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Original Paper

Collaborative Exploration of Plant Genetic Resources in Vietnam, 2015

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Summary

In October 2015, we collected 97 fruit and seed accessions (including 10 cucumbers, 30 pumpkins, and 21 amaranths) in northwest Vietnam. All accessions were stored as seeds at the Plant Resources Center of the Vietnamese Academy of Agricultural Science, and subsets were transferred to the Genetic Resources Center, National Agriculture and Food Research Organization (NARO).

KEY WORDS: Cucumber, Pumpkin, Amaranth, Genetic resource, Vietnam

Introduction

The highlands of northwest Vietnam, with maximum elevations of up to 1500 m, are inhabited by many ethnic groups who practice traditional agriculture and grow local landraces of various crops. The region is a promising source of genetic resources, including cucurbits (Yoshida *et al*., 1997; Saito T. *et al*., 2005; Sakata *et al*., 2008; Saito A. *et al*., 2009; Matsunaga *et al*., 2010, 2015; Sugiyama *et al.,* 2015) and both grain and leafy amaranths (Kawase *et al.,* 2012; Okuizumi *et al*., 2013, 2015; Domon *et al*., 2015a, b; Yamamoto *et al*., 2015a, b). The first survey to collect cucurbitaceous crops was conducted in 2014 under a Letter of Agreement (LOA) signed by National Institute of Agrobiological Sciences (NIAS) of Japan and the Plant Resources Center (PRC) of the Vietnamese Academy of Agricultural Science within the framework of the Plant Genetic Resources Asia (PGRAsia) project (Sugiyama *et al*., 2015).

In the first survey, 33 accessions of *Cucurbita moschata* Duchesne, 19 accessions of *Cucumis*

sativus L., and seven accessions of *Cucumis melo* L. were collected. Here, we report the results of our second survey to collect vegetable genetic resources (with a focus on cucumber, pumpkin, and amaranth). Furthermore, we visited northern Vietnam one month ahead of the first survey, because the cucurbitaceous fruits mainly harvested before October (Sugiyama *et al*., 2015). This collaborative exploration was also conducted based on the LOA between Dr. Hirohiko Hirochika, President of NIAS, and Dr. La Tuan Nghia, Director General of PRC, in 2014. All obligations and rights of the NIAS under the LOA were transferred to the National Agriculture and Food Research Organization (NARO), owing to the merger of NARO and NIAS in April 2016.

Methods

From 12th to 18th October 2015, we visited Mai Son, Bac Yen, and Van Ho districts in Son La Province by car (Table 1, Fig. 1). The climate here is rainy from March to September and dry from October to February. At 400 to 1500 m above sea level, the districts experience moderate temperatures all year round. We collected fruit and seed samples of local or wild landraces of crops from farmers and from the roadside. In parallel, we collected information on each sample from the farmers, including local plant name, sowing date, harvest date, usage and cultivation methods. We also recorded the place name, latitude and longitude, elevation, and characteristics of each collection site. The latitude, longitude, and elevation were determined by GPS receiver.

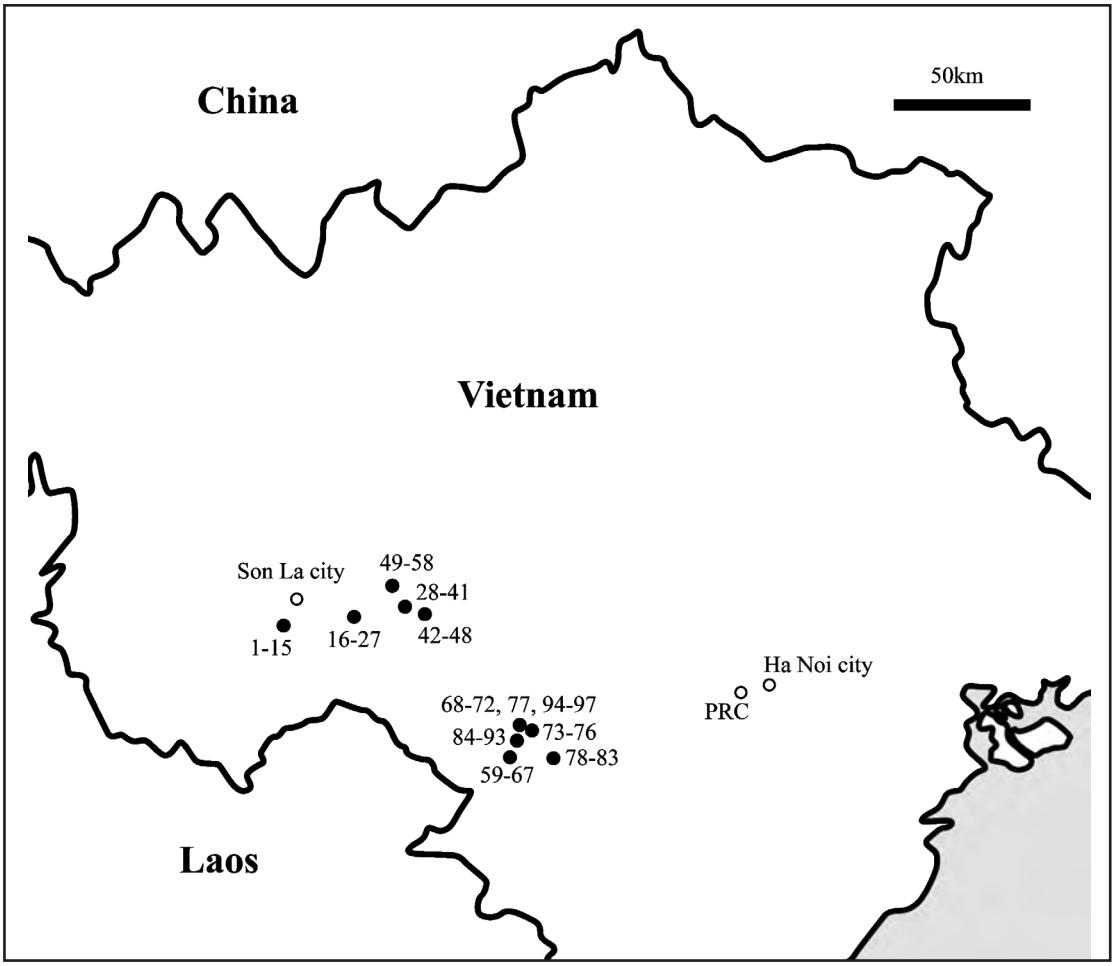

Fig. 1. Sites in northwest Vietnam where vegetable genetic resources were collected. Collection number 1-27 were collected at Mai Son, 28-58 were collected at Bac Yen, 59-97 were collected at Van Ho.

Table 1. Itinerary of the field survey in Vietnam, 2015

Date (month/day)	Day	Itinerary	Stay
10/10	Sat	Chubu Central International Airport – Hanoi	Hanoi
10/11	Sun	Hanoi – Son La city	Son La City
10/12	Mon	Son La city – Mai Son	Mai Son
10/13	Tue	Mai Son – Bac Yen	Bac Yen
10/14	Wed	Bac Yen	Bac Yen
10/15	Thu	Bac Yen	Bac Yen
10/16	Fri	Bac Yen – Van Ho	Van Ho
10/17	Sat	Van Ho	Van Ho
10/18	Sun	Van Ho	Van Ho
10/19	Mon	Van Ho – Hanoi	Hanoi
10/20	Tue	Hanoi, visit PRC	
10/21	Wed	Hanoi – Chubu Central International Airport	

Results and Discussion

We collected a total of 97 samples, including 10 of *Cucumis sativus*, 30 of *Cucurbita moschata*, 21 of *Amaranthus* spp, 12 of *Capsicum* spp, nine of *Brassica* spp, five of *Solanum* spp, four of *Cucumis melo*, two of *Luffa* spp, one of *Momordica charantia* L., *Lagenaria siceraria* (Molina) Standley, *Coriandrum sativum* L. and *Trichosanthes cucumerina* L. (Tables 2 and 3). All samples were stored as dried seeds in the PRC gene bank. Subsamples were transferred to the Genetic Resources Center, NARO. In Son La province, one of the most important agricultural feature are high quality and safety vegetable production. Controlling vegetable quality, the farmers avoid using pesticide, insecticide and/or fertilizer. The vegetables are transported to urban area such as Ha Noi city. These circumstances indicating that people in Viet Nam concern with food safety and security, and Son La province play an important role in Viet Nam agriculture system.

Cucumber

We collected two samples of fruit and eight of seed (as most fruits had already been harvested). Not many farmers grew cucumber in Son La province. The farmers indicated that most cucumber fruits are cylindrical, with skin colors at maturity of yellow, orange, brown, or white, and the maximum fruit weight is approximately 3 kg. Seeds were sown after the rainy season had started, and fruits were harvested until September. Future collecting might be scheduled for September in order to get both cucumber fruit and seed. The two fruit samples were cylindrical to round; one was yellow (No. 14) and the other was green and white striped (No. 15). Some farmers grew cucumber with upland rice (*Oryza sativa* L.) or maize (*Zea mays* L.) in mixed cropping.

Pumpkin

Cucurbita moschata is a major vegetable crop in Mai Son, Bac Yen, and Van Ho districts. We collected 29 samples of fruit and one of seed, but we did not find any other species of *Cucurbita*. Pumpkins were being harvested at the time of the survey. Many farmers grow pumpkins to eat or as feed for livestock and store them on the roof. They also eat pumpkin shoot. The fruits weighed between 1 and 8 kg. Fruit shapes were flattened (Nos. 1, 2, 18, 26, 27, 56, 57, 68, 81, and 85), cylindrical (No. 41), elongate form (Nos. 46, 69, and 94), globular (Nos. 17, 24, 35, and 86), pyriform (Nos. 16, 19, 58, 75, and 80), crooked

neck (Nos. 51 and 53), heart-shaped (Nos. 36 and 59), or triangular shaped (Nos. 28 and 89). The skin color of most fruits changed from green to brown at maturity. Most samples had entire light or deep yellow to orange flesh, but some were yellow or orange with green regions.

Table 2. A summary of collected genetic resources in Vietnam in 2015

Species	Total
Cucurbita moschata	30
Amaranthus spp.	21
Capsicum spp.	12
Cucumis sativus	10
Brassica spp.	9
Solanum spp.	5
Cucumis melo	4
Luffa spp.	2
Momordica charantia	1
Lagenaria siceraria	1
Coriandrum sativum	1
Trichosanthes cucumerina	1
Total	97

Amaranth

We collected ears of 20 *Amaranthus* genotypes and seeds of one genotype. One-third of them appeared to be *A. tricolor* based on visual characteristics. On account of their wide variety of colors, shapes, and sizes, the rest appeared to be various species that we could not distinguish. Amaranth is grown as both a cereal and a leafy vegetable in Southeast Asia. In Son La province, the farmers eat the young leaves or feed them to livestock. The ears and leaves could be broadly separated into red and green types, although some samples had different colors between ear and leaf; three samples had red ears and leaves (Nos. 30, 39, and 52), 13 had green ears and leaves (Nos. 21, 45, 54, 64, 66, 71, 72, 82, 84, 90, 92, 93, and 96), two had red ears and green leaves (Nos. 67 and 70), and two had red ears and red and green leaves (Nos. 22 and 29). Sample No. 54 had small spines in the ear. Most samples grew in the farmers' home gardens, but samples Nos. 67, 71, 72, and 93 grew on the roadside. Since the growing conditions of the various genotypes varied, we need a more precise investigation for taxonomic classification and to evaluate the characteristics of each genotype.

Acknowledgements

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ベトナムにおける野菜遺伝資源の共同探索，2015 年

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和文摘要

本報告は農林水産省委託プロジェクト研究「海外植物遺伝資源の収集・提供強化」の予算により実施され, 国立研究開発法人農業･食品産業技術総合研究機構とベトナム植物遺伝資源センターとの間で締結した共同研究協定（MOU）に基づいて行われたベトナム北西部における野菜遺伝資源の探索･収集に関わる調査報告書である．調査は, 2014 年 10 月 10 日～ 21 日にかけて行った．ソンラ省のマイソン県、バックイェン県およびバンホー県において探索・調査を行った．その結果，キュウリ（*Cucumis sativus*）10 点，ニホンカボチャ（*Cucurbita moschata*）30 点，アマランサス（*Amaranthus* spp.）21 点を含めた合計 97 点の野菜遺伝資源を収集した．収集された遺伝資源は，ベトナム植物資源センターと国立研究開発法人農業・食品産業総合研究機構との間に交わされた試料提供契約（MTA）に基づいて両研究機関で保存する．

Table 3. Genetic resources collected in Vietnam in 2015

Coll. No.	JP No.	Coll. date Oct. 2015	Species name	Local name	Type of sample	Status of sample	Coll. source	Province	District	Commune	Town or village name	Latitude	Longitude	Altitude (m)	Remarks
1	256646	12	*Cucurbita moschata*	Lo Van Chuoi	vegetable	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
2	256647	12	*Cucurbita moschata*	Lo Van Chuoi	vegetable	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
3	256648	12	*Brassica juncea*	Phac Kheo	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
4	256649	12	*Brassica juncea*	Phac Meo	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	Taller than No 3
5	256650	12	*Brassica* sp.	Phac Ca Lan	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
6	256651	12	*Solanum* sp.	Ma Khua Khop	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
7	256652	12	*Capsicum frutescens*	Na Uot Non	vegetable	landrace	farmland	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
8	256653	12	*Capsicum frutescens*	Na Uot Non	vegetable	landrace	farmland	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
9	256654	12	*Capsicum frutescens*	Ma Wot Non	vegetable	landrace	farmland	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
10	256655	12	*Amaranthus* sp.	Phac Hom	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
11	256656	12	*Cucumis sativus*	Ma Tanh Xang	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
12	256657	12	*Brassica* sp.	Phac Cat Tay	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	Small seeded, mixed with *B. juncea* seeds
13	256658	12	*Coriandrum* sp.	Hom Pen	seed	landrace	farm store	Son La	Mai son	Cang Chung	Cang	N21-13-52.89	E103-52-11.44	807	
14	256659	12	*Cucumis sativus*	Ki	vegetable	landrace	farmland	Son La	Mai son	Cang Chung	Santa	N21-13-10.27	E103-53-58.87	803	Harvested near farmland, mixed cultivation with upland rice
15	256660	12	*Cucumis sativus*	Ki	vegetable	landrace	farmland	Son La	Mai son	Cang Chung	Santa	N21-13-10.27	E103-53-58.87	803	
16	256661	13	*Cucurbita moschata*	Bi Ngo	vegetable	landrace	farmland	Son La	Mai son	Na Bo	No 8	N21-13-56.50	E104-08-54.53	822	Sweet; mixed cultivation with orange and coffee
17	256662	13	*Cucurbita moschata*	Bi Ngo	vegetable	landrace	farmland	Son La	Mai son	Na Bo	No 8	N21-13-56.50	E104-08-54.53	822	
18	256663	13	*Cucurbita moschata*	Bi Ngo	vegetable	landrace	farmland	Son La	Mai son	Na Bo	No 8	N21-13-56.50	E104-08-54.53	822	
19	256664	13	*Cucurbita moschata*	Bi Ngo	vegetable	landrace	farmland	Son La	Mai son	Na Bo	No 8	N21-13-56.50	E104-08-54.53	822	
20	256665	13	*Momordica charantia*	I ia	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
21	256666	13	*Amaranthus* sp.	Xu Tu	vegetable, seed	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
22	256667	13	*Amaranthus* sp.	Xu Tu Lia	vegetable, seed	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
23	256668	13	*Solanum* sp.	Lu	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
24	256669	13	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
25	256670	13	*Capsicum annuum*	Cua Cho	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
26	256671	13	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	
27	256672	13	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Mai son	Na Bo	Tong Tai	N21-15-32.91	E104-09-22.84	962	Sowing from May to June, harvesting from Sep. to Oct.
28	256673	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	H'Mong minority
29	256674	14	*Amaranthus* sp.	Rau Song Tu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	Home garden
30	256675	14	*Amaranthus* sp.	Rau Song Tu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	Home garden
31	256676	14	*Capsicum frutescens*	Ho Cho	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	Small fruit
32	256677	14	*Capsicum frutescens*	Ho Cho	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	Light green immature fruit
33	256678	14	*Capsicum frutescens*	Ho Cho	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-44.49	E104-23-07.40	1397	

Table 3 (Continued).

Coll. No.	JP No.	Coll. date Oct. 2015	Species name	Local name	Type of sample	Status of sample	Coll. source	Province	District	Commune	Town or village name	Latitude	Longitude	Altitude (m)	Remarks
34	256679	14	*Brassica juncea*	Rau Sua	seed	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N-21-17-42	E-104-23-10	1396	
35	256680	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N-21-17-42	E-104-23-10	1396	
36	256681	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N-21-17-41	E-104-22-57	1438	
37	256682	14	*Solanum* sp.	Khau Pau Da	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Hang C	N-21-17-41	E-104-22-57	1438	Used to relieve toothache
38	256683	14	*Solanum* sp.	Khau Pau Da	vegetable	wild	wild	Son La	Bac Yen	Ban Cheu	Hang C	N21-17-39.85	E104-21-50.84	1468	Roadside; used as a medicine
39	256684	14	*Amaranthus* sp.	Song Tu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Ban Cheu	Ban Chieu A	N21-17-34.06	E104-21-47.25	1476	
40	256685	14	*Lagenaria siceraria*	Tou A	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Ban Chieu A	N21-17-34.06	E104-21-47.25	1476	
41	256686	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ban Cheu	Ban Chieu A	N21-17-34.06	E104-21-47.25	1476	
42	256687	14	*Brassica juncea*	Nong Rau	seed	landrace	farm store	Son La	Bac Yen	Ta Xua	Chumn Trinh	N21-17-43.06	E104-25-22.11	1526	Sowing in Sep., harvesting in Mar.
43	256688	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ta Xua	Chumn Trinh	N21-17-43.06	E104-25-22.11	1526	
44	256689	14	*Capsicum baccatum*	Ho Cho	vegetable	landrace	farmland	Son La	Bac Yen	Ta Xua	Chumn Trinh	N21-17-28	E104-25-08	1526	
45	256690	14	*Amaranthus* sp.	Song Tu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Ta Xua	Chumn Trinh	N21-17-28	E104-25-08	1526	
46	256691	14	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Ta Xua	Chumn Trinh	N21-17-28	E104-25-08	1526	
47	256692	14	*Cucumis sativus*	(Nong) Di	vegetable	landrace	farm store	Son La	Bac Yen	Ta Xua	Moig Vang	N21-16-22	E104-26-34	1495	"Nong" means seed
48	256693	14	*Brassica juncea*	(Nong) Rau	vegetable	landrace	farm store	Son La	Bac Yen	Ta Xua	Moig Vang	N21-16-22	E104-26-34	1495	"Nong" means seed
49	256694	15	*Cucumis sativus*	(Nong) Di	seed	landrace	farm store	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-55.93	E104-18-34.97	1207	Sowing from Mar. to Apr., harvesting in Sep.
50	256695	15	*Solanum melongena*	Lu	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-55.1	E104-18-34.1	1225	
51	256696	15	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-55.1	E104-18-34.1	1225	
52	256697	15	*Amaranthus* sp.	Su Tu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-55.7	E104-18-36.3	1190	
53	256698	15	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-40.8	E104-18-45.0	1181	
54	256699	15	*Amaranthus* sp.	Su Tu Cu	vegetable, seed	landrace	farmland	Son La	Bac Yen	Hang Chu	Pa Ku Sang A	N21-21-40.8	E104-18-45.0	1181	
55	256700	15	*Brassica juncea*	Rau Sua	seed	landrace	farm store	Son La	Bac Yen	Hang Chu	Hang Chu	N21-21-52.78	E104-19-28.30	1350	
56	256701	15	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Hang Chu	N21-21-40.89	E104-19-35.10	1391	
57	256702	15	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Hang Chu	N21-21-40.89	E104-19-35.10	1391	
58	256703	15	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Bac Yen	Hang Chu	Hang Chu	N21-21-46.5	E104-19-32.0	1384	
59	256704	16	*Cucurbita moschata*	Tou Da	vegetable	landrace	farmland	Son La	Van Ho	Van Ho	Hua Tat	N20-46-45.20	E104-47-09.66	1114	
60	256705	16	*Cucumis sativus*	Di	seed	landrace	farmland	Son La	Van Ho	Van Ho	Hua Tat	N20-46-45.20	E104-47-09.66	1114	Sowing in June, harvesting in Sep. (or Aug.)
61	256706	16	*Brassica juncea*	Rau Sua	seed	landrace	farm store	Son La	Van Ho	Van Ho	Hua Tat	N20-46-45.20	E104-47-09.66	1114	Sowing in Sep., harvesting in Dec.
62	256707	16	*Capsicum frutescens*	Pieu Plat	vegetable	landrace	farmland	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-26.91	E104-47-18.23	921	Dao minority
63	256708	16	*Cucumis sativus*	Qua Chai	seed	landrace	farm store	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-26.91	E104-47-18.23	921	Dao minority; sowing from Feb. to Mar., harvesting from Apr. to May
64	256709	16	*Amaranthus* sp.	Lai Len	vegetable, seed	landrace	farmland	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-28.2	E104-47-18.7	920	
65	256710	16	*Luffa acutangula*	Lai Choi	vegetable	landrace	farmland	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-28.5	E104-47-19.0	923	

Table 3 (Continued).

Coll. No.	JP No.	Coll. date Oct. 2015	Species name	Local name	Type of sample	Status of sample	Coll. source	Province	District	Commune	Town or village name	Latitude	Longitude	Altitude (m)	Remarks
66	256711	16	*Amaranthus* sp.	Lai Len	vegetable, seed	wild	other	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-31.2	E104-47-21.4	919	On farmland
67	256712	16	*Amaranthus* sp.	Lai Len	vegetable, seed	wild	other	Son La	Van Ho	Van Ho	Suoi Lin	N20-48-31.0	E104-47-22.8	918	Roadside
68	256713	17	*Cucurbita moschata*	Mac Uc	vegetable	landrace	farm store	Son La	Van Ho	To Mua	Pan	N20-53-11.30	E104-49-51.84	828	Thai minority; sowing in Feb., harvesting in Sep.
69	256714	17	*Cucurbita moschata*	Mac Uc	vegetable	landrace	farm store	Son La	Van Ho	To Mua	Pan	N20-53-11.30	E104-49-51.84	828	Thai minority
70	256715	17	*Amaranthus* sp.	Phac Hom	vegetable, seed	landrace	farmland	Son La	Van Ho	To Mua	Pan	N20-53-11.30	E104-49-51.84	828	Thai minority
71	256716	17	*Amaranthus* sp.	Phac Hom	vegetable, seed	wild	other	Son La	Van Ho	To Mua	Pan	N20-52-51.4	E104-50-11.9	826	Roadside
72	256717	17	*Amaranthus* sp.	Phac Hom	vegetable, seed	wild	other	Son La	Van Ho	To Mua	Pan	N20-52-51.4	E104-50-11.9	826	Roadside
73	256718	17	*Cucumis melo*	Qua	seed	landrace	farm store	Son La	Van Ho	To Mua	Da mai	N20-52-12.55	E104-52-31.14	685	Mixed cultivation with upland rice; 10 fruits/plant; round fruit with stripes
74	256719	17	*Cucumis sativus*	Qua Chai	seed	landrace	farm store	Son La	Van Ho	To Mua	Da mai	N20-52-12.55	E104-52-31.14	685	
75	256720	17	*Cucurbita moschata*	Nhum Xi	vegetable	landrace	farmland	Son La	Van Ho	To Mua	Da mai	N20-52-12.7	E104-52-31.0	679	Sown with maize seeds, usually as feed for animals; no use of pesticide and fertilizer
76	256721	17	*Luffa cylindrica*	Lai Choi	vegetable	landrace	farmland	Son La	Van Ho	To Mua	Da mai	N20-52-13.4	E104-52-30.7	693	
77	256722	17	*Cucumis melo*	Tanh Lai	seed	landrace	farm store	Son La	Van Ho	To Mua	Pan	N20-52-51.4	E104-50-11.9	826	
78	256723	17	*Cucumis sativus*	Qua	seed	landrace	farm store	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	Mixed cultivation with maize
79	256724	17	*Capsicum frutescens*	Po Lat	vegetable	landrace	farmland	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	
80	256725	17	*Cucurbita moschata*	Nhum Xi	vegetable	landrace	farm store	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	
81	256726	17	*Cucurbita moschata*	Nhum Xi	vegetable	landrace	farm store	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	
82	256727	17	*Amaranthus* sp.	Lai Len	vegetable, seed	landrace	farmland	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	
83	256728	17	*Cucumis melo*	Qua Plen	seed	landrace	farm store	Son La	Van Ho	Chieng Yen	Pha Le	N20-46-25.35	E104-57-37.80	406	
84	256729	18	*Amaranthus* sp.	Phac Hom	vegetable, seed	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Do	N20-50-04.64	E104-48-55.60	543	Thai minority
85	256730	18	*Cucurbita moschata*	Mac Uc	vegetable	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Do	N20-50-02.2	E104-48-55.7	546	
86	256731	18	*Cucurbita moschata*	Mac Uc	vegetable	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Do	N20-50-02.2	E104-48-55.7	546	
87	256732	18	*Cucumis melo*	Mac Tanh Lai	seed	landrace	farm store	Son La	Van Ho	Chieng Khoa	Na Do	N20-50-02.2	E104-48-55.7	546	
88	256733	18	*Capsicum frutescens*	Mac Uot	vegetable	landrace	farm store	Son La	Van Ho	Chieng Khoa	Na Do	N20-50-02.2	E104-48-55.7	546	
89	256734	18	*Cucurbita moschata*	Mac Uc	vegetable	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Tem	N20-50-07.72	E104-49-16.9	535	
90	256735	18	*Amaranthus* sp.	Phac Hom	vegetable, seed	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Tem	N20-50-07.72	E104-49-16.9	535	
91	256736	18	*Trichosanthes cucumerina*	Mac Ray Phai	vegetable	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Tem	N20-50-07.6	E104-49-16.0	542	
92	256737	18	*Amaranthus* sp.	Phac Hom Danh	vegetable, seed	landrace	farmland	Son La	Van Ho	Chieng Khoa	Na Tem	N20-50-07.6	E104-49-16.0	542	
93	256738	18	*Amaranthus* sp.	Phac Hom	vegetable, seed	wild	other	Son La	Van Ho	Chieng Khoa	Na Tem	N20-50-09.6	E104-49-19.5	543	Roadside
94	256739	17	*Cucurbita moschata*	Mak U	vegetable	landrace	farmland	Son La	Van Ho	To Mua	Soui Liem	N20-52-50.05	E104-50-23.42	837	
95	256740	17	*Capsicum frutescens*	Mak Uot	vegetable	landrace	farmland	Son La	Van Ho	To Mua	Soui Liem	N20-52-50.05	E104-50-23.42	837	
96	256741	17	*Amaranthus* sp.	Phac Hom	vegetable, seed	landrace	farmland	Son La	Van Ho	To Mua	Soui Liem	N20-53-15.99	E104-49-33.20	847	
97	256742	17	*Cucumis sativus*	Ken Mak Tanh	seed	landrace	farm store	Son La	Van Ho	To Mua	Soui Liem	N20-53-15.99	E104-49-33.20	847	

Photo 1. Commercial cucumber cultivar at Ha Noi market

Photo 2. Pumpkin shoots at Ha Noi market

Photo 3. Pumpkin fruits at Luong Son market, Hoa Binh

Photo 4. Various cucurbit vegetables at Luong Son market, Hoa Binh

Photo 5. Amaranth grew at road side at Tong Tai village, Mai Son

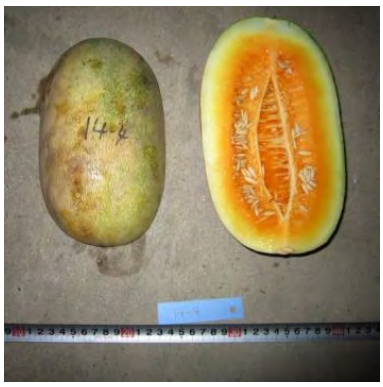
Photo 6. Pumpkin fruits stored at roof at Hang C village, Bac Yen

Photo 7. Investigating fruit traits at No.8 village, Mai Son Hang C village, Bac Yen

Photo 8. Interviewing local people at Pha Le village, Van Ho Hang C village, Bac Yen

Cucumber

No.11



No.14

No. 15

No. 47

No.49

No.60

No. 63

No. 74

No. 78

No. 97

Pumpkin

No. 1

No. 2

No. 16

No. 17

No. 18

No. 19

No. 24

No. 26

No. 27

No. 28

No. 35

No. 36

No. 41

No. 43

No. 46

No. 51

No. 53

No. 56

No. 57

No. 58

No. 59

No. 68

No. 69

No. 75

No. 80

No. 81

No. 85

No. 86

No. 89

No. 94

Amaranth

No. 10

No. 21 (green) & No. 22 (red)

No. 29

No. 30

No. 39

No. 45

No. 52

No. 54

No. 64

No. 66

No. 67

No. 70

No. 71

No. 72

No. 82

No. 84

No. 90

No. 92

No. 93

No. 96