TRIP REPORT TO PERU AND ARGENTINA

March 3 to April 5, 1985

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Summary

As to prepare future germplasm explorations for Phaseolus in Peru and Argentina, a desk study was undertaken in the most important herbariums of Peru and Argentina. Plant identifications were made and data about phenology and distribution were recorded. Then a germplasm exploration was carried out in northwestern Argentina, mainly in Tucuman; 26 populations of Phaseolus vulgaris var aborigineus and 2 of Phaseolus augusti were described and sampled. Data on ecology, diseases and pests reactions of these populations are presented. Nodule samples were also collected.

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Itinerary

March 3: Travel Bogotá-Lima

PERU

March 4: Contacts in Lima, Instituto Geográfico Militar, Work in Museo de Historial Natural de la Universidad de San Marcos.

March 5: Discussions with R. Burns (Previously at CIAT-GRU and bean collector in Peru), work in Museo de Historia Natural USM.

March 6: Discussions with G. Hernández Bravo, presentation of the project to the North Carolina Mission, discussion with Ing. R. Montalvo (INIPA-La Molina), and then with Dr. R. Ferreyra at USM.

March 7: Tried to see the Herbario Soukup in Jr. Ancash, work in Museo de Historia Natural USM.

March 8: Discussion with Dr. A. Cerrate, Universidad Nacional Agraria La Molina, work in the Herbario de la UNA-La Molina.

March 10: Travel Lima-Buenos Aires

ARGENTINA

March 11: Contacts in Buenos Aires, Instituto Geográfico Militar, discussions with Prof. J. Camara Hernandez and Ing. M. del Carmen Menendez of Facultad de Agronomía, Universidad de Buenos Aires, work in the Herbario Gaspar Xuarez (Buenos Aires).

March 12: Work in the Herbario Gaspar Xuarez.

March 13: Discussion with Ing. R. Palacios, work in the Herbario de la Facultad de Ciencias Exactas y Naturales, University of Buenos Aires, discussion with Dr. G. Favelukes (Universidad de La Plata).

March 14: Discussion with Ing. A. von der Pahlen (INTA headquarters, Buenos Aires), discussion with Dr. Bacigalupo, work in the Instituto Darwinion herbarium.

March 15: Work in the herbarium of the Darwinion Institute, meeting with Dr. J. H. Hunziker, director.

March 16: Travel Buenos Aires-Tucuman, meeting with Ing. J. R. Ricci and O. N. Vizgarra in Tucuman.

March 18: Meeting with Prof. P. R. Legname (Universidad Nacional de Tucuman), work in the herbarium of the Instituto Miguel Lillo, meeting with Ing. N. C. Dantur (Estación Experimental Obispo Colombres), travel to Jujuy.

March 19: Field work in Jujuy and Salta provinces.

March 20: Meeting with Ing. J.M.C. Carracedo (INTA-Cerrillos), field work in Salta.

March 21: Field work in Salta and Tucumán (Trancas) provinces.

March 22: Work in the Herbario Miguel Lillo.

March 23: Field work in Tucuman (Trancas).

March 25: Field work in Tucuman (Trancas).

March 26: Field work in Tucuman (Monteros, Tafi).

March 27: Work in the Herbario Miguel Lillo.

March 28: Field work in Tucuman (Chichigasta) and Catamarca.

March 29: Field work in Catamarca.

March 30: Field work in Tucuman (Tafi).

March 31: Field work in Tucuman (Tafi).

April 1: Work in the Herbario Miguel Lillo.

Phaseolus vulgaris var aborigineus (Burk.) Baudet
Population ≠ 646, found in Argentina, Catamarca, Andalgala, 2 Km north of Yanka Mustia, 28/03/1985, 1080 m a.s.l., 66°00' W, 27°27' S.

April 2: Field work in Tucuman (Burruyacu).

April 3: Desk study in EEAOC (Tucuman) and in the Instituto Miguel Lillo.

April 4: Desk study in Tucuman.

April 5: Travel Tucuman-Cali.

Introduction

The present status of Phaseolus germplasm collection for the important gene banks is now to fill gaps in seeds, information and to look for some specific variability.

In the case of Argentina, three genuine germplasm sources are worthwhile to be studied and if necessary collected:

-- Landraces of common bean Phaseolus vulgaris L. var vulgaris from the highlands of Jujuy (extreme northwestern Argentina). These climbers are the continuity of the indian production system as in eastern Peru and Bolivia. As revealed by the contacts in Buenos Aires, they offer interesting genetic variation.

-- Landraces of lima bean Phaseolus lunatus L. var lunatus from the lowlands of Formosa. Beside the "poroto manteca", a white sieva type commonly sold in markets, it seems that there are a few more types grown in dooryards and home gardens, which are eaten locally. They are colored types, probably not as ancient as the above mentioned common bean varieties.

-- Races of wild ancestors of common bean and lima bean, Phaseolus vulgaris var aborigineus (Burk.) Baudet and Phaseolus lunatus var silvester Baudet, respectively. These could be of interest for widecrosses in medium-term breeding programs, since they belong to the primary gene pool and therefore there are no sterility barriers.

The purpose of this trip was to review the current status of these three germplasm sources in Argentina, and to see how to complete our collections in this regard (see Table 1 for the status of our collections from Argentina in CIAT's GRU as of December 1984).

Table 1. Status of CIAT's GRU collection in Phaseolus species from Argentina as of December 1984.

Species	No. of accessions
Phaseolus vulgaris var vulgaris (cultivated)	88
Phaseolus vulgaris var aborigineus (wild)	5
Phaseolus lunatus var lunatus (cultivated)	15
Phaseolus lunatus var silvester (wild)	1
Phaseolus coccineus subsp. coccineus (cultivated)	1

As our collections were rather poor in wild ancestral forms, it was thought of interest to make some surveys in a few selected Argentinian herbariums to know exactly which Phaseolus species could be found there, where and when.

En route to Buenos Aires, a stop was made in Lima, Peru, to prepare the Phaseolus germplasm exploration which will take place next May and June.

Results

1. Lima

1.1 Work in the Museo de Historia Natural de la Universidad Mayor de San Marcos.

Thanks to the excellent work of Biol. Elida Carrillo Fuentes, the plants of Leguminosae were already properly classified at least up to the genus level. So the "Phaseolus complex" was already well split into Phaseolus, Macroptilium, and Vigna (among others) genus. The following materials were identified (see Table 2):

Table 2. Identifications made at the Museo de Historia Natural, USM, Lima, Peru

Species	No. of samples
P. vulgaris var aborigineus	2
P. augusti	10
P. pachyrrhizoides	8
P. lunatus var silvester (wild)	1
P. lunatus weedy type	1
P. lunatus var lunatus (cultivated)	17
P. sp. (new?!)	1
P. (incomplete)	1
Vigna species (*)	40
Macroptilium species (*)	13
Total	94

* Fully detailed list can be given on request.

As it can be seen in Figure 1 and Figure 2, the geographic distribution of P. augusti and P. pachyrrhizoides seem to be narrow, but it could well be because they were never looked for in other places! Interestingly, the wild vulgaris forms of Peru were different from the typical argentinian aborigineus forms, giving some support to the hypothesis of two subcenters in the andean center. Please note that P. pachyrrhizoides a perenial and vigorous vine, one thought to be close to P. lunatus var silvester, is different and grows at much higher altitudes than the wild lima bean. P. megatylus and P. polytylus should be considered as american Vigna belonging to the subgenus Sigmoidotropis.

1.2 Discussion with Ing. M.S. Robert Burns R. (formerly in charge of bean germplasm in CIAT and bean collector in Peru).

The discussion was focussed on the following topics:

-- Zones and Phaseolus species to be collected in Peru.

-- Passport data on previous collections.

-- Present situation of the peruvian bean germplasm.

About zones: there is an eastwards gradient, the Ceja de Selva and the Selva being much less collected than the Coast. In the Sierra, the degree of collection is linked to the road system: more dense, more collected.

About species: according to R.B., it will not be worthwhile to think about getting more cultivated P. vulgaris material. Curiously, one of R.B.'s assistants during the 1980 collection, has continued to collect in Cajamarca for three more years, and Dr. J.H.C. Davis has recently obtained more material from Peru! Retrospectively, the situation about P. vulgaris in Peru looks rather complicated because:

1. Two independent collections were maintained in La Molina using the same registration system, but on different materials.

2. One collection (the one of INIPA with 800 or so original peruvian entries) has been lost (loss of germination ability due to the lack of cold room facilities).

3. Restricted information on these collections exists in Peru; when the materials were sent abroad, less data came out with the seeds. On the other hand, selections have been done within the original samples; therefore, often there isn't any correspondence between the original description and the final seed product.

4. The majority of the collections recently made for CIAT were indirect ones. Seed source was often markets, because it was a better yielding collection job! The combination of these two explains the scarceness of reliable and standardized information.

5. Generally, no special care was taken about reviewing previous works: therefore materials could be duplicated in largely

distributed families (as canarios, caballeros, etc.).

According to R.B., the collections of P. lunatus are not yet representative: more material could be gathered from the Sierra and the Ceja de Selva - Selva. But it will be difficult (though not impossible: case of the big yellow lima bean from Ica) to find more new variability in the southwestern coastal region.

According to R.B., the collection of P. polyanthus are far from being representative. It should be looked for in northern Peru, where it could be the natural prolongation of the Colombian and Ecuadorian distributions. It would not enter into southern Peru because the Andes are too high there.

Asking about the wild materials, I was told: "En este no hemos entrado, porque no sabemos mucho en las cuestiones de botánica. Valdría la pena contactar a Ramón Ferreyra porque el conoce mucho de la flora peruana."

Finally, I was told that the bean GRU is still to be built in Peru, and that the management of the peruvian Phaseolus genetic resources should be transiently carried out elsewhere.

1.3 Work in the Herbario de la Universidad Nacional Agraria La Molina (Dr. O. Vilchez).

Among various leguminous plants, there were just 8 Phaseolastrae, and just 2 Phaseolus sensu stricto: 1 P. lunatus var lunatus (cultivated) from San Martín called "Frijo toda la vida", and 1 P. augusti (wild) from Cuzco growing at 3300 m.a.s.l. and blooming in December.

1.4 Discussion with Dr. A. Cerrate V. (Vicerector of the Universidad Nacional Agraria).

a) Status of their bean germplasm collections:

Species	No. of accessions
P. vulgaris (cultivated)	500 (40 are ñuñas)
P. lunatus (cultivated)	45
P. polyanthus (cultivated)	2
Other species	0

b) Areas covered by their team:

Ancash, Junin, Cajamarca, Pasco, La Libertad, Huancavelica, Ayacucho (in order of importance), and Ica for the "pallares."

Not covered:

Piura, Tumbes, Lambayeque, Amazonas, Loreto, Ucayali, Cusco, Moquegua, Apurimac, Arequipa, Puno. It must be mentioned that it is quite possible that some of these departments are not at all bean growing areas.

c) Interest of their team:

To provide the campesino with some high yielding varieties adapted to the cool highland conditions. The program was broadened to several pulses (sweet pea, chick pea, broad bean, tarwi, common bean) to improve the andean diet made of maize, amaranths, quinua, andean root crops.

d) Limitations:

Conservation: maintenance of the bean germplasm together with several crops (maize, soybean, tarwi, etc.) in a single cold room. Surprisingly, the amount of seeds in the plastic jars was highly variable, and there were mixtures in several jars. Some original collections had not been increased.

Collection: the data are related to the place (departamento, provincia, lugar), the common name, the name of the remitting person. The majority of the collections are from Sunday markets and then from the threshing areas.

Evaluation: Only 50 accessions are evaluated per year, taking benefit of a thesis work, on the basis of IBPGR indications. But, curiously, I was asked about the interest of evaluating seed color and flower color in time-space replications!

c) Cooperation with CIAT:

They are eager to publish a catalog with characteristics of their entries. They will be most grateful to us if we can provide them with information about the Peruvian material we have, so that they can select some entries to be included in their own breeding programs. For the time being, they would prefer to receive information instead of seed material, since large numbers of entries are not so easy to handle in their conditions. I requested a copy of the full passport data of their bean and pallar collection to check our possible gaps in Peruvian material. Finally, cooperation in future Phaseolus explorations seem to be quite possible; the collection form developed at CIAT's GRU was highly appreciated.

1.5 Presentation of the project CIAT-INIPA on Phaseolus germplasm explorations in Peru sponsored by IBPGR to the INIPA-North Carolina Mission.

During the same day, I was given the opportunity to present the project to Dr. G. Hernández-Bravo and co-workers, to Dr. D. Bandy and Dr. W. Cauto of the North Carolina Mission, and on the other hand to Dr. R. Ferreyra at USM.

The approach of working together with INIPA-GRU on Phaseolus germplasm was very welcome by the North Carolina Mission. The moment was quite appropriate since INIPA is planning to reorganize its germplasm bank. Therefore our documentation efforts prior to complementary collection activities will serve both CIAT and INIPA GRU's. Because of the need for Peru to also maintain important collection in other crops (tarwi, andean tubers, etc.), the interest in Phaseolus will be concentrated firstly in the cultivated forms of P. vulgaris and P. lunatus. INIPA will thus rely during the first steps on other GRUs (i.e. CIAT) to

maintain the other cultivated species and wild forms. Although they are just starting with the reorganization, INIPA's directors will try to find someone to go with DGD in the explorations planned for mid-May 1985.

When visitng Dr. R. Ferreyra at USM, during the conversation, he pointed out some eastern foothills in Amazonas and San Martin because of the richness of the undamaged natural vegetation. Some of these areas because of their remoteness seem to have been poorly collected.

2. Buenos Aires

2.1 Discussion with Prof. J. Camara-Hernández and Ing. M. del Carmen Menendez at the Faculty of Agriculture, University of Buenos Aires.

a) Status of their bean germplasm collection:

Species	No. of accessions
P. vulgaris (cultivated)	192
P. lunatus (cultivated)	12
Other species	0

b) Areas covered:

The collection activity, which is rather recent for beans, has been focused mainly in the northwestern highlands (Jujuy: Tilcara) occasionally in other parts (Formosa) when they were collecting maize samples. From some 17 original collections (the mixtures were considered as a sole collection), they started with their small germplasm collection; according to them, a lot of their entries are duplicates. But an interesting diversity was seen in these accessions of climbing types, probably the natural prolongation of the Bolivian andean production system.

c) Interest:

Evaluation studies were started in Jujuy in conditions close

to the original site of the sample. Attempts were made to follow the IBPGR descriptors, but the distance between the evaluation site and Buenos Aires did no help at all. There were also some problems in handling the descriptor list (type of data to be taken through the successive generations) and to this regard a training at CIAT's GRU was highly desired. Contacts were already undertaken with the breeding programs of INTA-Salta to remit them the germplasm once characterized. It seems that these preliminary evaluations are lacking from the agronomical points of view of pathology and entomology. The idea of studying the Argentinian germplasm of Phaseolus before remitting it to INTA-Pergamino for its long term conservation was welcomed by the Vavilov Laboratory (Prof. J. Camara-Hernández and his team). The procedure was followed before in the case of the maize germplasm from Argentina.

d) Limitations:

The team was working with maize germplasm in the past and now turns to Phaseolus. Basic education in handling Phaseolus germplasm and in offering adequate service to the breeders, as well as some field facilities seem to be the present bottlenecks for this team, maybe the most willing to study bean germplasm in Argentina. They asked for a special training at CIAT's GRU and they are planning a special course in Genetic Resources to be held in Buenos Aires in late 1985 of 1986 with the support of IBPGR. The last part of the training could well be a joint field exploration with CIAT's GRU, in the highlands of Jujuy, to end up with the collection of the cultivated P. vulgaris varieties, of which CIAT already has some (30 collections made by Dr. J.H.C. Davis).

2.2 Work at the Gaspar Xuarez Herbarium, Buenos Aires.

A total of 99 samples called "Phaseolus" were identified (Table 3), mainly from the northeastern provinces (Corriente, Missiones, Entre Rios). For botanists from Buenos Aires, these places are not so far from the Federal District and one can still find there some undamaged natural vegetation and of easy access.

Table 3. Identifications made at the Gaspar Xuarez Herbarium, University of Buenos Aires, Argentina.

S p e c i e s*	No. of samples
P. vulgaris (cultivated)	30
M. atropurpureum	1
M. prostratum	18
M. gibbosifolium (M. heterophyllum)	16
M. bracteatum	1
M. lathyroides	4
M. erythroloma	4
M. geophilum	1
M. sp. (2 incomplete; 1 unknown to DGD)	3
V. lasiocarpa	1
V. adenantha	5
V. caracalla	2
V. candida	1
V. peduncularis v.c.	7
V. longifolia	5

* Full details about origin, phenology, location, etc. can be obtained on request.

As expected the Mesopotamia is not to be recommended to collect Phaseolus, but forage germplasm.

2.3 Work at the Herbarium of the Facultad de Ciencias Exactas y Naturales, University of Buenos Aires (Prof. Ing. R. Palacios).

Some 48 samples called "Phaseolus" were identified from several provinces of Argentina, including the northwest (Table 4.).

Table 4. Identifications made at the Facultad de Ciencias Exactas y Naturales, Buenos Aires.

Species	No. of samples
P. vulgaris v aborigineus	3
P. lunatus v lunatus	1
P. lunatus v silvester	2
P. sp. (sample scrappy because of frost)	1
V. longifolia	1
V. caracalla	1
V. adenantha	5
V. unguiculata	1
V. peduncularis vc	3
V. candida	6
V. lasiocarpa	2
M. erythroloma	9
M. gibbosifolium (M. heterophyllum)	13

2.4 Discussions with Ing. A. von der Pahlen, Regional Director, INTA Headquarters, Buenos Aires.

I expressed the interest of CIAT in getting more material from Argentina, especially the two genuine kinds of germplasm. Dr. A. von der Pahlen exposed the Argentinian dilemma: because of its geographical situation (i.e. the gradient in latitude and the foothills of the Andes), Argentina holds a lot of interesting sources of plant genetic variability, but probably too much as compared to what can be used in practical terms for the time being. But Dr. A. von der Pahlen, now on leave to FAO-Rome, expressed the willingness of INTA to maintain the Phaseolus germplasm on a long term basis. To this regard, he informed me of the plans to build a new germplasm bank at Abra Pampa based on non conventional power supply (solar energy). The new Phaseolus collection form, recently developed at GRU-CIAT was also presented and disussed; there

was a mutual agreement on the techniques to increase variability when sampling the populations in the fields, and to limit the duplicates. The approach developed in this way by CIAT's GRU was welcomed, and Dr. A. v. der Pahlen stressed to me the need to meet the different Argentinian specialists to prepare an integrated project.

2.5 Work at the Instituto de Botánica Darwinion, Buenos Aires.

This is maybe the best place to study the flora in Argentina and the collections of this very fine herbarium were lately increased by Prof. A. Burkart through exchanges. Indeed he was planning to make a revision of Phaseolus before he died suddenly. DGD has just begun with the revision, but found two type specimens: Ramirezella lozani and Phaseolus pringlei! A total of 149 samples called "Phaseolus" were examined and identified (Table 5).

Table 5. Identification made at the Instituto de Botánica Darwinión, Buenos Aires.

S p e c i e s	No. of samples
P. vulgaris v aborigineus	3
P. augusti	4* + 1
P. angustissimus	1*
P. anisotrichus	2*
P. amblyosepalus	1*
P. coccineus (wild)	1*
P. coccineus (cultivated)	3
P. filiformis	1*
P. cocc. formosus	2*
P. lunatus v silvester	8* + 2
P. lunatus (weedy type)	1*
P. lunatus v lunatus	1*
P. metcalfei	1*
P. cocc. obvalatus	1*

continues...

P. pachyrrhizoides	3*
P. pedicellatus	1*
P. polyanthus	5*
P. polystachyus	1*
P. pringlei	2*
Macroptilium**	86
Vigna**	17
Ramirezella lozani	1

* Of non Argentinian origin.

** A fully detailed list can be given on request

This is perhaps just one quarter of the "Phaseolus" material; there are also more aborigineus specimens from other regions in Argentina (its distribution goes up to San Luis), since much of Burkart's collections are held there. The aborigineus forms are clearly distributed along the andean foothills (Figure 3) at intermediate elevations (1200-1600 m.a.s.l.), while the distribution of lunatus var silvester is more eastwards entering hilly and flat lands at lower elevations (400-1000 m.a.s.l.)(Figure 4).

2.6 Work at the Instituto Miguel Lillo, Tucuman.

This is also an important herbarium in Argentina, maybe with more material from the northwest of the country. A total of 183 materials called "Phaseolus" were identified (Table 6).

Table 6. Identifications made at the Instituto Miguel Lillo, Tucuman.

Species	No. of samples
Phaseolus	
vulgaris (wild mexican form)	1*
vulgaris (cultivated)	1
vulgaris var aborigineus	16
augusti	6*

continues...

filiformis	1*
cocc. formosus	2*
lunatus (weedy type)	1*
lunatus var silvester	4* + 1
polystachyus	2*
Macroptilium	
atropurpureum	2
bracteatum	5
erythroloma	16
geophilum	9
gibbosifolium (heterophyllum)	34
lathyroides	17
martii	1
monophyllum	2
prostratum	20
Vigna	
adenantha	5
candida	3
caracalla	11
firmula	1
juruana	1
lasiocarpa	5
linearis	4
luteola	1
peduncularis	11

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* of non Argentian origin; again a fully detailed list about taxonomy, phenology, and origin can be given on request.

This does not cover the whole material available in Tucuman, but approximately one third of the material called "Phaseolus," although it is quite possible that all the true Phaseolus sensu stricto were seen and identified.

2.7 Field work with the Estación Experimental Agroindustrial Obispo Colombres (EEAOC), Tucuman.

Some field collection trips were organized with Ing. José Raul Ricci and Ing. Oscar Niceforo Vizgarra, both of EEAOC, mainly in Tucuman. Ing. Roberto Neuman of INTA-Salta came with us for an exploration in Salta; Biol. Anibal Sanchez Caro of Universidad de La Plata - Departamento de Microbiología (Dr. Gabriel Favelukes) came with us for several explorations in Tucuman and Catamarca. As said previously and as a result of the herbarium examinations, one should look in these provinces for P. vulgaris var aborigineus and P. lunatus var silvester, maybe for other Phaseolus forms (for instance: Hunziker, Cabrera & Gamerra 10671, P. augusti, Jujuy, Capital, Termas de Reyes, 1860-1960 m, 8/03/1983, flower + green pod, in the Darwinion Institute, as reported here in Table 5).

Two concerns were basically taken into account during these explorations:

-- To look specifically for genetic diversity,
-- To make an integrated collection (seed for germplasm purposes, nodule samples, herbariums, etc., taken within the same population).

Because of their wild status and the overall presence of a few dominant genes, there is not too much variation to be expected in the morphological traits. On the other hand, one should remember that the biotic environment (disease, pests) is out of control, therefore it cannot serve as reliable guide in search of diversity, but it must be documented. Since documentation is a critical issue in germplasm management and further evaluations, some efforts were devoted to develop a collection form easy to enter into the computer (see Figure 5).

Twenty six populations of P. vulgaris var aborigineus were found, with the following collection numbers (those which are underlined also include nodule samples to look for Rhizobium): 621, 622, 623, 624, 626,

628, 629, 630, 632, 634, 635, 636, 637, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651. Two populations of P. augusti (or a form very close to this species) were found in Tucuman (633 and 638). For didactical purposes, three other Phaseolinae very often confused by people living in the countryside were also collected: Macroptilium gibbosifolium (heterophyllum) (625), M. geophilum (627) and Vigna caracalla (631).

Given the importance of the geographical and ecological data in search of diversity, one can list the aborigineus accessions as follows (Table 7). A brief characterization of the environment can be done according to the characters of the natural vegetation.

Table 7. Ecological characterization of the collected materials of P. vulgaris var aborigineus.

Environments / Range of altitudes	xeric	subxeric	mesophytic	subhumid	humid
700			650		
900					
1100	636		635		
1300		624,637	628,632		626,640
1500	639,651	629,634	621,646	641	643
1700			622,630, 642		644
1900			623.649	645	
2100			647		
2300			648		

The range of altitudes was given a standard deviation of 100 m as to include all the collections. When working on the same altitude gradient, a stop for sampling was made every 200 m as to have well separated

populations. When we have more than one population in a specific environment, then they differ in their geographic coordinates (longitude, latitude). Gradients in latitude could appear in the reaction of the populations to photoperiodism when the materials are fully evaluated. It is almost certain that some ecological niches can still be filled: mesophytic 900 m, subxeric 1100 m and 1700 m, subhumid 1300 m and 1700 m. Also in the future one should look for the extremes in altitude: at the low altitudes, we are at the same level as in the commercial varieties in most production areas of Salta, Tucuman and Santiago del Estero (this means in the same biotic environment); at the high altitudes, low tempratures begin to be a selection factor. Interestingly enough, at the medium range of altitudes, one can find the most diverse environmental conditions.

In terms of latitude, as it can be seen on the map (Figure 6) where the collections were plotted, there is still a gap around 25°30'S, because there was no secondary road to follow or to cross the latidudinal transect. The collection area was included between 24°00'S and 28°30'S, extending over nearly 500 km in latitude, thus giving us 6-8 latidudinal transects. The mountains and foothills are broadly north-southwards oriented, giving the same outline to the road system. Generally, the mountains are poorly communicated in terms of secondary roads crossing them, since there is no more timber to pick out, but cattle which can move itself downwards to the villages in the valleys.

This orographic outline also has strong influence on the direction of the humid winds coming from the eastern plains. At the Andean foothills, from east-westwards, the direction turns into south-northwards in Tucuman or north-southwards in Salta. Therefore pluviometric data can vary greatly in very short distances (e.g. in Trancas or in the Sierra Medina, Tucuman), and in some brooks, the vegetation can vary greatly from one exposed cliff to the unexposed one (e.g. in the Quebrada de Escoipe, Salta). Sometimes because the pluviosity drops drastically on short distances, the latidudinal transect cannot be thoroughly sampled (e.g. the Quebrada de Toro, Salta).

About diseases and pests, the following observations were made (Table 8). Sometimes the problem appeared with different degrees of expression within the same population. Because there is no control on infection/infestation, if the material is free, one cannot conclude anything about resistance nor tolerance. But the apparent lack of rust, bacterial diseases, viral diseases is worthwhile to be taken into account for further evaluation under artificial and sistematic conditions. The same could be said about Empoasca and bruchids. One should remember the economical incidence of all these diseases and pests in the commercial conditions, just a few miles away from the natural sites of distribution of P. vulgaris var aborigineus. Interestingly enough, very few populations escaped from anthracnose and thrips problems, but even in those cases, they were able to survive for centuries.

Nodulation was generally variable from abundant (e.g. 622, 623, 626, 628, 650) to poor (e.g. 621, 629, 630, 635, 639). Nodules were generally distributed in the upper part of the root system on tertiary order roots. In one population (636), there were so few plants that we preferred not to take any nodules as to give it a chance to survive and produce seeds. The same policy was followed for the uncommon P. augusti (633, 638); moreover, its tuberous root system (main root 50 cm long, diameter 5 cm) was not easy to dig up to have access to the thin roots. The period of seed maturity and the beginning of senescence do not appear as favourable (the nodules are brown, shrunken and probably dead) as seen in population 649. But it is not impossible to find some younger plants, even seedlings (germinating from late seeds) in the populations of P. vulgaris var aborigineus as it occurred several times (e.g. 644, 648).

When the wild populations grow close or even into small villages (as in El Mollar, 649), the peasants generally know the wild bean and call it: "Chaucha de Campo" (in San Lorenzo, Salta, 630; Raco, Tucumán, 635), "Sacha poroto" (in San Pedro de Colalao, Tucuman, 639; El Mollar, Tucuman, 649), or "Chauchita" (in El Sunchal, Tucuman, 650). But on the contrary to what was found by Brücher (1954; 1967) in

Table 8. Problems encountered in the populations of P. vulgaris var aborigineus at the site of collection.

	621	622	623	624	626	628	629	630	632	634	635	636	637
Fungi													
Angular leaf spot	X					X	X	X			X	X	X
Anthracnose	X		X			X	X		X	X	X		
Ascochyta				X	X	X	X	X					
Web blight												X	X
Root rot													
Floury Leaf Spot													
Insects													
Aphids													
Thrips	X		X	X	X	X	X	X		X	X		
Epilachna		X	X										
Leaf miners													
Epinotia													
Other Pests													
Nematods									X		X		X

Table 8. Continuation.

	639	640	641	642	643	644	645	646	647	648	649	650	651
Fungi													
Angular Leaf Spot				X	X					X		X	
Anthracnose			X	X	X	X		X	X	X	X		X
Ascochyta					X								
Web blight		X	X			X	X						
Root rot												X	
Floury Leaf Spot				X									
Insects													
Aphids												X	
Thrips			X			X	X	X		X	X	X	X
Epilachna													
Leaf miners									X				
Epinotia									X		X		
Others Pests													
Nematods			X										

Venezuela and other parts of Argentina, this bean was not eaten nor used in a special way in this part of Argentina. The name of "Sacha Poroto" was also used for other herbaceous vines as Ipomoea in Tafi del Valle or Ticucho, Tucuman, or Sicyos (Cucurbitaceae) in Ticucho, and this causes several vain checks.

2.8 Conclusions

1. In Tucuman, along a transect about the same latitude, it was possible to find Phaseolus vulgaris var aborigineus growing from 700 up to 2300 m thus defining 9 altitudinal zones, much more than expected. Going southwards in Argentina, one could expect this range to be narrowed, but it remains to be checked if at lower latitudes the same distribution will occur.

2. In Tucuman, the more numerous populations of P. vulgaris var aborigineus are clearly mesophytic, well distributed in the "Bosque de Altura" (Digilio & Legname, 1966), with about 1000 -1200 mm/year (from November to April), but some variants can be found in more humid areas at the upper limit of the "Selva de Mirtaceas" (Meyer, 1963) where the rainfall will be nearly 2000 mm/year, or in the drier areas (protected areas in the "Parque Chaqueño," Digilio & Legname, 1966) where it will probably rain less than 1000 mm/year.

3. Diseases and pests were already noted at collection site. The fact that all the materials were seen free of rust, bacterial and viral diseases strongly suggest to go on with more sistematic evaluations in controlled conditions. The same can be said about bruchids which is a very important problem in the seed storage plants of Salta, Tucuman and Santiago de Estero. Since beans are sold all year round, costly control must be undertaken.

4. Phaseolus lunatus var silvester was not found in Tucuman although it has been thoroughly looked for, but another species similar to P. augusti was found. In the case it is this taxon,

distributed in Peru and Bolivia at 3000 m.a.s.l., this will be the first record of distribution so southwards in Argentina. It was found at 1500 m.a.s.l. and just in 2 locations, in the "Bosque de Altura" with Alnus (heavily destroyed and replaced by a secondary grassland).

5. Retrospectively the choice of Tucuman, dictated by practical reasons was good as it was possible to collect seed from endangered populations (about 10 plants in 648!). Pressure from herds and flocks was everywhere high especially in the "Bosque de Altura" as well as in the "Parque Chaqueño." Important areas of the latter have been cut down to make way to bean and soybean crops. Because of this degradation, six stops were made in vain in Catamarca.

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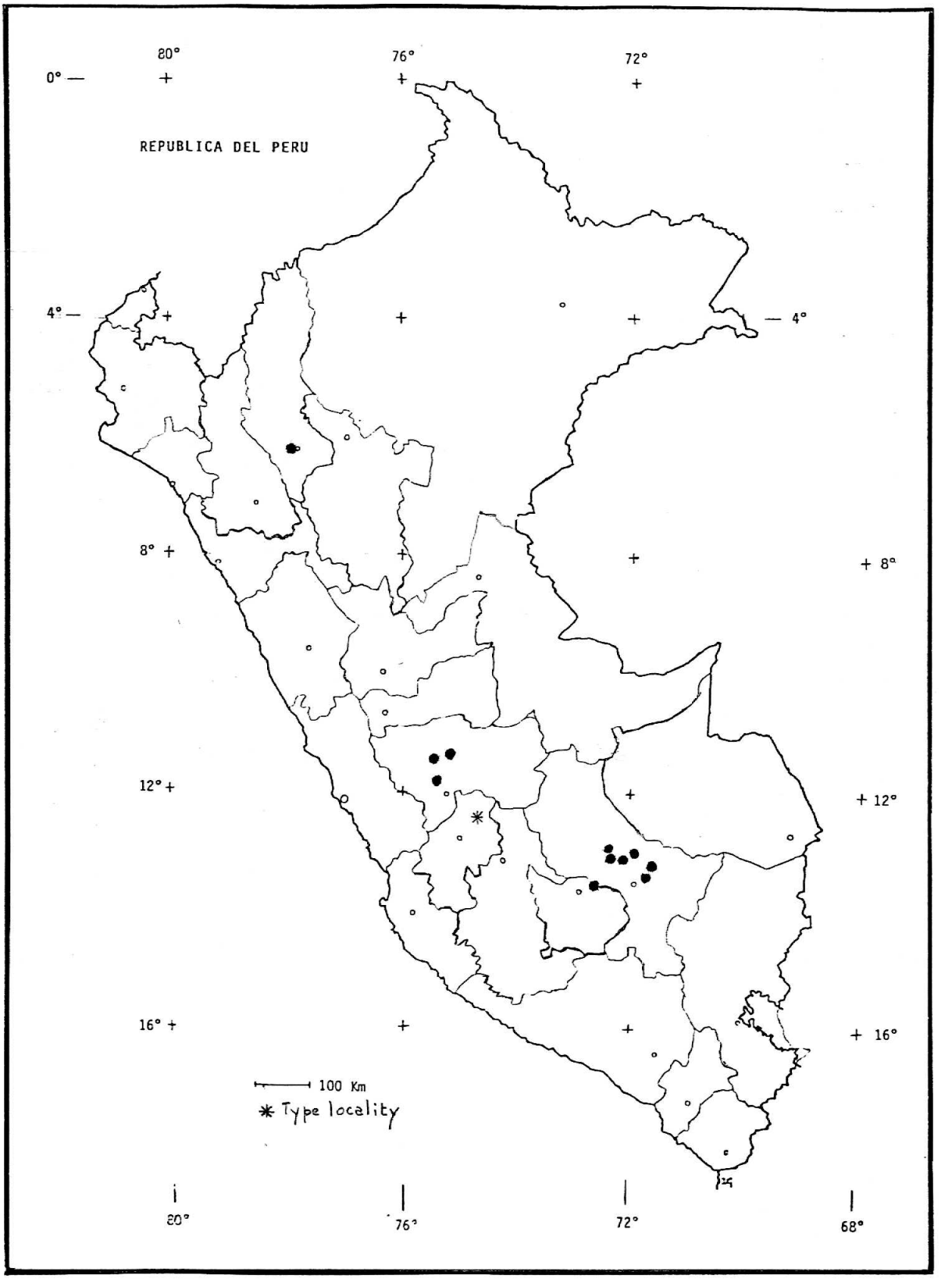

Figure 1 - Potential distribution of P.augusti in Peru.

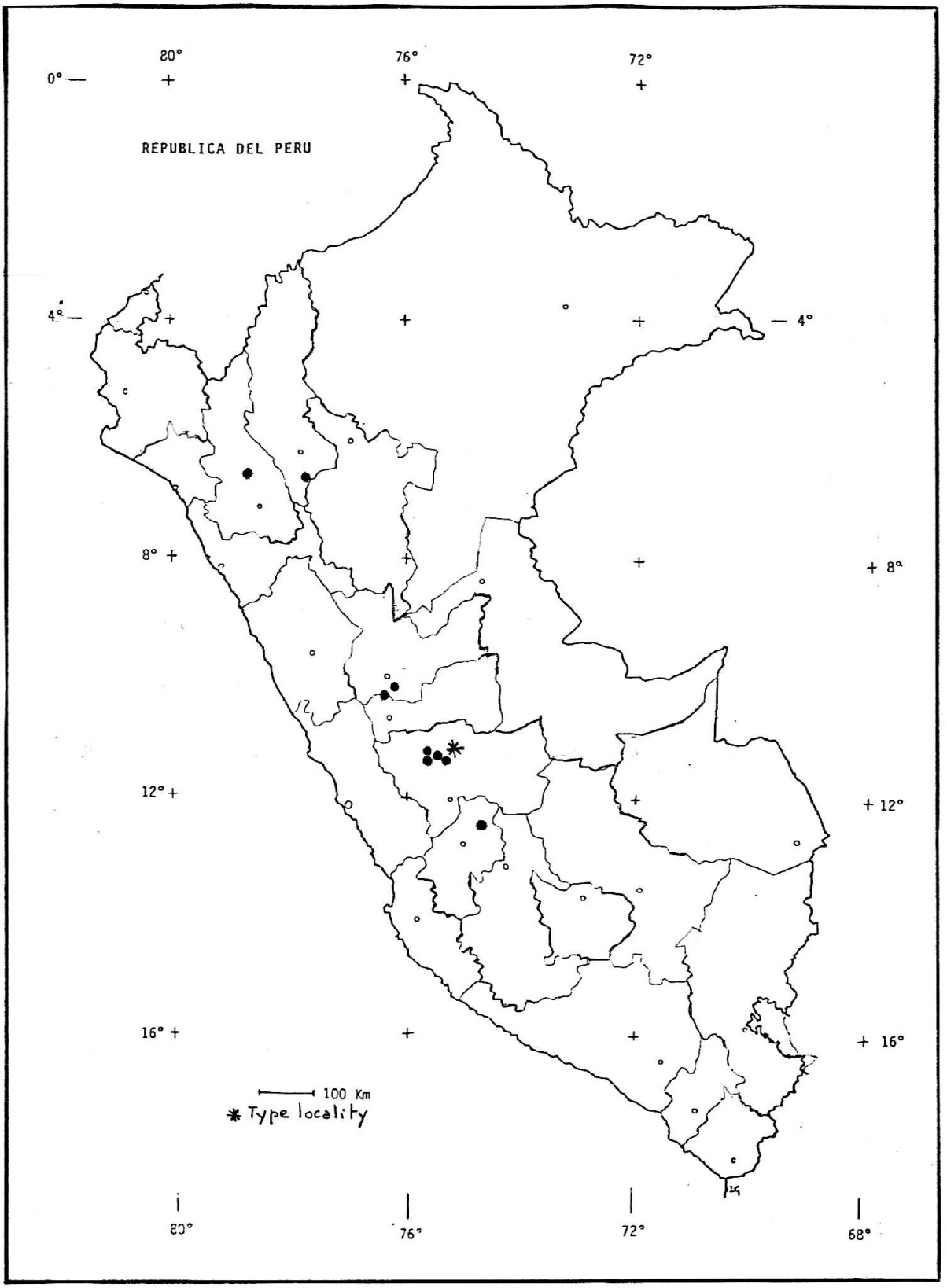

Figure 2 - Potential distribution of P.pachyrrhizoides in Peru.

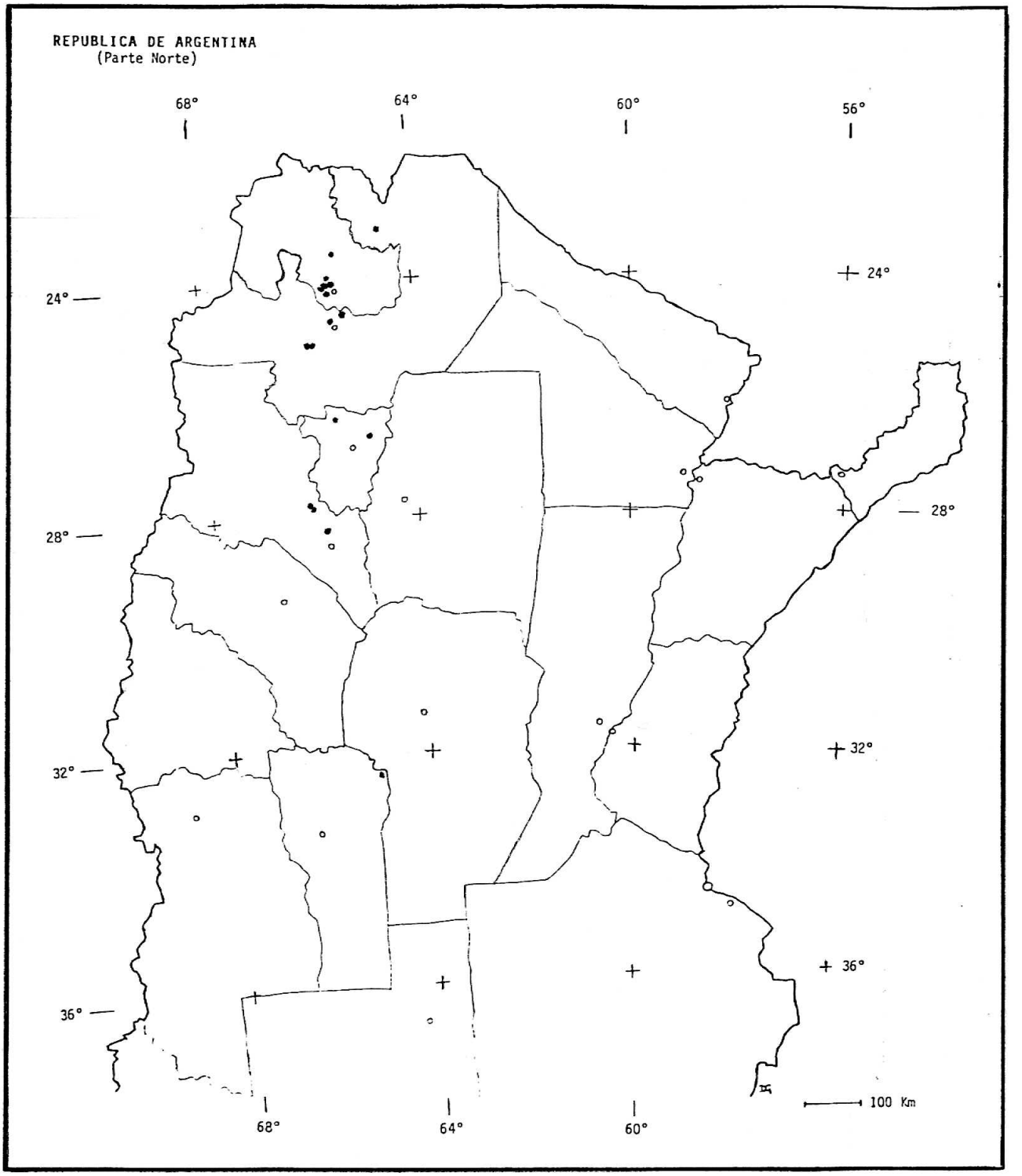

Figure 3 - Potential distribution of P.vulgaris var aboriqineus in northwestern Argentina.

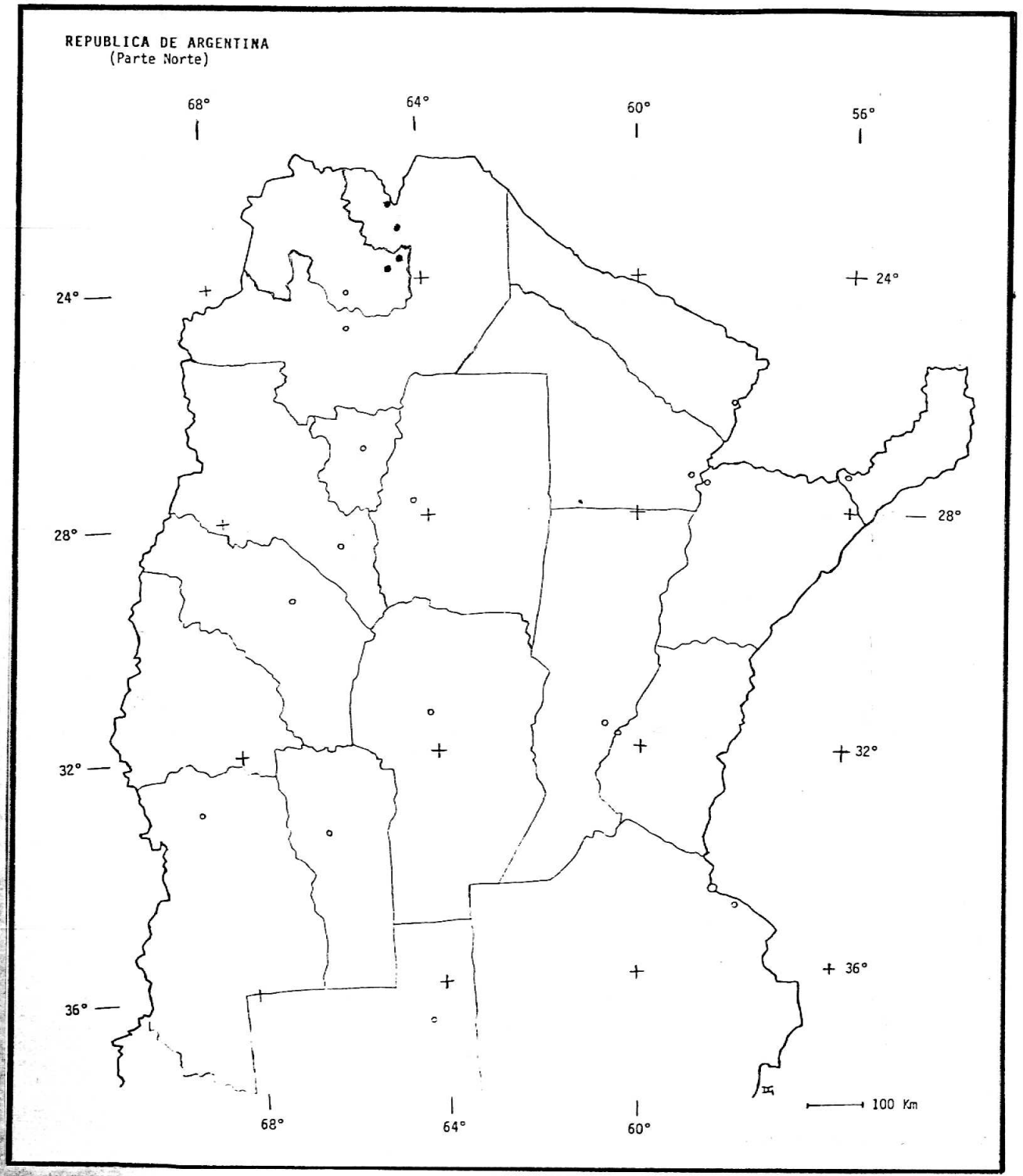

Figure 4 - Potential distribution of P.lunatus var silvester in northwestern Argentina.

Figure 5 - Phaseolus collection form used during this exploration.

CIAT

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1. NU STOCK: 650-DGD
2. NOMBRE Y NUMERO DEL COLECTOR:
3. INSTITUCION RESPONSABLE: CIAT-OC
4. LUGAR DEL PRIMER DEPOSITO: GEAOC-TUCU-ARG
5. ESPECIE: ABOR
6. NOMBRE LOCAL: CHAUCHITA
7. 4

LUGAR DE RECOLECCION:

NU STOCK | 8. PAIS: ARG | 9. ESTADO: TUCU | 10. DISTRITO: BURRUYACU | 11. SITIO: EL SUNCHAL, EL ASERRADERO | 12. PROXIMO PUEBLO: EL SUNCHAL

NU STOCK | 13. DISTANCIA AL PUEBLO: KS: 6. | DIRECCION N S O E: N | 14. LADO DE CARRETERA: 1 = SI 2 = NO: 1 | DE LA CARRETERA | 15. FECHA (DIA/MES/AÑO): 5 02 04 85 | 16. ALTITUD: M 710 | 17. LONGITUD: GRADOS MIN O/E: 65/01 0 | 18. LATITUD: GRAD MIN N/S: 26/33 S | 19. TOPOGRAFIA: 5 | 20. EXPOSICION: 1 | 21. TEXTURA DEL SUELO: 2 | 22. DRENAJE: 1 | 23. SALINIDAD: 1 | 24. NUMERO HERBARIO: 65 C | 25. TRANSPARENCIA: 1 | 26. RHIZOBIUM: 1 | 27. MUESTRA INSECTOS: 2 | 28. OTRA MUESTRA: 2 | 29. PROCEDENCIA INMEDIATA: 1 | 30. CANTIDAD:

DATOS AGRONOMICOS:

NU STOCK | 31. MUESTREO: | 32. PRODUCTIVIDAD: | 33. DENSIDAD: 7 | 34. FENOLOGIA AL ENCONTRAR: 2 | 35. SISTEMAS DE PRODUCCION: | 36. RIEGO: | 37. FERTILIZANTE: | 38. INSECTICIDA: | 39. FUNGICIDA: (1 = SI 2 = NO) | 40. DESHIERBA: | 41. HABITO DE CRECIMIENTO: 4 | 42. ENFERMEDADES: ALS, RR | 43. PLAGAS: THR, APH

NU STOCK | 44. USO: NINGUNO | 45. CUIDADO ESPECIAL: | 46. RAZONES POR COLECTAR: ALTITUD; PUEBLO | 47. NOTAS ADICIONALES:

Codigos para ENFERMEDADES y PLAGAS:

42. ENFERMEDADES:
Fungi: ALT, ALT, ASC, ANT, BOT, BRR, CER, DAP, CPY, MAC, PHY, R, RR, UDB, UHA.
Bacteria: BB, BBS, BU, HBL.
Virus: BCMV, BCLMV, BCMV, BRMV, BSMV, BSDV, BYMV, CMV, CTV.

43. PLAGAS:
APH, APN, BRU, CRI, EMP, HEL, HYL, MAR, MBO, MST, NEM, THR, UFL.

47. NOTAS ADICIONALES:

Nodulacion abundante superficial PULGONES. THRIPS CHINCHAS TINCASE ALS RR

Bosque primario bajo tipo ... Lapacho ... Cebil ... Ricinus, Ipomea, Pulolo ... Pagani, Tarco ... del Monte ...

El Sunchal: lugares desmontados hace tiempo, ambiente ... a subbosque

7. TIPO DE MUESTRA:
1 = [illegible]
2 = cultivado [illegible]
3 = [illegible]
(4) = silvestre

19. TOPOGRAFIA:
1 = Extenso
2 = [illegible]
3 = Plano
4 = Ondulado
(5) = Colinas
6 = Montañas

20. EXPOSICION:
(1) = al sol
2 = en la sombra
3 = intermedio

21. TEXTURA DEL SUELO:
1 = Arenoso
(2) = Franco
3 = Arcilloso
4 = Organico
5 = Pedregoso
6 = Diferentes

22. DRENAJE:
(1) = Normal
2 = Malo
3 = Excesivo

23. SALINIDAD EN EL SUELO:
(1) = Ausencia
2 = Presencia
3 = Desconocida

29. PROCEDENCIA INMEDIATA:
(1) = Campo abierto
2 = Campo cultivado
3 = Casa del agricultor
4 = Tienda
5 = Mercado local

32. PRODUCTIVIDAD:
1 = cultivado, < 400 KG/HA
2 = cultivado, 400-800 KG/HA
3 = cultivado, 800-1200 KG/HA
4 = cultivado, > 1200 KG/HA
5 = silvestre, baja
6 = silvestre, mediana
8 = silvestre, alta

33. DENSIDAD:
1 = cultivado, < 1 pl/m²
2 = cultivado, 2-4 pl/m²
3 = cultivado, 4-8 pl/m²
4 = cultivado, 8-12 pl/m²
5 = cultivado, 12 pl/m²
6 = silvestre, aislado
(7) = silvestre, en grupo

34. FENOLOGIA AL ENCONTRAR:
1 = vegetativo
(2) = en floracion
3 = en madurez

35. SISTEMAS DE PRODUCCION:
1 = monocultivo
2 = asociado con maiz
3 = asociado con otro
4 = multicultivo

40. DESHIERBA:
1 = Manual
2 = Mecanica
3 = Quimica
4 = Ninguna

41. HABITO DE CRECIMIENTO:
1 = Determinado arbustivo
2 = Indeterminado arbustivo
3 = Indeterminado postrado
(4) = Indeterminado trepador
5 = Otro

FICHA No 5

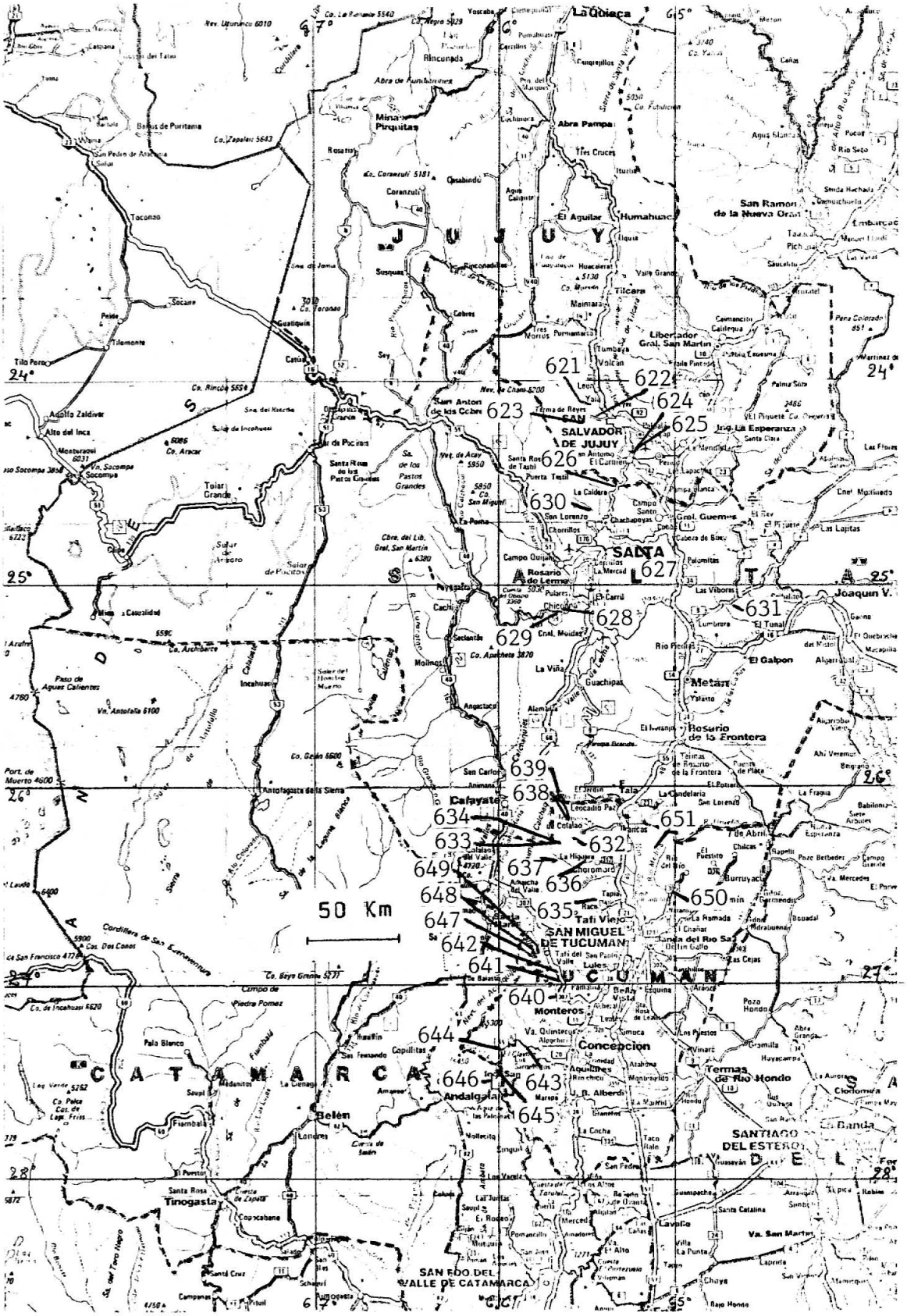

Figure 6 - Exploration sites as indicated by the collection numbers.