

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 | |

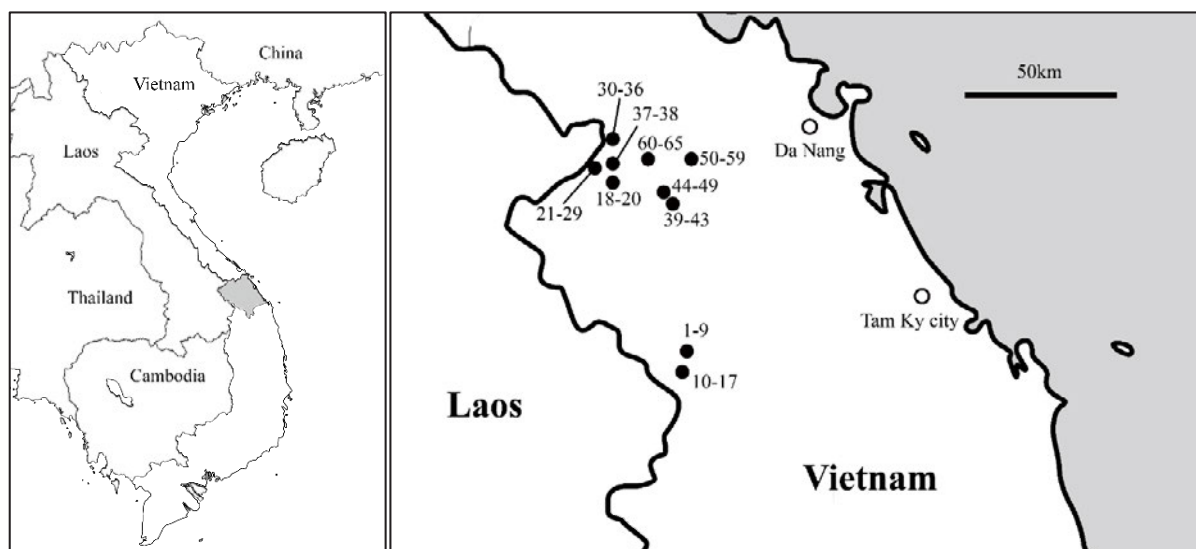


Fig. 1. The collection site, Quang Nam province (left, gray part), central Vietnam. An enlarged view of the collection site. Numbers 1-17 were collected at Phuoc Son district, 18-38 were collected at Tay Giang district and 39-65 were collected at Dong Giang district (right).

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 cultivartion 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 ; sepaled 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; sepaled 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 temperture 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 temperture 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.

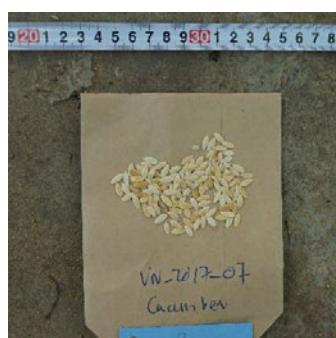


Photo 6. Collecting amaranth at the road side at Thon Hai village, Phuoc Son.

Cucumis sativus



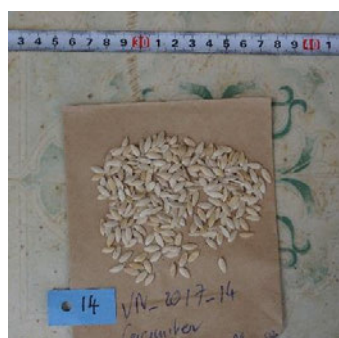
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No. 7



No. 10



No. 14



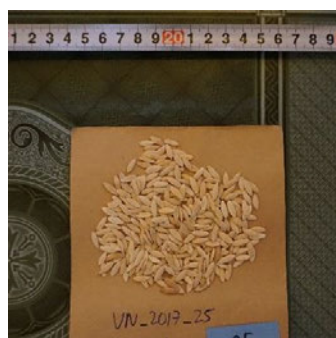
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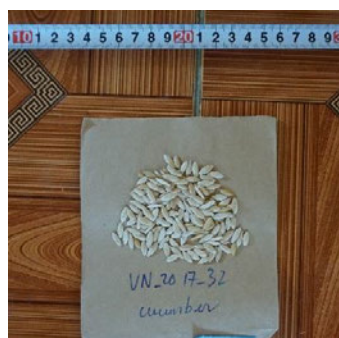
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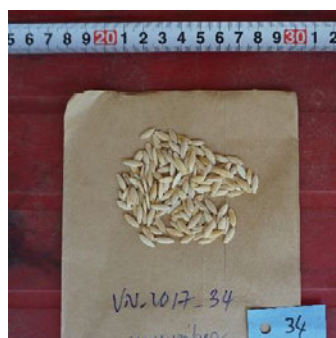
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No. 30



No. 32



No. 34



No. 36

Cucumis sativus



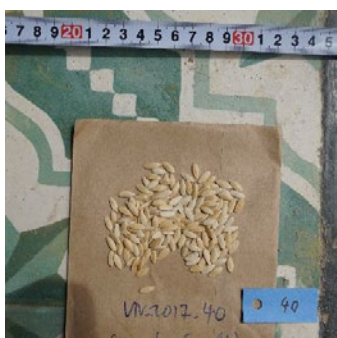
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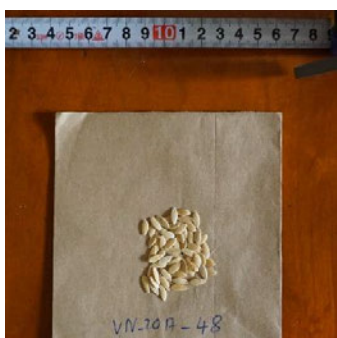
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No. 41



No. 44



No. 48



No. 52



No. 54



No. 55 (seeds)



No. 55 (fruits)

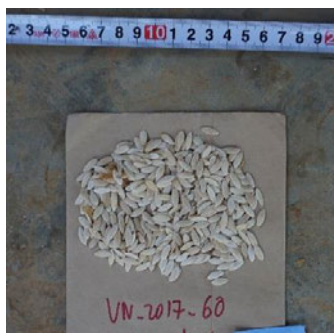


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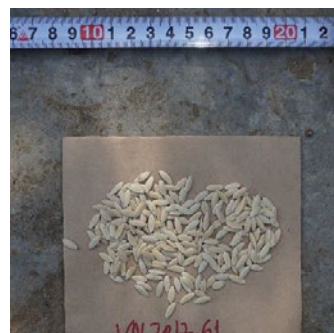
Cucumis sativus



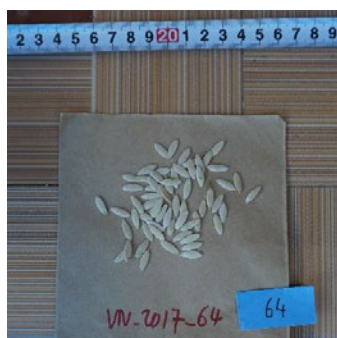
No. 59



No. 60



No. 61



No. 64

Allium chinense



No. 6



No. 50



No. 56

Amaranthus spp.



No. 1



No. 2



No. 9



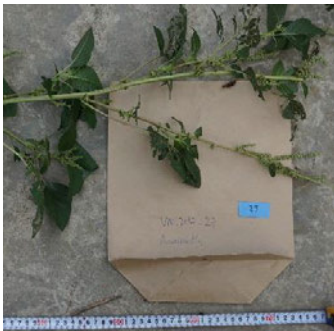
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No. 13



No. 16



No. 27



No. 28



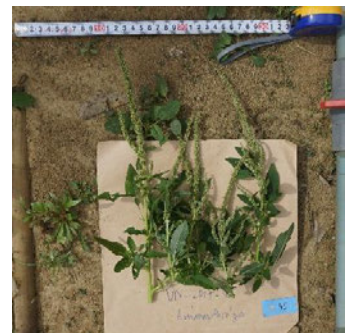
No. 29



No. 35



No. 43



No. 45

Amaranthus spp.



No. 46



No. 47



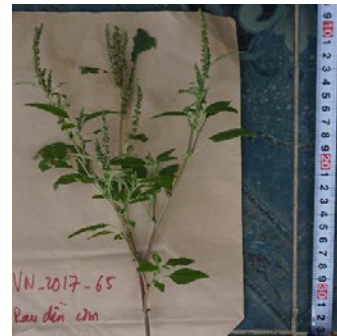
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No. 57



No. 63

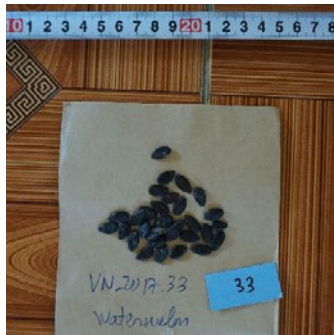


No. 65

Citrullus lanatus



No. 24



No. 33

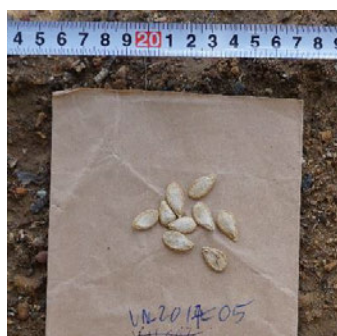


No. 49

Cucurbita moschata



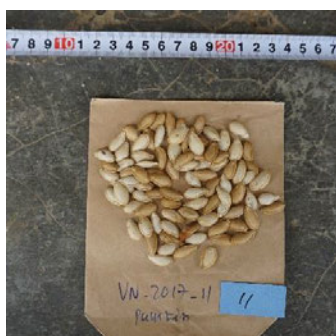
No. 4



No. 5



No. 8



No. 11 (seeds)



No. 11 (fruit)



No. 15



No. 19 (seeds)



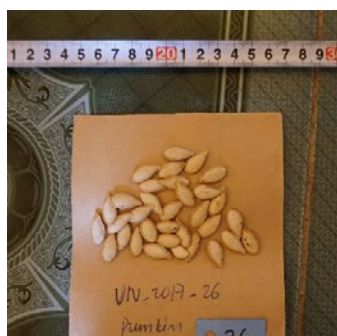
No. 19 (fruit)



No. 20



No. 23

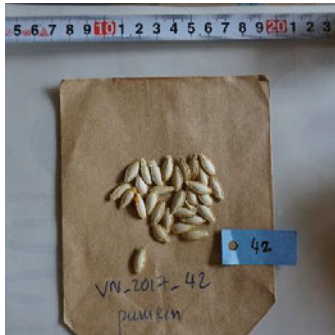


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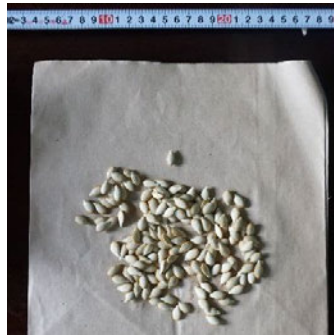


No. 31

Cucurbita moschata



No. 42



No. 51



No. 62

Momordica charantia



No. 17