

Original Paper

Collaborative Exploration of the Vegetable Genetic Resources in Vietnam, 2017

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Summary

A field survey was conducted in central Vietnam from August 18th to 26th, 2017. A total of 65 accessions were collected including, *Cucumis sativus* (27), *Amaranthus* spp. (18), *Cucurbita moschata* (13), *Citrullus lanatus* (3), *Allium chinense* (3) and *Momordica charantia* (1). All accessions have been stored as seeds or bulbs at the Plant Resources Center (PRC) at the Vietnamese Academy of Agricultural Science, and subsets were transferred to the Genetic Resources Center, the National Agriculture and Food Research Organization (NARO), Japan.

KEY WORDS: cucumber, amaranth, pumpkin, *Cucumis sativus*, *Amaranthus* spp., *Cucurbita moschata*, genetic resource, Vietnam

Introduction

The highlands of Vietnam are inhabited by many ethnic groups who practice traditional agriculture and grow local landraces of various crops. The collection of novel plant genetic resources, that have been handed down within these ethnic groups, is crucial for the development of new varieties that harbor desirable traits, such as disease and pest resistance, improved fruit quality and higher yields. To promote the development of these collections, the Plant Genetic Resources in Asia (PGRAsia) project was started in 2014. Vietnam, in terms of its physical geography, is a relatively long country running from north to south and there are subsequently noticeable climatic variations between the different areas of the country. Furthermore, there are many unique agricultural environments and practices throughout the different

climatic areas.

There have been three previous surveys of genetic plant resources in Vietnam: the first was conducted in the northern region from November 9th to 22nd in 2014 (Sugiyama *et al.* 2015), the second in the highlands of the northwest region from October 12th to 18th in 2015 (Shimomura *et al.* 2016), and the third was conducted in northern Vietnam from October 3rd to 13th in 2016 (Kawazu *et al.* 2017). In these three explorations numerous samples of important agricultural vegetable crop species were collected including: pumpkins (85), cucumbers (38), amaranths (56), peppers (12) and melons (20). Prior to the PGRAsia project, Yoshida *et al.* (1997) also conducted an exploration and collection of vegetable genetic resources in the northwest region of Vietnam, during which 144 accessions were collected. Here, we report the results from a fourth survey in the Quang Nam province in central Vietnam.

Methods

From August 18th to 26th, 2017, explorations for the collection of vegetable genetic resources in central Vietnam were conducted (Table 1). Japanese members arrived at Noi Bai airport in Hanoi from Japan on August 16th and joined with Plant Resource Center (PRC) members. The following day, the exploratory party moved to Da Nang by plane and began to explore and collect genetic resources by car from the Phuoc Son, Tay Giang and Dong Giang districts of Quang Nam province (Photo 1). Fruit, bulb, and seed samples of local varieties from a total of 26 sites from farmers and roadsides were collected (Fig. 1, Photo 2). Furthermore, information for each sample was collected through interviews, including the local plant name, sowing date, harvest date, usage and cultivation methods (Photo 3). In addition, the place name and precise latitude and longitude of the collection sites were recorded using Garmin eTrex20J GPS technology (Garmin International Inc., Olathe, KS, USA).

Results and Discussion

Quang Nam province, which is located in central Vietnam can be generally described as a mountainous coastal area; comprised of flat land along its eastern coast with increasingly higher

Table 1. Itinerary of the field survey in central Vietnam, 2017

Date (month/day)	Day	Itinerary	Stay
8/16	Wed	Chubu Central International Airport - Hanoi	Hanoi
8/17	Thu	Hanoi - Da Nang	Da Nang
8/18	Fri	Da Nang - Tam Ky - Phuoc Son	Phuoc Son
8/19	Sat	Phuoc Son	Phuoc Son
8/20	Sun	Phuoc Son - Tay Giang	Tay Giang
8/21	Mon	Tay Ginag	Tay Giang
8/22	Tue	Tay Ginag	Tay Giang
8/23	Wed	Tay Ginag - Dong Giang	Dong Giang
8/24	Thu	Dong Giang	Dong Giang
8/25	Fri	Dong Giang	Dong Giang
8/26	Sat	Dong Giang - Da Nang	Da Nang
8/27	Sun	Da Nang - Hanoi	Hanoi
8/28	Mon	Hanoi - Chubu Central International Airport	

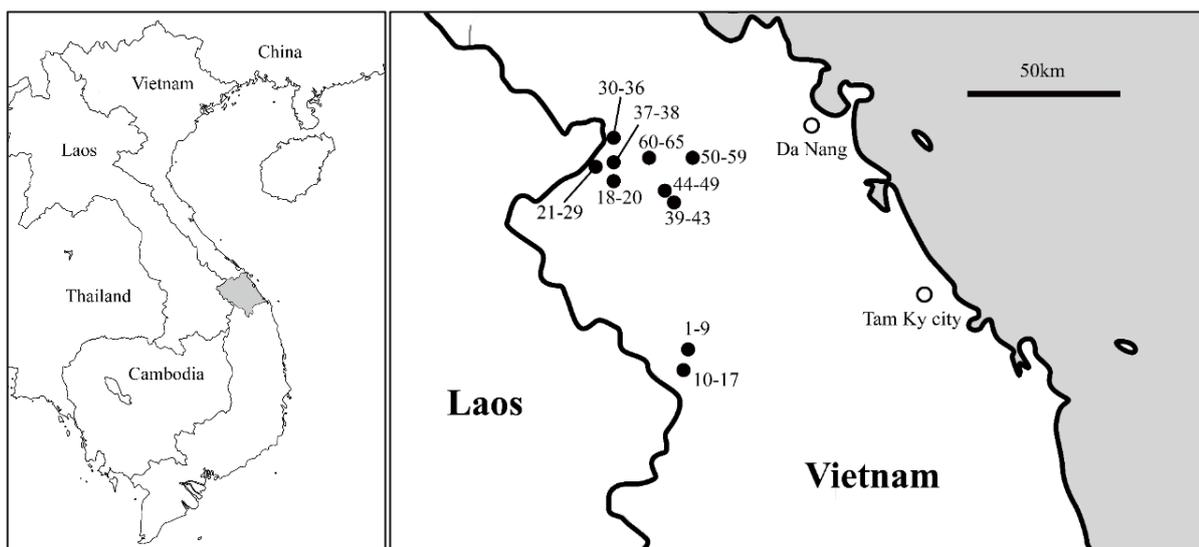


Fig. 1. The collection site, Quang Nam province (left, gray part), central Vietnam. An enlarged view of the collection site. Numbers 1-17 were collected at Phuoc Son district, 18-38 were collected at Tay Giang district and 39-65 were collected at Dong Giang district (right).

elevations towards the west. More than half of the province's area is covered by forests and the rainy season is from October to March with a dry season from April to September. The amount of precipitation during the rainy season is approximately 2,000 to 2,500 mm. The agricultural production area is 150,000 ha of which 11,600 ha are for vegetables. Two of the most important vegetable crops are watermelon (1,500 ha) and pepper (750 ha).

Some farmers practice mixed cropping. This practice helps to prevent serious crop losses from disease and/or insect pathogens, because if one crop is targeted by a specific pathogen the second crop may not be and thus there will still be a crop to harvest. Some farmers store multiple different varieties of seeds together in the same container (Photo 4). Furthermore, some farmers grow different varieties of the same species that are similar in appearance and are mixed within their seed stocks, we have thus treated these seed stocks as one accession.

Phuoc Son is the third largest district in the province, and almost 70 % of its area is classified as forest. Its major agricultural products are rice, maize, legume, cassava, cucumber and pumpkin. Amaranth is also an important vegetable crop that is not cultivated but harvested from the wild or as weeds from local gardens and fields. Tay Giang and Dong Giang were one district until recently; they share a great number of commonalities including ethnic groups (almost all "Co tu" group), culture and climate. In Tay Giang, some farmers provide crop seeds to neighboring farmers and receive the multiplied seeds from them the following year for stable production. Since dispersal of the same varieties within villages was known to occur, we did not collect accessions that were thought to be repeats, as determined from interviews with the farmers. There was a unique local (nearly wild) pepper in Dong Giang, whose fruit was very small (approximately less than 1 cm) and was extremely hot to taste, because of protected it by a local project, it spread in the district and farmers sold it as local specialty vegetable.

A total of 65 samples were collected including 27 cucumbers, 18 amaranths, 13 pumpkins, 3 watermelons, 3 Chinese onions and 1 bitter gourd (Table 2). All seed samples have been stored in a dried state in the PRC gene bank. Only the Chinese onions, which were collected as plants, were grown at the

PRC field and their seeds will be obtained next year after flowering.

Cucumber (*C. sativus*)

We collected 26 samples of cucumber seed and one fruit. Almost all of the samples were collected as seed because the cucumber cultivation season had finished. Fortunately, two accessions were observed as immature and mature fruits, respectively (No. 55 and 58). They matched the phenotypic expectations for cucumber; the fruits had green and white colored skin during their immature stage, and darker skin with accumulated carotene during their mature stage. According to farmers, there were various additional types of fruit shape and skin color in the area.

The sowing season was generally from October to December in Phuoc Son, from February to March in Tay Giang, and from August to October in Dong Giang. The harvesting season was from February to April in Phuoc Son, from May to July in Tay Giang, and from February to March in Dong Giang. However, sowing and harvesting times varied depending on the climatic conditions of each farm area such as altitude and temperature. Cucumber is generally cultivated with pumpkin and upland rice (Photo 5).

Over the last three explorations, a total of 233 samples of genetic resources have been collected for the PGRAsia project. However, only 38 cucumber samples were collected in the northern part of Vietnam (Sugiyama *et al.* 2015; Shimomura *et al.* 2016; Kawazu *et al.* 2017). In this survey, we collected 27 cucumber accessions. It is assumed that cucumber is cultivated more easily in the warmer central areas than in cooler northern areas.

Amaranth (*Amaranthus* spp.)

We collected 18 samples of amaranths from the roadsides (Photo 6). Amaranth is grown as both a cereal and a leafy vegetable in Southeast Asia. In Quang Nam province, people do not cultivate amaranths but harvest the young leaves from naturally growing wild plants. On account of the wide variety of colors, shapes and sizes, of the amaranths collected, they appeared to be from various species that we could not distinguish. Although we had information that red amaranth plants existed in the province, all of the collected samples were of a green color. 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.

Pumpkin (*C. moschata*)

We collected 10 samples of pumpkin seeds and 3 fruit for the species *C. moschata* and we did not find samples of the species, *C. maxima* and *C. pepo*. Interviews with farmers revealed that they do not usually use pesticides or fertilizers during pumpkin cultivation; this was reported previously for the northern areas of the country as well (Sugiyama *et al.* 2015; Shimomura *et al.* 2016; Kawazu *et al.* 2017). Pumpkins are cultivated in association with rice or maize and the fruits are used for human consumption such as in stews, stir-frying of shoots and young flowers, and steaming the fruits with sticky rice. The fruit

Table 2. A summary of the collected genetic resources in central Vietnam, 2017

Species	Total
<i>Cucumis sativus</i>	27
<i>Amaranthus</i> spp.	18
<i>Cucurbita moschata</i>	13
<i>Citrullus lanatus</i>	3
<i>Allium chinense</i>	3
<i>Momordica charantia</i>	1
Total	65

shapes of 3 samples that were collected were flattened (No. 11 and 19) and globular (No. 20).

Chinese onion (*A. chinense*)

We collected 3 samples of Chinese onions as plants. Their planting season is from March to April and they are harvested in January and February. *Allium* plants are very popular in central Vietnam and many farmers cultivate not only Chinese onion but also shallot (*A. cepa*) and garlic (*A. sativum*). Chinese onions are generally prepared for consumption by boiling with soup or with rice, pickles and spices.

Watermelon (*C. lanatus*)

We collected 3 samples of watermelon seeds. They were stocked and cultivated with other crop seeds such as cucumber, pumpkin and bitter gourd. Farmers sowed the watermelon seeds in March and harvested the crops in May and July.

Bitter gourd (*M. charantia*)

We collected 1 fruit sample of bitter gourd. The fruit size was small (approximately 5 cm) compared with a developed cultivar (No.17). The accession was collected from near a forested area and was cultivated in the garden of the military office in Phuoc Son.

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ベトナムにおける野菜遺伝資源の共同探索，2017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 遺伝資源センター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中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2017年8月18日～26日にかけて行った．カンナム省のフォクソン県、テイジャン県およびドンジャン県において探索・調査を行った．その結果，キュウリ（*Cucumis sativus*）27点，アマランサス（*Amaranthus* spp.）18点，ニホンカボチャ（*Cucurbita moschata*）13点を含めた計65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・食品産業技術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. List of genetic resources collected in Vietnam during the 2017 survey

Coll. No.	JP No.	Coll. Date Aug. 2017	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	267452	19	<i>Amaranthus</i> sp.	Rau Den Khum	vegetable, seed	weedy	farmland	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	Sowing at Jun., harvesting from Aug. to Sep.; stewing and stir frying
2	267453	19	<i>Amaranthus</i> sp.	Rau Den Khum	vegetable, seed	weedy	farmland	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	
3	267454	19	<i>Cucumis sativus</i>	Ca Pon	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	Sowing from Oct. to Dec, harvesting from Feb. to Apr.
4	267455	19	<i>Cucurbita moschata</i>	La O	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	
5	267456	19	<i>Cucurbita moschata</i>	La O	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	
6	267457	19	<i>Allium chinense</i>	Ci Tem	vegetable	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-51.21	E107-44-59.49	419	
7	267458	19	<i>Cucumis sativus</i>	Ca Pon	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-53.58	E107-46-02.02	409	Sowing from Oct. to Dec, harvesting from Feb. to Apr.; mixed cultivation with pumpkin after sowing rice in upland
8	267459	19	<i>Cucurbita moschata</i>	La O	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc Nang	Ba	N15-23-53.58	E107-46-02.02	409	Sowing from Oct. to Dec, harvesting from Mar. to May; stewing and stir frying, cultivated only in upland
9	267460	19	<i>Amaranthus</i> sp.	Sac ham	vegetable, seed	weedy	other	Quang Nam	Phuoc Son	Phuoc Nang	Thon Hai	N15-23-49.24	E107-45-16.16	412	
10	267461	20	<i>Cucumis sativus</i>	Ca Pon	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-20.56	E107-44-12.18	423	Sowing from Aug. to Oct., harvesting from Dec. to Feb.; stewing and stir frying, making salad; orange skin in mature fruit; mixed cultivation with pumpkin and maize
11	267462	20	<i>Cucurbita moschata</i>	Ze Ou	vegetable, seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-20.56	E107-44-12.18	423	Sowing from Aug. to Oct., harvesting from Nov. to Dec.; making soup, stewing and stir frying; no use of pesticide and fertilizer; mixed cultivation with cucumber and maize
12	267463	20	<i>Amaranthus</i> sp.	Khum	vegetable, seed	weedy	wild	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-18.74	E107-44-12.21	429	Road side
13	267464	20	<i>Amaranthus</i> sp.	Khum	vegetable, seed	weedy	wild	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-18.74	E107-44-12.21	429	Road side
14	267465	20	<i>Cucumis stivus</i>	Ca Pon	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-13.54	E107-44-08.35	453	Sowing from Aug. to Oct., harvesting from Dec. to Feb.; stewing and stir frying, making salad; orange skin in mature fruit; mixed cultivation with pumpkin and maize
15	267466	20	<i>Cucurbita moschata</i>	Ze Ou	seed	landrace	farm store	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-13.54	E107-44-08.35	453	Sowing from Aug. to Oct., harvesting from Nov. to Dec.; making soup, stewing and stir frying; no use of pesticide and fertilizer; mixed cultivation with cucumber and maize
16	267467	20	<i>Amaranthus</i> sp.	Rau Den com	vegetable, seed	weedy	other	Quang Nam	Phuoc Son	Phuoc My	Thon 5	N15-20-13.54	E107-44-08.35	453	Road side
17	267468	20	<i>Momordica charantia</i>	Kho qua rung	vegetable, seed	wild	farmland	Quang Nam	Phuoc Son	Phuoc My	Thon 4	N15-21-24.22	E107-44-40.09	464	Army office garden
18	267469	21	<i>Cucumis sativus</i>	A Cia	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Ra Bhuop	N15-52-34.90	E107-30-34.69	645	Sowing at Mar., harvesting from May to Jul.; making salad at immature, cooking at mature fruit sgate; mixed cultivation with rice and maize; round or cylindrical fruit shape
19	267470	21	<i>Cucurbita moschata</i>	Ca Dac	vegetable, seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Ra Bhuop	N15-52-34.90	E107-30-34.69	645	Sowing at Mar., harvesting from May to Jul.; making for soup using fruit, young shoot and flower, steaming fruit with sticly rice; mixed cultivation with rice and maize
20	267471	21	<i>Cucurbita moschata</i>	Ca Dac	vegetable	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Ra Bhuop	N15-52-53.40	E107-30-59.03	642	Sowing at Mar., harvesting from May to Jul.; making for soup with young shoot and flower, steaming fruit with sticly rice; mixed cultivation with rice and maize
21	267472	21	<i>Cucumis sativus</i>	A Cia	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Tr Lee	N15-54-13.33	E107-27-26.37	688	Sowing at Mar., harvesting from May to Jul.; orange skin and cylindrical shape at mature fruit stage

Table 3. (Continued).

Coll. No.	JP No.	Coll. Date Aug. 2017	Species name	Local name	Type of sample	Status of sample	Coll. Source	Province	District	Commune	Town or village name	Latitude	Longitude	Altitude (m)	Remarks
22	267473	21	<i>Cucumis sativus</i>	A Cia	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Tr Lee	N15-54-13.33	E107-27-26.37	688	Sowing at Mar., harvesting from May to Jul.; orange or white skin shape at mature fruit stage
23	267474	21	<i>Cucurbita moschata</i>	Ca Dac	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Tr Lee	N15-54-13.33	E107-27-26.37	688	Sowing at Mar., harvesting from May to Jul.
24	267475	21	<i>Citrullus lanatus</i>	Da cai	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Tr Lee	N15-54-13.33	E107-27-26.37	688	Sowing at Mar., harvesting from May to Jul.
25	267476	21	<i>Cucumis sativus</i>	A Cin	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Ta Vang	N15-54-23.91	E107-29-47.62	609	Sowing at Mar.
26	267477	21	<i>Cucurbita moschata</i>	Ca Dac	seed	landrace	farm store	Quang Nam	Tay Giang	A Tieng	Ta Vang	N15-54-23.91	E107-29-47.62	609	
27	267478	21	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	landrace	farmland	Quang Nam	Tay Giang	A Tieng	Ta Vang	N15-54-23.91	E107-29-47.62	609	
28	267479	21	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	landrace	farmland	Quang Nam	Tay Giang	A Tieng	Ta Vang	N15-54-23.91	E107-29-47.62	609	
29	267480	21	<i>Amaranthus</i> sp.	Rau gien dai co gai	vegetable, seed	wild	other	Quang Nam	Tay Giang	A Tieng	Ta Vang	N15-54-23.91	E107-29-47.62	609	Road side
30	267481	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 1	N15-58-00.75	E107-20-00.84	620	Sowing at Mar., harvesting from Jun. to Jul.; making salad, pickle and soup; mixed cultivation with rice; green or yellow skin at mature fruit stage
31	267482	22	<i>Cucurbita moschata</i>	Ka Duc	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 1	N15-58-00.75	E107-20-00.84	620	Sowing at Mar., harvesting from Jun. to Jul.; sepelated cultivation to rice
32	267483	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 1	N15-58-00.75	E107-20-00.84	620	
33	267484	22	<i>Citrullus lanatus</i>	Da Cai	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 1	N15-58-00.75	E107-20-00.84	620	
34	267485	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 2	N15-59-19.35	E107-30-27.89	641	
35	267486	22	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	other	Quang Nam	Tay Giang	Bha Lee	A Tep 2	N15-59-19.35	E107-30-27.89	641	Road side
36	267487	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Tep 2	N15-59-19.35	E107-30-27.89	641	Sowing at Mar., harvesting from Jun. to Jul.
37	267488	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Ung	N15-54-49.02	E107-31-03.06	598	Sowing at Mar., harvesting from Jun. to Jul.
38	267489	22	<i>Cucumis sativus</i>	A Cier	seed	landrace	farm store	Quang Nam	Tay Giang	Bha Lee	A Ung	N15-54-49.02	E107-31-03.06	598	Sowing at Mar., harvesting from Jun. to Jul.
39	267490	23	<i>Cucumis sativus</i>	A boc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Den	N15-48-30.28	E107-42-08.65	365	Sowing from Aug. to Oct., harvesting from Feb. to Mar.; making salad; sepelated cultivation to rice
40	267491	23	<i>Cucumis sativus</i>	A boc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Den	N15-48-30.28	E107-42-08.65	365	White skin color at mature fruit stage
41	267492	23	<i>Cucumis sativus</i>	A boc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Den	N15-48-30.28	E107-42-08.65	365	Brown skin color at mature fruit stage; bigger fruit
42	267493	23	<i>Cucurbita moschata</i>	Ca Doc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Den	N15-48-30.28	E107-42-08.65	365	Sowing from Aug. to Oct., harvesting at Mar.; making soup; sowing after 3 weeds of headign of upland rice
43	267494	23	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	other	Quang Nam	Dong Giang	Ma Cooih	A Den	N15-48-30.28	E107-42-08.65	365	Road side
44	267495	23	<i>Cucumis sativus</i>	A boc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Xoo	N15-50-23.22	E107-40-44.73	490	
45	267496	23	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	other	Quang Nam	Dong Giang	Ma Cooih	A Dal	N15-51-08.12	E107-42-11.44	355	
46	267497	23	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	wild	Quang Nam	Dong Giang	Ma Cooih	A Dal	N15-51-08.12	E107-42-11.44	355	
47	267498	23	<i>Amaranthus</i> sp.	Den com	vegetable, seed	weedy	wild	Quang Nam	Dong Giang	Ma Cooih	A Dal	N15-51-08.12	E107-42-11.44	355	
48	267500	23	<i>Cucumis sativus</i>	A boc	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Dal	N15-51-21.17	E107-42-26.17	381	
49	267501	23	<i>Citrullus lanatus</i>	Bha Kai	seed	landrace	farm store	Quang Nam	Dong Giang	Ma Cooih	A Dal	N15-51-21.17	E107-42-26.17	381	
50	267502	24	<i>Allium chinense</i>	Ha Diu	vegetable	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	La Dang	N15-56-13.44	E107-46-01.07	309	Making pickle within vinegar, spice, taking grind tuber with rice

Table 3. (Continued).

Coll. No.	JP No.	Coll. Date Aug. 2017	Species name	Local name	Type of sample	Status of sample	Coll. Source	Province	District	Commune	Town or village name	Latitude	Longitude	Altitude (m)	Remarks
51	267503	24	<i>Cucurbita moschata</i>	A doc	seed	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	La Dang	N15-56-13.44	E107-46-01.07	309	Sowing at Mar., harvesting from Jul. to Aug.; making soup, stewing and frying, fruit, young shoot and flower
52	267504	24	<i>Cucumis sativus</i>	A cier	seed	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Zo Ha	N15-56-25.84	E107-46-28.83	323	Sowing at Mar., harvesting from May to Jun., or sowing at Dec, harvesting from Mar. to Apr.; making salad at immature, soup at mature fruit stage
53	267505	24	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	other	Quang Nam	Dong Giang	Jo Ngay	Ngat	N15-56-14.67	E107-48-16.86	283	
54	267506	24	<i>Cucumis sativus</i>	A cier	seed	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Ngat	N15-56-14.67	E107-48-16.86	283	Mainly sowing at Jan., harvesting from Feb. to Mar. for obtaining immature fruit, or sowing at Sep., harvesting from Nov. to Dec.; making salad at immature, soup at mature fruit stage; bearing 8 to 10 fruit on a plant; warmer temperature than center of Dong Giang District
55	267507	24	<i>Cucumis sativus</i>	A cier	seed	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Cloo	N15-57-19.44	E107-48-06.23	304	Mainly sowing at Jan., harvesting from Feb. to Mar. for obtaining immature fruit, or sowing at Sep., harvesting from Nov. to Dec.; making salad at immature, soup at mature fruit stage; bearing 8 to 10 fruit on a plant; warmer temperature than center of Dong Giang District
56	267508	24	<i>Allium chinense</i>	Ha Diu	vegetable	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Cloo	N15-57-19.44	E107-48-06.23	304	
57	267509	24	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	wild	Quang Nam	Dong Giang	Jo Ngay	Brua	N15-57-43.42	E107-47-31.33	307	
58	267510	24	<i>Cucumis sativus</i>	A Kiel	vegetable	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Brua	N15-57-43.42	E107-47-31.33	307	Sowing at Oct., harvesting from Feb. to Mar., or sowing at Mar., harvesting from May to Aug.; making salad
59	267511	24	<i>Cucumis sativus</i>	A Kiel	seed	landrace	farm store	Quang Nam	Dong Giang	Jo Ngay	Arang 1	N15-57-11.78	E107-47-06.96	301	Sowing at Feb., harvesting from May to Jun., or sowing at Nov., harvesting from Feb to Mar.; making salad or stir frying
60	267512	25	<i>Cucumis sativus</i>	A Kiel	seed	landrace	farm store	Quang Nam	Dong Giang	Phao	A Dinh 1	N15-55-29.64	E107-37.47.46	507	Sowing from Feb. to Mar., harvesting from May to Jun.; making salad or stir frying
61	267513	25	<i>Cucumis sativus</i>	A Kiel	seed	landrace	farm store	Quang Nam	Dong Giang	Phao	A Dinh 1	N15-55-29.64	E107-37.47.46	507	Sowing from Feb. to Mar., harvesting from May to Jun.; white skin throughout a cultivation
62	267514	25	<i>Cucurbita moschata</i>	Ca Dac	seed	landrace	farm store	Quang Nam	Dong Giang	Phao	Ta Bac	N15-55-12.68	E107-39-36.62	509	
63	267515	25	<i>Amaranthus</i> sp.	Rau Den	vegetable, seed	weedy	other	Quang Nam	Dong Giang	Phao	Ta Bac	N15-55-12.68	E107-39-36.62	509	Sowing at May, harvesting after Aug.
64	267516	25	<i>Cucumis sativus</i>	A Kiel	seed	landrace	farm store	Quang Nam	Dong Giang	Phao	Ta Bac	N15-55-12.68	E107-39-36.62	509	Sowing from Feb. to Mar., harvesting from May to Jun
65	267517	25	<i>Amaranthus</i> sp.	Rau Den Khum	vegetable, seed	weedy	other	Quang Nam	Dong Giang	Phao	Ta Bac	N15-55-12.68	E107-39-36.62	509	Road side



Photo 1. A rice noodle “Mi Quang” is popular cuisine in central Vietnam.



Photo 2. Various vegetables at the Han Market in Da Nang.



Photo 3. Interviewing local people at Ba village, Phuoc Son.



Photo 4. Storing several crop species in the mixed state.



Photo 5. Desiccating harvested upland rice at Ta Vang village, Tay Giang.



Photo 6. Collecting amaranth at the road side at Thon Hai village, Phuoc Son.

Cucumis sativus



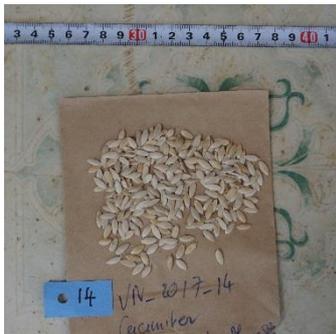
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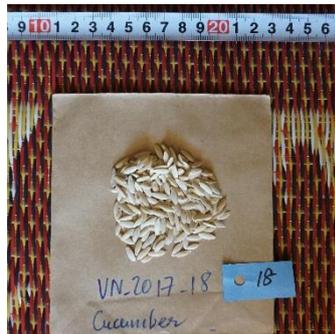
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No. 10



No. 14



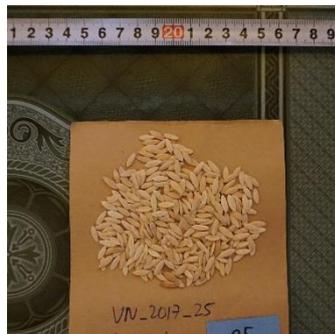
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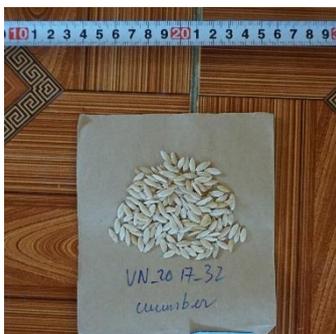
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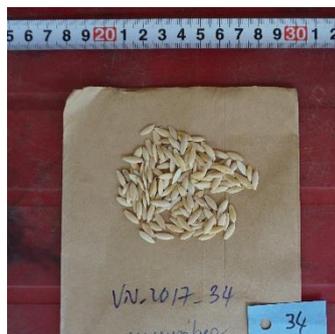
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No. 30



No. 32



No. 34



No. 36

Cucumis sativus



No. 37



No. 38



No. 39



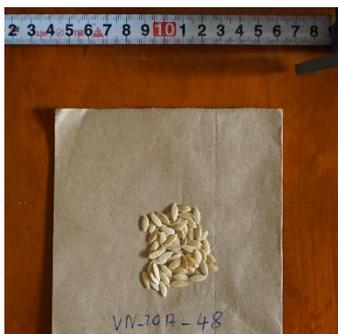
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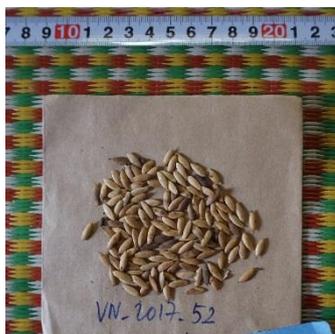
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No. 44



No. 48



No. 52



No. 54



No. 55 (seeds)



No. 55 (fruits)

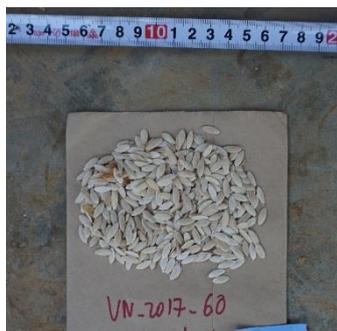


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Cucumis sativus



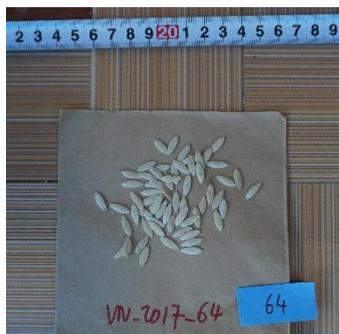
No. 59



No. 60



No. 61



No. 64

Allium chinense



No. 6



No. 50



No. 56

Amaranthus spp.



No. 1



No. 2



No. 9



No. 12



No. 13



No. 16



No. 27



No. 28



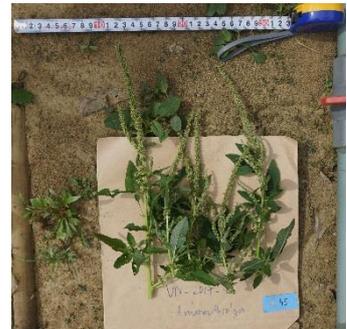
No. 29



No. 35



No. 43



No. 45

Amaranthus spp.



No. 46



No. 47



No. 53



No. 57



No. 63

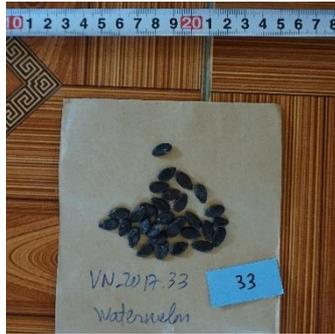


No. 65

Citrullus lanatus



No. 24



No. 33



No. 49

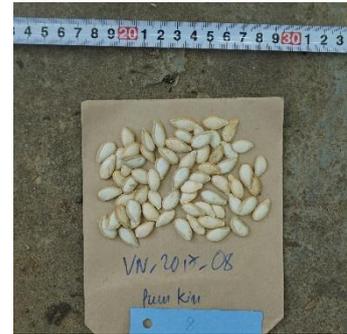
Cucurbita moschata



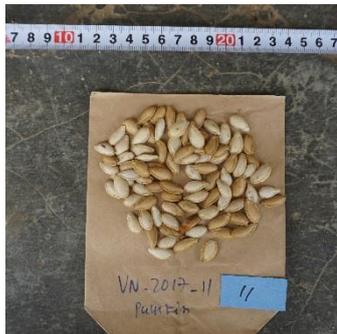
No. 4



No. 5



No. 8



No. 11 (seeds)



No. 11 (fruit)



No. 15



No. 19 (seeds)



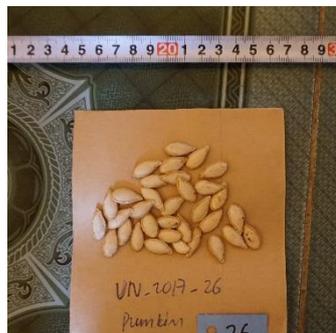
No. 19 (fruit)



No. 20



No. 23

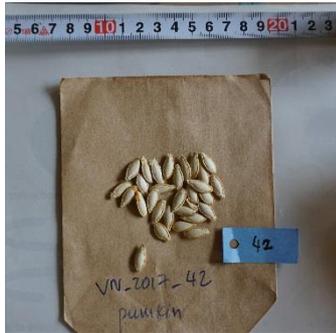


No. 26



No. 31

Cucurbita moschata



No. 42



No. 51



No. 62

Momordica charantia



No. 17