Ricans working at the farm nearby. The lower part of the mountain has completely been converted into grassland. Hoekstra hiked in and along a stream bed till the edge of the forest. He followed a small trail through the dense cloud forest till the top of the first ridge. From that point the trail was overgrown with bamboo vegetation and a machete would be needed to continue on the trail. He returned to the edge of the forest and found another much wider trail. He reached the top of the second ridge which is the border of the Zona Protegida of Parque Nacional Braulio Carillo. Between the second and the third ridge was an extremely steep valley of a stream of more than 10 meters deep. It was considered to be very risky to cross that valley as it had rained all day and the soil was very slippery. It was evident that other collectors entered the park from a different direction. There were some trails in this part of the forest, but there were no openings which are necessary to provide enough light for the growth of potato plants. Hoekstra returned to the car (located at 10°02.3' N, 84°01.5' W, 1510 m). As there was not sufficient time left for another hike Hoekstra drove back to the hotel, worked on the report and planned to return to Cerro Zurqui the next day.

December 17

Hoekstra drove to Cerro Zurqui via Rt. 32 to Limon. This time he entered Cerro Zurqui via the Calle Zurqui which is an unpaved side road from Route 32, starting 100 meters northeast of the junction of this route and the road to San Isidro. The end of the road is located just after the finca (farm) Zurqui at 10°03.1' N, 84°01.2' W, at 1780 m. This longitude and latitude here are identical with record 35. After 200 m there is a sunny open space with a habitat ideal for potato, with typical accompanying plants like *Gunnera*. He found no potatoes there. The search was continued along a good path which after 700 meters suddenly ended in a wild side stream of the Río Para Blanco. After hiking about 700 meters in the stream it became very difficult to continue, as the valley of the stream was steep and walking was difficult. He hiked up the NW side of the valley to look for a trail, but did not find any. The forest was very dense and could only be entered using a machete. He returned to the stream. On the SE side of the stream he found a few open places in the forest, but also without potatoes, and returned to the car again.

He then drove via San Isidro to an unpaved road which ends shortly after crossing the Río Lajas at 10°02.3' N, 84°02.1' W, 1570 meters. He hiked on the trail crossing the small stream Quebrada Caricias. This area has partially been deforested, and vegetation in the forests is grazed. He hiked to about 1900 meters and found no potatoes. In this area the mountain is

relatively flat and did not have any steep sides. Record 36, however, was collected at Cerro de Las Lajas at an altitude of 2000-2400 meters and potatoes may still grow there. He returned to the car to drive via San Rafael to Calle Lobo (IFAM map of Canton San Rafael, page 223) as the map showed a paved road to nearly 1900 meters. This road became extremely bad at about 1650 meters. Hoekstra returned to the hotel, worked on the report and planned the following two days.

Spooner left Dúrika (located at 9°16'N, 83°14'W, located on the Talamanca 1:200,000-scale topographic map, and on the Kamuk, 3543 I, 1:50,000-scale topographic map), with Cruz Villanueva and two residents of Dúrika (Daniel Brouhard and Nicholas [last name not obtained]). They hiked north, over Cerro Kai, to an abandoned cabin (at 2200 m) south of the apex of the Cordillera Talamanca at Cerro Hakú (at 2600 m). It began to rain heavily later in the afternoon. They camped in the cabin for the night. There was a cold wind and heavy rain the entire night.

December 18

Today's goal for Hoekstra was the record 6 (area 2) collected in the year 1926, in the area of Socorro, which lies on the route to the Volcán Miravalles, where he planned to search the following day. He drove from San José via San Ramón to Piedades Sur. Here the paved road becomes unpaved. Local people told that between Ran Ramón and Socorro no San Antonio exists. Therefore the record probably meant San Antonio NW of Socorro. The area between San Ramón and Socorro is relatively dry and low (1000-1200 m). The environmental conditions along the path from Socorro to San Antonio appeared to be about the same, not a suitable habitat for potato. The potato might have been collected in the mountains northeast of the path (Cerro Azelar), which are more humid. But they are not protected and still low (1600 m). Hoekstra drove to Liberia where he spent the night.

Spooner, Cruz Villanueva, and the two others searched above the cabin, ascending Cerro Hakú. The vegetation immediately above the cabin was second-growth oak forest, and farther up was primary oak forest. It was clear early in the day that it was going to rain heavily later in the day, and they decided that they would search only the Pacific side of the cordillera on this trip, and that Cruz Villanueva would search the other side of the cordillera in February. They split into two parties and agreed to meet in the cabin at 2:00 PM, for a descent to Dúrika later that day. Neither party found wild potatoes, and all walked to Dúrika to spend the night.

December 19

Today's goal for Hoekstra was to search for a possible new site for potatoes on Volcán Miravalles. At its base geothermal heat is being used for the production of electricity and therefore an excellent road exists from Bagaces (at the Pan American Highway) to the volcano. Miravalles is very humid and has appropriate elevations (2018 m) for potato. Hoekstra approached the volcano from different sides but there was no trail to the top. He hiked up a trail east of Las Hornillas, to a deserted farm in Bajo Los Chiqueros, at the base of Cerro Cabro Muco at the south side of the volcano (10°43.1'N, 85°09.1'W, 1050 m). There were trails to some old pastures which did not continue to the volcano. The dense vegetation was impossible to walk through without a machete. People in Guayabal at the W slope advised to plan a two days hike with a local guide. Unfortunately there was no time left for that. Hoekstra

drove to Volcán Tenorio to gather information on the accessibility of that volcano. Volcán Tenorio is very humid also and has appropriate elevations for potato (1916 m), but there are no potato records from it either. The volcano can be accessed from the south, from the side road of Corobici to Río Naranjo, 1 km before the bridge over Río Chiquito, in the direction Lake Arenal. At 10°37.3'N, 85°02.8'W, there is a road/path leading north to the volcano. Hoekstra got conflicting information on the presence of a trail to the top. Then he drove back to San José.

Spooner and Cruz Villanueva meet and make arrangements for Cruz Villanueva to return to the Cordillera Talamanca north of Dúrika on the Atlantic slope, in late February, with two others from his community. Cruz Villanueva earlier showed Spooner and Hoekstra where he had seen wild potatoes grow in a south tributary of the Río Lori north of the cordillera (located at approximately 9°21'N, 83°13'W, on the Siola, 1:50,000-scale topographic map). Spooner hiked downhill from Dúrika to the Buenos Aires-Utuyum Road at a place (no houses there) called Los Limones, took a taxi to Buenos Aires, and a bus from Buenos Aires to San José where he met Hoekstra who drove in that night from the north at Volcán Miravalles.

December 20

Spooner and Hoekstra went to INBio and:

1. gathered and separated the dried plants from the entire expedition and made an agreement to send herbarium labels within a week of returning home.
2. met Sra. Ana L. Vargas, Asistente Dirección Inventario, and made a agreement to have Renaldo Aguillar (INBio) return to the Valle de Silencio to try to get mature fruits of *S. longiconicum* (see December 4-6).
3. met J. T. Morales (record 57, see December 15) regarding his collection in the Cerro de Escazú. He showed us the exact place on the map where it occurred. He also told us of three places he might have seen the plant in the coastal hills south of San José (see December 20 report where we look for these),
4. picked up our export permits, one each for Spooner and Hoekstra (Appendix 4).

They returned to their hotel and worked on this report.

December 21

Spooner and Hoekstra drove to Cerro Escazú and searched for record 57 again on Alto Hierbabuena, based on their conversation the day before with J. T. Morales, but without success. Then they drove south to Monterrey, and searched in the Cerro Caragres along the road from La Legua via San Francisco to San Cristóbal (= direction Bajo Gamboa; see map 3345 II). This is a high area in the Coastal Cordillera (elev. 2,230 m), and we wished to see if potatoes may grow here. The road crests at about 2,100 m, and it is mesic on the north-facing slopes near the top. There is much *S. fraxinifolium* along the roadsides here, a member of a group related to potatoes, the *Solanum* sect. *Basarthrum* group. This species is very similar morphologically to *S. longiconicum* and could easily be confused with it, but it has basal pedicel articulation, unlike potatoes with medial pedicel articulation. They found no wild

Costa Rican 1996 wild potato collecting expedition 33

potatoes. Then they drove east to the area of San Cristóbal Sur and searched for records 59 and 60 along the road at the W slopes of the mountain N of San Cristóbal Norte, again without success. They returned the car to Hertz.

December 22

Spooner and Hoekstra worked on the report and financial accounting. Hoekstra flew back to the Netherlands in the late afternoon.

December 23

Spooner flew back to Madison in the morning.

REFERENCES

- Bamberg, J.B. & D.M. Spooner, 1994. The United States potato introduction station herbarium. *Taxon* 43: 489-496.
- Castillo, R.O., and D. M. Spooner. 1997. Phylogenetic relationships of wild potatoes, *Solanum* series *Conicibaccata* (sect. *Petota*). *Systematic Botany* 22: In press.
- Correll, D.S., 1952. Section *Tuberarium* of the genus *Solanum* of North America and Central America. U.S.D.A. Agric. Monogr. 11: 1-243.
- Correll, D.S., 1962. The potato and its wild relatives. *Contrib. Texas Res. Found., Bot. Stud.* 4: 1-606.
- Hawkes, J.G., 1966. Modern taxonomic work on the *Solanum* species of Mexico and adjacent countries. *Amer. Potato J.*: 43: 81-103
- Hawkes, J.G., 1959. The Birmingham University plant collecting expedition to Mexico and Central America. *Univ. Birmingham Gaz.* 11: 60-63.
- Hawkes, J.G., 1990. The potato: evolution, biodiversity and genetic resources. Belhaven Press, Oxford.
- Hoekstra, R., 1996. The Dutch-German potato collection. <http://www.bib.wau.nl/cgn/potato.html>.
- Holmgren, P.K., N.H. Holmgren & L.C. Barrett, 1990. Index herbariorum, Part I: the herbaria of the world. Ed. 8. *Regnum Veg.* 120: 1-693.
- Chinchilla-V, E. 1987. Atlas Cantonal de Costa Rica. Instituto de Fomento y Asesoría Municipal, San José, Costa Rica.
- Spooner, D.M., G.J. Anderson, and R.K. Jansen, 1993. Chloroplast DNA evidence for the interrelationships of tomatoes, potatoes, and pepinos (Solanaceae). *Amer. J. Bot.*: 80: 676-688.
- Spooner, D.M. & K.J. Sytsma, 1992. Examination of series relationships of Mexican and Central American wild potatoes (*Solanum* sect. *Petota*): evidence from chloroplast DNA restriction site variation. *Syst. Bot.* 17:432-448.
- Tribunal Supremo de Elecciones. 1993. Division territorial electoral de la Republica. Imprenta Nacional, La Urica, San José, Costa Rica.
- United States Department of Interior, 1986. Gazetteer of Costa Rica: official standard names approved by the U.S. Board on Geographic Names. Division of Geography, Department of Interior, U.S. Government, Washington, D.C.



Teléfono: 551-5333 • Apdo: 159 Cartago, Costa Rica • Fax: 551-5348

Cartago, March 12th, 1996

Dr. David M. Spooner
Research Botanist, USAD, Agricultural Research Service
Associate Professor
Department of Horticulture
University of Wisconsin
Madison, WI 53706-1590
Fax (608) 262-4743

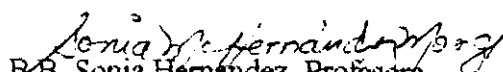
Dear Dr. Spooner:

We were informed by Ana Abdelnour Esquivel, our colleague of the Biology Department, about your project on wild potato germplasm collecting expedition to Costa Rica. Since Mrs. Abdelnour Esquivel will be participating in another project by the time you proposed to come in your last letter, we are offering you our help during the 67 days expedition. We are both biologist and will be pleased to help you to locate the proper places to do the collecting.

Please let us know at your earliest convenience the information we should be getting to insure the success of your expedition.

Looking forward to work with you.


MSc. Silvana Alverenga, Directora


B.B. Sonia Hernández, Profesora

Departamento de Biología
Instituto Tecnológico de Costa Rica
Cartago, Costa Rica
P.O. Box 159-7050
Fax (506) 551-5348



bb

cc: Msc. Ana Abdelnour Esquivel
Archivo

OFICINA NACIONAL
SISTEMA NACIONAL

MINISTERIO DEL AMBIENTE Y ENERGIA
SISTEMA NACIONAL DE AREAS DE CONSERVACION
DIRECCION GENERAL DE VIDA SILVESTRE

AREA DE CONSERVACION _____
LICENCIA No.: 00119485
800669369 U.S.A.
CED O PASAPORTE _____ NACIONALIDAD _____
RECOLECCION CIENTIFICA: Todo el Pais
TIPO DE LICENCIA _____ ZONA _____

NOMBRE: SPOONER DAVID
FECHA EXPEDICION: 04/12/95 FECHA VENCIMIENTO: 04/06/97
DEPOSITO No.: 144988D

☐ ☐ ☐ ☐

[Signature]
FIRMA RESPONSABLE

MOORE TEL. 24 2437 FAX 244 0421



Tel: (506) 244-0690 Fax: (506) 244-2816
Apto. 22-3100 Sto Domingo - Heredia - Costa Rica

REQUIREMENTS TO GET AN EXPORT PERMIT

Name of the Person and Destination Institution

Address of the Person and Destination Institution

Name of the person who will carry the material

Country of destiny

Date of departure


Airport of entry

Numbers of specimens

Quality of specimens: fresh dried spirit

Weight of the specimens → NO

Family, Genus, Species

| | | |
|--|--|--|
| Nombre y dirección del exportador Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, 200 m Norte y 1 m Oeste del cementerio, Costa Rica | | Lugar y fecha: 16 de diciembre de 1996 |
| Nombre y dirección del importador Dr. David Spooner University of Wisconsin, 1575 Linden Drive, Madison WI 53706-1590. U. S. A. | | Fecha de vencimiento 16 de enero de 1997 |
| Medio de transporte utilizado y ruta a seguir Aéreo | |  REPUBLICA DE COSTA RICA PERMISO DE IMPORTACION <input type="radio"/> EXPORTACION <input checked="" type="radio"/> ANIMALES DE VIDA SILVESTRE Y PLANTAS Importation-Exportation Permit for wild-life animals and plants. Dirección General de Vida Silvestre Ministerio de Recursos Naturales Energía y Minas |
| Lugar de salida Aeropuerto Juan Santamaría | | |
| Lugar de destino final U. S. A. | | |

Lugar de investigación, laboratorio de investigación, universidad, museo o parque zoológico para el que van los animales
 Institution Center, Investigation Laboratory, University, Museum, or zoo of destiny

University of Wisconsin.

Lista de especies con sus nombres vulgares científicos, número de animales a exportar
 Species with common and scientific names, number of animal to be exported.

| NOMBRE COMUN COMMON NAME | NOMBRE CIENTIFICO SCIENTIFIC NAME | NUMERO NUMBER | AUTORIZADO AUTHORIZED | |
|-----------------------------|---|--------------------------|--------------------------|----------|
| | | | SI YES | NO NO |
| U. L. | ASTERACEAE, CAMPANULACEAE, SOLANACEAE y VIOLACEAE U. L. | 40 especímenes. U. L. | X | |

Autorización:
 Por cumplir a cabalidad con los requisitos del caso,
 seguidamente autorizamos la exportación-importa-
 ción, del producto arriba detallado.

Authorization:
 Considering that the product fulfills the requirements,
 we hereby authorized the importation-exportation of
 the same.

[Signature]

No. 010403

**RESEARCH INVESTIGATION FORM
MONTEVERDE BIOLOGICAL CLOUD FOREST RESERVE
(PLEASE TYPE OR PRINT)**

Date: _____

Name: _____

Institution and address: _____

Telephone No.: _____ Fax No.: _____

Email Address: _____

Project title: _____

Master's degree __, Ph.D. __, or Doc. Postgrad. _____

Short term project __, or long term project __

Brief project description:

Duration of project: _____

Study sites (please include a map if possible).

Will specimens be collected? Yes __ No __

If yes, plant __ or animal __

Species name: _____

Class: _____

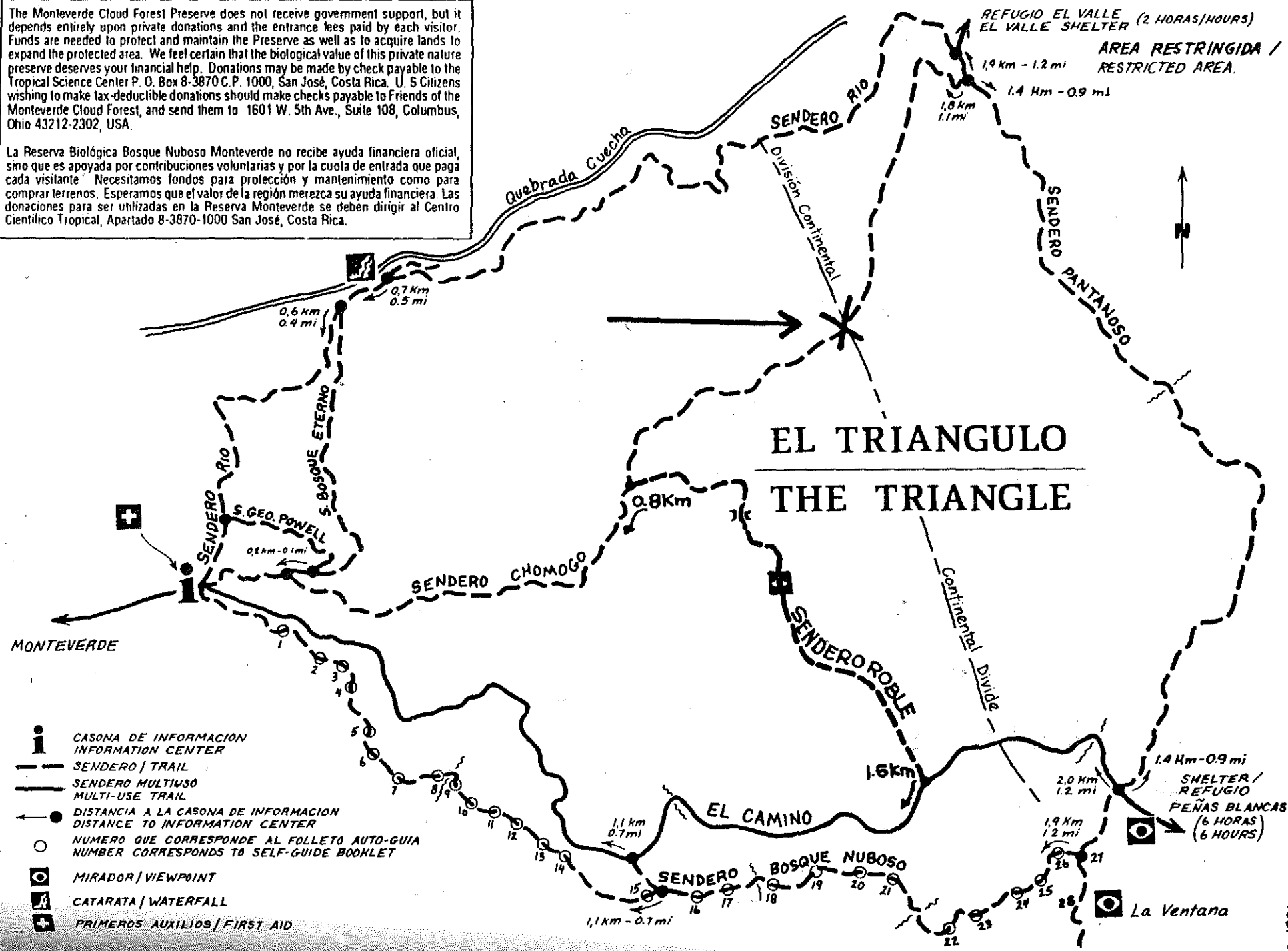
Number of specimens to be collected: _____

Status of collection permit _____

Description of types of field markers and equipment to be used:

La Reserva Biológica Bosque Nuboso Monteverde no recibe ayuda financiera oficial, sino que es apoyada por contribuciones voluntarias y por la cuota de entrada que paga cada visitante. Necesitamos fondos para protección y mantenimiento como para comprar terrenos. Esperamos que el valor de la región merezca su ayuda financiera. Las donaciones para ser utilizadas en la Reserva Monteverde se deben dirigir al Centro Científico Tropical, Apartado 8-3870-1000 San José, Costa Rica.

La Reserva Biológica Bosque Nuboso Monteverde no recibe ayuda financiera oficial, sino que es apoyada por contribuciones voluntarias y por la cuota de entrada que paga cada visitante. Necesitamos fondos para protección y mantenimiento como para comprar terrenos. Esperamos que el valor de la región merezca su ayuda financiera. Las donaciones para ser utilizadas en la Reserva Monteverde se deben dirigir al Centro Científico Tropical, Apartado 8-3870-1000 San José, Costa Rica.



Appendix 7. Distribution of report.

Latin American Distribution

Robert Carlson
Preserve Manager
Biológica Bosque Nuboso Monteverde
c/o Centro Científico Tropical
Apartado 8-3870-1000
San José, Costa Rica
email: montever@sol.racsa.co.cr;
FAX at Monteverde: 506 645 5034;
Telephone at Monteverde: 506 645 5122.

Dr. Raul Castillo
Chief, National Program, Plant Genetic
Resources
Casilla 17-01-340
INIAP
Quito, Ecuador
email: castillo@fitogen.sc.iniap.gov.ec

Ing. Andrea M. Clausen
Coordinator, National Program Genetic
Resources
C.C. 276 (7620)
Balcarce, Argentina
Tel: 54-266-22040/22041/22042
Fax: 54-266-21756

Dr. Ali Golmirzaie
Head, Dept. Genetic Resources
International Potato Center (CIP)
Apartado 1558
Lima 100, Peru
Tel: 51-1-436-6920; 435-4354
Fax: 51-1-435-1570
email: a.golmirzaie@cgnet.com

Dr. William Haber
Botanist, Missouri Botanical Garden
Apdo. 50-5655
Monteverde, Punterenas
Costa Rica

Dr. Zósimo Huáman
Germplasm Curator
International Potato Center (CIP)
Apartado 1558
Lima 100, Peru
Tel: 51-1-436-6920; 435-4354
Fax: 51-1-435-1570
email: z.huaman@cgnet.com

Ing. Carlos Ochoa
Taxonomist, Consultant
International Potato Center
Apartado 1558
Lima 100, Peru
Tel: 51-1-436-6920; 435-4354
Fax: 51-1-435-1570
email: c.ochoa@cgnet.com

Prof. Ramiro Ortega
Curator Cusco Potato Collection
Centro Regional de Recursos Genéticos de
Tuberosas y Raíces
CERRGETYR, University of Cusco
PO Box 295
Cusco, Peru

Dr. Pablo Sánchez V.
Herbario Nacional de Costa Rica
Apartado 749-1000
San José, Costa Rica

Carlos Mario Rodríguez Solís
Coordinador Inventario Nacional de
Biodiversidad (INBio)
P.O. Box 22-33100
Santo Domingo
Heredia, Costa Rica
Fax: 506-244-2816
email: cmrodrig@quercus.inbio.ac.cr

Ing. Santiago Pastor Soplin
Chief, Programa Nacional de Recursos
Genéticos y Biotecnología -
PRONARGE
Instituto Nacional de Investigación
Agraria - INIA
Av. La Universidad s/n
La Molina
Apartado Postal 2791
Lima 12, Peru
Tel: 51-14-351979
Fax: 51-14-361282
email: spastor@upch.edu.pe

Costa Rican 1996 wild potato collecting expedition 42

Ing. Maria Luisa Ugarte
Head, National Program Plant Genetic
Resources
Instituto Boliviano de Tecnología
Agropecuaria
Proyecto de Investigación de la Papa
(PROINPA)
Calle Man Césped 923, Casilla 4285
Cochabamba, Bolivia
Tel: 591-42-49506/49013
Fax: 591-42-45708
email: proinpa@papa.bo

Braulio Vilchez
Departamento de Biología
Instituto Tecnológico de Costa Rica
P.O. Box 159-7050
Cartago, Costa Rica
Tel: (506) 551-5333; FAX: 506 551-5348

German Cruz Villanueva
Reserva Biológica Dúrika
Apdo. 9, Buenos Aires, Zona Sur
Puntarenas, Costa Rica
Tel: 9 011-(506) 730-0657

Dr. David Williams
Acting Coordinator, International Plant
Genetic Resources Institute (IPGRI) for
Latin America
c/o CIAT
Apartado Aéreo 6713
Cali, Colombia
Fax: 5723-647243
email: okada@cgnet.com

Nelson Zamora
Head, Dept. Botany
Inventario Nacional de Biodiversidad
(INBio)
P.O. Box 22-33100
Santo Domingo
Heredia, Costa Rica
Fax: 506-244-2816
email: nzamora@randia.inbio.ac.cr

Dr. Hubert Zandstra
Director General, International Potato
Center (CIP)
Apartado 1558
Lima 100, Peru
Tel: 51-1-436-6920; 435-4354
Fax: 51-1-435-1570
email: h.zandstra@cgnet.com

United States Distribution

NRSP-6 Technical Committee

Note: The country code "+1" has not been
added to the telephone and Fax.

Dr. John Bamberg
USDA, ARS
Potato Introduction Station
4312 Highway 42
Sturgeon Bay, WI 54235
Tel: 414-743-5406
Fax: 414-743-1080
email: nr6jb@sol.ars-grin.gov

Dr. Richard L. Dunkle
USDA, ARS
Midwest Area Director
1815 N. University St.
Peoria, IL 61604
Tel: 309-685-4011
Fax: 309-681-6684
email: a03admwa@attmail.com

Dr. Florian I. Lauer
University of Minnesota
Dept. of Hort Science
305 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108
Tel: 612-624-3612
Fax: 612-624-4941
email: lauer002@maroon.tc.umn.edu

Dr. Richard L. Lower
University of Wisconsin
240G Agricultural Hall
1450 Linden Drive
Madison, WI 53706
Tel: 608-262-2349
Fax: 608-265-6434
email: richard.lower@ccmail.adp.wisc.edu

Dr. J. Creighton Miller, Jr.
Texas A&M University
Dept. Hort Sciences
Rm 202 Hort/Forest Sci Bldg
College Station, TX 77843
Tel: 409-845-3828
Fax: 409-845-0627
email: jcmillerjr@tamu.edu

Costa Rican 1996 wild potato collecting expedition 43

Dr. Alvin R. Mosley
Oregon State University
Dept. of Crop Science
Crop Science Bldg, Mailroom 107
Corvallis, OR 97331
Tel: 503-737-5835
Fax: 503-737-1589
email: mosleya@css.orst.edu

Dr. Joe J. Pavek
USDA, ARS
University of Idaho
Research and Extension Center
1693 S 2700 West, PO Box AA
Aberdeen, ID 83210-0530
Tel: 208-397-4181
Fax: 208-397-4311
email: aberdeen@ag.uidaho.edu

Dr. Al F. Reeves
Aroostook State Farm
59 Houlton Road
Presque Isle, ME 04769
Tel and Fax: 209-762-8281
email: reeves@maine.maine.edu

Dr. Robert C. Seem
New York State Ag Exp Station
Administrative Advisor
PO Box 462
Geneva, NY 14456-0462
Tel: 315-787-2211
Fax: 315-787-2276
email: rcs4@cornell.edu

Dr. Henry L. Shands
USDA, ARS
Assoc. Deputy Admin - Genetic Res
Room 117, Bldg 005, BARC-West
10300 Baltimore Avenue
Beltsville, MD 20705-2350
Tel: 301-504-5059
Fax: 301-504-5467
email: shands@sol.ars-grin.gov

Dr. Cecil Stushnoff
Colorado State University
Department of Horticulture
113 B. Shepardson
Fort Collins, CO 80523-1173
Tel: 303-491-7110
Fax: 303-491-7745
email: stushnof@lamar.colostate.edu

Dr. T. Richard Tarn
Agriculture Canada,
Research Centre and Agri-Food
850 Lincoln Road
PO Box 20280
Fredericton, NB E3B 4Z7
Canada
Tel: 506-452-3260
Fax: 506-452-3316
email: ag3090000@ncccot2.agr.ca

Dr. V. Van Volk
Oregon State University
Oregon Ag Exp Station
Corvallis, OR 97331
Tel: 503-737-4251
Fax: 503-737-3178
email: volkv@cgrb.orst.edu

**NRSP-6 Technical Committee
Associates:**

Dr. Robert E. Hanneman, Jr.
USDA, ARS, Univ. of Wisconsin
Department of Horticulture
1575 Linden Drive
Madison, WI 53706
Tel: 608-262-1399
Fax: 608-262-4743
email: rehannem@facstaff.wisc.edu

Dr. Roger Lawson
USDA, ARS, NPL
Horticulture and Sugar Crops
10300 Baltimore Avenue
Room 234, Bldg 005, BARC-West
Beltsville, MD 20705
Tel: 301-504-5912
Fax: 301-504-5467
email: a03eciverolo@attmail.com

Mr. Max W. Martin
Potato Introduction Station
4312 Highway 42
Sturgeon Bay, WI 54235
Tel: 414-743-5406
Fax: 414-743-1080

Dr. Philipp W. Simon
USDA, ARS, Univ. of Wisconsin
Department of Horticulture
1575 Linden Drive
Madison, WI 53706
Tel: 608-262-1248
Fax: 608-262-4743
email: psimon@facstaff.wisc.edu

Dr. David M. Spooner
USDA, ARS, Univ. of Wisconsin
Department of Horticulture
1575 Linden Drive
Madison, WI 53706
Tel: 608-262-1399
Fax: 608-262-4743
email: dspooner@macs.wisc.edu

Dr. Arnold Tschanz
USDA, APHIS, PPQ, NPGQC
Bldg. 580, Barc-East
Beltsville, MD 20705
Tel: 301-436-8896
Fax: 301-436-8700
email: a348atschanh@attmail.com

European Distribution

Ing. Daniel Ellissèche
Curator INRA Potato Collection
INRA
Sta. d'amélioration de la pomme de terre
et des plantes à bulbes
Kéraïber
29260 Ploudaniel
France
Tel: 33-98-836 176
Fax: 33-98-836 559

Dr. Lothar Frese
Curator BGRC genebank
Institut für Pflanzenbau (FAL)
Bundesallee 50
38116 Braunschweig
Germany
Tel: 49-531-596600
Fax: 49-531-596365
email: frese@pf.fal.de

Dr. L. Visser
Director Centre for Genetic Resources
The Netherlands (CGN)
CPRO-DLO/CGN
PO Box 16
6700 AA Wageningen
The Netherlands
Tel: 31-317-477001
Fax: 31-317-418094
email: cgn@cpro.dlo.nl

Dr. Geoffrey C. Hartin
Director, International Plant Genetic
Resources Institute (IPGRI)
Via delle Sette Chiese 142
00145 Rome, Italy
Tel: 39-6-518921
Fax: 39-6-5750309
email: ipgri@cgnet.com

Prof. Jack Hawkes
Dept. Continuing Studies
University of Birmingham
School of Biological Sciences
Edgbaston, Birmingham B15 2TT
United Kingdom
Tel: 44-021-472-1301, ext. 3649

Dr. J. Peter Hjerting
Botanisk Have
Københavns Universitet
Øster Farimagsgade 2B
DK-1353 København K
Denmark

Ir. Roel Hoekstra
Curator German-Dutch Potato Collection
CPRO-DLO/CGN
PO Box 16, 6700 AA Wageningen
The Netherlands
Tel: 31-317-477001
Fax: 31-317-418094
email: r.hoekstra@cpro.dlo.nl

Prof. Dr. Evert Jacobsen
Dept. Plant Breeding (I.V.P.)
Wageningen Agricultural University
PO Box 386
6700 AJ Wageningen
The Netherlands
Tel: 31-317-48236
Fax: 31-317-483457
email: evert.jacobsen@users.pv.wau.nl

Dr. Stepan Kiru
Curator VIR Potato Collection
N.I. Vavilov Research Institute of Plant
Industry (VIR)
Bolshaya Morskaja Street 42-44
190000 St. Petersburg
Russia
Tel: 7-812-314 4848
Fax: 7-812-311 8762
email: vir@glas.apc.org

Dr. G. Ramsay
Curator Commonwealth Potato Collection
(CPC)
Scottish Crop Research Institute (SCRI)
Invergowrie
Dundee DD2 5DA
United Kingdom
Tel: 44-1382-562 731
Fax: 44-1382-562 426
email: g.ramsay@scri.sari.ac.uk

Dr. Konrad Schöler
Curator GLKS Potato Collection
Inst. für Pflanzengenetik und
Kulturpflanzenforschung Gatersleben
Genbank Außenstelle Nord - Groß
Lüsewitz
18190 Groß Lüsewitz
Germany
Tel and Fax: 49-38209-80525
email: genbank.luesewitz@t-online.de

Dr. Ronald G. van den Berg
Department of Plant Taxonomy
Wageningen Agricultural University
Generaal Foulkesweg 37
PO Box 8010, 6700 ED Wageningen
The Netherlands
Tel: 31-317-483160/483377
Fax: 31-317-484917
email:
ronald.vandenberg@algem.pt.wau.nl