

Collaborative Exploration of Plant Genetic Resources in Southern Cambodia, 2019

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Summary

Under the Plant Genetic Resources in Asia (PGRAsia) project, National Agriculture and Food Research Organization (NARO) and Cambodian Agricultural Research and Department Institute (CARDI) have conducted several collaborative explorations in Cambodia since 2014. As part of the project, we surveyed and gathered plant genetic resources in Southern Cambodia from October 1 to 10, 2019. In the survey, we explored the genetic resources in 14 districts of Southern Cambodia in Svay Rieng, Pery Veng, Kandal, Phnom Penh, Kampong Speu, Preah Sihanouk, Koh Kong, Kampot, and Takeo provinces and collected 85 accessions from farmers' storages, back yards, or fields. The accessions corresponded to Solanaceae (34), Cucurbitaceae (35), Fabaceae (8), and Amaranthaceae (8). Among 34 Solanaceae accessions, 29 were from *C. frutescens*. As the present study was conducted in a flood-prone area, vegetable cultivation during the rainy season was low, and flood-tolerant luffa and hyacinth bean were considered important vegetables for cultivation. The collected seeds were divided equally, and half the seeds were conserved at CARDI in Cambodia. The other half was transferred to the Genetic Resources Center, NARO, Japan, under the standard material transfer agreement.

KEY WORDS: Cambodia, Solanaceae, Cucurbitaceae, Fabaceae, Amaranthaceae

Introduction

Plant genetic resources are important for improving traits such as pest and disease resistance, poor environmental condition tolerance, and high yield.

The Plant Genetic Resource Asia (PGR Asia) project was conducted by the National Agriculture and Food Research Organization (NARO) in collaboration with the Cambodian Agricultural Research and Development

Institute (CARDI) since 2014.

Previous explorations had been carried out by Tanaka *et al.* (2016), Sreynech *et al.* (2016), and Matsushima *et al.* (2018) to explore Eastern Cambodia while Matsunaga *et al.* (2015) and Takahashi *et al.* (2015) explored Western and Northwest Cambodia. The northern region of Cambodia was explored by Sugita *et al.* (2017), Tanaka *et al.* (2017), and Kondo *et al.* (2019). However, Southern Cambodia was explored only by Matsunaga *et al.* (2018), and the collected samples were relatively less than the other three regions. Under the PGR Asia project, Shinshu University has already explored North, East, and West Cambodia, except in the Southern region. Therefore, it is necessary to explore and collect more genetic resources in Southern Cambodia. The objective of this survey was to explore and collect plant genetic resources, mainly Solanaceous (especially *Capsicum* spp.) and Cucurbitaceous families, in Southern

Cambodia.

Methods

A field survey was conducted from October 1 to 10, 2019 in Southern Cambodia, including Svay Rieng, Pery Veng, Kondal, Phnom Penh, Kampong Speu, Preah Sihanouk, Koh Kong, Kampot, and Takeo provinces (Table 1, Fig. 1). We visited farmers' houses using two vehicles. We could not reach some of the places by car because of narrow and flooded roads. At that time, we reached those farmers' places on foot. During the interviews, we clarified that most of the farmers cultivated imported and improved varieties. Therefore, we were careful to collect only local varieties of seeds produced by farmers themselves. In this survey, we mainly focused on chili pepper under the Solanaceae family, and other vegetables belonging to the Cucurbitaceae family. The accession's local

Table 1. Itinerary plan followed during the 2019 exploration in Southern Cambodia

Date	Day	Itinerary	Stay
30-Sep	Mon	Narita -- Phnom Penh	Phnom Penh
1-Oct	Tue	Visit CARDI and central market	Phnom Penh
2-Oct	Wed	Phnom Penh -- Svay Rieng	Svay Rieng
3-Oct	Thu	Svay Rieng -- Prey Veng	Prey Veng
4-Oct	Fri	Prey Veng -- Kandal -- Phnom Penh -- Kampong Speu	Kampong Speu
5-Oct	Sat	Kampong Speu -- Koh Kong -- Preah Sihanouk -- Koh Kong	Koh Kong
6-Oct	Sun	Koh Kong--Kampot	Kampot
7-Oct	Mon	Kampot -- Takeo	Takeo
8-Oct	Tue	Takeo -- Phnom Penh	Phnom Penh
9-Oct	Wed	Visit CARDI and arrange the collected seed	Phnom Penh
10-Oct	Thu	Phnom Penh -- Narita	



Fig. 1. Route map of exploration and collection sites of Southern Cambodia in 2019.

name, utilization, location name, and characteristics of collection site were recorded using farmer information and field observations during sample collection (Photo 1). Images of the samples were taken at the point of collection (Photo 2). Longitudinal sampling locations, latitudes, and altitudes were recorded (Photo 3) using the Garmin eTrex20J GPS technology (Garmin International Inc., Olathe, KS, USA). The collected seeds were divided equally, and half were conserved CARDI in Cambodia. The other half was transferred to the Genetic Resources Center, NARO, Japan, using the standard material transfer agreement.

Results and Discussion

In this exploration, we collected 85 accessions from four families: Solanaceae, Cucurbitaceae, Fabaceae, and Amaranthaceae. Collected seed samples included 29 chili peppers (only *C. frutescens*), 5 *Solanum* spp., 35 Cucurbitaceae, 8 Fabaceae, and 8 Amaranthaceae (Table 2). Fruits samples were mainly collected from farmers' home gardens and seed samples collected from farmers' seed storage. Usually, farmers stored their seeds in wood containers or bags and used the cables (Photo 4 and No. 60). Finally, the collected seeds of samples were equally



Photo 1. Collection of fruit samples in Prey Veng area



Photo 2. Obtaining fruit sample photos

shared between the Genetic Resources Center, NARO, Japan, and CARDI.

Exploration records

1) Svay Rieng province (October 2)

We moved to the Savy Rieng province from Phnom Penh city by car then we visited Veal village in Svay Teap district and collected four plant accessions. The accessions were two chili peppers (*C. frutescens*) (No. 1 and No. 3), one luffa seed (No. 2) from dry fruit, and one amaranth seed (No. 4) from inflorescence of the plant in the backyard. The first chili pepper accession (No. 1) was collected from a farmer's field and did not have any virus infection. However, the second chili pepper (No. 3), which was collected from the backyard of a house in Svay Teap village, had a virus infection in the whole plant (Photo 5).

2) Prey Veng (October 3)

The explorer team left the Svay Rieng and traveled to the Prey Veng province (Photo 6) on the same road. We visited Peam Chor district, Mean Chey village and Prey Veng city, in the Shkor Dach and Knoy areas, respectively. We collected a total of 21 seed and fruit samples (No. 5 - No. 25) in Prey Veng province. We mainly explored the accession in forestry areas, home gardens, backyards, and farmers' fields.



Photo 3. Determining GPS coordinates



Photo 4. Farmer's seed storage



Photo 5. Chili pepper plant severely infected with a virus

3) Kandal (October 4)

We reached the Kandal province in Takhmau district and explored Prek Loung village but found only one accession of *Luffa cylindrica* (No. 26).

4) Phnom Penh (October 4)

We left Kandal and moved to Kampong Speu district. While traveling to the Kampong Speu, we had to pass Phnom Penh again. Near Phnom Penh, Pou Senchey district, on the roadside of the Prey Ta Khea village, we found an ivy gourd (No. 27).



Photo 6. Rural area scenery in Prey Veng province

5) Kampong Speu (October 4 and 5)

It was raining heavily on the way from Phnom Penh to Kampong Speu. We explored Chba Moun district, Som Pov village and Tang Kroch district, Choum Phey village in Kampong Speu province. We visited the market in Chba Moun district, Pea Nichakam village and collected six fruit samples of chili pepper (No. 29, 30, 32, 33, 34, and 37), two samples of squash (No. 35 and 36), one sample of angled luffa (No. 28), and one sponge gourd (No. 31).

6) Preah Sihanouk (October 5)

We moved to the Preah Sihanouk province, Kampong Seila district, and explored Veal and Thmey

Table 2. Total collected accessions in Southern Cambodia in 2019

Family	genus	species	
Solanaceae			34
	<i>Capsicum</i>	<i>frutescens</i>	29
	<i>Solanum</i>	<i>melongena</i>	3
		<i>torvum</i>	1
		<i>trilobatum</i>	1
Cucurbitaceae			35
	<i>Luffa</i>	<i>cylindrica</i>	10
		<i>acutangula</i>	3
	<i>Cucurbita</i>	<i>moschata</i>	9
	<i>Benincasa</i>	<i>hispida</i>	4
	<i>Cucumis</i>	<i>melo</i>	3
		<i>sativus</i>	2
	<i>Lagenaria</i>	<i>siceraria</i>	2
	<i>Momordica</i>	<i>charantia</i>	1
	<i>Coccinia</i>	<i>grandis</i>	1
Fabaceae			8
	<i>Lablab</i>	<i>purpureus</i>	4
	<i>Vigna</i>	<i>unguiculate</i>	3
		<i>radiata</i>	1
Amaranthaceae			8
	<i>Amaranthus</i>	spp.	8
Total			85

villages. In these villages, we collected three chili peppers (No. 38, 40, and 41), one sponge gourd (No. 39), and one bottle gourd (No. 42) accessions from the backyards of farmers' houses. Then, we moved to Koh Kong province.

7) Koh Kong (October 6)

We visited Koik Chrom village in Thmor Bang district and collected four chili pepper fruit samples (No. 43, 45, 46 and 47) and one turkey berry fruit sample (No. 44) from the durian and mangosteen fields.

8) Kampot (October 7)

We collected 10 accessions, including three chili peppers (No. 50, 51, and 56); two hyacinth beans (No. 49 and 55); and one amaranth (No. 48), squash (No. 52), melon (No. 53), sponge gourd (No. 54), and bottle gourd (No. 57) seed and fruit samples in Kampot province. The villages of Chrous Tasoum, Dom Nak Chombo, and Phnom Threal, in Kompong Trach, Sorn Rong Ler, and Angkor Chey districts, respectively, were explored before we moved to the Takeo province.

9) Takeo (October 7 and 8)

In Takeo province, we collected samples in Prey Kabas district, Bak Kout, Khach Trouk, and Ang Koki villages. We collected the many accessions on October 8, until afternoon. We were able to collect 16 samples on the last day in the Prey Kabas district, Choum Phoprik village. We collected a total of 28 accessions in Takeo province, including five chili peppers (No. 58, 63, 69, 77 and 78), four squashes (No. 62, 67, 72 and 85), three sponge gourds (No. 61, 75 and 80), two amaranths (No. 64 and 79), two hyacinth beans (No. 60 and 68), two cucumbers (No. 66 and 84), two wax gourds (No. 70 and 73), two melons (No. 71 and 83), two cowpeas (No. 81 and 82), two eggplants (No. 59 and 74), one angled luffa (No. 65), and one bitter gourd (No. 76).

Collected plant genetic resources

1) Solanaceae accessions

In the present survey, 34 Solanaceae accessions were collected from Southern Cambodia. Among the collected samples, 29 were chili pepper and 5 were from genus *Solanum*.

Chili pepper

In the present study, all 29 accessions we collected were *Capsicum frutescens*. Globally, five species of chili pepper are domesticated: *C. annuum*, *C. frutescens*, *C. chinense*, *C. baccatam*, and *C. pubescens* (Bosland

and Votava 1999). However, only *C. annuum* and *C. frutescens* are observed in Cambodia, according to previous studies (Matsunaga *et al.* 2015, 2018; Tanaka *et al.* 2016; Sugita *et al.* 2017; Kondo *et al.* 2019). In fact, *C. annuum* was also grown in Southern Cambodia; however, in our survey, most farmers revealed that in Southern region, they use imported and improved chili pepper varieties from Vietnam. Particularly, in the case of *C. annuum*, all varieties grown in the Southern region we found were improved varieties. Therefore, we did not collect *C. annuum* accessions. In Southern Cambodia, *C. frutescens* has two types of local names: "Mate Ach Sath" and "Mate Sor." "Mate" means chili pepper, while "Ach Sath" and "Sor" means "Bird's dropping" and "White," respectively. The immature fruit of "Mates Sor" were white. Accessions No. 77 and No. 78 were grown in farmers backyards and home gardens, respectively; however, the farmers told us that the seeds were not sown by them but were carried by birds and dropped there. Seed dispersal by birds is probably the origin of the name of the variety. According to the 2018 exploration in Northern Cambodia (Kondo *et al.* 2019), most of the dominant type of *C. frutescens* was suggested as "Mate Ach Sath." In the present study, out of 29 *C. frutescens* accessions, 19 were "Mate Ach Sath." This finding was identical to the result of the previous exploration in 2018.

Most of the chili accessions found in Southern Cambodia had viral infections. Accession No. 45, 46, and 47 were more severely infected with the virus than other accessions. However, some chili accessions were free of viral diseases, such as No. 14. Such accessions might be expected as good genetic resources for developing new resistant varieties.

According to our observations at the collection site, the mature fruit of accession No. 56 was separated from the calyx and pedicel very easily. The trait of easy separation of the pepper fruit from the calyx is for seed dispersal, but it is not desirable for the development of commercial varieties because the trait is associated with extreme fruit softening and juiciness. However, not all accessions of *C. frutescens* mature fruits were extremely soft and easily separated from the calyx. Some accessions' fruits required a little force to be separated from the calyx and were not too soft.

Eggplant

We collected five accessions of the genus *Solanum*, including three accessions of *S. melongena*, one of *S. torvum*, and one of *S. trilobatum*. *S. torvum* had a light green color pericarp and clustered small fruits. In Japan,

S. torvum is not eaten, but instead used as rootstock for eggplant grafting. Cambodian people eat immature fruits of *S. torvum* as vegetables (No. 44). We also had a chance to taste *S. torvum* soup with fresh vegetables in Phnom Penh (Photo 7). In our study, we did not find fresh mature fruits but only immature fruits; however, we collected dried mature fruits as accession No. 44. We also collected the accession (No. 74) of *S. trilobatum* for the PGR Asia Project in Cambodia. The surface of immature fruits of *S. trilobatum* showed a mottled green pattern, which became a mottled red pattern after maturing (No. 74). The stem of the grown *S. trilobatum* accession was a vine and had sharp prickles. Flowers were purple in color with a projecting stamen. According to interviews with farmers, they eat only the leaves of this vine and not its fruits.

2) Cucurbitaceous accessions

We collected 35 accessions of cucurbitaceous accessions, including 10 sponge gourds (*Luffa cylindrica*), 3 angled luffas (*L. acutangula*), 9 squashes/pumpkins (*Cucurbita moschata*), 4 wax gourds (*Benincasa hispida*), 3 melons (*Cucumis melo*), 2 cucumbers (*C. sativus*), 2 bottle gourds (*Lagenaria siceraria*), 1 bitter melon (*Momordica charantia*), and 1 ivy gourd (*Coccinia grandis*). All accessions' fruits were used as vegetables, except for bottle gourd and ivy gourd. Ivy gourd inhabited the roadside or backyard of farmers' houses as a weed, and, in some cases, the young leaves and tendrils are eaten as vegetables. We collected 2 species from the genus *Luffa* (sponge gourd and angled luffa), however, people who live in the collection area were not able to differentiate the two and their local name was the same ("No Nong"). Two species of *Luffa* were cultivated with trellis training, and almost all of the farmers stocked their seeds or dried fruits for the next season. The exploration site is a flood-prone area during the rainy season. Therefore, farmers told us that



Photo 7. Vegetables usage in Cambodian local cuisine (*Solanum torvum* is also included in the dipping sauce in the right)

they did not grow many vegetables in the rainy season. However, in most of the home gardens and backyards, we could observe one of two species of luffa sponge gourds because they told us that sponge gourds are able to survive in flood conditions. They stated that these luffa plants resisted not only floods but also droughts. Therefore, sponge gourd accessions might be useful for the breeding of drought and flood resistant varieties in Cucurbitaceae vegetables, if research will be improved.

3) Fabaceous accessions

The accessions of Fabaceae included four hyacinth beans (*Lablab purpureus*), three cowpeas (*Vigna unguiculate*), and one mungbean (*Vigna radiata*). Many farmers grew hyacinth beans because they stated it can thrive in the rainy season. Because of the limited crops available in flood-prone areas, only luffa and hyacinth beans were cultivated predominantly during the rainy season.

4) Amaranthaceous accessions

We collected eight species of *Amaranthus* accessions. All accessions were of the weedy type, which has black seeds, mainly *A. blitum*, and they are used as leafy vegetables. In the forestry area of Mean Chey village in Prey Veng province, we found an amaranth accession (No. 7) with thorns, identified as *A. spinosus*. Because amaranth is highly weedy, it grows in backyards and gardens even if farmers do not grow it, but in some cases, such as flood-prone areas, their seeds have been self-produced and preserved. The farmers stated that amaranth is a fast-growing plant and can be cultivated toward the end of the rainy season.

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References

- Bosland PW and Votava EJ (1999) Peppers: vegetable and spice capsicum. CABI, Wallingford, pp. 14-22.
- Kondo F, Layheng S, Tokuda M, Rathnayaka RMSMB, Sophany S and Matsushima K (2019) Collaborative exploration of plant genetic resources in northern Cambodia, 2018. AREIPGR 35: 162-184.

[View this article]

- Matsunaga H, Matsushima K, Tanaka K, Theavy S, Lay Heng S, Channa T, Takahashi Y and Tomooka N (2015) Collaborative exploration of the Solanaceae and Cucurbitaceae vegetable genetic resources in Cambodia, 2014. AREIPGR 31: 169-187.
[View this article]
- Matsunaga H, Yokota M, Leakhena M and Sophany S (2018) Collaborative exploration of Solanaceae vegetable genetic resources in southern Cambodia, 2017. AREIPGR 34: 102-117.
[View this article]
- Matsushima K, Layheng S, Hatakeyama K, Kurumada S and Sophany S (2018) Collaborative exploration of plant genetic resources in eastern Cambodia, 2017. AREIPGR 34: 118-136.
[View this article]
- Sugita T, Matsunaga H, Theavy S and Sophany S (2017) Collaborative exploration of *Capsicum* genetic resources in northern Cambodia, 2016. AREIPGR 33: 207-221.
[View this article]
- Sreynech O, Sophany S, Nonaka E and Okuizumi H (2016) Collaborative exploration and collection of plant genetic resources in Cambodia November 2015. AREIPGR 32: 89-107.
[View this article]
- Takahashi Y, Lay Heng S, Channa T, Makara O and Tomooka N (2015) Exploration of leguminous crops and their wild relatives in western regions of Cambodia, 2014. AREIPGR 31: 121-149.
[View this article]
- Tanaka K, Duong T-T, Yamashita H, Lay Heng S, Sophany S and Kato K (2016) Collection of Cucurbit crops (Cucurbitaceae) from eastern Cambodia, 2015. AREIPGR 32: 109-137.
[View this article]
- Tanaka K, Shigeta G, Sophea Y, Thun V, Sophany S and Kato K (2017) Collection of melon and other Cucurbitaceous crops in Cambodia in 2016. AREIPGR 33: 175-205.
[View this article]
- Tanaka Y, Matsunaga H, Theavy S, Lay Heng S and Sophany S (2016) Collaborative survey of Solanaceous genetic resources in eastern Cambodia, 2015. AREIPGR 32: 139-157.
[View this article]

南カンボジアにおける植物遺伝資源の共同探索，2019 年

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和文摘要

Plant Genetic Resources in Asia (PGRAsia) プロジェクトの下，研究開発法人 農業・食品産業技術総合研究機構 (NARO) とカンボジア農業開発研究所 (CARDI) は，2014 年からミャンマーにおける植物遺伝資源探索を共同実施している．その一環として，2019 年 10 月 1 日から 10 日までカンボジア南部の植物遺伝資源の探索・収集を実施した．探索は，Svay Rieng, Pery Veng, Kondal, Phnom Penh, Kompong Speu, Preah Sihanouk, Koh Kong, Kompot, Takeo 県を含むカンボジア南部の 14 地区で実施し，農家で保存している種子の他，庭または畑の植物から合計 85 系統を収集した．これらにはナス科が 34 系統，ウリ科が 35 系統，マメ科が 8 系統そしてヒユ科が 8 系統含まれ，そのうち，ナス科ではトウガラシが 29 系統収集されたが，いずれも *C. frutescens* に属するものであった．今回の探索地域は洪水多発地域であったため，雨季は通常の野菜栽培が少なく，洪水時でも栽培可能なヘチマ類やフジマメが重要な野菜とされていた．収集した遺伝資源種子は，SMTA によりカンボジアの CARDI と日本の農研機構遺伝資源センターのジーンバンクに均等に分配された．

Table 3. List of plant accessions collected in Cambodia during 2019 exploration

JP No.	Individual No.	Date	Species name	Local name	Province	District	Commune	Village	Latitude	Longitude	Altitude (m)	Source
271483	1	2-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Svay Rieng	Svay Teap	Chrokmaras	Veal	N11°03'37.2"	E106°00'13.0"	7	Field
271484	2	2-Oct	<i>Luffa acutangula</i>	No Nong	Svay Rieng	Svay Teap	Chrokmaras	Veal	N11°03'37.2"	E106°00'13.0"	7	Field
271485	3	2-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Svay Rieng	Svay Teap	Chrokmaras	Veal	N11°04'06.5"	E106°00'15.9"	5	Backyard
271486	4	2-Oct	<i>Amaranthus</i> sp.	Pty Dong	Svay Rieng	Svay Teap	Chrokmaras	Veal	N11°04'06.5"	E106°00'15.9"	5	Backyard
271487	5	3-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	11	Forest
271488	6	3-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	11	Forest
271489	7	3-Oct	<i>Amaranthus</i> sp.	Pty Dong	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	11	Forest
271490	8	3-Oct	<i>Luffa cylindrica</i>	No Nong	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	11	House
271491	9	3-Oct	<i>Vigna unguiculata</i>	Son Deak Kour	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	11	House
271492	10	3-Oct	<i>Amaranthus</i> sp.	Pty Dong	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	18	Backyard
271493	11	3-Oct	<i>Benincasa hispida</i>	Tro Lach	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	18	House
271494	12	3-Oct	<i>Cucurbita moschata</i>	Lapov	Prey Veng	Peam Chor	Kosh Chek	Mean Chey	N11°04'23.1"	E105°13'50.8"	18	House
271495	13	3-Oct	<i>Amaranthus</i> sp.	Pty Dong	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'31.2"	E105°20'50.0"	*	Backyard
271496	14	3-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'31.2"	E105°20'50.0"	*	Backyard
271497	15	3-Oct	<i>Cucurbita moschata</i>	Lapov	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	House
271498	16	3-Oct	<i>Vigna radiata</i>	Son Deak Bay	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	House
271499	17	3-Oct	<i>Benincasa hispida</i>	Tro Lach	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	House
271500	18	3-Oct	<i>Solanum melongena</i>	Trob Srouy	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	House
271501	19	3-Oct	<i>Luffa cylindrica</i>	No Nong	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	House
271502	20	3-Oct	<i>Capsicum frutescens</i>	Mates Sor	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	Backyard
271503	21	3-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Prey Veng	Prey Veng city	Ta Ko	Shkor Dach	N11°30'50.4"	E105°21'02.5"	7	Backyard
271504	22	3-Oct	<i>Capsicum frutescens</i>	Mates Sor	Prey Veng	Prey Veng city	Ta Ko	Knoy	N11°31'24.5"	E105°21'40.0"	9	Backyard
271505	23	3-Oct	<i>Solanum melongena</i>	Trob Srouy	Prey Veng	Prey Veng city	Ta Ko	Knoy	N11°31'24.5"	E105°21'40.0"	9	Field
271506	24	3-Oct	<i>Amaranthus</i> sp.	Pty Dong	Prey Veng	Prey Veng city	Ta Ko	Knoy	N11°31'24.5"	E105°21'40.0"	9	Backyard
271507	25	3-Oct	<i>Luffa cylindrica</i>	No Nong	Prey Veng	Prey Veng city	Ta Ko	Knoy	N11°31'24.5"	E105°21'40.0"	9	House
271508	26	4-Oct	<i>Luffa cylindrica</i>	No Nong	Kandal	Takmoa	Roka Khpos	Prek Loung	N11°23'12.5"	E105°00'02.1"	13	House
271509	27	4-Oct	<i>Coccinia grandis</i>	Shlik Bas	Phnom Penh	Pou Senchey	Bing Thuom	Prey Ta Khea	N11°28'47.8"	E104°44'58.1"	34	Roadside
271510	28	4-Oct	<i>Luffa acutangula</i>	No Nong	Kampong Speu	Chba Moun	Chba Moun	Som Pov	N11°28'22.7"	E104°28'14.7"	43	House
271511	29	4-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Kampong Speu	Tang Kroch	Tang Kroch	Choum Phey	N11°28'28.3"	E104°26'45.1"	47	Backyard
271512	30	4-Oct	<i>Capsicum frutescens</i>	Mates Sor	Kampong Speu	Tang Kroch	Tang Kroch	Choum Phey	N11°28'30.3"	E104°26'40.7"	47	Backyard
271513	31	4-Oct	<i>Luffa cylindrica</i>	No Nong	Kampong Speu	Tang Kroch	Tang Kroch	Choum Phey	N11°28'31.1"	E104°26'41.2"	44	Field
271514	32	5-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'40.3"	E104°31'16.2"	39	Market
271515	33	5-Oct	<i>Capsicum frutescens</i>	Matas Sor	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'40.3"	E104°31'16.2"	39	Market
271516	34	5-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'40.3"	E104°31'16.2"	39	Market
271517	35	5-Oct	<i>Cucurbita moschata</i>	Lapov Klong	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'40.3"	E104°31'16.2"	39	Market
271518	36	5-Oct	<i>Cucurbita moschata</i>	Lapuv Roy	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'40.3"	E104°31'16.2"	39	Market
271519	37	5-Oct	<i>Capsicum frutescens</i>	Mates Sor	Kampong Speu	Chba Moun	Roka Yhwn	Pea Nichakam	N11°27'42.2"	E104°31'16.3"	38	Market
271520	38	5-Oct	<i>Capsicum frutescens</i>	Mates Sor	Preah Sihanouk	Kompong Seila	Kompong Seila	Veal	N11°05'09.5"	E103°54'12.3"	16	Backyard

Table 3. (Continued).

JP No.	Individual No.	Date	Species name	Local name	Province	District	Commune	Village	Latitude	Longitude	Altitude (m)	Source
271521	39	5-Oct	<i>Luffa cylindrica</i>	No Nong	Preah Sihanouk	Kompong Seila	Kompong Seila	Thmey	N11°04'32.0"	E103°54'26.2"	14	Backyard
271522	40	5-Oct	<i>Capsicum frutescens</i>	Mates Sor	Preah Sihanouk	Kompong Seila	Kompong Seila	Thmey	N11°04'32.1"	E103°54'26.3"	14	Backyard
271523	41	5-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Preah Sihanouk	Kompong Seila	Kompong Seila	Thmey	N11°04'32.2"	E103°54'26.4"	14	Backyard
271524	42	5-Oct	<i>Lagenaria siceraria</i>	Khlok	Preah Sihanouk	Kompong Seila	Kompong Seila	Thmey	N11°04'32.3"	E103°54'26.5"	14	House
271525	43	6-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Koh Kong	Thmor Bang	Russie Chrom	Koki Chrom	N11°38'50.3"	E103°23'52.8"	346	Field
271526	44	6-Oct	<i>Solanum torvum</i>	Trob Jour	Koh Kong	Thmor Bang	Russie Chrom	Koki Chrom	N11°39'11.4"	E103°24'14.5"	346	Field
271527	45	6-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Koh Kong	Thmor Bang	Russie Chrom	Koki Chrom	N11°39'11.4"	E103°24'14.5"	356	Field
271528	46	6-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Koh Kong	Thmor Bang	Russie Chrom	Koki Chrom	N11°39'11.4"	E103°24'14.5"	356	Field
271529	47	6-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Koh Kong	Thmor Bang	Russie Chrom	Koki Chrom	N11°39'11.4"	E103°24'14.5"	356	Field
271530	48	7-Oct	<i>Amaranthus sp.</i>	Pty Dong	Kampot	Kompong Trach	Prasat Phnom Khcorg	Chrous Tasoum	N10°36'19.1"	E104°31'36.2"	8	Backyard
271531	49	7-Oct	<i>Lablab purpureus</i>	Po Peay Khda	Kampot	Kompong Trach	Prasat Phnom Khcorg	Chrous Tasoum	N10°36'19.1"	E104°31'36.2"	8	Backyard
271532	50	7-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Kampot	Kompong Trach	Prasat Phnom Khcorg	Chrous Tasoum	N10°36'19.1"	E104°31'36.2"	8	Backyard
271533	51	7-Oct	<i>Capsicum frutescens</i>	Mates Sor	Kampot	Kompong Trach	Prasat Phnom Khcorg	Chrous Tasoum	N10°36'19.1"	E104°31'36.2"	8	Backyard
271534	52	7-Oct	<i>Cucurbita moschata</i>	Lapov	Kampot	Sorn Rong Ler	Bontey Meas	Dom Nak Chombok	N10°43'54.4"	E104°35'36.7"	16	Market
271535	53	7-Oct	<i>Cucumis melo</i>	Tro Sork Srov	Kampot	Sorn Rong Ler	Bontey Meas	Dom Nak Chombok	N10°44'27.4"	E104°35'56.9"	20	Market
271536	54	7-Oct	<i>Luffa cylindrica</i>	No Nong	Kampot	Angkor Chey	Phnom Kong	Phnom Threal	N10°46'11.8"	E104°39'15.6"	22	Backyard
271537	55	7-Oct	<i>Lablab purpureus</i>	Po Peay Khda	Kampot	Angkor Chey	Phnom Kong	Phnom Threal	N10°46'11.8"	E104°39'15.6"	22	Backyard
271538	56	7-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Kampot	Angkor Chey	Phnom Kong	Phnom Threal	N10°46'11.8"	E104°39'15.6"	22	Backyard
271539	57	7-Oct	<i>Lagenaria siceraria</i>	Khlok	Kampot	Angkor Chey	Phnom Kong	Phnom Threal	N10°46'14.0"	E104°39'10.0"	20	House
271540	58	7-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Takeo	Tram Kak	Leay Bou	Bak Kout	N10°59'32.6"	E104°42'04.4"	11	Backyard
271541	59	7-Oct	<i>Solanum melongena</i>	Trob Srouy	Takeo	Tram Kak	Leay Bou	Bak Kout	N10°59'32.6"	E104°42'04.4"	11	Backyard
271542	60	7-Oct	<i>Lablab purpureus</i>	Po Peay Khda	Takeo	Tram Kak	Leay Bou	Bak Kout	N10°59'32.6"	E104°42'04.4"	11	House
271543	61	7-Oct	<i>Luffa cylindrica</i>	No Nong	Takeo	Tram Kak	Leay Bou	Bak Kout	N10°59'32.6"	E104°42'04.4"	11	House
271544	62	7-Oct	<i>Cucurbita moschata</i>	Lapov	Takeo	Tram Kak	Leay Bou	Bak Kout	N10°59'32.6"	E104°42'04.4"	11	House
271545	63	7-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Takeo	Tram Kak	Leay Bou	Khach Trouk	N10°59'32.8"	E104°42'43.4"	10	Backyard
271546	64	7-Oct	<i>Amaranthus sp.</i>	Pty Dong	Takeo	Tram Kak	Leay Bou	Khach Trouk	N10°59'32.8"	E104°42'43.4"	10	Backyard
271547	65	7-Oct	<i>Luffa acutangula</i>	No Nong	Takeo	Tram Kak	Leay Bou	Ang Koki	N10°59'22.8"	E104°43'18.5"	8	House
271548	66	7-Oct	<i>Cucumis sativus</i>	Tro Sork	Takeo	Tram Kak	Leay Bou	Ang Koki	N10°59'22.8"	E104°43'18.5"	8	House
271549	67	7-Oct	<i>Cucurbita moschata</i>	Lapuv Roy	Takeo	Tram Kak	Leay Bou	Ang Koki	N10°59'22.8"	E104°43'18.5"	8	House
271550	68	7-Oct	<i>Lablab purpureus</i>	Po Peay chhlog	Takeo	Tram Kak	Leay Bou	Ang Koki	N10°59'22.8"	E104°43'18.5"	8	House
271551	69	7-Oct	<i>Capsicum frutescens</i>	Mates Sor	Takeo	Tram Kak	Leay Bou	Ang Koki	N10°59'22.8"	E104°43'18.5"	8	Backyard
271552	70	8-Oct	<i>Benincasa hispida</i>	Tro Lach	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°09'18.0"	E104°54'21.0"	10	Backyard
271553	71	8-Oct	<i>Cucumis melo</i>	Tro Sork Srov	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'41.0"	E104°54'19.0"	10	House
271554	72	8-Oct	<i>Cucurbita moschata</i>	Lapov Klong	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'41.0"	E104°54'19.0"	10	House
271555	73	8-Oct	<i>Benincasa hispida</i>	Tro lach	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'41.0"	E104°54'19.0"	10	House
271556	74	8-Oct	<i>Solanum trilobatum</i>	Trob jour	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'43.0"	E104°54'19.0"	10	Backyard
271557	75	8-Oct	<i>Luffa cylindrica</i>	No Nong	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'45.0"	E104°54'18.0"	10	Backyard
271558	76	8-Oct	<i>Momordica charantia</i>	Mar rah	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	Field

Table 3. (Continued).

JP No.	Individual No.	Date	Species name	Local name	Province	District	Commune	Village	Latitude	Longitude	Altitude (m)	Source
271559	77	8-Oct	<i>Capsicum frutescens</i>	Mates Sor	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	Backyard
271560	78	8-Oct	<i>Capsicum frutescens</i>	Mates Arch Sath	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	Backyard
271561	79	8-Oct	<i>Amaranthus</i> sp.	Pty Dong	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	Backyard
271562	80	8-Oct	<i>Luffa cylindrica</i>	No Nong	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House
271563	81	8-Oct	<i>Vigna unguiculata</i>	Son Deak Vag	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House
271564	82	8-Oct	<i>Vigna unguiculata</i>	Son Deak Seag	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House
271565	83	8-Oct	<i>Cucumis melo</i>	Tro Sork Srov	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House
271566	84	8-Oct	<i>Cucumis sativus</i>	Tro Sork	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House
271567	85	8-Oct	<i>Cucurbita moschata</i>	Lapov Klong	Takeo	Prey Kabas	Choum Pa	Choum Phoprik	N11°07'44.0"	E104°54'15.0"	10	House

Photo of the collected genetic resources and samples



Sample Photo 1.
No. 1. *Capsicum frutescens*



Sample Photo 2.
No. 2. *Luffa acutangula*



Sample Photo 3.
No. 3. *Capsicum frutescens*



Sample Photo 4.
No. 4. *Amaranthus* sp.



Sample Photo 5.
No. 5. *Capsicum frutescens*



Sample Photo 6.
No. 6. *Capsicum frutescens*



Sample Photo 7.
No. 7. *Amaranthus* sp.



Sample Photo 8.
No. 8. *Luffa cylindrica*



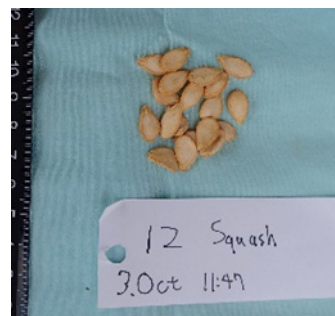
Sample Photo 9.
No. 9. *Vigna unguiculata*



Sample Photo 10.
No. 10. *Amaranthus* sp.



Sample Photo 11.
No. 11. *Benincasa hispida*



Sample Photo 12.
No. 12. *Cucurbita moschata*

Photo of the collected genetic resources and samples



Sample Photo 13.
No. 13. *Amaranthus* sp.



Sample Photo 14.
No. 14. *Capsicum frutescens*



Sample Photo 15.
No. 15. *Cucurbita moschata*



Sample Photo 16.
No. 16. *Vigna radiata*



Sample Photo 17.
No. 17. *Benincasa hispida*



Sample Photo 18.
No. 18. *Solanum melongena*



Sample Photo 19.
No. 19. *Luffa cylindrica*



Sample Photo 20.
No. 20. *Capsicum frutescens*



Sample Photo 21.
No. 21. *Capsicum frutescens*

Photo of the collected genetic resources and samples



Sample Photo 22.
No. 22. *Capsicum frutescens*



Sample Photo 23.
No. 23. *Solanum melongena*



Sample Photo 24.
No. 24. *Amaranthus* sp.



Sample Photo 25.
No. 25. *Luffa cylindrica*



Sample Photo 26.
No. 27. *Coccinia grandis*



Sample Photo 27.
No. 28. *Luffa acutangula*



Sample Photo 28.
No. 29. *Capsicum frutescens*



Sample Photo 29.
No. 30. *Capsicum frutescens*



Sample Photo 30.
No. 31. *Luffa cylindrica*



Sample Photo 31.
No. 32. *Capsicum frutescens*



Sample Photo 32.
No. 33. *Capsicum frutescens*



Sample Photo 33.
No. 34. *Capsicum frutescens*

Photo of the collected genetic resources and samples



Sample Photo 34.
Sold fruit of No. 35 *Cucurbita moschata*, at the market.



Sample Photo 35.
No. 35. *Cucurbita moschata*



Sample Photo 36.
No. 36. *Cucurbita moschata*



Sample Photo 37.
No. 37. *Capsicum frutescens*



Sample Photo 38.
No. 38. *Capsicum frutescens*



Sample Photo 39.
Immature fruit of No. 39 *Luffa cylindrica* on the plant.



Sample Photo 40.
Dried mature fruit of No. 39. *Luffa cylindrica* for seeds.



Sample Photo 41.
No. 40. *Capsicum frutescens*



Sample Photo 42.
No. 41. *Capsicum frutescens*

Photo of the collected genetic resources and samples



Sample Photo 43.
No. 42. *Lageneria siceraria*



Sample Photo 44.
No. 43. *Capsicum frutescens*



Sample Photo 45.
No. 44. *Solanum torvum*



Sample Photo 46.
No. 45. *Capsicum frutescens*



Sample Photo 47.
No. 46. *Capsicum frutescens*



Sample Photo 48.
No. 47. *Capsicum frutescens*



Sample Photo 49.
No. 48. *Amaranthus* sp.



Sample Photo 50.
No. 49. *Lablab purpureus*



Sample Photo 51.
No. 50. *Capsicum frutescens*



Sample Photo 52.
No. 51. *Capsicum frutescens*



Sample Photo 53.
No. 52. *Cucurbita moschata*



Sample Photo 54.
No. 53. *Cucumis melo*

Photo of the collected genetic resources and samples



Sample Photo 55.
No. 54. *Luffa cylindrica*



Sample Photo 56.
No. 55. *Lablab purpureus*



Sample Photo 57.
No. 56. *Capsicum frutescens*



Sample Photo 58.
No. 57. *Lagenaria siceraria*



Sample Photo 59.
No. 58. *Capsicum frutescens*



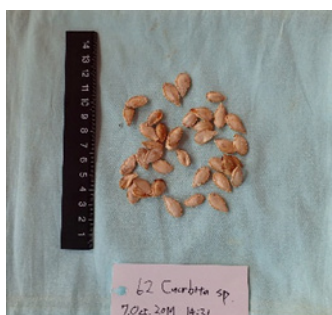
Sample Photo 60.
No. 59. *Solanum melongena*



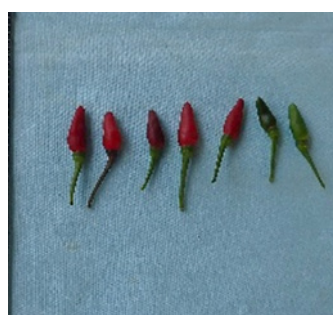
Sample Photo 61.
No. 60. *Lablab purpureus*



Sample Photo 62.
No. 61. *Luffa cylindrica*



Sample Photo 63.
No. 62. *Cucurbita moschata*



Sample Photo 64.
No. 63. *Capsicum frutescens*



Sample Photo 65.
No. 64. *Amaranthus* sp.

Photo of the collected genetic resources and samples



Sample Photo 66.
No. 65. *Luffa acutangula*



Sample Photo 67.
No. 66. *Cucumis sativus*



Sample Photo 68.
No. 67. *Cucurbita moschata*



Sample Photo 69.
No. 68. *Lablab purpureus*



Sample Photo 70.
No. 69. *Capsicum frutescens*



Sample Photo 71.
No. 70. *Benincasa hispida*



Sample Photo 72.
No. 71. *Cucumis melo*



Sample Photo 73.
No. 72. *Cucurbita moschata*



Sample Photo 74.
No. 73. *Benincasa hispida*



Sample Photo 75.
No. 74. *Solanum trilobatum*



Sample Photo 76.
Flower of No. 74. *Solanum trilobatum*

Photo of the collected genetic resources and samples



Sample Photo 77.
Leaves of No. 74. *Solanum trilobatum*



Sample Photo 78.
Flower of No. 75. *Luffa cylindrica*



Sample Photo 79.
Mature fruit of No. 75. *Luffa cylindrica*



Sample Photo 80.
No. 76. *Momordica charantia*



Sample Photo 81.
No. 77. *Capsicum frutescens*



Sample Photo 82.
No. 78. *Capsicum frutescens*



Sample Photo 83.
No. 79. *Amaranthus* sp.



Sample Photo 84.
No. 80. *Luffa cylindrica*



Sample Photo 85.
No. 81. *Vigna unguiculata*

Photo of the collected genetic resources and samples



Sample Photo 86.
No. 82. *Vigna unguiculata*



Sample Photo 87.
No. 83. *Cucumis melo*



Sample Photo 88.
No. 84. *Cucumis sativus*



Sample Photo 89.
No. 85. *Cucurbita moschata*