PLANT GERMPLASM COLLECTION REPORT

USDA-ARS
FORAGE AND RANGE RESEARCH LABORATORY
LOGAN, UTAH

Foreign Travel to:
Bolivia, Ecuador, and Peru
April 21-May 21, 1981

U.S. Participants

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GERMPLASM ACCESSIONS

Purpose of trip:

To obtain seeds and nodules of alfalfa (Medicago sativa L.) For inclusion in USDA germplasm collections.

Summary:

A 31 day expedition to Bolivia, Ecuador, and Peru by M. D. Rumbaugh and W. F. Lehman resulted in the addition of 205 accessions of seeds and 55 accessions of Rhizobium spp. from legume nodules to USDA germplasm collections. Forty-six paired accessions of alfalfa (Medicago sativa) seeds and nodules will be especially useful for study of nitrogen fixation processes. Nodules also were obtained from 12 legume species other than alfalfa.

Forty-five samples of forage grass seeds representing 16 genera were collected from a variety of plant communities. Many of these accessions should prove useful in breeding cultivars adapted to high altitude, semiarid rangelands. Germplasm of potato (Solanum spp.), barley (Hordeum vulgare, chickpea (Cicer arietinum, flax (Linum usitatissimum), rice (Oryza sativa), and wheat (Triticum vulgare) was obtained. Seeds Andean crops not widely grown in the United States also were collected. One accession of amaranth (Amaranthus sp.), two of cañahua (Chenopodium pellidicaulle), twelve of lupine (Lupinus mutabilis), one of Oca (Oxalis sp.), and eleven of quinua (C. quinoa) will be of interest in southern higher altitude locations.

The alfalfa populations included ecotypes from coastal areas, central highlands, and high Sierra regions. Much of this germplasm will be of interest to scientists in the southwestern states. The ecotypes from the higher elevations should be moderately dormant and adapted to the central and norther states. Certain accessions appeared to grow well on soil of medium salinity.

The alfalfa germplasm resources of Peru are more extensive and varied than those of Bolivia or Ecuador. One Peruvian authority estimated that there are 80-150 distinct and potentially useful ecotypes in Peru which should be included in the U.S. collection. Many of these are in remote regions and difficult to obtain. Seeds of 37 ecotypes were acquired from an existing collection maintained at La Molina Experiment Station by the Ministry of Agriculture of Peru. We recommend that an alfalfa germplasm collection expedition to Peru be funded to obtain the remaining ecotypes. This would require a trip of one to two months duration and active involvement of a Peruvian scientist(s) for that period of time.

The Festuca spp. and Stipa spp. grass resources of Bolivia and Peru are impressive and USDA germplasm holdings of these species are minimal. These grasses have evolved in very arid environments and at a wide range of elevations. They have been grazed by wild and domestic herbivores for centuries and should be useful in certain types of United States rangelands and for land reclamation and conservation purposes. We recommend that a grass specialist investigate the potential utility of these species and prepare a plant exploration proposal if appropriate. This trip could be combined with the one suggested above for alfalfa.

Travel details:

April 21: Traveled from Logan, Utah to Los Angeles, California.

April 22: Met Dr. W. F. Lehman at the Los Angeles Airport in the afternoon and we made the final plans and preparations for the trip. We left for South America on an evening flight.

April 23: Arrived at LaPaz, Bolivia and were met by Dr. James H. Thomas, Chief of Party, Consortium for International Development. Bolivian currency was purchased and necessary supplies for the collection were obtained. CID supplied a four wheel drive vehicle without charge but all operating costs and the salaries and per diem expenses of a driver and a guide were paid by USDA. The guide was Ing. Luis P. Spiaggi, Director del Projecto Bol/80/004, Casilla 2611, Cochambamba, Bolivia. He had obtained an M.S. degree at Kansas State University in grass breeding, spoke English very well and was widely experienced and knowledgeable about Bolivian agriculture. Ing. Spiaggi was aware of the importance of germplasm preservation and should be a primary contact and resource person for any future explorations in Bolivia.

April 24: We left LaPaz and traveled to the small village of Achocalla, 10 km south of El Alto. The elevation was 3, 350 m and we could not find seeds of alfalfa. We did obtain nodules of alfalfa as well as nodules and seeds of Medicago polymorpha and seeds of a wild species of Lupinus.

We traveled to the agricultural experiment station as Patacamaya. This station, like others in Bolivia, is largely self-supporting and raises comparatively large acreages of crops for marketing. The station was started in 1958 as a sheep livestock station but now also has 300 llama, 60 alpaca, 32 vicuña, and 100 chinchilla in breeding herds. There are 9,014 ha of land available for research. Ing. Hugo Mendieta, Station Superintendent, is working with alfalfa, weeping lovegrass, Brazilian grass, and barley. The alfalfa cultivars which have performed best in both dryland and irrigated hay yields trials were `Ranger' and `Saranac'. Approximately 5-7 t/ha can be obtained in 2 cuttings with irrigation. The major problem is the green pea aphid. The alfalfa seed is not inoculated.

Ing. Gualberto Espindola C. is in charge of breeding quinua (Chenopodium quinoa) and cañahua (C. pellidicaulle). He is attempting to breed saponin free quinoa cultivars. Cañahua does not contain saponin and is high in protein. It is popped and ground (pito) and then consumed with milk. Both species are adapted to high elevations (2,800-4,000 m) and are frost tolerant. Quinoa has yielded as much as 5 t/ha in experiments and produces 2 t/ha in farmer's fields. Some wild populations will tolerate -10C temperatures but the crop requires 180-200 days to mature. Cañahua may be of interest as a potential high protein cereal crop. Ing. Espindola gave us seeds of 10 quinoa and 2 cañahua populations. We stayed overnight in Oruro.

April 25: Traveled from Oruro to Cochabamba. Collected Festuca sp. and Medicago sativa in a dry lake bed about 200 m from an area of salt flats. The mountain rangelands are badly overgrazed. They contain primarily Festuca species but we also collected Setaria, Agropyron, and Bouteloua species.

April 26 (Sunday): Went to the Capinota area 100 km south of Cochabama in search of a local ecotype of alfalfa. We saw alfalfa used as an understory crop in several corn fields. Seeds and nodules of `Capinota' were collected in two fields of differing soil types and seeds also were purchased in the market place in Capinota. This ecotype is believed to have originated form California Common and is very susceptible to foliage diseases, leaf hoppers, and aphids. Seeds of a condiment species called "Killquiña" also were purchased. Leaves of this plant are used along with chili peppers and green tomatoes in preparing an excellent hot sauce. Large bales of dried coca leaves were being sold in the market. In the evening we collected several grasses in the foothills above Cochabamba.

April 27: Visited an experiment station at La Violeta operated in cooperation with the Universidad Mayor de San Simon. More than 40 theses have been based on research done at this station. Breeding research is done on alfalfa, ladino, red clover, strawberry clover, sebterranean clover, berseem clover, fescue, oats, wheat, triticale, and corn. The plant breeder is:

Ing. Jamie Chacón Centro de Investigacion en Forrajes La Violeta Facultad de Ciencias Agricolas y Pecuarias Casillas 593/992 Universidad Mayor de San Simon Cochabamba, Bolivia

He is a knowledgeable and industrious scientist but handicapped by a lack of communication with other scientists. The program is well funded. Alfalfa is irrigated and seven cutting are normally obtained. Nematodes are not a problem but blue aphid, pea aphid, and leafhoppers are. The importance of root and crown diseases have not been recognized and stand loss is attributed

to poor water management or mineral deficiencies. No seeds were obtained at the station but we were given a package of `Rhizomack' alfalfa inoculum which was developed by the Programa de Pastos, Universidad Nacional de San Cristobal de Huamanga, Ayacucho, Peru. In the afternoon we visited an outstanding dairy farm near La Violeta. It was owned and operated by Señor Alfonso Gondeck. The 46 ha farm has 36 ha in forage crops which feed 200 dairy animals and a complementary swine operation. Only concentrates are purchased. Corn silage yields 85-100 tons/ha. Butter and cheese are manufactured on the farm and sold direct to the consumer. One field planted to a grass-alfalfa mixture last September had an excellent stand. Senor Gondeck said that he wanted to be certain of the stand so seeded 150 kg alfalfa per hectare along with the grass.

April 28: Went to Punata and collected seeds of the `Criolla' alfalfa which the farmers said performed better than imported cultivars. However, the fields that we saw were badly infested with blue and pea aphids, common leafspot, downy mildew, and stemphyllium. A farmer who produces seed of Criolla said that he sold it for the equivalent of $4.80/pound. We next went to a plant breeding station. I had hoped to visit with Ing. Freddy Villazón H. who is working with Lupinus mutabilis; however, he had gone to Cochabama. The station primarily functions to breed potatoes and is under the direction of:

Ing. Gonzalo Claure V. Estacion Experimental Toralapa Casilla 2631 Cochabamba, Bolivia

The station is well maintained, has excellent facilities and has a collection of more than 700 accessions of potatoes. We went on to Aiquile.

April 29: Traveled to the experiment station at Chinoli. The crops growing in the river bottoms along the way included corn, sugar cane, vegetables, papaya, and citrus. In the upland areas we saw corn, sugar cane, vegetables, papaya, and citrus. In the upland areas we saw corn, wheat, barley, quinoa, amaranth, dry peas, garbanzo beans, and flax. There was little alfalfa at any elevation and the fields that we checked had only small, white nodules.

April 30: We toured the plots on the station with the director:

Ing. Rodolfo Castro Chinoli Estacion Experimental Casilla No. 388 Potosi, Bolivia

Research emphasis is on small grain and management of goats but they do not have any interest in grasses for conservation, alfalfa, and Lupinus mutabilis. Nodules on the alfalfa were abundant, small and white. The seeds had not been inoculated. Nodules on the Lupinus mutabilis were large and purple. The lupine is used in a rotation of legume-potato-wheat. We observed Medicago polymorpha being harvested for hay near Puña but were able to purchase seeds. Stayed overnight in Camargo.

May 1: Traveled through the areas of Abecia, El Puente, Pomeya, and Carrizal and then returned to Camargo. The soils, topography and vegetation appeared to be similar to those of southern Utah and Arizona. I estimated he annual precipitation to be 5-10 inches. Alfalfa seed is produced in this region. One grower stated that he harvested 9,000 m^2 and obtained 150 kg of clean seed. Another grower had both `Moapa' and the native `Criolla' and preferred the latter. They start

cutting alfalfa for hay in September and let it go for seed after the January harvest. Major hazards were hail, grasshoppers, aphids, common leafspot, downy mildew, and crown rots. Rust and red spider mites also were seen. Most fields did not appear to be well nodulated.

May 2: Traveled from Camargo to Oruro. Near Pasar Kancha we collected seeds and nodules of `California' alfalfa which had been recycled many generation on a very salt soil.

May 3 (Sunday): Traveled to LaPaz.

May 4: We met our guide for the remainder of the exploration in northern Bolivia and southern Peru. He was:

Dr. Victor Otazú CID Casilla 3229 Cochabamba, Bolivia

Dr. Otazú is a Peruvian citizen who was trained as plant pathologist in the United States. He is very knowledgeable about the agriculture and geography of southern Peru and knew many of the scientists working in the Departamentos de Arequipa, Moquegua, Puno, and Tacna. We attempted to enter Peru but were turned back at the border near Copacabana, Bolivia. There was no acceptable alternative but to return to LaPaz.

May 5: We went to the Bolivian Migracion office in LaPaz and resolved the problem with Bill Lehman's visa for a fee of 1,500 pesos. The border crossing into Peru was somewhat complicated by the fact that Bill was suppose to have documents showing how much he had earned in Bolivia for income tax purposes. However, the officials accepted our explanations and allowed us to leave. This problem would not have occurred if it had been possible to issue Dr. Lehman an official passport. WE visited the Centro Experimental Camacani located 24 km southeast of Puno, Peru. Their forage program had been discontinued but the superintendent (Ing. Machicao) said that they had clover growing in a dryland wheat field. Upon examination it proved to be Medicago polymorpha and we obtained a sample. Spent the night in Puno.

May 6: Went to the University Experimental Farm near Puno and collected seeds of a number of grass species and of several Lupinus mutabilis accessions from their field plots. The lupines had not been inoculated but bore an abundance of nodules with reddish interiors. Drove to Arequipa, Peru.

May 7: Purchased seeds of `Omate', `Caravali', and `Yaragua' alfalfa in the Arequipa market. There are almost no seeds in the fields here at this time of year. Nodules are difficult to find.

May 8: Collected nodules form `Moapa' and `Yaragua' alfalfa from a new irrigation project in an area near LaJoya which receives almost no precipitation. The seeds were not inoculated before planting. Also collected alfalfa nodules and purchased seed from a farmer in the Tambo River Valley. Seed of `Chamcay' and `Milagroso' rice were collected near El Arenal before proceeding to Tacna, Peru.

May 9: Visited Ing. Luis M. Velasco Barrionuevo in Tacna. His position would be the equivalent of a Director of Agricultural Research and Extension in two states and we sought his advice

about local alfalfa strains. We then drove to the Sama River Valley. Alfalfa is grown extensively but it was first cut by hand and then grazed by cattle and sheep. The livestock are tethered and grazing is very carefully controlled and very thorough. Seed was being produced by a farmer.

Ing. Tito Chocano O. Av. Grau 54 Tacna, Peru

He had tested a number of improved cultivars of alfalfa and `Rhizomack' inoculum and concluded that the local seeds and bacteria produced better crops. Soils in the valley appeared to be quite salty. His fields were well nodulated with large, pink nodules and the plant were vigorous and apparently resistant to root rots. Alfalfa stands are used intensively but last for six years. They are cut for forage or seed and then pastured. Seeds and nodules of this cultivar, `Curibaya`, were obtained. We then traveled to Ilo and Moquegua. All the alfalfa in these areas proved to be `Moapa' `Tambo', or `Yaragua'.

May 10 (Sunday): Drove from Moquegua to Puno, Peru via a northern route passing through Torata and Betara. The first grass seed after leaving Moquegua was in the mountains about 45 km northeast of the city. This is a very arid region and these grasses should be explored, collected, and evaluated by a knowledgeable grass breeder familiar with western U.S. rangelands. An interesting succulent called "Yareta" grows on very arid sites in these mountains at 2,500 m and above. Plants are 1 m tall, 1-3 m wide, pale green, and resemble a rock covered by lichens or moss. This plant is very resinous and is used by the Indians for fuel.

May 11: Returned to LaPaz, Bolivia.

May 12: Flew to Lima, Peru.

May 13: Met our guide and driver in the office of Richard Barnes, the Agricultural Attache, and then left for Huaraz. The guide was:

Ing. Ruben Zambrano Estacion Experimental La Molina Apartado 2791 Lima 100, Peru

He obtained a master's degree from Cornell University under Dr. Crowder and is an authority on Peruvian alfalfa ecotypes.

May 14: Purchased seeds of the `Macate' alfalfa ecotype in Huaraz and of the `Boba San Pedro' ecotype in Tingua. We visited Ing. Tommy Fairlie, Director of the experiment station at Mal Paso. They have been conducting alfalfa yields trials but the research budget had been reduced and all forage research was to be dropped. Next we traveled to Huaylas. Nodules were obtained and alfalfa seed purchased from a farmer. Returned to Huaraz.

May 15: Went to the village of Chiquian and obtained seeds of `Llaclla' alfalfa, wild lupines, and plants of Trifolium amabilis. Returned to Lima.

May 16: Visited the alfalfa breeding plots and facilities at La Molina. Obtained seed samples of 37 alfalfas from Ing. Ruben Zambrano's collection. Ing. Zambrano is a capable scientists and anxious to cooperate with other breeders. His research program is somewhat handicapped by inadequate equipment but ample land and labor are available.

May 17 (Sunday): Flew to Quito, Ecuador.

May 18: We traveled with Ing. Jaime Morillo B., an alfalfa forage producer, to the Sant Catalina Experiment Station. The forage agronomist at the station is:

Ing. Marco Sanchez C. INIA Estacion Experimental Sta. Catalina Apartado 340 Quito, Ecuador

Three types of alfalfa have been identified; Abatoriana, La Nacional, and Morada. These are purple stemmed types which probably came from Peru. We were told that alfalfa stands used to last 15 years but now survive only 3 or 4. This was attributed to two factors: (1) A. Fusarium sp.-nematode disease complex and (2) a "weakening" of the native types by the introduction of foreign cultivars. Two cultivar yield trails are conducted -- one in northern and one in southern Ecuador. The northern test is harvested every 35 days and the southern test every 45 days. Data are also obtained on plant height, regrowth, and leafspot disease severity. The tests are terminated after 12 harvests. Alfalfa seed is produced south of Quito at Ambatado. Marginal land is used by small farmers who individually may produce 10-15 kg of seed which they sell for the equivalent of $3.60 U.S. per pound. Urophlyctis alfalfae (crown rot pathogen) is an important problem in seed fields. The local alfalfas do not tolerate trampling by livestock and `Diablo Verde' and `African' are seeded for pasture. Most alfalfa is fed as green-chopped forage. We looked at the plots on the station and `Thor' appeared better adapted than `Diablo Verde' or `San Pedro'. Alfalfa is not inoculated prior to planing and the agronomist do not believe it to be necessary. In the afternoon we examined forage production fields of `CUF-101', `Abunde Verde' and `Moapa'. Seeds had not been inoculated but there were abundant nodules, some of which were large and pink. Leafspots, especially common leafspot (Pseudopeziza medicaginis), was a severe problem.

May 19: We visited two dairy farms and a seed production field of `Morada' alfalfa. Weeds, downy mildew, and bacterial wilt were common problems. We also examined a 35 cultivar yield trial at Luis A. Martinez College in Ambato. `Liguen', `Moapa', `Nacional', `San Pedro', 'U.S. Salton, and `Verneuil' appeared to be better adapted than the other cultivars which included `Apollo', `Glacier', `Thor', and `Ranger'.

May 20: Consulted with Ing. Jaime Morillo about alfalfa production in Ecuador and with W. Lynn Abbot, the U.S. Agricultural Attache, about sending our samples to the United States. Spent the remainder of the day preparing to leave South America.

May 21: Flew from Quito to Los Angeles and then to El Centro, CA (W. F. Lehman) and Logan, UT (M. D. Rumbaugh).

APPENDIX

Table 1. Plant materials collected on an alfalfa collection trip to parts of Bolivia, Peru, and Ecuador in April and May 1981.

Number of Collections	Name
75	Medicago sativa seed (alfalfa). Field seed collected but no nodules found, 4
29	Nodules from alfalfa roots Paired nodules and seed collected, 20 Nodules but no seed collected, 9
1	Package of inoculum of Rhizobium meliloti
6	Medicago spp. seed probably polymorpha
1	Nodules from Medicago spp.
1	Medicago lupulina (no nodules)
13	Lupinus spp. seed
9	Nodules from Lupinus spp.
2	Trifolium spp. (no nodules)
1	Pisum sp. (no nodules)
1	Crotalaria sp. (no nodules)
1	Cicer sp. (Garbanzo bean) (no nodules)
1	Melilotus alba (sweetclover)
1	Nodules from Melilotus alba
1	Vicia faba (no nodules)
9	Other legumes
1	Nodules from other legumes
46	Grasses from about 15 genera
11	Chenopodium quinoa (quinua)
2	Chenopodium pellidicaulle (cañahua)
7	Triticum vulgare (wheat)
7	Hordeum vulgare (barley)
2	Oryza sativa (rice)
4	A composite, probably Helianthus (sunflower)
3	Plantago spp.
2	Solanum spp. (potato)
2	Schinus molle (pepper tree)
1	Amaranthus sp.
1	Pyrocantha with black seeds
1	Unknown condiment herb

1	Oxalis sp. tubers (oca)
1	Unknown cactus
1	Linum sp. (flax)
1	An unknown high elevation succulent
1	Sorghum bicolor (a sweet sorghum)
1	An unknown shrub

Table 2. A listing and description of alfalfa germplasm obtained in South America in 1981 by M. D. Rumbaugh and W. F. Lehman.

Name	Collection Number	Location where collected or originated	Description
Agua Salada	R251	Lacumba, Peru	A winter type resistant to salinity.
Alta Sierra	R252	Peru	A winter type from the high Sierra. A very variable population.
Boba San Pedro	R325	Tingua, Peru	Not as pubsecent as San Pedro and more of a winter type. A very variable population.
California	R164	Pasar Kancha, Bolivia	Originated as California Common but has been recycled several generations on a very saline soil. Grown at 3,420M.
Capinota	R83	Capinota, Bolivia	An adapted strain of California Common used many years in the Capinota area. Collected on an alluvial flood plain with heavy soil at 2,450 M. Many diseases.
Capinota	R92	Capinota, Bolivia	Growing on sandy soil near Capinota. Well nodulated, tall, erect, and susceptible to Stemphyllium, leaf hopper, and aphids.
Capinota	R93	Capinota, Bolivia	Market purchase.
Caravali	R188	Arequipa, Peru	Market purchase. Said to be a local population used at low elevation.
Muyuquiri*	R142	Muyuquiri, Bolivia	Growing without irrigation at 3,210 m elevation.
Sucre*	R118	Sucre, Bolivia	Growing on sandy soil at 2,600m.
Coro	R241	Moquegua, Peru	A winter type from the highlands of southern Peru.
Criolla	R102	Punata, Bolivia	Growing on a very heavy, irrigated soil at 2,700m. Badly deseased with common leafspot. Many aphids.
Criolla	R105	Punata, Bolivia	Similar to R102.
Criolla	R107	Punata, Bolivia	Irrigated field that was very well nodulated. Population probably came from Peru many years ago. Growing at 2,760m.
Criolla	R144	Sestapa, Bolivia	An irrigated field at 2,390m. Only a few small, white nodules.
Name	Collection Number	Location where collected or originated	Description
Criolla	R146	Pompagua, Bolivia	Irrigated field with saline soil on a river flood plain. Well nodulated, 2,420m.
Criolla	R149	Pompeya, Bolivia	Irrigated field at 2,425 m. Many small nodules.
Criolla	R152	Pompeya, Bolivia	Irrigated field at 2,460 m. Not nodulated.
Criolla	R153	Santana, Bolivia	Growing at 2,480 m. Very few nodules.
Criolla	R154	Chayaza, Bolivia	Susceptible to aphids. Growing at 2,500m.
Criolla	R155	Chayaza, Bolivia	Irrigated field at 2,540 m. Some plants infested with Fusarium and pea aphids. Not well nodulated.
Criolla	R156	Chayaza, Bolivia	Growing on heavy soil at 2,500 m, irrigated. Not nodulated.
Criolla	R157	Pampa Grande, Bolivia	Irrigated field at 2,520 m. Few nodules. Plants taller and more erect than other fields of Criolla.
Criolla	R158	Carrizal, Bolivia	Grown on an irrigated sandy soil. A very tall, erect type said to produce more forage than Moapa.

Criolla	R160	Tacaquira, Bolivia	Grown at 3,200 m.
Cuestacaqui	R253	Lampolla, Peru	A winter type grown at 1,900 m.
Cullaspurro	R236	Peru	
Curibaya	R201	Sama, Peru	Growing on moderately saline soil and well nodulated. Said to be resistant to root rots. 620 m. Elevation in the Sama River Valley.
Curibaya	R248	Curibaya, Peru	Collected at 3,200 m. A winter type.
Cuyruchaca	R258	Cuyruchaca, Peru	Collected at 3,000 m near Coracora.
Huanara	R232	Huanara, Peru	A winter ecotype from the highlands north of Tacna. Said to resist leafhopper and leaf diseases.
Huaychamaca	R256	Quimacha, Peru	Collected near Coracora at 2,100 m.
Huaylas	R219	Huaylas, Peru	Tall erect plants, not very pubescent, a winter type grown at high elevation in the northern part of Ancash Department.
Ica	R257	Ica, Peru	A winter type from the highlands near Ica.
Name	Collection Number	Location where collected or originated	Description
Jequetepeque	R260	Jequetepeque, Peru	From near the northern coast in La Libertad Department. A summer type which requires warm night temperatures.
Llaclla	R225	Chiquian, Peru	Grown at 3,500 m in the Department of Ancash. A winter type.
Locumba	R245	Peru	A winter type, leafy.
Macate	R212	Macate, Peru	Produced at 2,400 m. Pubescent stems. Macate is in northern Ancash Department. Seed purchased in Huarez.
Macate	R215	Tingua, Peru	Seed purchased in Tingua, south of Macate.
Mochona	R239	Peru	A summer ecotype.
Monsefu	R243	Monsefu, Peru	A summer type from near the coast. Susceptible to leaf miner.
Moro Moro	R242	Peru	A winter type from the highland of the Department of Monquegua. Resistant to leaf diseases.
Nacional	R268	Quito, Ecuador	This is the best cultivar in northern Ecuador. Tall, coarse stems which tend to be purplish and pubescent.
Ocurunga	R234	Peru	A winter type with superior leafiness. Early.
Omate	R187	Omate, Peru	A high altitude population. Seed purchased in Arequipa, Peru.
Oruro*	R75	Oruro, Peru	Tall, erect plants growing in old lake bed 200 m from salt flats. Susceptible to aphids 3,650 m elevation.
Pacanga	R250	Pacanga, Peru	A summer type from near the coast in La Libertad Department.
Pachas	R240	Peru	A winter ecotype from the highlands near Moquegua.
Pacoyo*	R140	Pacoyo, Bolivia	Growing at 3,380 m 20 km south of Bentanzos.
Paijan	R261	Peru	A pubescent, summer ecotype.
Pallasca	R233	Peru	A summer type with branched stems.
Para	R254	Peru	
Pompeya	R151	Pompeya, Bolivia	Seed purchased from farmer. Grown at 2,460 m.
Pompeya	R150	Pompeya, Bolivia	Field collected at 2,460 m. Severe infestation of spider mites and rust.
Precuz	R266	Lima, Peru	An early synthetic bred by Ing. Ruben Zambrano from `Liguen', `Africa', `Hariy Peruvian', and `Moapa'. Cut 14 times a year at Lima.
Puña*	R134	Puña, Bolivia	A farm purchase near Puña 3,400 m.
Puquio	R255	Peru	A winter type from near Ayachucho.
Rancap	R235	Peru	A winter type from the center highlands near Huaylas.
Reque	R247	Peru	A summer ecotype.

Salada Grande	R230	Peru	A winter type from the Sama River Valley. Resistant to soil salinity.
Sama Grande	R229	Peru	A winter type.
San Francisco	R238	Omate, Peru	A winter type from the highlands in Moquegua Department. Has larger leaflets than other winter types and is resistant to leaf diseases. Outstanding in the number of nodes per stem.
San Jose	R237	San Jose, Peru	
San Miguel	R246	Peru	A winter type.
San Pedro	R269	Peru	Seed was produced in Peru but obtained in Ecuador. A "Hairy Peruvian" summer ecotype. Tall, erect, large leaflets and long internodes.
Santa Cruz	R228	Peru	A winter type from the southern highlands of Moquegua at Quinistaquillas.
Santa Lucia	R262	Peru	A summer type from thenorthern coastal area. Pubescent. One of the highest forage producing ecotypes at Lima.
Sarria	R231	Peru	A winter type from the southern highlands. Higher foliar area and resistant to leaf diseases.
Talavera	R249	Peru	A winter type from near Ayachucho.
Name	Collection Number	Location where collected or originated	Description
Tambo	R195	Peru	Purchased from a farmer in the Tambo River Valley 100 km southwest of Arequipa. 220 m elevation.
Tarahuay	R227	Peru	A winter type from the southern highlands of Tacna near Curibaya. Resistant to foliar disease and rust.
Tibillo	R259	Peru	
Vitor	R244	Vitor, Peru	A winter type from the highlands near Arequipa.
Yaragua	R186	El Cural, Peru	Growing on a sandy soil in an irrigated field. Not nodulated. 2,250 m.
Yaragua	R189	Arequipa, Peru	Seeds purchased in a market place. Said to be the alfalfa most commonly grown in the area around Arequipa.

* Population named after nearest city or village by the collectors.

Table 3. Alfalfa diseases, insects, and other problems found on an alfalfa collection trip to parts of Bolivia, Peru, and Ecuador in April and May 1981.[1]

Possible Importance of the Pest or Problem		
High	Intermediate or Low	Unknown
Common leafspot	Leafhopper	
Stemphylium leafspot	Spider mite	Phytophthora root rot
Blue alfalfa aphid	Black stem	Rgizoctonia root rot
Pea ahpid	Anthracnose	Root nematodes
Leaf roller	Armyworm	Fusarium root rot
Downy mildew	Alfalfa butterfly	Bacterial wilt
Soil salinity	High water table	

[1] Only common name are given because positive identification was impossible. The pests found were the same or similar to these pests or symptoms in the United States.