

Collaborative Exploration of Plant Genetic Resources in Northern Vietnam, 2020

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Communicated by K. EBANA (Research Center of Genetic Resources, NARO)

Received Aug. 12, 2021, Accepted Oct. 6, 2021

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Summary

Collaborative explorations of plant genetic resources are organized annually and conducted jointly by scientists of the Plant Resources Center (PRC) at the Vietnamese Academy of Agricultural Science and the National Agriculture and Food Research Organization (NARO), Japan, as part of the Plant Genetic Resources in Asia (PGRAsia) project that surveys the genetic diversity of crops in Asia. Due to COVID-19 regulations, the 2020 northern Vietnam exploration was conducted by only Vietnamese scientists from October 17 to 26, 2020. This region is important in terms of biodiversity, anthropological resources, and socioeconomic status. The exploration was conducted in the Quan Ba, Dong Van, and Meo Vac districts of the Ha Giang Province, Bao Lam district of Cao Bang Province, and Ba Be district of Bac Can Province. A total of 71 samples were collected, including 45 chili peppers (14 *Capsicum annuum*, 15 *Capsicum frutescens*, 1 *Capsicum baccatum*, and 15 *Capsicum* spp.), 17 eggplants (14 *Solanum melongena* and three *Solanum* spp.), two pumpkins (*Cucurbita moschata*), one mung bean (*Vigna radiata*), and six snap beans (*Phaseolus vulgaris*). This paper presents the results of the collected crop germplasm along with locally reported characteristics, applications, and planting regimes. The collected samples were divided for storage and evaluation at the PRC and NARO facilities to enable the assessment of agrobiological characteristics and markers of genetic diversity.

KEY WORDS: PGRAsia, chili pepper, eggplant, pumpkin, legume, genetic resources, Vietnam

Introduction

Collaborative exploration of plant genetic resources in Vietnam has been a component of the Plant Genetic Resources Asia (PGRAsia) project, funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan, since 2014. The goals of this component include organizing field surveys in agroecological zones and collecting crop germplasm as well as relevant local information to conserve and use in the sustainable development of food resources. From 2014 to 2019,

vegetable resource surveys in Vietnam were conducted in the northern region in 2014 (Sugiyama *et al.* 2015), the highlands of the northwest region in 2015 (Shimomura *et al.* 2016), the northern central region in 2016 (Kawazu *et al.* 2017), the Quang Nam province in the central region in 2017 (Fujito *et al.* 2018), the central highland in 2018 (Kami *et al.* 2019), and two provinces in the central region in 2019 (Sugita *et al.* 2020).

Southeast Asia is one of the centers of genetic diversity for vegetables, including Solanaceae crops.

Eggplant is the fifth most economically important solanaceous crop after potato, tomato, pepper, and tobacco (Taher *et al.* 2017).

Pepper (*Capsicum* spp.) is a globally important vegetable crop owing to its variety of flavor profiles and high nutritional value, and is becoming an increasingly popular product, with industrial production expanding worldwide (Zhang *et al.* 2016).

Previous surveys clearly demonstrated the immense genetic diversity of Vietnam’s vegetable resources. These surveys allow for the informed breeding, management, and development of new vegetable varieties.

In 2020, exploration was conducted in northern Vietnam by Vietnamese scientists. The Ha Giang, Cao Bang, and Bac Kan Provinces are located in the northeastern region of Vietnam. To survey and collect genetic vegetable resources, we selected two districts of Ha Giang Province with a typical tropical monsoon climate and the Ba Be District of Bac Kan Province with a hot and humid climate. Quan Ba, Dong Van, and Meo Vac are located in the northern highlands of Ha Giang Province, which is known as the Dong Van Plateau. Approximately 90 % of the Dong Van and Meo Vac districts are occupied by limestone mountains, forming a typical karst topography. Quan Ba is known as the gateway to the Dong Van Karst Plateau (Photo 1). It is approximately 40 km north of Ha Giang City along National Road 4C. Due to time limitations, we only surveyed the Quyet Tien market in the Quan Ba District. Bao Lam is a mountainous district located in the west of Cao Bang Province. After collection in Ha Giang

Province, we surveyed the Khuoi Vin market of the Bao Lam District on the road to Bac Kan Province, which is located in the central northeastern region of Vietnam. Ba Be is located 60 km north of Bac Kan City and is one of the three mountainous districts of Bac Kan Province. The district has a complex topography characterized by rivers, streams, and mountains and maintains a self-sufficient economy.

Methods

The survey was conducted from October 17 to 26, 2020, in the Ha Giang, Cao Bang, and Bac Kan provinces of northern Vietnam (Table 1). In Ha Giang Province, we visited three districts: Quan Ba, Dong Van, and Meo Vac. In the Bac Kan Province, we visited the Ba Be District. In each district, the locations at which our surveys were conducted were determined



Photo 1. The majestic scenery of Dong Van Karst Plateau Geopark.

Table 1. Itinerary of vegetable landrace exploration in the northern mountainous area of Vietnam in 2020 (Ha Giang, Cao Bang, and Bac Kan provinces)

Date	Day	Itinerary	District	Stay
17/10/2020	Saturday	Meet Department of Agriculture and Rural Development (DARD) of Ha Giang Province	Ha Giang City	Ha Giang City
18/10/2020	Sunday	Survey and collect in Quyet Tien market, Quan Ba Town, Dong Van market	Dong Van	Ha Giang City
19/10/2020	Monday	Meet DARD of Dong Van District; Survey and collect in Dong Van Town	Dong Van	Dong Van Town
20/10/2020	Tuesday	Survey and collect in Dong Van Town, Lung Cu commune, Sa Phin commune	Dong Van	Dong Van Town
21/10/2020	Wednesday	Meet DARD of Meo Vac District; Survey and collect in Ta Lung commune, Sung Tra commune	Meo Vac	Meo Vac Town
22/10/2020	Thursday	Survey and collect in Tat Nga commune, Giang Chu Phin commune, Can Chu Phin commune	Meo Vac	Meo Vac Town
23/10/2020	Friday	Move to Bao Lam District in Cao Bang Province and Ba Be District in Bac Kan Province; Collect in Khuoi Vin market, Ly Bon commune of Bao Lam District in Cao Bang Province	Bao Lam, Ba Be	Ba Be Town
24/10/2020	Saturday	Meet DARD of Ba Be District; Survey and collect in Dia Linh commune, Yen Duong commune	Ba Be	Ba Be Town
25/10/2020	Sunday	Survey and collect in Yen Duong commune, Chu Huong commune, Chu Huong market	Ba Be	Ba Be Town
26/10/2020	Monday	Come back to Hanoi		

DARD: Department of Agriculture Rural Development

through informed discussions with our local colleagues of the Department of Agriculture (Photo 2) and were predominantly based on ecological and ethnobotanical importance. Samples were collected from farmers' households, fields, backyards, and roadsides (Photos 3 and 4). Information associated with the samples (place name, latitude and longitude, elevation, characteristics of each collection site, local names, sowing date, harvest date, usage, and cultivation methods) was collected through interviewing with the farmers (Photos 5 and 6). After collection, seeds were extracted from mature fruits, washed, dried, and appropriately stored.



Photo 2. Visit to the Department of Agriculture, Ha Giang Province.



Photo 3. Measuring the height of plants in a home garden of Thien Huong Village, Dong Van Town, Ha Giang Province.



Photo 4. Chili peppers in Quyet Tien Market, Quan Ba District, Ha Giang Province.

Results

The itinerary used in our study is described in Table 1. The collection sites were located in five districts: Quan Ba, Dong Van, Meo Vac (Ha Giang Province), Bao Lam (Cao Bang Province), and Ba Be (Bac Kan Province) (Fig. 1). In Quan Ba and Bao Lam, we surveyed only markets. The number of samples collected is listed in Table 2. A total of 71 samples were collected, including 45 chili peppers (14 *Capsicum annuum* L., 15 *Capsicum frutescens* L., 1 *Capsicum baccatum* L., and 15 *Capsicum* spp.), 17 eggplants (14 *Solanum melongena* L. and three *Solanum* spp.), two pumpkins (*Cucurbita moschata* D.), one mung bean (*Vigna radiata* L.), and six snap beans (*Phaseolus vulgaris* L.).

Discussion

Chili peppers

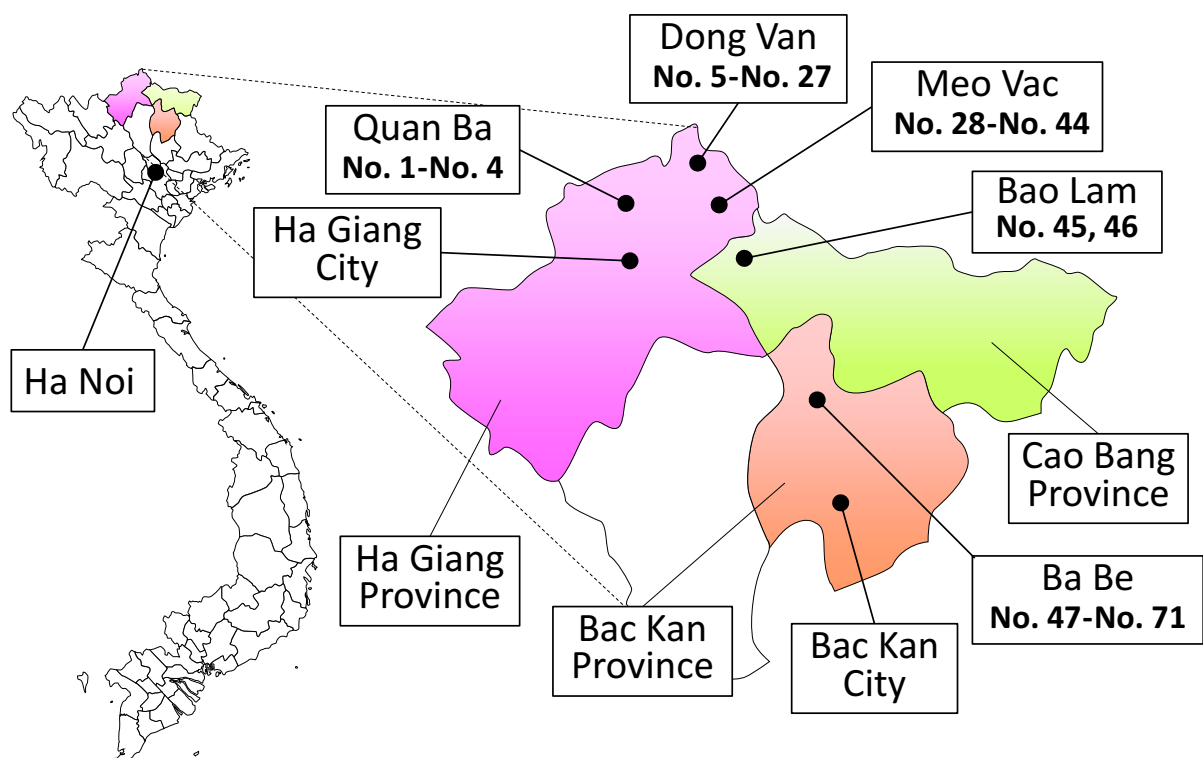
A total of 45 *Capsicum* samples were collected. Based on the characteristics of the flowers and fruits, we separated the samples into three species. Fourteen *Capsicum annuum* samples were recorded. A total of 15 samples of *Capsicum frutescens* were recorded in Ha Giang Province (Nos. 9, 10, 12, 14, 15, 17, 22, 31, 32, and 37) and Bac Kan Province (Nos. 55, 58, 60, 67, and



Photo 5. Interviews with local residents of Thien Huong Village, Dong Van Town, Ha Giang Province.



Photo 6. A terraced home garden in the Meo Vac District, Ha Giang Province.



Vietnam

Fig. 1. Sites in northern Vietnam where plant genetic resources were collected. Samples 1 -44 were collected in Ha Giang Province, 45 and 46 were collected in Cao Bang Province, and 47-71 were collected in Bac Kan Province.

71). Fruit size and color varied among the samples. No. 37 had the smallest fruit size (fruit length and width: 10 and 3 mm, respectively). *Capsicum baccatum*, collected in Ba Be (No. 59), had petals with yellow spots. The color of the young fruit changed from purple to orange and red during maturation. Fifteen of the samples have not yet been classified. Among them, nine samples were collected from the markets in Quan Ba (Ha Giang Province) and Bao Lam (Cao Bang Province). In the

Ba Be District, we collected one sample (No. 51) with purple stems, purple leaves, purple flowers, and drooping fruit with skin changing from purple to red during maturation. Sample No. 64 had purple spots on the petals, and the number of floral axes per node ranged from 2 to 4. The young fruit were green and turned red at maturity. Four samples (Nos. 18, 53, 56, and 70) had spots on the petals, and the number of floral axes per node was one.

Table 2. A summary of crop genetic resources collected in Vietnam in 2020

Scientific Name	Number of collected samples					Total
	Ha Giang Province			Cao Bang Province	Bak Kan Province	
	Quan Ba	Dong Van	Meo Vac	Bao Lam	Ba Be	
<i>Capsicum annuum</i>	0	4	6	0	4	14
<i>Capsicum frutescens</i>	0	7	3	0	5	15
<i>Capsicum baccatum</i> var. <i>pendulum</i>	0	0	0	0	1	1
<i>Capsicum</i> spp.	4	4	0	2	5	15
<i>Cucurbita moschata</i>	0	1	1	0	0	2
<i>Solanum melongena</i>	0	3	2	0	9	14
<i>Solanum</i> spp.	0	2	1	0	0	3
<i>Vigna radiata</i>	0	0	0	0	1	1
<i>Phaseolus vulgaris</i>	0	2	4	0	0	6
Total	4	23	17	2	25	71

The results of this survey indicated that *Capsicum* species represent the greatest proportion of vegetable diversity in the Ba Be District. In Ha Giang Province, the sowing time for chili pepper is from February to March, and the harvesting time is from May to November. In the Bac Kan Province, the sowing time for chili pepper is from January to February, and the harvesting time is from April to November. Some local chili pepper varieties with high spicy and aromatic qualities are commonly produced by local farmers. These varieties were sold at high prices, and include No. 37, which was collected in the Meo Vac District. In the Dong Van District, one local chili pepper named “ot gio” was commercially produced because of its flavor and pungency.

Further research on the morphological characteristics and genotype is necessary to document the diversity of the collected *Capsicum* samples and their potential use for breeding and development of new varieties.

Eggplant

We collected 17 *Solanum* samples in total. Five samples of *Solanum melongena* were recorded in Ha Giang Province (Nos. 13, 16, 19, 38, and 39). Nos. 13, 16, 38, and 39 had a small globular fruit shape, with a yellow color at maturity. No. 19 had a long purple fruit and purple leaf. In the Bac Kan Province, we collected nine samples (Nos. 47, 48, 50, 57, 61, 62, 63, 66, and 68). No. 57 had large and pear-shaped fruits, while other samples (Nos. 47, 48, 50, 61, 62, 63, 66, and 68) had small fruits. A range of skin colors were apparent in the young fruit. For example, No. 50 was white; No. 63 was light green; Nos. 47, 62, and 66 were purple; and No. 48 was white to purple. In Dong Van and Meo Vac, the time for sowing eggplant is from February to March, and the harvesting time is from May to October. In Ba Be, the sowing time for eggplant is from January to February, and the harvesting time is from April to October. These young fruits are popularly boiled, fried, or cooked in soup.

Three samples were wild eggplants collected from Ha Giang Province (Nos. 8, 20, and 30). The plant height of No. 30 was 220 cm. The fruit was globular and small and the fruits color changed from green to orange during maturity. No. 20 had spines on the stem, purple petals, and globular fruit. They occurred on roadsides as well as in home gardens. Farmers cook young fruits and leaves with pork or eggs and claimed that the plants are beneficial for liver health.

Pumpkin

Two pumpkin samples were collected from Ha Giang Province (No. 24 from Dong Van District and No. 36 from Meo Vac District). Based on their morphological characteristics, they were identified as *Cucurbita moschata*. No. 24 had a cylindrical fruit shape, brown fruit skin, and yellow fruit flesh. No. 36 had a pyriform fruit shape, brown fruit skin, and yellow fruit flesh. The time for sowing pumpkin was February, and the harvesting time was from July to October. Local residents would cook young shoots and flowers as vegetables. The mature fruit was cooked in soup, stir-fried in garlic, and boiled. They are also used to feed cattle.

Snap bean

The snap bean is a very important crop in the two districts of Ha Giang Province due to their adaptability, high yield, and nutritional value. Six samples were collected from two districts of Ha Giang Province (Nos. 26 and 27 in Dong Van District and Nos. 29, 35, 43, and 44 in Meo Vac District). These samples belong to the species *Phaseolus vulgaris*. Snap beans can be planted twice a year. The sowing times were March and July and the harvesting times were June and October. They were cultivated in upland fields either alone or as companion crops with maize. Farmers would cook mature seeds with pork, and the young fruit can be boiled as vegetables.

Mung bean

One mung bean sample (No. 69) was collected from the Ba Be District in the Bac Kan Province and was sown in the upland fields. The sowing time was from April to May, and the harvesting time was from June to July. Mature seeds are used in soups and cakes.

Acknowledgments

This work was supported by MAFF commissioned project study on “A Collaborative Research Project on Characterization and Evaluation of Plant Genetic Resources for Food and Agriculture (PGRAsia)” Grant Number JPJ007117).

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2020年ベトナム北部地域における 植物遺伝資源の収集

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和文摘要

農業・食品産業技術総合研究機構（NARO）とベトナム植物遺伝資源センター（PRC）は、ベトナム国内における野菜類を中心とした遺伝資源を探索するため、PGRAsia（Plant Genetic Resource in Asia）プロジェクトのもと、2014年から共同研究を実施している。本プロジェクトの一環として、2014年から2019年にかけてベトナム北部、中部および中南部地域において、植物遺伝資源の探索・調査をベトナムと日本共同で実施している。しかし、2020年はコロナ禍の影響を受け、探索・調査はベトナムの研究員のみで2020年10月17～26日にベトナム北部地域に位置するHa Giang省、Cao Bang省およびBac Can省において実施した。本探索において、トウガラシ45点（*Capsicum annuum* 14点、*Capsicum frutescens* 15点、*Capsicum baccatum* 1点、*Capsicum* spp. 15点）、ナス17点（*Solanum melongena* 14点および*Solanum* spp. 3点）、カボチャ2点（*Cucurbita moschata*）、マメ科植物7点（*Vigna radiata* 1点および*Phaseolus vulgaris* 6点）の合計71点の遺伝資源を収集した。これらの種子は、ベトナムPRCで種子調整および包装作業の後、素材移転契約により日本に導入した。

Table 3. List of genetic resources collected in northern Vietnam in 2020

Collection No.	Passport No.	JP No.	JP Name	Date	Scientific Name	Crop Name	Local Name	Status of Plant	Collection Site	Latitude	Longitude	Altitude (m)	Collecting Source	Sampling method
1	30082178	273804	COL/VIETNAM/2020/NIVFS-PRC/VN2020.01	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Quo chao quo na	landrace	Quyet Tien market, Quan Ba, Ha Giang	N23-03-59-1	E101-59-25-6	886	Market	From bulk plants
2	30082179	273805	COL/VIETNAM/2020/NIVFS-PRC/VN2020.02	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Quo chao quo na	landrace	Quyet Tien market, Quan Ba, Ha Giang	N23-03-59-1	E101-59-25-6	886	Market	From bulk plants
3	30082180	273806	COL/VIETNAM/2020/NIVFS-PRC/VN2020.03	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Ot gio	landrace	Quyet Tien market, Quan Ba, Ha Giang	N23-03-59-1	E101-59-25-6	886	Market	From bulk plants
4	30082181	273807	COL/VIETNAM/2020/NIVFS-PRC/VN2020.04	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Ot gio	landrace	Quyet Tien market, Quan Ba, Ha Giang	N23-03-59-1	E101-59-25-6	886	Market	From bulk plants
5	30082182	273808	COL/VIETNAM/2020/NIVFS-PRC/VN2020.05	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Ot chi thien	landrace	Dong Van market, Dong Van, Ha Giang	N23-16-38-3	E105-21-31-3	1,057	Market	From bulk plants
6	30082183	273809	COL/VIETNAM/2020/NIVFS-PRC/VN2020.06	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Quo chua	landrace	Dong Van market, Dong Van, Ha Giang	N23-16-38-3	E105-21-31-3	1,057	Market	From bulk plants
7	30082184	273810	COL/VIETNAM/2020/NIVFS-PRC/VN2020.07	Oct. 18	<i>Capsicum</i> sp.	Chili pepper	Ot gio	landrace	Dong Van market, Dong Van, Ha Giang	N23-16-38-3	E105-21-31-3	1,057	Market	From bulk plants
8	30082185	273811	COL/VIETNAM/2020/NIVFS-PRC/VN2020.08	Oct. 18	<i>Solanum</i> sp.	Wild eggplant	Ca dang	landrace	Dong Van town, Dong Van, Ha Giang	N23-16-45-5	E105-21-41-6	1,068	Back yard garden	From single plant
9	30082186	273812	COL/VIETNAM/2020/NIVFS-PRC/VN2020.09	Oct. 19	<i>Capsicum frutescens</i>	Chili pepper	Mac ot	landrace	Thien Huong, Dong Van Town, Ha Giang	N23-18-32-2	E105-21-42-1	954	Back yard garden	From single plant
10	30082187	273813	COL/VIETNAM/2020/NIVFS-PRC/VN2020.10	Oct. 19	<i>Capsicum frutescens</i>	Chili pepper	Mac ot	landrace	Thien Huong, Dong Van Town, Ha Giang	N23-18-32-2	E105-21-42-1	955	Back yard garden	From single plant
11	30082188	273814	COL/VIETNAM/2020/NIVFS-PRC/VN2020.11	Oct. 19	<i>Capsicum annum</i>	Chili pepper	Mac ot	landrace	Thien Huong, Dong Van Town, Ha Giang	N23-18-31-3	E105-21-43-9	952	Back yard garden	From single plant
12	30082189	273815	COL/VIETNAM/2020/NIVFS-PRC/VN2020.12	Oct. 19	<i>Capsicum frutescens</i>	Chili pepper	Mac ot	landrace	Thien Huong, Dong Van Town, Ha Giang	N23-18-31-3	E105-21-43-9	952	Back yard garden	From single plant
13	30082190	273816	COL/VIETNAM/2020/NIVFS-PRC/VN2020.13	Oct. 19	<i>Solanum melongena</i>	Eggplant	Ca phao	landrace	Ma lu, Dong Van Town, Ha Giang	N23-17-09-4	E105-23-23-8	728	Back yard garden	From single plant
14	30082191	273817	COL/VIETNAM/2020/NIVFS-PRC/VN2020.14	Oct. 19	<i>Capsicum frutescens</i>	Chili pepper	Mac sat	landrace	Ma lu, Dong Van Town, Ha Giang	N23-17-09-4	E105-23-23-8	728	Back yard garden	From single plant
15	30082192	273818	COL/VIETNAM/2020/NIVFS-PRC/VN2020.15	Oct. 19	<i>Capsicum frutescens</i>	Chili pepper	Mac ot	landrace	Ma lu, Dong Van Town, Ha Giang	N23-16-54-4	E105-23-30-8	796	Back yard garden	From single plant
16	30082193	273819	COL/VIETNAM/2020/NIVFS-PRC/VN2020.16	Oct. 19	<i>Solanum melongena</i>	Eggplant	Ca phao	landrace	Ma lu, Dong Van Town, Ha Giang	N23-16-53-6	E105-23-31-9	787	Back yard garden	From single plant
17	30082194	273820	COL/VIETNAM/2020/NIVFS-PRC/VN2020.17	Oct. 20	<i>Capsicum frutescens</i>	Chili pepper	Mac sat	landrace	Ma le, Ma Le, Dong Van, Ha Giang	N23-18-36-1	E105-17-59-6	1,269	Back yard garden	From single plant
18	30082195	273821	COL/VIETNAM/2020/NIVFS-PRC/VN2020.18	Oct. 20	<i>Capsicum</i> sp.	Chili pepper	Ot	landrace	Ma le, Ma Le, Dong Van, Ha Giang	N23-18-11-6	E105-18-28-9	1,216	Back yard garden	From single plant
19	30082196	273822	COL/VIETNAM/2020/NIVFS-PRC/VN2020.19	Oct. 20	<i>Solanum melongena</i>	Eggplant	Nung ue	landrace	Lo Lo Chai, Lung Cu, Dong Van, Ha Giang	N23-21-54-5	E105-18-10-5	1,367	Back yard garden	From single plant
20	30082197	273823	COL/VIETNAM/2020/NIVFS-PRC/VN2020.20	Oct. 20	<i>Solanum</i> sp.	Wild eggplant	Nung cu kho	landrace	Lo Lo Chai, Lung Cu, Dong Van, Ha Giang	N23-21-59-5	E105-18-10-5	1,367	Back yard garden	From single plant
21	30082198	273824	COL/VIETNAM/2020/NIVFS-PRC/VN2020.21	Oct. 20	<i>Capsicum annum</i>	Chili pepper	Ot	landrace	Lo Lo Chai, Lung Cu, Dong Van, Ha Giang	N23-21-59-5	E105-18-10-5	1,367	Back yard garden	From single plant
22	30082199	273825	COL/VIETNAM/2020/NIVFS-PRC/VN2020.22	Oct. 20	<i>Capsicum frutescens</i>	Chili pepper	Cho cua na	landrace	Cang Tang, Lung Cu, Dong Van, Ha Giang	N23-21-51-4	E105-19-25-5	1,352	Back yard garden	From bulk plants

Table 3. (Continued).

Collection No.	Passport No.	JP No.	JP Name	Date	Scientific Name	Crop Name	Local Name	Status of Plant	Collection Site	Latitude	Longitude	Altitude (m)	Collecting Source	Sampling method
23	30082200	273826	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.23	Oct. 20	<i>Capsicum annuum</i>	Chili pepper	Ot	landrace	Lung Hoa A, Sa Phin, Dong Van, Ha Giang	N23-15-18-9	E105-14-39-9	1,451	Farmers field	From bulk plants
24	30082201	273827	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.24	Oct. 20	<i>Cucurbita moschata</i>	Pumkin	Bi do	landrace	Lung Hoa A, Sa Phin, Dong Van, Ha Giang	N23-15-18-9	E105-14-39-9	1,451	Farmers field	From single plant
25	30082202	273828	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.25	Oct. 20	<i>Capsicum annuum</i>	Chili pepper	Ot	landrace	Lung Hoa A, Sa Phin, Dong Van, Ha Giang	N23-15-19-0	E105-14-39-9	1,451	Farmers field	From single plant
26	30082203	273829	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.26	Oct. 20	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Lung Hoa A, Sa Phin, Dong Van, Ha Giang	N23-15-15-4	E105-14-44-4	1,434	Farmers storage	From single plant
27	30082204	273830	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.27	Oct. 20	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Lung Hoa A, Sa Phin, Dong Van, Ha Giang	N23-15-15-4	E105-14-44-4	1,434	Farmers storage	From bulk plants
28	30082205	273831	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.28	Oct. 21	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	Ha Che, Ta Lung, Meo Vac, Ha Giang	N23-10-12-0	E105-20-38-0	1,365	Back yard garden	From bulk plants
29	30082206	273832	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.29	Oct. 21	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Ha Che, Ta Lung, Meo Vac, Ha Giang	N23-10-12-0	E105-20-38-0	1,365	Farmers storage	From bulk plants
30	30082207	273833	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.30	Oct. 21	<i>Solanum</i> sp.	Wild eggplant	Ca dang	landrace	Ha Che, Ta Lung, Meo Vac, Ha Giang	N23-10-13-8	E105-23-34-2	1,316	Back yard garden	From single plant
31	30082208	273834	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.31	Oct. 21	<i>Capsicum frutescens</i>	Chili pepper	Cho	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Back yard garden	From single plant
32	30082209	273835	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.32	Oct. 21	<i>Capsicum frutescens</i>	Chili pepper	Cho	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Back yard garden	From single plant
33	30082210	273836	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.33	Oct. 21	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Back yard garden	From single plant
34	30082211	273837	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.34	Oct. 21	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Back yard garden	From single plant
35	30082212	273838	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.35	Oct. 21	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Farmers storage	From bulk plants
36	30082213	273839	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.36	Oct. 22	<i>Cucurbita moschata</i>	Pumkin	Tau da	landrace	Ha Che, Sung Tra, Meo Vac, Ha Giang	N23-10-25-8	E105-21-36-5	1,244	Back yard garden	From single plant
37	30082214	273840	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.37	Oct. 22	<i>Capsicum frutescens</i>	Chili pepper	Mac sat hay nu	landrace	Na Dau, Tat Nga, Meo Vac, Ha Giang	N23-05-38-2	E105-33-43-3	652	Farmers field	From bulk plants
38	30082215	273841	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.38	Oct. 22	<i>Solanum melongena</i>	Eggplant	Mac che hao	landrace	Na Dau, Tat Nga, Meo Vac, Ha Giang	N23-15-36-7	E105-23-48-0	670	Farmers field	From single plant
39	30082216	273842	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.39	Oct. 22	<i>Solanum melongena</i>	Eggplant	Mac che loc	landrace	Na Dau, Tat Nga, Meo Vac, Ha Giang	N23-15-36-7	E105-23-48-0	670	Farmers field	From bulk plants
40	30082217	273843	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.40	Oct. 22	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	De Lang, Giang Chu Phin, Meo Vac, Ha Giang	N23-11-45-8	E105-26-27-1	1,337	Back yard garden	From single plant
41	30082218	273844	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.41	Oct. 22	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	De Lang, Giang Chu Phin, Meo Vac, Ha Giang	N23-11-45-8	E105-26-27-1	1,337	Back yard garden	From single plant
42	30082219	273845	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.42	Oct. 22	<i>Capsicum annuum</i>	Chili pepper	Cho	landrace	Ha Ia, Can Chu Phin, Meo Vac, Ha Giang	N23-07-38-8	E105-23-46-7	1,291	Back yard garden	From single plant
43	30082220	273846	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.43	Oct. 22	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Ha Ia, Can Chu Phin, Meo Vac, Ha Giang	N23-07-39-5	E105-27-46-8	1,286	Farmer storage	From single plant
44	30082221	273847	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.44	Oct. 22	<i>Phaseolus vulgaris</i>	Snap bean	Tau la	landrace	Ha Ia, Can Chu Phin, Meo Vac, Ha Giang	N23-07-39-5	E105-27-46-8	1,286	Farmer storage	From bulk plants

Table 3. (Continued).

Collection No.	Passport No.	JP No.	JP Name	Date	Scientific Name	Crop Name	Local Name	Status of Plant	Collection Site	Latitude	Longitude	Altitude (m)	Collecting Source	Sampling method
45	30082222	273848	COL/VIETNAM/2020/NIVFS-PRC/VN2020.45	Oct. 23	<i>Capsicum</i> sp.	Chili pepper	Hua cho	landrace	Khuoi Vin market, Ly Bon, Bao Lam, Cao Bang	N22-29-21-4	E105-29-23-1	300	Market	From bulk plants
46	30082223	273849	COL/VIETNAM/2020/NIVFS-PRC/VN2020.46	Oct. 23	<i>Capsicum</i> sp.	Chili pepper	Hua cho	landrace	Khuoi Vin market, Ly Bon, Bao Lam, Cao Bang	N22-29-21-4	E105-29-23-1	300	Market	From bulk plants
47	30082224	273850	COL/VIETNAM/2020/NIVFS-PRC/VN2020.47	Oct. 24	<i>Solanum melongena</i>	Eggplant	Mac khua	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-25-05-2	E105-44-39-6	324	Back yard garden	From single plant
48	30082225	273851	COL/VIETNAM/2020/NIVFS-PRC/VN2020.48	Oct. 24	<i>Solanum melongena</i>	Eggplant	Ca phao	landrace	Tat Dai, Dia Linh, Ba Be, Bac Kan	N22-25-56-7	E105-45-21-3	184	Back yard garden	From single plant
49	30082226	273852	COL/VIETNAM/2020/NIVFS-PRC/VN2020.49	Oct. 24	<i>Capsicum annum</i>	Chili pepper	Mac phet	landrace	Tat Dai, Dia Linh, Ba Be, Bac Kan	N22-25-56-7	E105-45-21-3	184	Back yard garden	From bulk plants
50	30082227	273853	COL/VIETNAM/2020/NIVFS-PRC/VN2020.50	Oct. 24	<i>Solanum melongena</i>	Eggplant	Ca	landrace	Pac Nghe, Dia Linh, Ba Be, Bac Kan	N22-26-21-8	E105-44-58-7	165	Back yard garden	From single plant
51	30082228	273854	COL/VIETNAM/2020/NIVFS-PRC/VN2020.51	Oct. 24	<i>Capsicum</i> sp.	Chili pepper	Ot	landrace	Pac Nghe, Dia Linh, Ba Be, Bac Kan	N22-26-21-7	E105-44-59-6	162	Back yard garden	From bulk plants
52	30082229	273855	COL/VIETNAM/2020/NIVFS-PRC/VN2020.52	Oct. 24	<i>Capsicum annum</i>	Chili pepper	Ot	landrace	Pac Nghe, Dia Linh, Ba Be, Bac Kan	N22-26-21-7	E105-44-59-6	162	Back yard garden	From single plant
53	30082230	273856	COL/VIETNAM/2020/NIVFS-PRC/VN2020.53	Oct. 24	<i>Capsicum</i> sp.	Chili pepper	Ot	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-25-21-1	E105-44-47-9	290	Back yard garden	From single plant
54	30082231	273857	COL/VIETNAM/2020/NIVFS-PRC/VN2020.54	Oct. 24	<i>Capsicum annum</i>	Chili pepper	Ot	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-25-21-1	E105-44-47-9	290	Back yard garden	From single plant
55	30082232	273858	COL/VIETNAM/2020/NIVFS-PRC/VN2020.55	Oct. 24	<i>Capsicum frutescens</i>	Chili pepper	Ot	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-25-21-1	E105-44-47-9	290	Back yard garden	From single plant
56	30082233	273859	COL/VIETNAM/2020/NIVFS-PRC/VN2020.56	Oct. 24	<i>Capsicum</i> sp.	Chili pepper	Ot	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-25-96-1	E105-44-40-6	305	Back yard garden	From single plant
57	30082234	273860	COL/VIETNAM/2020/NIVFS-PRC/VN2020.57	Oct. 24	<i>Solanum melongena</i>	Eggplant	Mac khua	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-24-55-1	E105-44-30-8	330	Back yard garden	From single plant
58	30082235	273861	COL/VIETNAM/2020/NIVFS-PRC/VN2020.58	Oct. 24	<i>Capsicum frutescens</i>	Chili pepper	Mac phet	landrace	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-24-58-8	E105-44-31-4	318	Back yard garden	From single plant
59	30082236	273862	COL/VIETNAM/2020/NIVFS-PRC/VN2020.59	Oct. 24	<i>Capsicum baccatum</i> var. <i>pendulum</i>	Chili pepper	Mac phet	bred line	Ban Vang, Dia Linh, Ba Be, Bac Kan	N22-24-56-9	E105-44-31-5	317	Back yard garden	From single plant
60	30082237	273863	COL/VIETNAM/2020/NIVFS-PRC/VN2020.60	Oct. 24	<i>Capsicum frutescens</i>	Chili pepper	Khau san	landrace	Ban La, Yen Duong, Ba Be, Bac Kan	N22-21-47-8	E105-47-50-5	317	Back yard garden	From single plant
61	30082238	273864	COL/VIETNAM/2020/NIVFS-PRC/VN2020.61	Oct. 24	<i>Solanum melongena</i>	Eggplant	Mac che dau	landrace	Ban La, Yen Duong, Ba Be, Bac Kan	N22-21-47-8	E105-47-50-5	317	Farmers storage	From single plant
62	30082239	273865	COL/VIETNAM/2020/NIVFS-PRC/VN2020.62	Oct. 25	<i>Solanum melongena</i>	Eggplant	Ca tim	landrace	Pu Mat, Chu Huong, Ba Be, Bac Kan	N22-21-21-6	E105-49-36-4	264	Back yard garden	From single plant
63	30082240	273866	COL/VIETNAM/2020/NIVFS-PRC/VN2020.63	Oct. 25	<i>Solanum melongena</i>	Eggplant	Ca phao	bred line	Na Giao, Yen Duong, Ba Be, Bac Kan	N22-23-30-9	E105-47-38-3	264	Back yard garden	From single plant
64	30082241	273867	COL/VIETNAM/2020/NIVFS-PRC/VN2020.64	Oct. 25	<i>Capsicum</i> sp.	Chili pepper	Mac phet	bred line	Na Giao, Yen Duong, Ba Be, Bac Kan	N22-23-21-1	E105-47-38-3	250	Back yard garden	From single plant
65	30082242	273868	COL/VIETNAM/2020/NIVFS-PRC/VN2020.65	Oct. 25	<i>Capsicum annum</i>	Chili pepper	Mac phet	bred line	Na Giao, Yen Duong, Ba Be, Bac Kan	N22-23-21-1	E105-47-38-3	250	Back yard garden	From single plant
66	30082243	273869	COL/VIETNAM/2020/NIVFS-PRC/VN2020.66	Oct. 25	<i>Solanum melongena</i>	Eggplant	Mac khua	wild	Na Giao, Yen Duong, Ba Be, Bac Kan	N22-23-38-9	E105-47-33-2	237	Natural habitat	From single plant

Table 3. (Continued).

Collection No.	Passport No.	JP No.	JP Name	Date	Scientific Name	Crop Name	Local Name	Status of Plant	Collection Site	Latitude	Longitude	Altitude (m)	Collecting Source	Sampling method
67	30082244	273870	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.67	Oct. 25	<i>Capsicum frutescens</i>	Chili pepper	Pia chiu	landrace	Pu Met Market, Chu Huong, Ba Be, Bac Kan	N22-21-05-5	E105-49-31-3	268	Market	From bulk plants
68	30082245	273871	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.68	Oct. 25	<i>Solanum melongena</i>	Eggplant	Ca phao	landrace	Pu Mat, Chu Huong, Ba Be, Bac Kan	N22-21-21-6	E105-49-36-3	264	Back yard garden	From single plant
69	30082246	273872	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.69	Oct. 25	<i>Vigna radiata</i>	Mung bean	Thua kheo	landrace	Pu Mat Market, Chu Huong, Ba Be, Bac Kan	N22-21-05-5	E105-49-31-3	268	Market	From bulk plants
70	30082247	273873	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.70	Oct. 25	<i>Capsicum sp.</i>	Chili pepper	Mac pet	landrace	Pu Mat, Chu Huong, Ba Be, Bac Kan	N22-21-20-8	E105-49-26-7	254	Back yard garden	From single plant
71	30082248	273874	COL/VIETNAM/2020/NIVFS-PRC/ VN2020.71	Oct. 25	<i>Capsicum frutescens</i>	Chili pepper	Mac pet	landrace	Pu Mat, Chu Huong, Ba Be, Bac Kan	N22-21-20-8	E105-49-26-7	254	Back yard garden	From single plant

Photos of collected Samples

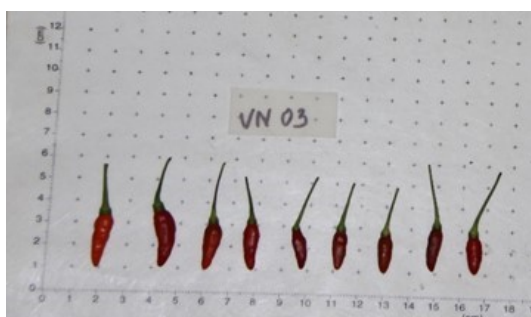
Chili pepper



Sample Photo 1.
VN 001



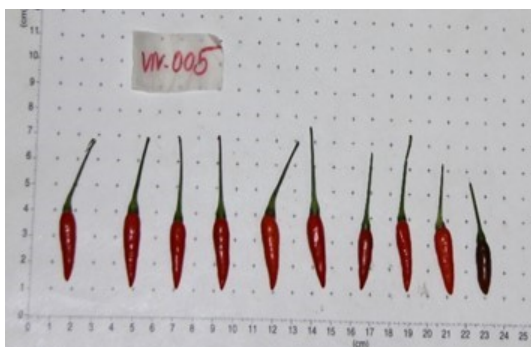
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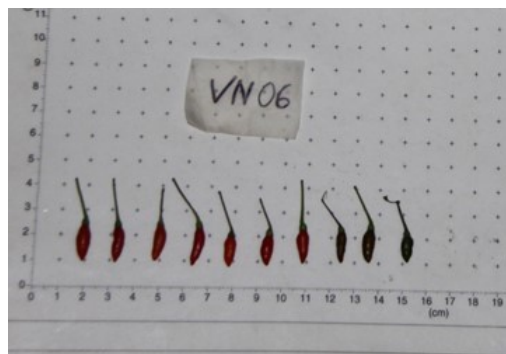
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VN 003



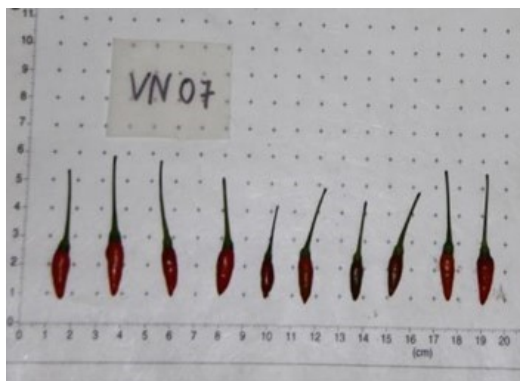
Sample Photo 4.
VN 004



Sample Photo 5.
VN 005



Sample Photo 6.
VN 006



Sample Photo 7.
VN 007



Sample Photo 8.
VN 009

Chili pepper



Sample Photo 9.
VN 010



Sample Photo 10.
VN 011



Sample Photo 11.
VN 012



Sample Photo 12.
VN 014



Sample Photo 13.
VN 015



Sample Photo 14.
VN 017

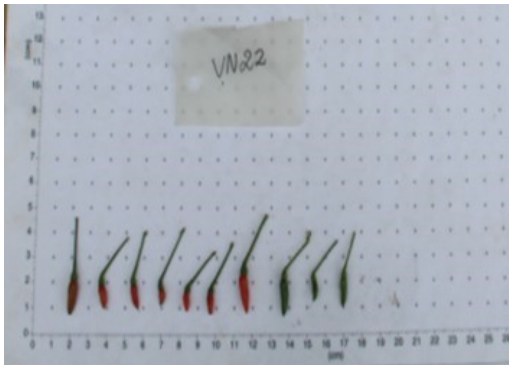


Sample Photo 15.
VN 018



Sample Photo 16.
VN 021

Chili pepper



Sample Photo 17.
VN 022



Sample Photo 18.
VN 023



Sample Photo 19.
VN 025



Sample Photo 20.
VN 028



Sample Photo 21.
VN 031



Sample Photo 22.
VN 032



Sample Photo 23.
VN 033

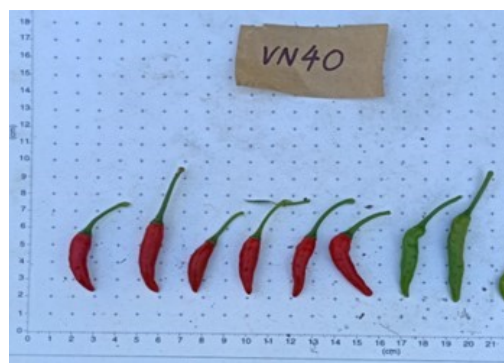


Sample Photo 24.
VN 034

Chili pepper



Sample Photo 25.
VN 037



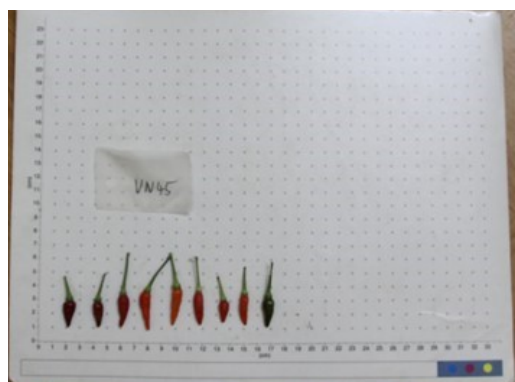
Sample Photo 26.
VN 040



Sample Photo 27.
VN 041



Sample Photo 28.
VN 042



Sample Photo 29.
VN 045



Sample Photo 30.
VN 046



Sample Photo 31.
VN 049

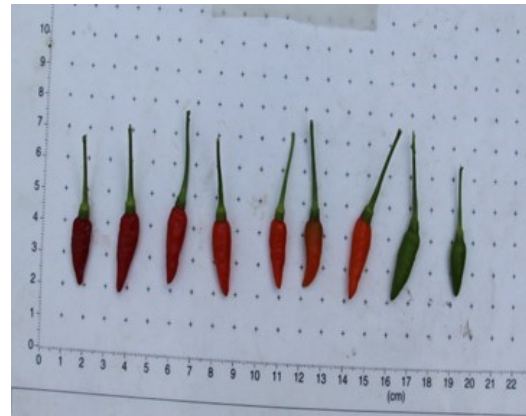


Sample Photo 32.
VN 051

Chili pepper



Sample Photo 33.
VN 052



Sample Photo 34.
VN 053



Sample Photo 35.
VN 054



Sample Photo 36.
VN 055



Sample Photo 37.
VN 056



Sample Photo 38.
VN 058



Sample Photo 39.
VN 059



Sample Photo 40.
VN 060

Chili pepper



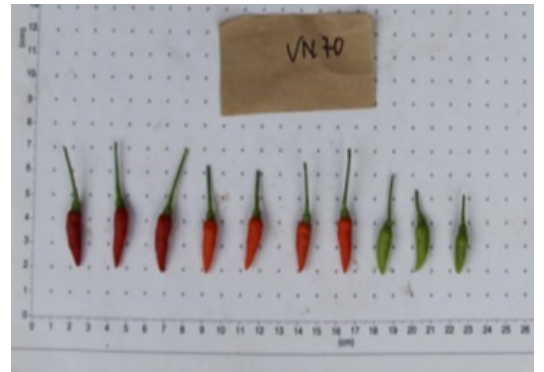
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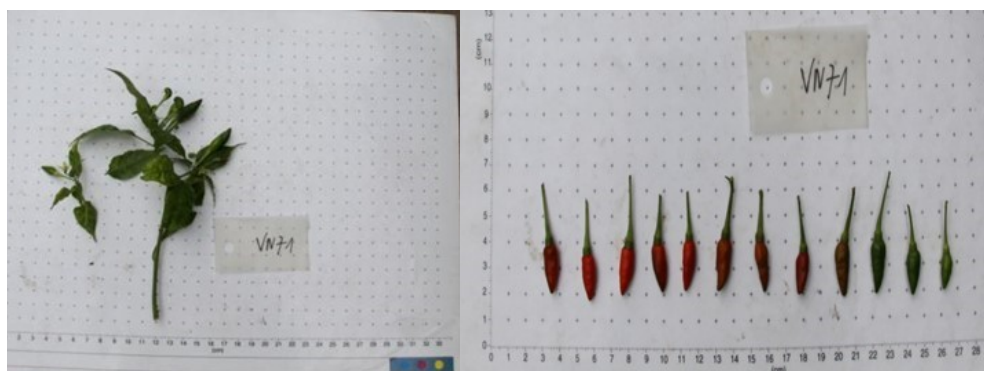
Sample Photo 42.
VN 065



Sample Photo 43.
VN 067



Sample Photo 44.
VN 070



Sample Photo 45.
VN 071

Eggplant



Sample Photo 46.
VN 008



Sample Photo 47.
VN 013



Sample Photo 48.
VN 016



Sample Photo 49.
VN 019



Sample Photo 50.
VN 020



Sample Photo 51.
VN 030

Eggplant



Sample Photo 52.
VN 038



Sample Photo 53.
VN 039



Sample Photo 54.
VN 047



Sample Photo 55.
VN 048



Sample Photo 56.
VN 050



Sample Photo 57.
VN 057

Eggplant



Sample Photo 58.
VN 061



Sample Photo 59.
VN 062



Sample Photo 60.
VN 063



Sample Photo 61.
VN 066



Sample Photo 62.
VN 068

Pumpkin



Sample Photo 63.
VN 024



Sample Photo 64.
VN 036

Snap bean



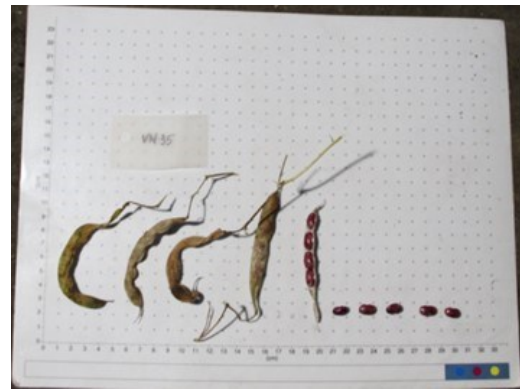
Sample Photo 65.
VN 026



Sample Photo 66.
VN 027



Sample Photo 67.
VN 029



Sample Photo 68.
VN 035



Sample Photo 69.
VN 043



Sample Photo 70.
VN 044

Mung bean



Sample Photo 71.
VN 069