Plant Collecting in East Asia - 1981

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The trip and report which follows resulted from plans and arrangements begun more than a year before the start of the trip. Many people, both here and in Asia, helped to make it a success. We have identified 77 people from Japan, Taiwan and Korea who helped in some way. A few helped a great deal.

During the Japan and Taiwan segments I was accompanied by Dr. Paul Li, a plant hardiness expert from the University of Minnesota. He was helpful with the collecting but was especially helpful in translating both Japanese and Chinese into English when needed. Trip expenses for both of us were paid for by plant exploration funds of the National Plant Germplasm Committee, the W-6 Plant Germplasm Project and the Northwest Plant Germplasm Repository.

We were able to collect seed of 57 fruit and nut species, representing 22 genera. These included 18 Rubus (raspberry), 7 Prunus (stone fruits), 2 Corylus (hazelnut), 3 Pyrus (pear), 4 Malus (apple), 1 Juglans (walnut), 2 Vitis (grape), 2 Ribes (currant), 1 Vaccinium (blueberry), and 1 Humulus (hops). Others include the minor genera Sambucus (elder), Zizyphus (jujube), Elaeagnus, and Actinidia (Chinese gooseberry). Also we collected 8 genera of the sub-family Pomoideae which have some graft compatibility with pear and thus might be useful as dwarfing rootstocks. In addition to the species we collected, our colleagues in Asia are to collect a number of late ripening species as the seed mature and send them to us.

The entire trip covered 48 days, from August 1 to September 17. During this time I packed up and moved 28 times. The normal work day was 12 hours, but some ran to 18 or 20. Despite the energy and effort required, it was an exhilarating experience and one that should be a useful beginning for the new national clonal repositories. At least 6 of the wild species we sought appear to be extinct now, so future explorations should focus first on those species most likely to disappear during this decade.

East Asia Plant Collecting - 1981
M.N. Westwood day journal

JAPAN SEGMENT

August 1-2, Seattle-Tokyo

Left home 7 a.m., arrived Tokyo 10 p.m. PDT - lost a day by crossing the international date line. The big 747 was full, mostly Japanese. The movie shown was "Idlemaker", rated "X". It was crass, vulgar, pointless and a poor representation of the USA to the people of another country. Everyone here seems to speak English. We were met at Narita by Mr. Tsuchiya and Dr. Kajiura who drove us to Tsukuba Science City through a beautiful countryside of planted forest trees, kudzu, neatly kept gardens and endless fields of rice, which they overproduce. Side roads are narrow and they drive on the left. People are everywhere, 120 million at last count. Sun Route Hotel is similar to ours, only rooms, beds, etc. are much smaller. Pillow filled with rice hulls. Too hard.

August 3, 1981, Tsukuba

Visited the fruit tree research station Tsukuba-Yatabe, Ibaraki. Drs I. Kajiura and Y. Machida are the pear breeders here. Dr. T. Nishida is doing radiation breeding of apple. The pear breeding is with P. pyrifolia, and the main selection criteria are for disease resistance, fresh quality and productivity. The worst disease is black spot (Alternaria kikuchiana), which infects both leaves and fruit. They screen for this by inoculating the young seedlings. They also look for rust (Cedar apple?) resistance. Another bad disease is trunk canker (Phomopsis spp.). Nijisseiki is the most important cultivar (29% of acreage) but is declining because of black spot. Then come Chojuro (21%), Kosui (16%), Shinsui (10%), and Hosui (9%). These last three are resistant to black spot. Hokusei and two other cultivars were developed in Northern Japan and are hardier than those developed here. They also have found a self-fertile mutant of Nijisseiki that sets heavily. They have just released a new nectarine that does not tip crack and is tolerant to brown rot. Most Japanese peaches are clingstone but they have moderate tolerance to peach leaf curl. They are sweet and have low acid.

Dr. K. Kumagai showed us through the new seed germplasm storage (see reprint). He has a mini-computer room plus a terminal to a big one. He has it programmed to call up any information desired on an accession, on the screen or printout. Seed selection and retrieval from cold storage is automatic by robot control (USA document retrieval system). Huge card file is manual on a rotating reel--like a big lawnmower reel. A first class operation.

Dr. M. Iisuka told us of a wild filbert grove near where we will go tomorrow at Tatsuno-Inashi. Dr. K. Kumashiro might collect some this fall before the children or varmints get them.

August 4, 1981, Tokyo-Ina

Dr. S. Tsuchiya met us at 6:30 a.m. at the Dai-ichi Hotel and led us on a series of city rail trips, ending up at the main railway station, where his wife had waited in line since 6 a.m. holding a place for us so that we'd have a seat on the 8 o'clock express to Ina, Nagano Prefecture. Before we left there, the aisles were crowded with people who stood up during the 3-hour trip. Everywhere our hosts go out of the way to help with our every need.

No sooner do we ask about doing something or going to see someone, and arrangements are quickly started. At each new place we are ushered into the main office, everyone bowing low; tea is set before us, then whatever fruit is in season is brought in for us. And what we don't eat is put in a box and given to us to eat later at the hotel. It is my idea of heaven. At the research stations and the hotels, one is expected to remove his shoes and wear the house slippers placed at the front door. But none of them are close to being big enough for my #12 foot. Even with the biggest pair my heel extends off the end and onto the floor. After several tries they've given up and let me wear my street shoes in the buildings. I told Paul they should nickname me Bigfoot.

Dr. K. Kumashiro met us at the station and drove us to Nanshin Experimental Station where we saw two species of walnut, Juglans sieboldiana and J. subcordiformis. The former is under test there with selection criteria being larger seed and ease of kernel removal. The shell is thick, so they soak the nuts 2 days in water, then roast them for a short while to cause the suture to open up. The shell is then pried off and the kernel comes out whole. Selection #7 is easiest to split after roasting. The inflorescence is large, with red or pink stigmas and may set 12 or 14 nuts in one cluster. The kernels are collected from wild trees in the area and sold for 500 to 700 yen per kg. Dr. H. Makita may be able to collect seed of these two wild species when they mature in September or October. Both grow in the southern half of Nagano-Prefecture.

Also Dr. Kumashiro plans to collect seed of Corylus heterophylla for us in September when they are mature. The nut is the size of a medium Barcelona. Dr. Kumashiro says there is no other Corylus species in Japan. At Shinshu University in Ina he teaches pomology and works on physiological problems, such as rootstocks to prevent hard end, propagation of pear and apple stocks, and transpiration burn of pear leaves. He has OHXF 51 and 97, from Oregon, also Malus prunifolia rinki which seems easy to root from cuttings but is not true M. prunifolia. The leaves are serrate and the fruit are 2 cm diameter, green and have persistent calyx. The pear rootstocks they use are mostly hybrids of P. pyrifolia from open pollinated seed. One tree at Ina appears to be pure P. betulaefolia but they use open pollinated seed of it for rootstocks. Except for one tree of P. calleryana all others so marked are P. dimorphophylla or a hybrid of it and P. pyrifolia (the type designated by Makino as Ainashi P. uyematsuana). I need to develop a simple key to separate these species and send to them. Also it would be useful to send them seed of pure species so they could see what each looks like compared to their many hybrid forms.

The money here is wild. One dollar = 239 yen, so 100 yen = 42¢, 1000 = $4.20, etc. A good meal may cost 6000 yen, a room 10,000 to 12,000. The food is good, e.g. rice wrapped in sea weed, sweet and sour pork or beef, raw salted fish, fried shrimp and lobster, fried eggplant in egg batter, soybean and potato soup, green tea or iced coffee.

August 5, 1981, Ina-Ueda Nagano)

Paul, Dr. Kumashiro and I left Ina by train at 7 a.m. for Ueda. These trains are a wonder. They arrive and leave at the appointed time! We were told that 15 years ago most trains in Japan were diesel powered. Now they are all run by electricity. This was a swift and decisive action in response to the growing cost (and uncertain supply) of petro-fuel. These people appear fast on their feet and adaptable to new situations.

At Shinshu University we met Dr. Y. Yokozawa and research associate M.

Yajima, who work on walnuts (J. regia). They select for large size and thin shell. They use only seedling regia rootstocks and want me to send them new information on black-line disorder. They have an interesting walnut (4X) from colchicine treatment which, when selfed, set nuts twice as large as those set by crossing.

After being told yesterday that only Corylus heterophylla occurs in Japan we were told today at Ueda that C. sieboldiana can be found in one spot in the mountains and that seed collections could be made in the fall for us.

In late afternoon Dr. Kumashiro put us aboard a train to Toyama and bade us goodbye, saying he hoped to see us again.

August 6, 1981, Toyama

Last evening Dr. N. Naruhashi met us at the Toyama station. There remained two hours of daylight, so, after checking in at the Koho Hotel, he drove us to a high ridge overlooking the city on one side and a vast new group of pear orchards on the other, on the high ground of the Kureha district (about 100 m elevation, slight acid pH) overlooking the ubiquitous rice fields in the lowlands. Here the growers have planted the new pears known as the "three waters", Shinsui (new water), Kosui (good water) and Hosui (much water), plus a very early variety Kimizukawase which ripens only 108 days after full bloom. All are P. pyrifolia and all bloom here about April 20. Shinsui is about two weeks earlier than Bartlett, Kosui is about five days before, and Hosui about 25 days after Bartlett. They are of excellent quality but do not store more than a month or two.

A fruit hard-end problem known as "Yuzuhada" seems to be caused by the use of either P. pyrifolia rootstock or a hybrid of it.

One very large pear (400-600 g), Okusankichi, is said to be suited to 6 to 8 months storage. It is only moderate in quality and is sold mostly in Hongkong.

Early this morning Dr. Naruhashi took us up the Ida River Canyon past Yatsuo village. There we saw Juglans sieboldiana growing all along the river. The nuts are immature but can be collected in the fall. On up the canyon at 500-600 m near a power dam we collected fruit of Rubus parviflorus L. and R. crataegifolius Bunge. Both were well past their peak fruiting periods. The soil was moist, rocky and pH of about 6. Near this site we found Potentilla togashii but with no fruit or seed. It can be collected later. Also we found Rubus palmatus growing here but it had fruited much earlier and no fruit or seed were found. Back down the Ida river to a small tributary at about 200 m elevation we found root sprouts of Prunus grayana Maxim., but the original fruiting tree had been cut down. It was at the edge of a small farm garden a short way from a small private Buddist shrine.

We saw where many wild lilies are growing but not flowering now. Dr. Naruhashi referred us to a man in north Japan who knows where many lily species grow: Dr. Koji Ito, Laboratory of Conservation of Biosystems, Division of Environmental Conservation, Graduate School of Environmental Science, Hokkaido University, Sapporo. This man also knows where to find many species of Fragaria, Vitis, Malus, Sorbus, etc. We will visit with him next week at Sapporo.

Back at Toyama (To=many, Yama=mountains) at the university we saw the grand collection of Rubus in a small plot of about 1/4 acre. Many were earlier sent to Bruce Barritt at Puyallup, but a number from tropical countries such as Sumatra were not previously sent. Seed of some of these in the collection were saved last year and given to us: R. microphyllus, R. palmatus, R. crataegifolius, R. minusculus, R. hirsutus, and R.

phoenicolasius.

August 7, 1981, Kyoto-Tokyo

Aside from finding one pear specimen, apparently P. hondoensis, growing in the formal garden at the Heian Shrine, we did not botanize during the half-day spent in Kyoto. Most of the old pear collection at Kyoto University had been moved to Tsukuba and we saw it earlier in the week with Dr. Machida.

Kyoto is a historical city, with many old well-preserved structures and edifices relating to Japan. It is the old Capital of Japan. The name means Capital City. In 1868 the capitol was moved to Tokyo, whose name simply means Capital of the East (east of Kyoto). Because of its historical significance and its priceless national treasures, it was spared from bombing during World War II, as there were no key war industries near there.

Called Heian prior to 1868, Kyoto was the Capital of Japan beginning in 794. A reduced scale replica of the original Imperial Palace was built in 1895 to commemorate the 1100th anniversary of the capital and is called the Heian Shrine. The architecture is 8th century Chinese from the Tang Dynasty. The elaborate and ornate Nijo Castle was built in 1603 as the abode of the Shogun. It is complete with a moat and a massive stone wall surrounding it. The walls of the rooms are lined with silk screens and panels on which artists have painted the classical art we know as distinctively Japanese. The broad hallways connecting the rooms of the castle have floors made of special planks that make birdlike sounds when walked on, hence they are called nightingale floors. They were built thus to warn the Shogun or his guards of invading assassins. Such was life at the top of a pyramid of war lords. But here in the Great Audience Hall in 1867, the 15th and last Shogun, Yoshinobu Tokugawa announced his decision to return the government to the Emperor, bringing to a close the Shogunate reign of 265 years.

In late afternoon we boarded the famous "bullet train", the Shinkansen (New Main Line) for Tokyo. It provides service from Hakata on the lower island of Kyushu to Tokyo. Not only is this the fastest train in the world, but is likely the most precise. Everything from ticket purchase to arrivals and departures are computerized. Our tickets indicated that we were to be in car 14, seats 1A and 1B. We were told to simply stand at the point on the platform marked "14". At precisely 6:18 the train came in (as listed in the schedule book) and the door to car 14 opened at exactly the spot marked "14", and we stepped aboard, with no frantic running up and down with baggage, looking for a car number. It makes Amtrak look like a stone age operation.

August 8, 1981, Tokyo

Early this morning Dr. Isao Shimura met us at our hotel and guided us by subway, train and taxi to Tokyo Noko University. Most of the day was spent looking at research plots and visiting with not only Dr. Shimura but also emeritus professor H. Iwagaki, professor M. Matsumoto, and assistant professor in berry breeding, Dr. S. Ishikawa.

The research group at Noko are doing extensive breeding of North American Vaccinium species and varieties to adapt cultivars to soil and cultural conditions in Japan. They have a fine collection of the native Vaccinium of Japan numbering 16 species (see reprint of Iwagaki et al, 1977). We will request seed of these when available. None were mature at this time. V. ashei is used as a rootstock.

Work on Pyrus at this station is interesting. They now have intergeneric hybrids of Pyrus pyrifolia cv Kosui X Malus domestica cv Fuji and P. pyrifolia X Cydonia oblonga (Russian seedling). (These clones are grafted to P.

pyrifolia rootstock.) We will request them when available for distribution. One clone only of P. hondoensis is here, having been collected by Dr. Y. Tanaka long ago from Okietsu, Shizuoka prefecture. Also there is one clone of P. betulaefolia here, collected from Manchuria, so it should be hardy.

The grafting of Fuji apple onto Chojuro or Nijisseiki pear was only partly successful. Even with pear leaves left below the grafts, they were weak and died after 5 or 6 years.

A few miscellaneous items are of interest to us or to other repositories:

1) They have a peach x plum hybrid here.
2) Vitis thunbergii is growing wild at the edge of the research station. Other Vitis species (six) are native to Japan, mostly in Kyushu, Shikoku, and Honshu, but at least some are found in the cold climate of Hokkaido.
3) Malus sieboldii trees are wild here or have escaped cultivation near the station.
4) Dr. Shimura has two large-fruited jujube trees obtained from Shantung Provence, China, where also grow wild apples and pears.
5) He also has one chestnut tree from Hopei Provence, China.
6) Humulus japonica is found growing as a weed at the research station. It can be collected when the seed mature.

August 9, 1981, Tokyo

We spent about half the day examining specimens at the Tokyo Botanical Garden, run by Tokyo University. Items of interest found there were a dwarf Sorbus species (pinnate leaves), a Crataegus species with simple leaves and vicious 5 cm thorns, a Malus halliana tree that looks to me like M. prunifolia, several Prunus mume trees (no fruit) and numerous Prunus yedoensis cherry (no fruit).

What I consider to be a good discovery was a large grove of Chaenomeles sinensis Koehne. This is related to C. lagenaria (the common Japanese flowering quince of our gardens). C. sinensis is a tree rather than a shrub and has large, many-seeded fruit ovate in shape about 4 cm in diameter and 6 cm long. The seed are immature, but each fruit contains perhaps 100 seed, so we will be able to obtain plenty of seed this autumn. I shall ask Dr. Shimura to collect them.

August 10, 1981, Tokyo-Sapporo

Once again Mr. Tsuchiya and his wife came to the Dai-ichi hotel to help us. At 7 a.m. they came with our air tickets to Sapporo. They helped with our luggage and guided us to the right train to take us to the skyway monorail to which we transferred and arrived at Haneda Airport well before flight time. A one-hour and 5 minute flight by Japan Airlines 747 brought us to Sapporo, where another local group of Japanese scientists awaited us and helped get us to the Koseinenkin Kaikan Hotel in Sapporo.

The plant hardiness conference to be held here from August 11-14 will bring in most of the scientists from Northern Japan, several of whom we will contact in making plans for plant collecting in this region from August 15 to 20.

Dr. Tsuchiya told us that, as plant introduction officer, he will publish in September a list of plants available in Japan. He and others here have already made trips to China and Taiwan and have a number of new materials for distribution. Also he said that Dr. McKenzie in New Zealand had obtained some oriental quince and was learning some interesting things about it. He didn't know if it is the same species we found at the Tokyo Botanic Garden. Dr. Tsuchiya said that someone at the Fruit Station at Morioka would help us find

Corylus species in that area.

August 11, 1981, Sapporo

Today began the international symposium on plant hardiness here at Hokkaido University, home of the Institute of Low Temperature Science. The meeting is being coordinated by Dr. A. Sakai of Hokkaido University and by my travelling companion Dr. Paul Li, University of Minnesota.

During the meeting today there were 12 countries represented, and I was fortunate to get to visit with Dr. Sung-Gak Hong, an ecologist and taxonomist for the Forestry Department in South Korea. He knows where many of the wild species grow which we are hoping to collect for the NWPG Repository. He will meet my plane at Seoul on September 3 and help me get ready to collect. He will coordinate this effort with Dr. Kyu Kim who has already agreed to help even though that will be his busy season for teaching at the University.

Also it was my further good fortune to meet four scientists from China, one of whom is a forester and taxonomist from Harbin in central Manchuria. He is anxious to help Paul and me collect very hardy species next summer. The other scientists are from Beijing, Shanghai (east central) and Canton (southern). All are willing to help collect fruit and nut species, including citrus. Paul Li says that they are all high quality scientists and it will be to our advantage to keep in touch with them. One of them, Dr. Hong-Chun Wang was a classmate with Dr. Te May Ching of OSU when she was a graduate student at Michigan State University.

Many of the participants in the conference are also members of our W-130 technical commitee. The subject matter alone is worth the time and effort, but the contacts with people from many countries will be even more valuable to me in developing necessary liaison for future germplasm collections.

August 12, 1981, Sapporo

It was raining hard when we awoke this morning. By previous arrangement I was met at the conference by Mr. Hisaaki Watanabe of the Hokkaido Central Experiment Station. We went first to the Hokkaido University Botanic Garden. It was pouring rain, so we were neither able to take notes nor pictures of the plants. We did, however, obtain copies of the layout of the Botanic Garden and more importantly booklets listing all of the species held in the greenhouse, garden and arboretum. Should this collection turn out to be as good as it looks, it will truly be a bonanza. They list the following species:

Genus	Number of species	Genus	Number of species
Fragaria	3	Carya	3
Potentilla	16	Ficus	12
Rubus	4	Morus	1
Vaccinium	13	Juglans	7
Gaultheria	2	Corylus	4
Ribes	5	Castanea	1
Vitis	1	Sambucus	3
Actinidia	2	Diospyros	2
Malus	4	Mentha	1
Sorbus	10	Prunus	35
Amelanchier	6	Carica	1
Chaenomeles	2	Punica	1
Crataegus	5	Citrus	4
Cydonia	1	Agave	10

Also of possible interest to other OSU faculty are 42 species of Acer, 17 of Lilium and 17 of Cornus. When it stops raining I shall look at these species in detail, take notes and photograph them. Possibly next spring we can get someone here to do some hand crossing of key species to obtain unmixed seed.

Next Mr. Watanabe took me to the Hokkaido National Agriculture Experiment Station, located about 8 km from Sapporo. Work there involves livestock, soils, pasture, vegetable and fruit breeding. Fruit breeding involves apple and pear selection for cold hardiness, and variety testing of Ribes, Rubus and Vaccinium.

The main pear variety of Hokkaido is Mishirazu, grown in the Yaichi district. It is a pyriform pear, thought to be a chance seedling of Yar Li and very hardy. Newly introduced varieties are as follows:
Hokusei = Mishirazu x Nijisseiki
Hokuho = Mishirazu x Chojuro
Hokkan = Kangyoka (Chojuro x Mishirazu) x Nijisseiki
*Mishirazu = "He doesn't know his own strength "(name comes from its tendency for heavy overset of fruit).

All begin with Hok--- to designate the hardy series developed in Hokkaido. A new clone of mint also has been developed at this station. It is Mentha spicata var. crispa, strain number 15.

August 13, 1981, Sapporo

Attended the plant hardiness symposium and discussions the entire day. Several of the papers could be of direct interest to fruit growers. One by Dr. Steve Lindow (University of California at Berkeley) indicates that, if ice-nucleating bacteria are eliminated or reduced from the surface of a non-hardy plant (such as a pear tree in bloom) then that plant can avoid injury by supercooling to -6 to -9° C during a spring frost. Then others, including Ed Proebsting of Prosser reported that fruit buds at a somewhat earlier stage (and thus hardier) could avoid injury if ice nucleation is induced early in the freezing period, thus preventing supercooling which usually would result in death of the bud when rapid ice propagation occurs suddenly after the super-cooling. Thus at one stage inducing ice nucleation would protect the buds, while at a later stage the prevention of nucleation is helpful. Lindow also suggested that the buildup of ice nucleating bacteria (Pseudomanas syringae) on the plant surfaces would likely be antagonistic to the development of the fire blight bacterium Erwinia amylovora. This could explain why there is no fire blight disease in the Willamette Valley.

Dr. Sakai made arrangements for me to meet with Dr. Koji Ito tomorrow afternoon to discuss collection of wild fruit species and to go through the species collections at the University Botanic Garden.

August 14, 1981, Sapporo

I attended the morning session of the plant hardiness symposium. This group of papers dealt with breeding programs to solve problems of freeze and dessication stress. Dr. Ikeda of Hiroshima reported that the Satsuma Mandarin orange/tangerine is hardier than most others to freezes and that when used as a parent that clone passes along added hardiness to its progeny. Likewise Dr. N. Estrada of Columbia reported that several degrees (°C) of hardiness could be bred into potatoes from frost resistant primitive species. Even tea was shown by Dr. T. Toyao of Kyushu to have genes for frost resistance. The fact that some of the biggest losses of both crops and trees the world over are due

to freeze or frost damage, indicates to me that we at the repository should develop a freeze chamber for routinely screening all of our plant materials for winter hardiness and resistance to spring frost.

At 1:30 I was met by Dr. Koji Ito and we walked down the street about a mile to the Botanic Garden. We discussed the purpose of my visit regarding collection of fruit and nut species with Dr. Tatsuichi Tsujii and assistant Hideki Takahashi. (They are all fair to good with English, though sometimes I have to write my questions out on paper before they understand.) Then Mr. Takahashi took me around the arboretum and shrub garden to look at the species I had listed. It was not easy to find everything as a number of species had no labels and others could not be found, presumably because there is no detailed grid map of the species. Several of the Rubus, Ribes, Juglans, Vaccinium and Fragaria had fruit but some were not ripe. Dr. Ito will collect seed of these later if we do not find them in the wild.

Tomorrow at 9 a.m. Dr. Ito will pick me up and we will go into the hills 100 km from here to look for wild species to collect. We will also stop at a Forestry arboretum to look at a few wild species collected there. The day was pleasant but dark and overcast so I did not take photos of the species. Perhaps it will be brighter when we go to the Botanic Garden just before leaving Sapporo on August 16.

August 15, 1981, Kuriyama

Paul was to meet Dr. Sakai today and also was to see a doctor to get an allergy shot, so he did not go with us to the wilderness area. At 9 a.m. Dr. Ito came by with Mr. Takahashi and a student who drove the car. We drove for 1 1/2 hours, taking successivly narrower and rougher roads, and came to a large estate and laboratory office. This was the Oji Institute for Forest Tree Improvement at Kuriyama owned by the Oji Paper Company, Ltd. We were met by Dr. Shigeru Chiba, Director of the Institute, who, as is the custom here, promptly sat us down at a low table on even lower cushioned chairs. From nowhere came a lady with hot green tea which we drank before getting on with business.

Along with their many forest species and hybrids (among the clones of hybrid Populus tremuloides, Betula, Fraxinus, and Alnus),Dr. Chiba has collected a large number of fruit and nut species native to Hokkaido, which he maintains in a well-kept arboretum.

Besides those photographed, Dr. Chiba also has the following species at the arboretum:

Malus hupehensis -(theifera)
Malus hupehensis - rosa
Cotoneaster (5 spp)
Crataegus (5 spp, Europe and USA)
Sambucus sieboldiana
Prunus ssiori (cherry)
Prunus sargentii (cherry)

Both Drs Ito and Chiba will cooperate in collecting seed of specified species. Some might be hybrids so we must authenticate them as they are established in the repository.

Before leaving the Institute, we were served a delightful lunch of Japanese sandwiches, beer, orange aid, boiled soy beans in the pod, cheese, pressed meat, melon and coffee at the end, English style. The girl who served us also stood at the door as we left to help us get our shoes on, using the long two-foot shoe horn.

From Kuriyama we drove over hill and dale to the Hokkaido University Tomakomai Experimental Forestry Station, elevation 200 m. Mr. Maeda brought out a map of the forest reserve on which he marked the spots where various wild species could be found. Off we went on a dirt road that needed grading. The gate leading to the forest was rusted tight so we all got out to help open it, which yielded to superior numbers. We then found several species right inside the gate (elevation 40 m) so began to botanize without further ado.

Site data: Soil is volcanic, porous, pH 6.7, average temperature in January -7°C, average minimum temperature January -14.5°C.

Other items of interest: Dr. Ito will try to collect Fragaria yezoensis next month. (Yezo is the old name for Hokkaido.) Also he says that wild pears grow on a small hill at Hakodateyama in Southern Hokkaido, which he will try to collect. We saw none, but Dr. Ito says one native species of Mentha and two of Humulus grow in Eastern Hokkaido, He will collect seed in September. Dr. Ito says that in Nykko, one hour by train from Tokyo, grow wild groves of Malus sieboldii, M. zumi (Note: Zumi is the common Japanese name of M. sieboldii) and Toringo crab (To = old name for China; Ringo = apple).

Relative to our China trip next year, Dr. Ito has a friend in SW China who can help with locating many fruit species:

Professor Wang, Director of Botanical Institute, Yunnan, University (He is a taxonomist).

The Honda car we were in today quit just as we were starting back to Sapporo, so we took a $60 taxi ride back to the hotel. Got back at 8:30 p.m., finished dinner at 10:30, finished day journal at 1 a.m.

August 16, 1981, Sapporo - Aomori

We packed our ponderous bags, paid our room rent, stored the baggage at the front desk, and at 7:30 a.m. walked the several blocks to meet Dr. Ito and Mr. Takahashi at the main gate of the Botanic Garden, located near downtown Sapporo. The day was bright as we had hoped for, so we could photograph the plant species of interest to us. As we walked through each section Dr. Ito looked at each specimen to decide if it was labelled correctly (he found several that were not). I have noted each species with fruit and will ask Dr. Ito to collect those from the garden not available from wild material.

Through the kindness of Mr. Sobu, a friend of Dr. Ichiki, Paul, Tad Holubowicz (a Polish scientist) and I were transported by car from Sapporo to the ferry to Aomori. On the way we stopped at a viewpoint overlooking Toya (name means hill lake) and the active volcano just beyond the lake, itself a volcanic lake. We had 3 hours to kill prior to the 10:30 p.m. departure of the ferry, so he got tickets for a boat ride across the lake, past small farms of rice, pole beans, potato and squash. The wild grape, so prized by the Hokkaido bear, were to be seen all along the roadsides and climbing on shrubs and trees. The boat went to an island where it stopped at a museum and shop for a time. We found planted cherry, apple and one pear tree on the grounds. After a dinner of curry rice near the dock we boarded the ferry for the 7 hour trip to Aomori. This ferry is unlike any I've seen. No seats in the main passenger area, only raised pallets covered with a hard rug. We were issued a blanket to ease the firmness of the "mattress" and told to remove our shoes before entering the pallet. We are all expected to have a good night's sleep before arriving at Aomori at 5:20 a.m. Many are already asleep. Now I shall try same.

August 17, 1981, Kuroishi, Aomori

Last night's ferry ride might have been pleasant but for the fact that air circulation was poor and all those bodies in one big room generated enough heat to drive the temperature up to about 90°F. I slept only fitfully until 3 a.m., then walked out on deck and looked at the moon for a while and cooled off but never really got back to sleep. We arrived at Aomori at 5:20 a.m. and waited until 8 a.m. for a car and driver from the Apple Experiment Station to pick us up. From there we were taken for a wild ride (every ride in Japan is wild) up to Mt. Hakkoda where Mr. Matsunaka and Dr. Ichiki showed us about an acre grove of shrubby apple trees at Tashiro Dai Kohgen Plateau about 2m tall, these plants have decidedly single lobed leaves, with fruit about .9 cm diameter. This type will be collected and compared with apparantly more vigorous forms seen in collections.

A long winding backroad with one leg of it by boat across a large lake, brought us finally to the Apple Experiment Station at Kuroishi, Aomori. (Kuro=Black,Ishi=Stone). From this station came the famous Mutsu apple variety in 1958. (Mutsu is the name of the whole area around Aomori.) The main activities at this station are breeding of new varieties suitable to Aomori prefecture conditions and with high quality, and studies on disease and insect control, rootstocks, tree training systems, and effects of viruses on tree health and longevity. Pathologist K. Matsunaka does the virus work relating to rootstocks and species. He found that a specific virus in the scion causes Malus prunifolia rootstock to overgrow the scion and to develop stem pitting below the union. This same virus causes Malus sieboldii stock to have discontinuous bark, and here the scion overgrows the stock.

Dr. Ichiki explained how they grow red Mutsu apples, a fruit that is naturally yellow. The fruit are enclosed during the growing season in paper bags to exclude direct light. Then two weeks before harvest the bags are removed, the trees are covered with special netting to attenuate the light, thus preventing sunburn. The fruit are a bright pink-red at harvest.

At Aomori the general tree vigor as related to rootstocks is: Seedling > M. sieboldii > M. prunifolia > MM 106 > M 7 > M 26 > M 9. The common stocks used 100 years ago when western varieties were started in Japan were wild Malus sieboldii and possibly other seedlings. In more recent times growers have switched to the easy-to-propagate M. prunifolia imported from China. Very recently the Malling and Malling-Merton stocks from England have been used. Even newer stocks are now being tried at various spacings and with different tree training systems.

The Malus species collection at Aomori consists of mostly single-clone specimens of several species and species hybrids. Without going into the taxonomy of them now, the names and descriptions will be given as I observed them:

Malus floribunda -- looks correct
M. platycarpa - similar to M. coronaria -- correct
M. theifera -- lvs serrate, frt 2 cm, calyx persistent
M. baccata var. mandschurica -- 1.5-2.0 cm frt, not like wild trees seen with Dr. Ito. (probably a hybrid)
M. halliana -- lvs like M. prunifolia, frt .8 cm, deciduous calyx
M. micromalus -- lvs like M. prunifolia, frt 1.5 cm, deciduous calyx, yellow with blush.
M. prunifolia -- large coarse lvs, frt 1.5-2.0 cm, persistent calyx, yellow (not prunifolia).
M. schneideckeri -- frt 1.0 cm, deciduous calyx, yellow with blush, apomict, sensitive to apple latent virus, red spots on leaves, bark necrosis.

M. transitoria -- lvs 2-lobed, frt 1.0 cm, deciduous calyx, apomict.
M. sieboldii -- lvs single-lobed, fruit long stemmed, 1.0 cm deciduous, yellow with blush.
M. prunifolia var? -- frt. 2.0 cm, persistent calyx, not prunifolia.
M. floribunda var arnoldiana -- arboretum hybrid?

Dr. Ichiki says the trees don't need as much Bordeaux as they get, but the growers like to spray and don't sleep well if they haven't done it.

The ubiquitous Vitis coignetiae still seen everywhere.

August 18, 1981, Kuroishi - Morioka (210 m elevation)

We boarded the train at 8:20 a.m., made two transfers, and arrived at Morioka station at 12:15 p.m. At 2:30 we were picked up by two men from the station who took our bags to the Carina Hotel, then took us to the station. Drs. Hong from Korea and Holubowicz from Poland again accompanied us, as they had also planned to visit Morioka Fruit Research Station after the hardiness conference. It was raining when we arrived at the station, about 40 km from the hotel, so we remained in the lab and exchanged information for the two hours left in the day.

The Morioka station has undergone some organizational changes since it started in 1959, but in 1973 it became a part of the national system of Branch Tree Fruit Research Stations, Ministry of Agriculture, Forestry and Fisheries. It has 29.7 hectares of which 69% is in orchards. There are 37 employees, 18 of whom are researchers. The main research activities are apple breeding, apple growing and storage, mineral nutrition, plant diseases, and insect pests and their control. The breeding work also has included some work on rootstocks for apple. Well known variety introductions from the breeding program are Fuji (1962), Akane (1970), and Hatsuake (1976). Fuji accounts for 35% of all apple productin in Japan.

Dr. Yoshida reviewed the local availability of wild fruit species for us. M. baccata, M. siebildii, and M. prunifolia (imported from China) are here for seed collections. Both Corylus heterophylla and C. sieboldiana are found wild nearby, as is one species of walnut, probably J. sieboldiana. The main current apple species used as a commercial rootstock is a weeping (pendulant) non-flowering clone of M. prunifolia. It roots easily without special treatment when taken in March and simply placed in rooting beds, is resistant to wooly apple aphid, and is hardy. This clone is likely a mutation of the normal upright, flowering form of the species. Its tree size as a rootstock stands between M 26 and MM 106 Dr. Yoshida suggests we try to obtain a copy of the old book "The Crabapples and Nectarines of Japan" by Yoshichi Asami, 1927.

Note: Vitis coignetiae along roadsides, some evidence of leaf spotting now (formerly we saw only healthy plants).

August 19, 1981, Morioka

Typhoon #15 moved in last night, with rain still coming down at 8 a.m. Two people were sent by car to pick Paul and me up (one would have been quite enough). Because of the wet weather we went to Dr. Yoshida's lab to talk about the day's activities and to call the U.S. Embassy in Tokyo about how to handle the delayed collection of seed and its transmittal to U.S. Plant Quarantine.

I visited with Mr. Daniel Berman in the Agricultural Attache's office as he said he was handling our trip from that end. He agreed to my proposal to have all of the Japanese collectors send their fruit or nut seed to Dr. S.

Tsuchiya, Chief Plant Introduction Officer for the National Fruit Tree Station at Tsukuba. When all seed are in, say by October 25, he will take them to Mr. Berman at the Embassy who will affix the green/yellow labels (which I will supply) and send them by APO mail to Beltsville, Maryland, to be forwarded to me at Corvallis. I am to write clarifying letters to Dr. Tsuchiya, Mr. Berman and all of the cooperating collectors in a day or two from Taiwan.

By 10 a.m. the rain had quit, so we took a walk along the roads and borders of the Research Station. Surprisingly there was a lot to see. We found native Walnut, filbert, grape, peach, cherry, and Rubus. The peach might not be native but looks like a wild type. Ask Dr. Yoshida to collect seed when ripe. The following materials are to be collected also when ready:

Species:
Corylus heterophylla
C. sieboldiana (get from Forests - Forest Research Station)
Juglans sieboldiana
Castanea sp.
Malus baccata 4n (station)
M. hupehensis (station)
Prunus persica (roadside)
Fragaria sp. wild (ask Dr. Kei Masake, vegetable station)
Prunus wild cherry
Vitis coignetiae if possible
Rubus 2 species, near station fence

The Malus arboretum had several of the same arboretum hybrids seen at Aomori, e.g. M. halliana, M. robusta #5; and several clones of M. sieboldii from wild sources in Japan. Note: Dr. Yoshida says that "Zumi" is the local common name of wild M. sieboldii. The imported M. prunifolia which everyone seems to be using is not at all like my wild trees from Korea. These (Morioka) trees have larger leaves and broader, and fruit that is not red all over and ripens much later than mine. It is from this tree that the pendulant non-flowering mutant arose - the one used as a rootstock because of its ease of propagation and its resistance to a certain root rotting fungus. This mutant gene is unstable because we saw a pendulant tree on which one branch had mutated back to the upright, flowering form. The pendulant form is a diploid, so ploidy is not going on.

The clonal wild Prunus used here as a cherry rootstock is called Aobazakura (Aoba=green-leafed, Zakura=cherry). This possibly is Prunus sargentii which is seen in many areas of Northern Japan. The clone used in Japan roots easily when cuttings are taken in March and placed in rooting beds.

One interesting collection at the station is one of Malus sieboldii collected from 17 different sites in Japan. These show quite a lot of variation, yet are similar in most respects. I think they are all the same species because of what we observed later in an isolated mountain site north of Morioka. Some trees had very small fruit (about 0.5 cm) but none had as large fruits as the specimen at Aomori. Late today we drove north of Morioka into the mountain area called Appi Plateau. This open meadow at 900 m elevation was surrounded by birch and other deciduous trees. The meadow itself consisted of a few shrubby Prunus, some grass, many wild rhododendrons, and a marvelous array of small shrubby clumps of Malus sieboldii. Here we saw all of the variations in leaf form and size and in fruit size observed in the station collection noted above.

The rootstock breeding program at Morioka started with reciprocal crosses of M 9, M 27, M 26, M. baccata, M. sieboldii, and M. prunifolia. Now they are looking at bark/wood ratios to detect dwarfing types. Selection will come later.

The small Pyrus species collection at this station consists of a few trees more than 50 years old, moved in trucks from a station at Aomori prefecture when this new Morioka station was started. Dr. Yoshida does not have the history of origin of these. Here is my assessment of these clones:

ARBORETUM LABEL	PROBABLE NAME (WESTWOOD)
Pyrus aromatica	Pyrus dimorphophylla
Iwate Yamanashi	P. fauriei
P. ussuriensis	P. pyrifolia
Ainashi	P. hondoensis
Korean pea pear	P. fauriei
P. serotina	P. serotina X hybrid with a pea pear
P. bretschneideri	P. betulaefolia hybrid
P. uyematsuana	P. pyrifolia hybrid with pea pear

There is a collection of European plums at this station, mostly Prunus domestica. They do not have the Oregon "Brooks" prune which should delight the Japanese palate, which mostly prefers very sweet, non-acid fruits.

I collected bark of both Japanese and Chinese chestnuts today for a researcher at Connecticut Experiment Station to look for an organism that is antagonistic to chestnut blight. (These were later discarded because I had no import quarantine label for them).

August 20, 1981 Morioka - Tokyo/Narita Airport

We left the Carina Hotel by taxi at 5:30 this morning to catch the 6:40 train to Tokyo (one must wait in line to get a seat without previous reservations). The train was an express and was comfortable and quiet. I spent the time composing letters to our Japanese colleagues to coordinate the seed collections to be done as the seed mature. Then Paul and I prepared the documentation for the several Rubus and one Prunus species we did collect and got them ready to mail to Tsuchiya from the airport, which we did just before boarding for the flight to Taiwan.

We continued to see the same wild grape and walnut that we've been seeing in the north. Both were seen along the roadside as we approached the Tokyo-Narita airport. Along with the everpresent rice we saw numerous mulberry farms along the way. They appeared to be a clone as they looked very uniform in leaf size, shape and color. They are used to culture the silk worm rather than for fruit. The trees are closely spaced, perhaps 1 x 2 meters and are cut back to the crown each year, so that they are now about 2 meters tall.

We arrived in Tokyo-Ueno Station at 1:13 p.m. and walked about 1 km with our great bulge of baggage. This seemed like hazardous duty till we arrived at Taipei and went through 3 or 4 check stations, each with a long queue. The humanity was overpowering and the chaos was complete, with carts, people and baggage bucking through the lines at right angles. Finally we emerged to the outside world and were met by two colleagues from National Chung-Hsing University and by Paul's parents and his sister and brother-in-law. After 18 hours on the road I am quite ready for a sleep.

TAIWAN SEGMENT

August 21, 1981 - Taipei

At 9 a.m. professor Nien-tze Fan and Dr. Chou Tou "Berg" Shii (recently a grad student at OSU) came to the China (Chunggwa) Hotel to get us started on a busy itinerary. Briefly we are scheduled to meet today with a Forest Research group to locate native fruit species, then we will meet the pomology staff of National Taiwan University in the p.m. Saturday, August 22 we leave by bus for Taichung to visit National Chung-Hsing University and a tour of orchards and vineyards of temperate fruits as they grow them in the tropics. Monday through Friday we'll spend at 3 or 4 mountain stations, with several hikes to collect wild species. Then we go back to Taichung for another round of research conferences, collecting trips and a seminar or two at the University.

(Later August 21)

We had a fine meeting this morning with Dr. Valiant T. Liu of the Taiwan Forest Research Institute. He showed us the 6-volume "Flora of Taiwan" and from it we learned that this small island (less than one fourth the size of Oregon) contains more than 4,000 species of higher plants. These are needed for our U.S. repositories:

Pyrus	Pear Rootstocks:	Other:
Rubus	Photinia	Vitis
Corylus	Cotoneaster	Prunus
Fragaria	Crataegus	Diospyros
Vaccinium	Sorbus	Ficus
Ribes	Malus	Juglans
Actinidia	Eriobotrya	
Mentha		
Humulus		

Dr. Liu will photocopy the list of these native species for us and will help us identify any that we find in the country. His English is excellent, as he got his doctorate under Dr. Bill Chilcote of OSU and has been back to Oregon twice since then.

We went to the Hotel for an elaborate "lunch" of 5 courses, too much for my meager appetite, then we were taken by van across the teeming city of 3 or 4 million (all large cities teem) to the Horticulture Department of National Taiwan University, where we were greeted by Dr. Yeou-Der Kang, Department Head, and several of the Pomology staff -- Lih Hung, Professor, Asparagus breeder; Su-Shien Ma, Professor, Tissue culture and propagation (he worked in Beijing with Dr. Shen in 1941); and Cheng-Yung Cheng, Professor of Pomology and Viticulture (he worked on bud rest in grape in W. Germany for his Ph.D.). We got acquainted by talking of the programs going on at the University and by our telling them of our mission in Taiwan. Word had gone ahead of us that I am fond of fruit, so they brought out a marvelous large tray of tropical fruits, which we sampled throughout most of the afternoon as we continued our informal seminar. As I recall we had carambola (star apple), passion fruit, kaki, longan, cherimoya (looks like a gray pine cone), muskmelon, banana, and guava. Berg Chii is a member of the department and has outdone himself to make us welcome. We are not used to such royal treatment, but Paul says I'd better get used to it because that's the way these people treat visiting scientists. Paul has been a valuable asset to this trip and is especially helpful here in his former home. All of the ususal language

problems have disappeared, which will make the collecting and the information gathering much more effective than I could ever have done by myself. Temperature today was 37° C, the hottest day of the year - relative humidity about 80%.

August 22, 1981 - Taipei-Taichung

We checked out of the China Hotel at 8:30 a.m. and carried our baggage the three blocks to the bus station. We waited there for an hour in the heat and the immense crush of people, jostling for standing room or trying to go somewhere. Finally we boarded a nice air-conditioned bus, all of us with reserved seats, for the 2 1/2 hour freeway ride to Taichung. We got there just at noon and Professor Fan met us, conducted us on foot to the Taichung Hotel where we deposited our luggage and went off to a mandarin-style lunch. I gingerly helped myself to the dishes served as I had still not fully recovered from the grand feast we'd had last night as honored guests of the horticulture department at Taipei.

At 2 p.m. we took a taxi to the National Chung-Hsing University for an afternoon session with some faculty and grad students. Mostly we talked about rootstock influences on tree physiology. They have learned (as I published in 1963) that a low-chilling rootstock can lower the chilling requirement of the scion. The suggestion is that the root produces more cytokinins which helps counteract the rest inhibitor in the buds. One grad student brought in a group of pear fruits and twigs to be identified. Most of them appeared to be complex hybrids between P. koehnei (Liou Li = bird's pear) and domestic escapes, mostly P. pyrifolia. P. koehnei seems to be extinct in the wild state now. This mixture of what they call the evergreen pear is what is being used as rootstock for commercial orchards. One method used to grow pears is to take Shinseiki twigs with flower buds from the mountain areas, bring them to the valley each year and graft them to trees of Hengsan pear, where they flower and produce good fruit. The Hengsan variety is a low chilling type introduced from South China, Fuken, about 100 years ago. Also Professor Fan says there is a gigantic pear named Dai Li from China that we should obtain for the repository. The fruit of Dai Li often weigh 2 kg each (5 lbs).

Professor Fan today gave me seed of two Rubus species collected July 15 and kept moist in the refrigerator since then:

T1 Rubus morii Hay (Mori's raspberry)
T2 Rubus formosensis Kuntze (Taiwan raspberry)

August 23, 1981, Taichung

At 7 a.m. Professor Fan and several cohorts picked me up at the hotel for a trip into the country in search of the elusive evergreen pear, P. koehnei. Despite a diligent search we were able only to find hybrids of it. These hybrids apparently arose from natural crossing with P. pyrifolia cultivars. They are numerous in the Tzolan area where there are many commercial orchards, primarily of the Hengsan variety. This evergreen "bird's pear" is used as a rootstock in Taiwan. Often they are propagated by dormant cuttings taken in November or December. The 30 cm cuttings are simply placed in soil or rooting beds with no hormone treatment.

The culture of temperate-zone fruit in the tropics is special and is unlike any culture of adapted plants, either in the tropics or in temperate climates. They begin with low-chilling varieties but which, under temperate climates, have a definite chilling requirement. Grafting to the evergreen pear further reduces the chilling requirement. Thus in Tzolan at about 400 m elevation they grow pears and grapes with no chilling in the classical

sense. Two crops of pears per year are grown, totaling about 60 tons per ha. The "natural" crop is in August, after which the trees are defoliated with penta-chlorophenol (PCP) at 500-2000 ppm, pruned and started into a new cycle. Recently they have begun bringing chilled twigs of Shinseiki down from the cool mountain area and grafting them to the Hengsan trees, where they grow and produce fruit in one season. They have been grafting about 120 twigs to each tree each year, but they find that Shinseiki does fairly well as a permanent resident of the lowlands. Young Dr. Chin-Ho Lin will be working on the complex physiology of these 3-piece trees.

The main diseases here are pear scab, powdery mildew, and rust. The main insects are Oriental fruit fly, leaf hoppers and spider mites.

Grape culture here is somewhat similar to pear, but grape is better adapted to such a climate. The main variety is Kyoho, a 4X clone from Japan. These are grafted to the Japanese stock Teleki 8B (V. vinifera x V. labrusca). Older stocks were 5BB and 420. The present stock adapts the grape to old rice lands - wet clay soil, and is resistant to rye grass competition. After defoliation and pruning, they use ethylene chlorhydrin sprays to get the buds to start faster. The "V" system of training (monsoon system) can be cropped three times before having to be severely cut back and defoliated. Each new cycle is initiated by cutting back the new growth at a stage that will induce flowering again.

August 24, 1981, Taichung-Mei Feng Farm

Professor Fan collected us from the hotel at Taichung at 8:15 a.m. and we went by taxi to the bus station. There we met Drs. Liu, Shii and Mr. Cheng Chu Nee where we boarded a bus for Wu-shih (Wu = fog, shih = village). Then we changed to a van sent down from the mountain farm. We climbed up a steep mountain on a narrow dirt road with hairpin turns similar to the uranium ore roads of the Colorado Plateau. Despite rock outcroppings, everything else is covered with the varied rich verdure of a many-layered lamina of plant species. Dr. Valiant Liu says there are over 4,000 species of vascular plants in Taiwan.

We arrived at Mei Feng (Mei = apricot, Feng = peak) just before noon. It is a beautiful mountain research farm whose main office stands at 2100 m elevation. The extensive peach, pear, apple and cabbage plantings range up and down the mountain on narrow terraces and small mesas. This farm is a part of National Taiwan University (NTU) and is used mainly to train students in crop culture and farm management. The peaches grown here are mostly Japanese varieties, partly resistant to Taphrina leaf curl. Their main apples are Golden Delicious, Delicious, McIntosh, Mutsu and Jonathan. Rootstocks used are a hybrid form called Malus rotundifolia, fruit reddish blush over green, persistent calyx, 4 carpels. Stocks are produced by rooting cuttings or using open pollinated seedlings of these trees. Lately they have planted some Malling stocks. Pear varieties are Shinseiki, Nijuseiki and Chojuro. Rootstock is the evergreen pear. We are staying in a good dormitory here and take our meals with the rest of the staff at the farm dining hall, 100% Chinese fare and very good.

Just after lunch we walked around the farm borders and the roads connecting the several orchards. Here we discovered several species of Rubus, Prunus, Actinidia, Eriobotrya, and a very large specimen of Malus formosana about 15 m tall. One large-fruited raspberry wins the record for having the longest name of the day: i.e. Rubus glandulosopunctatus Hayata.

Then we toured the native plant collection here, planted and maintained by horticulturist Mu Chi Tsai. He has several plants of the only Ribes species

of Taiwan, Ribes formosanum Hayata. Also he has a fruiting vine of the high elevation species Vaccinium emarginata, native Actinidia chinensis with oval, round and flat fruited variants. Other species of interest are the one mint of Taiwan, Mentha canadensis and a group of wild native white lilies.

Horticulturist and farm manager Chung Chen was most helpful in showing us around the station and explaining the organization and general operation of the facility.

August 25, 1981, Mei Feng Farm

We awoke to a bright sun at 6 a.m. I walked to the upper cabbage patch we had seen at dusk last night and photographed a whole mountainside covered with nearly mature cabbage. 50 hectares (150 acres) over irregular topography, some on 60° slopes, was a sight to behold in the early morning sun. This crop is marketed commercially to raise money to help with the overall farm budget.

This morning we toured the orchard plots and discussed the research and development program with Mr. Chen. He is propagating 10,000 apple stocks and varieties for planting new rocky hillsides. Rootstocks are mostly M 26, M 7, MM 106, MM 111. Varieties are mostly strains of Red and Golden Delicious, Mutsu, Fuji and a few new ones. Peaches are planted on wild peach stock from China, as are the plums. The trees look healthy. There are three different clones of pear here named Ya Li. One looks like the Corvallis clone, one like Kieffer, and one similar to the first but with a very short neck. I collected this third one (scions) to send back, as it seems to be good quality.

After lunch Paul, Professor Fan, Mr. Chen, Mr. Cheng Chu Nee, Dr. Liu and I went off down a steep narrow trail/road toward the lower 3rd farm to collect whatever wild species we could find. The following species were found:

Lilium formosana	narrow linear lvs, pure white, at 2100 & 1850 m elev.
Humulus scandens	male flowers only, 1500 m elev.
Actinidia chinensis*	much fruit, not ripe, 1990 m elev.
Rubus kawakamii*	simple lvs., frt. dried, black, 1990 m elev.
Rubus sp.	had a simple leaf acer-shaped, no frt. 1980 m elev.
Rubus glandulosopunctatus	red tips, 3-foliate, no frt. 1990 m elev.
Vitis thunbergii	lvs. pink, pubescent, frt. not ripe 1980 & 1950 m elev
Prunus taiwaniana	(white flrs) no fruit, cherry? 1970 elev.
Prunus phaeosticta	no fruit, cherry? 1960 m elev.
Prunus campanulata	no fruit, cherry? 1960 m elev.
Sambucus formosanus*	fruit red, 2 to 3 mm, ripe 1830 m elev.
Rubus fraxinifolius*	5-foliate lvs. frt. red, ripe 1990 m elev.

(* Seed of these collected 8-25-81)

Mr. Nee will get scions of the big pear Professor Fan referred to as Dai Li. Nee says it is the well-known variety Hengshan. It gets very large in hot climates, when given average nitrogen and especially heavy thinning. Also ask him for scions of the smallest fruited evergreen pears and native apple, M. formosana.

August 26, 1981, Mei Feng Farm - Chung Hsing Farm

Professor Fan, Mr. Nee, Paul Li and I packed our gear early and after breakfast left Mei Feng on foot, bound for Chung Hsing Farm 8 km away. As it turned out it was 4 km straight down and 4 km straight up, literally from one mountain top to a deep valley and then up to the top of another mountain. Our journey began at 2100 m elevation, went to 1640 m in the valley, then we

climbed to 2077 m to Chung Hsing Farm. We botanized the entire way, partly along roadsides and partly along jungle paths. The two dogs from Mei Feng came along without invitation and were the cause of some trouble when we arrived at Chung Hsing Farm as the resident dogs had already staked out the territory. After two or three fights they settled down for the night.

Our botanizing was good in general, but we missed Dr. Liu's expert help, as he had to return to Taipei by bus early this morning. Our first stop was at the two large Malus formosana trees near the entrance to Mei Feng, where we gathered some immature fruit, hoping the seed would mature off the tree. Down the road at 2060 m we collected ripe fruit of a small prostrate Rubus growing on a moist, shady bank, pH 4 to 5. The leaves were simple and looked like those of a miniature grape. This species tends to root at each node as it grows along the ground.

We left the road at 2040 m elevation and plunged into a dense primeval forest where very little sunlight reaches the plants on the forest floor. The trail was well marked and both Professor Fan and Mr. Nee had been over it many times before. The dead leaves and small branches on the trail were wet with dew which made them as slippery as grease on a pavement. I was the first to loose my footing where the trail took a turn downward at about a 60° angle slope. I landed on my right hip but luckily wounded nothing more than my ego. Subsequently all the others also fell, so I was in good company.

At about 2030 m we found a very large tree of Malus formosana, after which we found them all along the trail until we reached 1850 m elevation. At that point we found an old monarch tree whose trunk we estimated to be 2.25 meters in circumference and whose height was about 20 meters. We collected immature fruit that had been dropped from the trees by birds, squirrels, or monkeys. Seed of these might be mature enough to keep.

We descended the trail and came to the road at 1630 m elevation. There we found a large Rubus vine with large red-orange berries, plus many green ones and some green-white petalled flowers. Leaves were 9 to 11-foliate, pinnate.

We continued up a side road and came to a point which Nee said was the dividing ridge between the Southern and Northern watersheds of the mountains. After a short way, at 1710 m elevation, we took another jungle trail uphill and came out on the upper road a while later. At 1850 m we saw Juglans formosana trees, but with no fruit. Also at 1770 m we saw a narrow-leafed Actinidia species but could find no fruit.

Chung Hsing Farm is a part of Chung Hsing University, Taichung and is much smaller than Mei Feng. Only two people work here on about 30 ha, part of which is leased out to grow garlic (only the leaves are used). Both apple and pear orchards are kept, but due to the lack of budget, they have not been sprayed for insects and diseases. The apples are being pulled because of this. A few seedling walnuts, pecans, and filberts are grown there but seldom have any crop. Professor Fan says that the crops grown get enough chilling (upper farm elevation is 2077). Today the maximum temperature was 25° C and the minimum 14° C.

On the way to the upper farm at 1970 m we found a medium sized Malus formosana tree and collected fruit. At the farm and in waste places we saw many beautiful wild lilies Lilium formosana, some white with purple ribs and others pure white. The wild apple here doesn't show scab, but at the upper farm we saw a M. formosana tree in a domestic apple orchard and this wild tree was nearly defoliated from scab.

August 27, 1981, - Chung-Hsing Farm-Taichung

Left Chung Hsing Farm at 7:30 on foot. At 1800 m on trail we found a medium sized Malus formosana tree. At 1640 m we again struck to the road leading down the mountain. At 1630 m we found a whole clump of Juglans formosana trees. The nuts appear immature but we collected a few to see if they are mature. From this point all the way down to the village are numerous Juglans trees. At 1600 m we found a large kaki tree, the first such appearance of the oriental persimmon.

Our 12 km walk to the bus stop was most all downhill and our knees felt the strain at the end. We had to stand up on the bus during the 1 hour ride down the mountain but transferred to a bus with reserved seats to ride on in to Taichung.

After arriving back at the hotel and cleaning off the grime of 4 days on the mountain, I prepared and mailed off to Japan a letter to the many cooperating collectors there, giving them instructions on what species we wanted them to collect and that such collections were to be sent to Dr. Tsuchiya for consolidating.

August 28, 1981, Taichung - Lishan Farm

We were up at 6 to process and package the seed samples collected the previous two days. At 7:30 Professor Fan guided us to a bus on which we rode to the edge of Taichung to the Taiwan Agricultural Research Institute (TARI). Here we met Dr. Mong-Ju Yen, Head, Horticulture Department and Dr. Lin, the latter to accompany us to Lishan Farm on the mountain. TARI is mostly working with citrus and other subtropical and tropical species but is doing some pear breeding for low-chilling types.

We drove by van up the steep mountain road, and stopped at 900 m elevation and found what looked like a wild grape, a small plant with glabrous leaves and sky blue berries about 0.6 cm diameter. We collected this and also found a 7-foliate Rubus with no fruit.

Near Lishan we saw many steep mountainside orchards of pear and some apple. These trees are generally supported by bamboo frames, and some are on slopes of about 60°. It is hard to see just how these are managed without accidentally falling out of the orchard at times.

At Lishan we met our host of the evening Mr. Sung, Ching-Yun, Director of Fu Shou Shan Farms, an 825 ha operation run by military veterans. They grow mostly pears, apples, and peaches. Most of the varieties grown are those either from Japan or China, but they have a few from the United States. While here we are eating and sleeping in the well-appointed guest house of the Farm.

Tomorrow Mr. Sung will lead us to some wild Mentha.

August 29, 1981 - Lishan to Wu-Ring Farm, 1700 m elevation

It rained last night but was clear by 11 p.m. and the stars bright at the 2200 meter elevation. The hospitality at Lishan Farm was unbeatable. Director Sung does not speak English but told Paul that they had tried grafting varieties to the wild Malus formosana but they were incompatible. Yet he said the reciprocal graft was compatible.

At 7:30 Mr. Sung loaded us up with pears, apples, and fried egg sandwiches, plus canned fruit juice, and we were off on a short botanizing trip with an old local resident who knew where wild fruits grew around Lishan. When we got out in the forest, he told Mr. Nee that the wild apple trees he sought had been cut down., When we asked about the other wild fruits, he said he didn't know where to find them. So we had a nice 1-hour walk through the trees for nothing. We then loaded into the van and headed

uphill toward the native forests.

At 2500 m we came to a fancy residence on top of a hill and learned that this was once a retreat for President Chiang. While at this site we found Fragaria hayatai non-fruiting, and a yellow-fruited Rubus similar to the red-fruited I 6 collected at Mei Feng. We collected many seed of this. Leaving there we went over a pass and down to an open area near a dense forest. We wanted to search for Vaccinium in the edge of the forest but found a thick stand of bamboo and a heavy, head-high grass, whose razor-sharp blades caused us to abandon that site and head back through Lishan village toward Wu Ring Farm, another old soldiers' farm where we were to spend the night.

Just short of Wu-Ring Farm we stopped at a river bridge near a large red Buddah to eat lunch. There we found a wild cherry tree with no fruit at the river's edge, 1650 m elevation. We came along to Wu-Ring Farm and near its entrance by the road Paul found a small trifoliate Rubus with a few berries still on. The drupelets were very large but each berry only had one or two, so we got only a few seed.

We left the van at the farm, checked in with the director, Mr. Lo, Chen Kiu, who served us Red Bartlett and Chojuro pears, then discretely mentioned that some government dignitaries were coming soon, so we should not hang around to complicate things. So we went for a nice long hike along the river and found a marvelous clump of wild walnuts (Juglans cathayensis) 8 or 10 to the cluster but not yet ripe. Mr. Nee will collect later.

They grow apple, pear, and peach here at Wu-Ring. Pears are mostly Japanese varieties and Bartlett. Apples are both Japanese and American-European varieties. They use the weeping (mutant) Japanese stock "M. prunifolia" for apples, and the wild evergreen pear (hybridized with P. pyrifolia) for pear. In a tour of the orchards, I found 7 or 8 bud misses in which they had left the rootstock to grow as a pollinizer. Of these, most were hybrids of P. koehnei, plus some P. pyrifolia and one P. communis. But one of them looks like pure P. koehnei as we know it, the first I've seen in the entire island.

Mr. Nee told us that apple production (mostly in the mountains) amounts to only 1800 tonnes per year, but they produce 350,000 tonnes of pears. Of these 250,000 tonnes are Hengsan grown at low elevations and the rest are Shinseiki, Chujuro, Nijuseiki, etc. on the mountains.

August 30, 1981 - Wu-Ring,Taichung

At 7:30 a.m. we met Mr. Ming-Fwo Huang, Deputy Director of Wu-Ring (also called Wu-Ling) Farm for a brief tour of orchards and packing shed. Mr. Huang is the professional horticulturist of the organization and generally runs that part of the operation. Of the 700 hectares total, about 200 are in buildings and grounds and 500 in orchards. Apples (Golden Delicious, Red Delicious, Mutsu, Fuji and others) comprise 380 ha, and pears (Shinseiki, Nijuseiki, Chojuro and others) make up 120 ha. According to Mr. Nee, apples bring NT $40 per 600 gm, while the best Shinseiki pears bring NT $30. The lowland (low chilling) Hengsan pear of lower quality may bring only NT $5 to $10. Thus the interest in apples.

The packing shed here had a mechanical sizer, but all other operations were by hand. One girl took about 15 seconds to clip off the stem and wrap one pear and place it in the box. Their cold storage units are very small and are used only to hold fruit till it can be loaded on a truck for market. From here to Lishan (Pear Mountain) and beyond there is an incredible traffic jam this time of year during the pear and apple harvest. As we left Wu-Ring to return to Taichung we often had to stop, back up, or pull over precariously

close to the edge of a precipice to let the fruit trucks pass. Put simply, they are trying to use 19th century roads for 20th century traffic.

We found another tree of Pyrus koehnei along the roadside near Lishan. Now we have two. Mr. Nee will propagate these at Chung Hsing University and cross them to get seed for us. Near Taichung at Tzolan (400 m) we stopped to look at an old evergreen pear known by a local resident to be about 40 years old. It was, as usual, a hybrid with nearby P. pyrifolia. While at this site (400 meters from the van) a typhoon rain hit us and we were soaked to the bone in less than 10 minutes.

Note: When we ate lunch at Tzolan, the fellows told me we were eating fish that came from mainland China. I asked how this could be, and they said that the Taiwan fishing boats go over near the China shore in the Taiwan straits and trade silver, gold rings, and other valuables for the fish caught by the Red Chinese. This seems like a good omen to me.

August 31, 1981 - Chiayi, Taipei

The van with Dr. Lin, Mr. Nee and Professor Fan came at 7:15 a.m. to collect us at the hotel. We then drove south on the freeway to Chiayi (pronounced Jy-ee) to the Taiwan Agricultural Institute Station for subtropical crops. Dr. Chu, Ching-Kuo is head of the Department of Horticulture there. The arboretum director gave us a tour of the station and told us of their many collections of fruit and nut species. They have collections of bananas, citrus, avocado, olive, date palm, oil palm, coconut palm, etc. (see published list reprint). The pecans from the United States are dying from trunk borers. The macadamia nut does well in Taiwan but has not become commercial here because the typhoon winds do too much damage to the trees. Dr. Chan-Ya Chang thinks he can locate a very old tree of the evergreen pear for Mr. Nee. Also he thinks there is a wild grape near Chiayi that can be collected later. Work with chestnut is mainly to hybridize Chinese x Japanese species and select away from the tough outer skin of the otherwise good Japanese types.

At 2:09 p.m., following a blinding rain storm, Paul and I boarded an express train to Taipei. The news had said a typhoon would hit the north part of the island by late tonight and we wanted to be securely in Taipei when it hit. At 11:30 p.m. it apparently has missed us, as the weather is nice, with a brisk breeze.

September 1, 1981 - Taipei

This morning was scheduled for seminars at National Taiwan University. Paul Li's seminar was on the cold hardiness symposium at Sapporo, with examples of frost-hardiness development and/or frost avoidance in potato, Solanum species. Mine was about the establishment of the new clonal repository system in the United States, with examples from our 20 years' of pear species work.

The afternoon was used in conferring with Dr. "Berg" Shii who will coordinate the collection of seed in Taiwan during this autumn season. I prepared a letter to go out to all potential collectors, with instructions as to how to prepare the seed and the information sheet to go with each lot. The following people were asked to help:

Dr. Valiant Liu, Forest Specialist (several species)
Mr. Nee, Chung Hsing Agricultural University (Fragaria, Pyrus, Vitis, Malus)
Mr. Chen, Mei Feng Farm, (Malus, Eriobotrya, Vitis, Actinidia)
Mr. Tsai, Mei Feng Farm, (Mentha, Vaccinium, Ribes, others)
Professor Fan, Chung Hsing University (Juglans, Actinidia, Vitis, Rubus)

Dr. S. Lin, Taiwan Agriculture Research Institute (Vitis, Pyrus, others)
Dr. Cheng, National Taiwna University (Vitis, others)
Mr. Huang, Wu-Ling Farm (Juglans, Pyrus, Malus)

All seed that come in to Dr. Shii will be consolidated and turned over to Mr. Edwin Bauer, U.S. Agriculture officer in Taipei, for shipment to the U.S. on November 1, 1981.

September 2, 1981 - Taipei

"Berg" Shii and I spent 3 hours sightseeing this morning at the National Palace Museum at the edge of Taipei. Here we saw some very ancient writing on bones (flat shoulder blades of animals) several thousand years old. Many beautiful tapestry paintings, some 1000 years old. Some were of the peach and the Mei (flowering plum) which they think is symbolic of bravery, as it blooms so early that frost and snow may still be a threat. Also we saw many famous pieces of Ming and other dynasty porcelain, and numerous wood, ivory and jade carvings of exquisite beauty and complexity. Some carvings were done on a single walnut shell, showing a whole scene of people, houses, trees, birds, flowers and animals. Horticulture has played an important part in their lives and culture for centuries.

This afternoon "Berg" and I prepared the many letters and P.I. information sheets to be mailed out to those in Taiwan who will be collecting seed for us later this fall. I was unable to reach Mr. Edwin Bauer, U.S. Agricultural Officer in Taipei by phone to inform him of the plan to have Dr. Shii receive the collections till November 1, then turn them over to him for shipment by pouch mail to plant quarantine, Beltsville. I'll write him a letter well ahead of shipment time.

My bags are packed and ready to leave early in the morning for Seoul, Korea.

KOREA SEGMENT

September 3, 1981 - Seoul, Suweon, Korea 11 p.m.

Dr. Shii came to the China Hotel at 8 a.m. and helped Paul and me carry our luggage to the bus station two blocks away. It was raining but we managed to avoid most of it by taking an underground walkway that passed under several busy intersections. Chiang Kai-Shek Airport was crowded as usual and the long lines through customs etc. were chaotic as usual, with people heavily laden with baggage having to buck across several closely packed lines moving at right angles. Paul's plane for Seattle/St. Paul was 50 minutes before mine so he was processed first. I bade him goodbye and found myself alone without his able assistance for the first time during our trip. Luckily, everyone I asked for guidance knew at least a little English, and the 2-hour flight to Seoul was on schedule.

Drs. Seon-Kyu Kim and Sung-Gak Hong met me at the Seoul Airport and we took a taxi to Seoul and then a train on to Suweon, where they lodged me in the Suweon Hotel, a place that has seen better days but is adequate. There we met Dr. Kwang-Chool Ko, Head of the Horticulture Department of Seoul National University, who will be looking after me for the next few days. Both Drs. Kim and Hong are very busy teaching this time of year.

I was to meet Dr. Kun-Hwan Yun, Director of Rural Development, in the morning but learned that due to the typhoon and heavy flooding in the south, he would not be here to see me. He is the same fellow who, as a young man, spent the summer of 1959 with Jack Batjer and me in ARS research in

Wenatchee. Now he is one of the most important officials dealing with agriculture in the whole of South Korea.

September 4, 1981 - Suweon

Dr. Ko came at 10 a.m. and fetched me to the Horticultural Experiment Station (Office of Rural Development) to give a seminar and to tour the research and breeding plots at the station. I am utterly helpless here without a Korean colleague who speaks English. The hotel clerks know no English, nor do the cab drivers, the street vendors or the cafe waiters. The street signs are all in Korean. At my seminar (on the Germplasm Repository system) a graduate student translated my remarks for the group of technicians and researchers.

Dr. Ko introduced me to Mr. Cho, Mu-Yun, a forester who knows Dr. Sung-Gak Hong and Mr. Carl Miller, an amateur botanist who has a large collection of native plants at his farm near the west coast of Korea. Mr. Cho will arrange for me to visit Mr. Miller later in the week.

The filbert research and breeding program is directed by Mr. Kim, who is hybridizing Corylus heterophylla with C. avellana from Oregon and Europe. Also a few crosses were made between the two native species, C. heterophylla x C. sieboldiana. Some selections of C. heterophylla (this species is partly self-fertile) have been made, resistant to disease and insects and hardy to the area (to -25° C). One, HF-1 is a medium-sized long nut. It cracks out only 37% but the kernel contains 66% oil. The European varieties are not hardy enough and bloom too early. The native selections are hardy and bloom in mid-March, a better time for this climate. No commercial production yet.

The main fruit here is the apple. Citrus is second and pear is third, then grape. Apple acreage is 35% Ralls, followed by Fuji, Jonathan, Red Delicious and Golden Delicious. But Ralls is fading fast and soon will be second to Fuji. With pears the main variety is Jioseng-Paldal. The name means "Early-Mountain of Suweon". It is a cross of Arp Li x Isipseki, (P. ussur. x P. pyrif.) The second leading variety is Okusankichi which we learned at Toyama is a very large pear that can be stored as long as 8 months. This pear is not of high quality but has been used for a starchy vegetable (like water chestnut or bamboo sprouts) in cooking and in making Kimchi, usually made with Chinese cabbage. The main grape is for eating and is the V. labrusca x V. vinifera hybrid, Campbell's Early.

We visited the Malus and Pyrus collections at the station. Both were meagre and no non-Asian species. Several were hybrids similar to the ones noted in Japan, the source of most of their material.

Late today Mr. Moon took us on a walk about 1 km from a grade school near the station where we found a small clump of small Pyrus fauriei trees, which I collected fruit of for seed. Then we stopped to see Malus asiatica at a retired professor's home but the fruit were gone. But Dr. Ko told me this fruit is 3-4 cm diameter, persistent calyx and is not a hybrid because it was grown and eaten here for 500 years. European apples have been here but little more than 100 years. We will try to find it wild. Also at the same place we saw a tree form quince, Chaenomeles sp. with immature fruit. The bark of this tree is not as red or pale as the C. sinensis we saw in the Tokyo Botanic Garden.

Setember 5, 1981 - Suweon

The morning I went to visit Dr. Tchang Bok Lee, author of the major work "Illustrated Flora of Korea" Hyangmun Publishing Company, Seoul, 1980, and Director of the new 5-year-old Kwanak Arboretum of the College of Agriculture,

Seoul National University, Suweon. We went in his 4-wheel drive Jeep the few km to the Arboretum, a more than 700 ha reservation along both sides of a narrow river canyon. It is a rocky granite soil of pH 5 and low in nitrogen from the looks of the plants. As we approached the closed iron gate at the entrance to the arboretum, Dr. Lee tooted his horn 2 or 3 times and two attendants ran out, opened the gate, saluted and bowed low as we passed the portal. I wondered if this might catch on at the Lewis-Brown Farm.

Some of the plants in the arboretum are planted and some are natural. We collected ripe fruit of the following:

Malus sieboldii -- Natural
Amelanchier asiatica -- Planted
Vitis amurensis -- Natural
Ribes mandschurica -- Planted (red)
Ribes fasciculatum -- Planted (yellow)

The red currant, service berry and grape are edible. Because Dr. Lee is planting populations of each wild species, this collection will be more valuable than most other arboreta for breeding and for genetic studies. Besides the seed we collected, he has some seed left over from 1980 collections which he will share with us.

Note: Dr. Lee wants Juglans seed from Japan and Taiwan. Also he wants Cornus canadensis (10 cm high) from North America.

September 6, 1981 - Suweon, Seoul

At 8 a.m. I was escorted by Dr. Ko via electric train to the Forest Research Institute Hongnung Arboretum, Seoul (40-60 m elevation, coarse granite soil, pH 4 to 5). There we met the curator Mu Yun Cho, Dr. S.G. Hong, S.K. Park, C.C. Kim, and Dr. Shim. Mr. Cho is the second top taxonomist of Korea. Here I learned also that Dr. C.C. Kim was the one who collected seed of P. fauriei many years ago, which he gave to Mr. L. Gattoni to send to me. Dr. Kim also knows Dr. Edgar Vestal who worked in Korea and is now retired and living in Corvallis. This Forest Arboretum, located in the city of Seoul, is under great pressure to allow buildings and other encroachment upon the grounds and hillside where the many native and exotic plants grow. It would be a shame to have to move it because it is one of the few arboretums containing authentically labelled species and in most cases has populations rather than the single type specimen representing each species.

The pale blue "grape" we collected in Taiwan turned out not to be Vitis but the related Ampelopis brevipedunculata. Mr. Cho said he could collect the following for us:

Castanea crenata and C. bungeana (wild stands in north)
Sorbus alnifolia and Juglans asiatica (arboretum area)
Malus asiatic and M. baccata (wild) (wild trees in North)
Photinia (Pourthiaea) villosa var longipes (arboretum)
(J. asiatica is hardy and blooms here in May.)

In the future if we want wild seed we should write the request to:
The Director
Office of Forestry
Forest Research Institute
Seoul, Korea
(See Hong Nung Arboretum Bulletin)

Dr. Ko wants to obtain large-fruited jujube from China if possible. Check

to see if they already have this in Japan or Taiwan and let him know.

Dr. Shim says that Meigetsu pear is very low in polyphenoloxidase and thus has little browning when peeled. Get this for NWPGR for that genetic trait. Also he says that the Tsukuba Station in Japan is doing water-logging studies with pear rootstock. Write to them.

September 7, 1981 - Suweon, Cheongju

Dr. Ko came at 7:30 with a taxi to get me and my bags, and we went to the bus stop to send me on to Cheongju. As we got on the bus, Dr. Ko saw a pretty girl he knew, Miss Joung-gi Heu, daughter of the well-known rice breeder. She speaks English very well and so we had a nice visit, then when we arrived at Cheongju she called the University to have someone come to take me to the hotel. My room is on the 5th floor - no elevator, but the hot water runs hot water - this is a big improvement.

At noon we took a hot lunch, then Dr. Kyu Kim and a local resident, Yim, No-Hoon, and I took a bus out over a mountain to a village and by taxi on to an even more remote village. Some of the mountain had been replanted with various trees, some was natural. Species found but not collected were: *Juglans mandshurica*, *Prunus* (cherry sp.) *Mentha* sp., *Fragaria* sp., and *Castanea* sp. Fruits were immature or lacking.

Seed collected from *Corylus heterohpylla*, *C. sieboldiana*, *Vitis amurensis*, *Zizyphus*, sp., *Pyrus* (green, persistent calyx 2.5-3.0 cm), *Pyrus* (Rus. deciduous, 3.0-3.5 cm), and *Humulus japonicus*.

The road over the mountain was not nearly as narrow and hazardous as those in Taiwan, but similar in other respects. Kyu Kim said that I must be the first white person seen by some of the people in the tiny village where we left the taxi and climbed up the mountain. The people stared at me a lot, so now I know what side-show performers go through. Somewhere in the Kudzu and *Rubus* thickets on the mountain I lost my glasses. Kim and his friend insisted on back-tracking all the way down the mountain to try to find them. When we got back to the village at 6 p.m. Kim said we would walk back to the place to catch the bus. I estimated it at at least 20 km. We started out on the road but soon Kim's friend said we'd turn off to a short-cut. Well we crossed the stream and struck an old road, which ran parallel to the "main" road all down the canyon. The "short-cut" simply was rougher and had more streams to cross without bridges. After an hour's walk we came to a bridge construction crew and Kim got the boss to take us into town in his Jeep. We caught the bus for Cheongju at 8:15, arrived back at the hotel at 9:30 p.m.

September 8, 1981 - Cheongju

This day was spent at Chungbuk National University here, with miscellaneous activities: protocol, consultation with research faculty, planning for a trip to the mountains tomorrow, a general seminar titled "American Pomology Today", and phone calls to Mr. James K. Freckmann to arrange for consolidation and shipment of seed to the United States. Mr. Freckmann is Agricultural Attache, U.S. Embassy, Seoul.

University President Chung, Bom-Mo just returned from a hospital stay, yet he arranged for me to visit him at 11:30 then took us out to lunch (white-gloved chauffeur) to a fancy upstairs place in town. He sends greetings to President MacVicar and all his friends at OSU. Later Agriculture Dean, Dea-Sik Bae was upset because Dr. Kim didn't tell him about my seminar so he missed it. Even though he was engaged this evening, he sent an assistant dean, and Dr. Jong-Wook Kim (International student director) and Kyu Kim to take me to dinner on his behalf. They take their protocol seriously around

here.

We had a good session with two taxonomists Dr. S. Park and H.E. Kim who told us where to look for certain fruit species on Sog Ri and Woal Ark (Worak) mountains, our collection sites for the next two days.

September 9, 1981 - Chungbuk University Forestry Camp

Kyu Kim magically found a friend who works for ORD, who supplied us with a 4-wheel drive jeep and driver to take us to this mountain camp. It took about half a day to get here, but we stopped on the way at an ORD branch station near Chungju (not Cheongju). Here they have several apple plots and are growing also a mutant of Jonathan they claim is a month earlier. We ate some of these fruit which were very sweet and thus atypical of Jonathan. It doesn't store well but might be used as an early apple for late August. Also at this station we saw what they said were trees of Malus asiatica with green-yellow blushed fruit about 2 cm diameter, persistent calyx, oblate, long stem, --not like the domestic M. asiatica we saw in a yard in Suweon. They were conic, 3 to 4 cm diameter, red. Dr. Ko claims this edible wild form was used for 400 years before the introduction of European apples. But most interesting at this branch station I saw for the first time in Korea the same Malus prunifolia I received years ago from a wild site in Korea. Fruit are all red, about 1.0 to 1.5 cm diameter, deciduous calyx, with a long, elegant pedicel; leaves plum-like, dark green. Now if only we can find some wild trees.

We arrived at base camp at 2 p.m. after having taken an early lunch at a town on the way. Kyu engaged a local guide who knows the mountain, Mr. Kwan-Bin Yu. Kyu, Yu and I started up a narrow mountain valley road that would soon narrow to an ox trail, then on down to a squirrel run that seemed to end at a hole in an old tree stump. From there Yu showed us how to make trail with a sharp little hand scythe. All summer we've looked for Rubus, but now that all the fruit are gone, we found more than we wanted. Despite Yu's expert hacking, we were scratched all the way to the top of this mountain, and all the way down. These mountains are not exceedingly high, but they seem so when you must cut your way through a dense jungle to get there. For a time the thin path skirted the edge of a deep precipice but was so covered with vines we had to poke ahead with a long walking stick to see if there was a place to step. Kyu Kim fell into a hole on the way up but was not hurt. On the way back I made a mis-step and went off the ledge we were walking on and found myself neck deep in a maze of briars and kudzu. It was nearly dark and hard to see. That kudzu vine is a tough one to walk through, but its redeeming feature is its thornlessness. After 5 1/2 hours in the jungle, we came back to base camp by moonlight, and almost made it back without mishap, but while jumping the rocks to cross the bold stream near the camp I slipped in the dim light, bruised a leg, and got one foot wet all the way to the knee.

Plants seen but not collected were:
Mentha, 360 m elevation; Fragaria sp., 300 to 600 m elevation; Diospyros lotus at 550 m elevation; Juglans sinensis and J. mandshurica at 700 m elevation; and Castanea sp. at 400 m elevation.

Plant seed collected today are:

Crataegus pinnatifida	330 m
Humulus japonicus	360 m
Prunus persica	500 m
Pyrus pyrifolia	500 m
Prunus salicina	550 m

Pyrus ussuriensis (hybrid?)	550m
Actinidia arguta	660 m
Vitis amurensis	710 m
Elaeagnus crispa	580 m

The grape is edible but my tongue gets sore if I extract the seed by eating the pulp. It is very acid. The small Actinidia arguta fruit are ripe and very good to eat. We restrained our appetites and saved some fruit for seed. The Elaeagnus is good to eat also, but is so small it is worrisome.

The camp building has a VIP room with fancy furniture etc. for special visitors. They wanted me to sleep there, but I said no, I'd go to the general dorm with the others.

September 10, 1981 - Worak Mountain, Cheongju

After our moonlight walk to camp last night, we slept well on the floor-palate bed and stayed in till 7:30 this morning. I worked up some of the "juicy" samples while the others ate breakfast. At 9:30 we met our uncanny guide, Mr. Kwan-Bin Yu a couple of km upstream from camp. By then he had found some Corylus sieboldiana trees with a few mature nuts, which he collected for us. He then told us that today's trail to the high ridges would be a highway compared to yesterday's. He was right, but he didn't say the trail went nearly straight up the mountain at a 60 to 70° slope. Part way up we had a short break while Yu took time to pick some of the famous pine mushrooms along the trail. These are sold to dealers at about $4.00 per pound, then flown fresh to Japan where they bring 4 or 5 times that. Then we stopped again at 10:30 to eat an apple and rest a bit. At 11:30 we reached the top of the ridge where stood a giant granite monolith at the top. Just under it in sparse pine and oak and some wild rhododendron was our prize, the small but hardy Vaccinium koreanum. But we could find no fruit, though this is the season for it. Mr. Yu said this is an off year for most everything on the mountain, perhaps because of a very cold winter last year that damaged the buds. We were ready to descend when Mr. Yu found two tiny fruit for us. These "blueberries" were bright red and oval rather than round. And so we climbed to the top for two small red berries. If even two of the seed grow it will have been worth it.

At 3 p.m. the ORD jeep brought us out and back to Cheongju at 6:00. This trip netted us seed of 12 species.

Collected today:
Vaccinium koreanum, 500 m elevation; Corylus sieboldiana, 290 m elevation; Corylus heterophylla, 240 m elevation.

September 11, 1981 - Cheongju, Chollipo Arboretum

Dr. Kim and I delayed leaving Cheongju till 11:30 a.m. so that we could meet the ORD Director (Chungbuk area) to ask for the loan of a jeep and driver to take us to Mr. Carl Miller's Arboretum on the West Coast of Korea. The answer was a polite "No", so we took a taxi to the bus depot. But there was an endless line at the bus station, as tomorrow is Korean Thanksgiving. For 2000 years people have returned to their home towns for this annual event, marked by the full moon of autumn. So we bargained with taxi drivers to carry us part way, and ultimately all the way. At times there were six people in these small taxis each with an agreed-on fee. It was wild on the highway with cars and buses darting in and out of each other's way; half the time was spent in the left-hand lane. The fee for the final leg of the trip for Kyu and me was 35,000 won (not quite as bad as it looks - $50.00). We hit some

unfinished rough road and one big bump tore loose the exhaust pipe from the manifold flange. So we stopped at a nearby village to get it welded and went a bit more cautiously on our way.

The Miller complex and Arboretum is situated on a hill overlooking the Yellow Sea (which is more blue than yellow). Mr. Miller was a naval officer who came here in 1945 and has been here since. He is a naturalized citizen of Korea, unmarried, and has an adopted Korean son. He loves plants, especially holly and magnolia, so 10 years ago he started his own arboretum. It is about 500 hectares, not all planted. Some of the species I want are growing here: Malus, Pyrus, Corylus, Rubus, Ribes, Vaccinium, Fragaria, Sorbus, Amelanchier, Chaenomeles and tree Photinia. He works as a consultant to the Bank of Korea and seems to have the funds to support this ambitious program. But he recently established the Chollipo Arboretum Foundation which is probably intended to get some help from others. For now he is the sole supporter of the Arboretum. He is trying to collect wild forms of plant species mostly those used as ornamental and shares my view that if more collecting is not done soon we will lose many small-area species. He also has seen evidence of such loss of species particularly in the tropics where land clearing has destroyed the only habitat for certain delicate species. When any species becomes extinct we lose one set of unique genes, never to be found again.

September 12, 1981 - Chollipo Arboretum

Due to the tremendous demand for public transportation, all the bus tickets for tomorrow (Sunday) are sold from here to Suweon where I'm to go next. Thus Kyu Kim decided to return the Cheongju today, which is Thanksgiving. I feel bad about his being away from his family today, but he made these arrangements without telling me of this important holiday. Carl Miller returns to Seoul tomorrow by car but has a full car and cannot take me out. It seems my only chance is to go on Monday with a graduate student who works here and will be going by bus to Seoul then. (The several transfers required necessitates my going with someone who speaks Korean). From Seoul he can put me on a train that goes to Suweon, where Dr. Ko will meet me at 5 p.m.

Mr. Miller took Kyu and me on a tour of the lower Arboretum this morning, and we found several species missed yesterday. Because of possible outcrossing, I collected very few seed here but got some good information on the wild sources of several species. I did collect seed of Juglans mandshurica here which is alone and apparently selfed. Also I found a clump of 3 trees of M. baccata (Korean) which I collected. Then I collected seed of Malus micromalus which may be pollinated by another species. This tree came from wild trees in isolated mountains of the south island (Cheju). From Mr. Miller's description of the site, it must be a true species. The fruit and leaves are very small as is the tree. He is going there in two weeks and will try to collect seed for me.

This arboretum contains numerous species of oriental and exotic Cotoneaster, Sorbus, and tree Photinia which will be of interest when I can learn where the wild forms were obtained.

Most of the p.m. was spent extracting seed from the numerous fruits collected during the past week. It is tedious work and the tannins in many of them turn the fingers and fingernails black, so that it looks like I haven't washed recently. The electricity went off at 7:30, so I rested until it came on again at 9:00.

They invited me to share their Thanksgiving dinner as there is no eating place near the Arboretum. We had the usual kimchi, seaweed, radishes, rice and tofu, plus several local vegetables such as kolrabi, sesame leaves, greens

of several species, and two kinds of delicious and expensive mushrooms and beef strips. For dessert we had a rare and tasty Elaeagnus pie from one of the large-fruited species in the Arboretum.

September 13, 1981 - Chollipo,Seoul

The day was spent processing fruit and seed samples, further study in the arboretum and a 6-hour drive to Seoul with the Miller family. In the arboretum we found an apricot named Prunus mandshurica. It is hardy and healthy and should be collected when seed are available. Also native peaches grow here and seem not to have peach leaf curl. I saw several trees of Malus baccata with red rather than yellow fruit and leaves like our OSU trees. Check Bean's book on "Trees hardy to England" for the supposed relationship of M. baccata, M. prunifolia, M. prunifolia Rinki, and M. asiatica.

Because Mr. Miller's helper got an unexpected ride back to Seoul early today, the Millers offered me a ride back with them later this afternoon. It was unbelievable the number of cars, trucks, taxis and buses on the road today. One fourth of Korea's 38 million people live in Seoul and they were all trying to get back today from their Thanksgiving holiday in other parts of the country. These taxi drivers get a lot of long distance business during such days because the buses are full and most people don't have cars of their own. But their driving in heavy traffic can only be described as maniacal; they will stack 5 or 6 people into a small cab then break every rule in the book to get there, collect, and find another fare. They pass on the center line with 3 abreast or even on the right side, half off the shoulder. We passed several wrecks today, some very bad, involving taxis. Luckily I rode with a sane driver. On arrival at Seoul, Carl Miller dropped me off at the Seoul Garden Hotel and told me to call Dr. T.B. Lee near here to ask for a ride to Suweon tomorrow. This was done and he will pick me up at 8:30. I continue to extract, dry and package seed samples through this evening and will arise early tomorrow to finish packaging those dried overnight. There are 5 lots drying and 5 yet to be extracted.

September 14, 1981 - Seoul, Suweon

Today was moving day again. Dr. Lee came for me as agreed. He drives his own 4-wheel drive diesel jeep van everywhere, including remote collecting sites where there are no roads. Today we drove through Seoul to the south edge where he stopped at the main campus of Seoul National University. This school was moved from the old east site a few years ago, so the campus is brand new. (13,000 students for a nation of 38 million and a city of 10 million). It is very attractive and is kept spotless with a whole platoon of sweepers and grounds keepers. Besides the usual ginkgo, pine and poplar, they are planting flowering cherry and apples, Syringa, Tilia, Liriodendron, Acer and a few others. Across the road from the campus begins the backside of the Arboretum Dr. Lee took me to last week. It is a steep slope leading up to Kwanak mountain which divides the two sides of the Arboretum. Most of it is natural regrowth vegetation but many native and exotic species will be planted as resources are available. I will send Dr. Lee a list of plants we have available and have agreed to send whatever he wants. We drove on a road that skirts around Kwanak mountain on the way to Suweon. On the way we saw a huge building development going up out in the country. Dr. Lee said this was to be the site of many of the national government buildings in a move to decentralize. The place is called by a name meaning Fruit River.

We arrived at the Suweon campus at 11 a.m. and I spent most of the day in

Dr. Lee's herbarium looking at various species of interest. At. 2:00, however, Dr. Ko came and took me for a half-hour visit with Dr. Kun Hwan Yun, my old friend who worked with us in fruit research at Wenatchee Washington in 1959. He is director general, Office of Rural Development in Korea. We had a good visit about old times. He did not know that both Drs. Batjer and Degman had died or that Drs. Woodbridge and Benson had retired. We also compared grandchildren, of which I have a few more than he. Then I reminded him of the time at Grady Auvil's up the Columbia river when we were getting fruit set counts on apples in a chemical thinning test. As we came to a certain tree I told him, "When we got blossom counts here earlier this spring, we killed a rattlesnake under this tree." Yun then jumped up on the second rung of the ladder and peered nervously into the grass below, till I assured him there probably were no snakes there now. But as we were getting ready for lunch a while later, Yun picked a shady spot under a tree and was just about to sit down, when I yelled, "Oh, don't sit there!". He jumped up and moved quickly away. "You were going to sit in some poison ivy", I told him. After finally finding a good spot, Yun said to me quietly, "This is a very dangerous orchard."

Dr. Yun has invited me to dinner tomorrow night, and told his assistant to have a car and driver at my disposal as long as I'm here. Then he gave me a large velvet lined box in which is a bronze placque of the ORD emblem. Having just given away the last copy of my book, I promised to send him one when I get home.

Before leaving the herbarium today, Dr. Lee gave me 20 lots of seed collected last year. These are on my list to collect, so this brings to more than 50 the species seed collected in Korea.

September 15, 1981 - Suweon

Arose at 6 a.m. to try to finish extracting all seed samples before noon. It was incredibly hard to get the seed from *Malus sieboldii*. The fruit were very small and hard as a rock. Cutting them with a knife usually resulted in cutting the seed which of course ruined it. I finally resorted to crushing them, then picking the unharmed seed from the debris, and finished lot number 55 at about 1 p.m.

Drs. Ko and Kim came at 2 p.m. to spend the afternoon making final arrangements for the handling of seed shipments and further collections of late-maturing species. Also we spent some time discussing problems of translating my pomology book. The two of them are in the final stages of completing the Korean translation for use at their agricultural universities. Most of the problems were resolved, but I am to write them regarding the names of some herbicides and their specific chemical content. Also I will write a brief preface to the Korean edition soon after I return to the states. Then as soon as possible I am to call Ed Proebsting to find out if he can accept Dr. Kyu Kim next August-September (1982) for hardiness studies with stone fruits and grapes, after which I am to write Dr. Kim relative to studies at Oregon on hardiness of pear.

September 16, 1981 - Suweon, Seoul

Beginning at 9:00 this morning we began a whirl-wind round of calls prior to departure for Seoul at 11:00. First we went for coffee and a short visit with Dean of Agriculture Lee, Eun-Woong, also Professor of Agronomy. He worked at the International Rice Institute, Philippines and knows Ritchie Cowan there. Then we went to the ORD Horticulture Experiment Station to

arrange for Mr. Kim to collect for us nut samples of 2 Corylus heterophylla subspecies and 3 of C. sieboldiana. Then Mr. Moon learned of an old orchard near Seoul which grows the ancient edible apple Malus asiatica which I was not able to find in the wild. So we (Mr. Moon, Dr. Ko, Dr. Cho and I) loaded into the ORD car for VIP's and took off for Seoul. After a Korean barbeque of ribs and kimchi we looked up the M. asiatica orchard in the edge of the hills in a suburb. The one old tree was no more than 20 cm diameter but in a sterile rocky granite slope it had survived more than 100 years, having been planted by the present owner's great grandfather. Two edible varieties are grown here -- one early and one late -- we got fruit of the late one. The rootstock is wild apple and is the same as I am calling M. prunifolia. (Some of the seed may be pollinated from a few escapes of this). The fruit is oblate, bright red or blushed and has a thin pedicel 12 to 20 mm long. Length/diameter are 33/43 to 26/34 mm but the grower says they get much larger with good care. The flesh is crisp, tender and juicy, subacid and pleasant flavor, and fruit have 5 carpels. Dr. Ko says this was cultivated for centuries before European apples were introduced, so it is not a hybrid. This is a great find after failing at all turns previously. It made my day, and tonight I dined out with Dr. Yun and friends, returned to the Hotel Lille at 11 p.m. and extracted the apple seed, packed my bags and am ready to return home.