

Collaborative Exploration of Solanaceae Vegetable Genetic Resources in Central and Mid-Western Cambodia in 2018

メタデータ	<p>言語: eng</p> <p>出版者:</p> <p>公開日: 2020-03-12</p> <p>キーワード (Ja):</p> <p>キーワード (En): Capsicum annuum, Capsicum frutescens, chili pepper, eggplant</p> <p>作成者: 松永, 啓, 田中, 義行, LEAKHENA, Mat, Sophany, SAKHAN</p> <p>メールアドレス:</p> <p>所属:</p>
URL	<p>https://doi.org/10.24514/00003225</p>

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Original Paper

Collaborative Exploration of Solanaceae Vegetable Genetic Resources in Central and Mid-Western Cambodia in 2018

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Communicated by N. TOMOOKA (Genetic Resources Center, NARO)

Received Oct. 19, 2019, Accepted Dec. 2, 2019

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Summary

The National Agriculture and Food Research Organization (NARO) and Cambodian Agricultural Research and Development Institute (CARDI) have collaborated since 2014 under the Plant Genetic Resources in Asia (PGRAsia) project to survey the vegetable genetic resources available in Cambodia. As part of this project, four field surveys of Solanaceae crops were conducted in November 2014, 2015, 2016, and 2017 in western, eastern, northern, and southern Cambodia, respectively. In November 2018, we conducted a fifth field survey in central and mid-western Cambodia, including the Kampong Cham, Kampong Thom, Preah Vihear, Kampong Chhnang, Kamdal, Pursat, and Battambang Provinces. We collected a total of 75 accessions, including 64 chili pepper (15 *Capsicum annuum* and 49 *Capsicum frutescens*) and 11 eggplant (*Solanum melongena*) fruit samples, from farmers, a market, and a mini mart. After seeds were harvested from the collected fruits, the seeds were equally divided in two: half were conserved in the CARDI, and the other half were transferred to the Genetic Resource Center, NARO, by using the standard material transfer agreement.

KEY WORDS: *Capsicum annuum*, *Capsicum frutescens*, chili pepper, eggplant

Introduction

Many genetic resources for vegetables are available in Southeast Asia, such as Solanaceae crops (Yamamoto and Nawata 2005; Matsunaga *et al.* 2010); owing to their remarkable genetic diversity, they are considered valuable resources for breeding programs (Saito *et al.* 2006; Matsunaga *et al.* 2015). However, only a few worldwide chili pepper genetic resources from Cambodia are available (Matsunaga *et al.* 2015). Therefore, promoting the collection and exploration of genetic resources in this area is necessary. Recently, chili pepper (*Capsicum* spp.) landraces traditionally cultivated in this region have been replaced by high-quality and high-yielding varieties imported from neighboring countries (Sugita *et al.* 2017). The genetic diversity among the crops grown in this region has thus begun to decrease, indicating the need to preserve and ensure the diversity of traditional landraces.

In July 2014, the National Agriculture and Food Research Organization (NARO) in Japan and the Cambodian Agricultural Research and Development Institute (CARDI) established a Joint Research Agreement (JRA) under the Plant Genetic Resources in Asia project (PGRAsia project) in trust of the Ministry of Agriculture, Forestry and Fisheries of Japan to preserve and ensure the effective use of genetic resources. As a part of the JRA, four Solanaceae crop field surveys were completed in Cambodia. The first survey was conducted in November 2014 in western Cambodia and covered a route through to the south of Tonlé Sap Lake (Matsunaga *et al.* 2015). The second survey was conducted in November 2015 in eastern Cambodia and included the Mondulkiri and Ratanakiri highlands (Tanaka *et al.* 2016). The third survey was conducted in November 2016 in northern Cambodia and covered a route through to the north of Tonlé Sap Lake (Sugita *et al.* 2017). The fourth survey was conducted in November 2017 in southern Cambodia and covered a route through to the south of Phnom Penh capital (Matsunaga *et al.* 2018).

In 2018, NARO and CARDI again established the JRA under the PGRAsia project phase 2. As a part of the JRA, we conducted Solanaceae crop field survey in central and mid-western Cambodia in November 2018 as the fifth survey and collected chili pepper and eggplant samples. This report presents the results of the fifth survey.

Methods

A field survey was conducted in the central and mid-western region of Cambodia between November 7 and 15, 2018 (Table 1, Fig. 1). The survey trip started in Phnom Penh on November 7. We then explored the Kampong Cham, Kampong Thom, Preah Vihear, Kampong Chhnang, Kamdal, Pursat, and Battambang Provinces. Survey activities included the collection of accessions (obtained from farmers' houses, backyards, and fields; a market; and a mini mart), interviews, and plant observations. We used a car for transportation. We stopped at markets (Photos 1 and 2) and farmers' houses and interviewed persons (Photos 3 and 4) regarding the local names, origins, cultivation, and utilization of chili pepper and eggplant accessions. During the survey, chili pepper and eggplant plants were observed in all provinces visited. We collected representative accessions to cover the diversity in the area. In farmers' backyards and fields, we attempted to collect mature fruits from one plant. In markets, we attempted to collect mature fruits that seemed, based on their appearance, to be harvested from the same accession. After mature fruits were collected, we harvested the seeds from them within three days. The identification of the *Capsicum* species was based on a taxonomic key (Eshbaugh 2012). When a sample was collected, we further recorded the place name and location information (latitude, longitude, and altitude), which were determined using a global positioning system.

Results

Summary of samples collected

Seventy-five fruit samples were collected at the survey sites (44 farmers' backyards; three from farmers' fields; and one each farmers' shop, market, and mini mart) in central and mid-western Cambodia. The samples consisted of 15 *C. annuum*, 49 *C. frutescens*, and 11 *Solanum melongena* (Tables 2 and 3). The detailed information for the accessions collected is shown in Table 3. The seeds were shared equally between NARO and CARDI.

Table 1. Itinerary followed during the 2018 survey in central and mid-western Cambodia

Date	Day	Itinerary	Stay
6-Nov	Tue	Chubu 00:30 (TG647) -- 05:10 Bangkok 07:40 (TG2586) -- 08:50 Phnom Penh Cambodian Agricultural Research and Development Institute (CARDI).	Phnom Penh
7-Nov	Wed	Phnom Penh -- Kampong Cham -- east side of Mekong river -- island in Mekong river -- Kampong Cham	Kampong Cham
8-Nov	Thu	Kampong Cham -- west side of Mekong river -- Kampong Chem --Kampong Thnor -- Kampong Thom	Kampong Thom
9-Nov	Fri	Kampong Thom -- Sambour -- Phnom Deck -- Kampong Thom	Kampong Thom
10-Nov	Sat	Kampong Thom -- Udong -- south area of Udong -- Kampong Chnang	Kampong Chnang
11-Nov	Sun	Kampong Chnang -- Romeas -- Ou Ruessei -- Kampong Chnang	Kampong Chnang
12-Nov	Mon	Kampong Chnang -- Route 145 -- Pursat -- Phnum Kravanh -- Pramoay -- Pursat	Pursat
13-Nov	Tue	Pursat -- Svay Luong -- Route 55 -- Svay Sa -- Pursat -- Route 146 -- Pursat	Pursat
14-Nov	Wed	Pursat -- Route 5 -- Route 150 -- Route 5 -- Battambang -- Route 154 -- Battambang -- Pursat	Pursat
15-Nov	Thu	Pursat -- Phnom Penh	Phnom Penh
16-Nov	Fri	Meeting in CARDI. Phnom Penh 16:05 (TG2583) -- 17:15 Bangkok	on flight
17-Nov	Sat	Bangkok 00:05 (TG644) -- 7:30 Chubu	

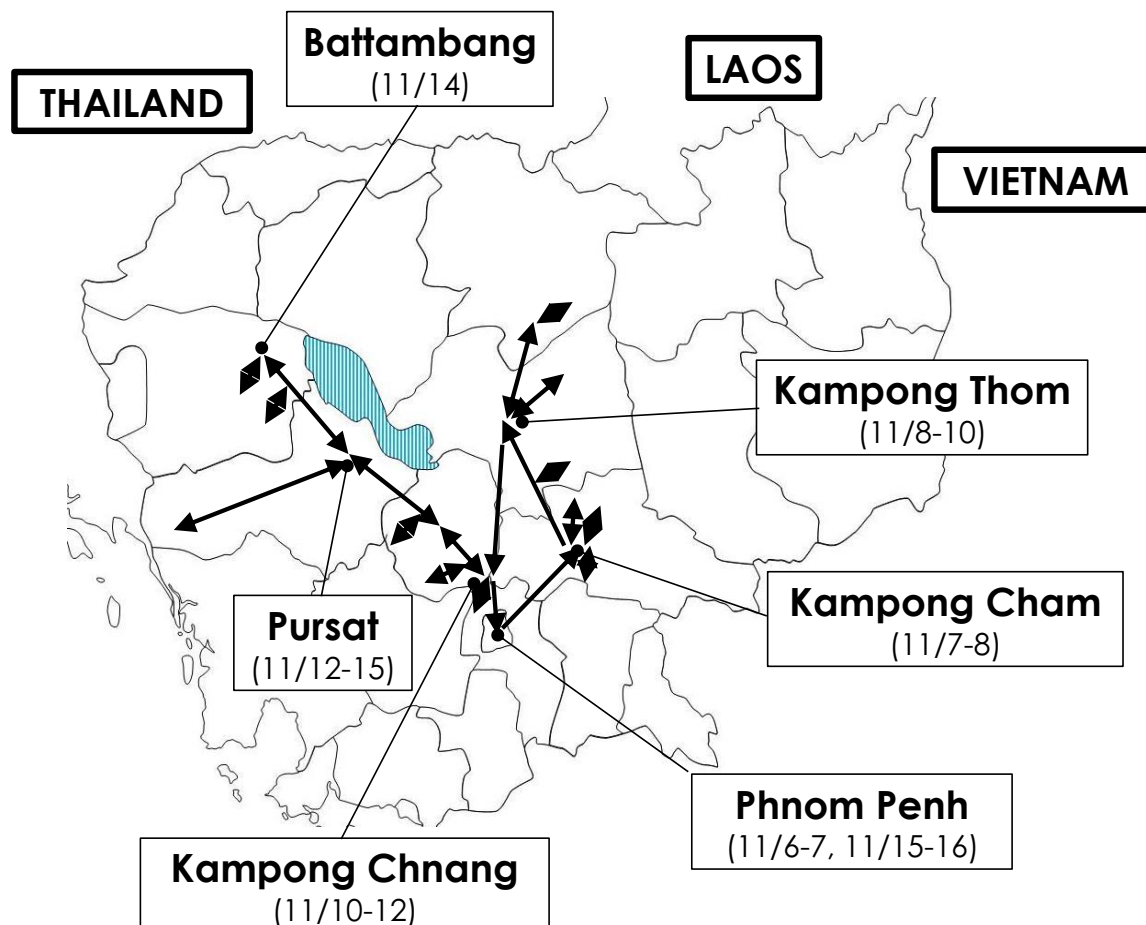


Fig. 1. The route of the fifth field survey in 2018 in central and mid-western Cambodia.

Daily record of the field survey

November 7: We left Phnom Penh and traveled toward Kampong Cham Province on Route 6A and 7. After arrived at Kampong Cham, we went to the west side of the Mekong River and collected one chili pepper fruit sample (No. 1). Subsequently, we went to the east side of the river and found several vegetable fields; however, most plants were young and had no fruits (Photo 5). This area received excessive rain until the end of September, and vegetable cultivation started in October. Hence, we stopped collecting samples from this area and moved to an island in the Mekong River. From this island, we collected one eggplant fruit sample (No. 2) and three chili pepper fruits samples (Nos. 3-5) from two neighboring farmers.

November 8: Before breakfast, we collected one chili pepper fruits sample (No. 6) decorated in front of mini mart (Photo 6). The owner of the mini mart said that it was derived from Thailand. We went to north on the road along the west side of the Mekong River. Along the road, we collected one chili pepper fruit sample (No. 7) from a farmer, one chili pepper fruit sample (No. 8) from another farmer, two chili pepper fruit samples (Nos. 9 and 10) from a third farmer, one eggplant fruit sample (No. 11) from a fourth farmer, two chili pepper fruit samples (Nos. 12 and 13) from a fifth farmer, and one eggplant fruit sample (No. 14) from a sixth farmer.

Next, we moved to Kampong Thnor on Routes 7, 71, and 6. First, we visited a market (Bongkok market). In this market, we found *C. annuum* and eggplants, but not *C. frutescens*. We did not collect the fruits because they appeared to be hybrid accessions. Subsequently, we surveyed north area of Route 6. A few farmers cultivated chili peppers in this area; we collected two chili pepper fruit samples (Nos. 15 and 16) from the backyards of two farmers.

November 9: We went to Sambour area located in northeast Kampong Thom. In this area, we collected two chili pepper fruit samples (Nos. 17 and 18) from a farmer, one chili pepper fruit sample (No. 19) from a farmer's shop (Photo 7), one chili pepper and eggplant fruit samples (Nos. 20 and 21) from another farmer, and one chili pepper fruit sample (No. 22) derived from Thailand from a third farmer. Next, we visited Taouk market. In this market, we found several kinds of *C. annuum* and eggplants, but not *C. frutescens*. Subsequently, we moved north. We collected one chili pepper fruit sample (No. 23) from a farmer and two chili pepper fruit samples (Nos. 24 and 25) from another farmer. Sample No. 24 was an ornamental accession (Photo 8).

Table 2. Samples collected during the 2018 survey in central and mid-western Cambodia

Collection site (province)	<i>C. annuum</i>	<i>C. frutescens</i>	<i>S. melongena</i>	Total
Kampong Cham	4	7	3	14
Kampong Thom	2	8	1	11
Preah Vihear	0	4	0	4
Kandal	2	3	1	6
Kampong Chhnang	2	9	3	14
Pursat	2	15	2	19
Battambang	3	3	1	7
Total	15	49	11	75

After lunch, we moved northward and surveyed an area in the southern region of Preah Vihear Province. We collected two chili pepper fruit samples (No. 26 and 27) from a farmer, one chili pepper fruit sample (No. 28) from another farmer, and one chili pepper fruit sample (No. 29) from a third farmer in this area.

November 10: First, we visited Kampong Thom market. We found both *C. annuum* and *C. frutescens*. According to interviews with farmers, most *C. annuum* were derived from neighboring countries, and most *C. frutescens* were harvested in domestic areas.

Next, we moved to Udong located in Kandal Province on Routes 6, 7, 61, and 5. After arriving at Udong, we first visited Udong market. In this market, we found various kinds of *C. annuum*, but farmers informed us that almost all of them were derived from neighboring countries. Conversely, we found *C. frutescens* that were harvested in Kampong Chhnang Province.

We moved southward from Udong. We collected one chili pepper fruit sample (No. 30) from a farmer and two chili pepper fruit samples (Nos. 31 and 32) from another farmer. We moved further and collected one chili pepper fruit sample (No. 33) from a farmer and one chili pepper and eggplant fruit samples (Nos. 34 and 35) from another farmer.

November 11: We visited a mango field (Photo 9) located southward of Kampong Chhnang along Route 53. In this field, some workers harvested young mango fruits. We found some *C. frutescens* plants that had been growing for more than five years and some *C. annuum* plants growing for one to two years. We collected two chili pepper fruit samples (Nos. 36 and 37) from this field. We went further southward and collected one chili pepper fruit sample (No. 38). In addition, we moved to southeast and collected one chili pepper and eggplant fruit samples (Nos. 39 and 40) from a farmer who mainly cultivated rice. We also collected one chili pepper and eggplant samples (Nos. 41 and 42) from a neighboring farmer.

While returning to Kampong Chhnang, we visited Romeas market. In this market, we found some *C. annuum* fruits, but no *C. frutescens* fruits. After arriving at Kampong Chhnang, we went southward on the road of Route 5 and we turned west at Ou'Ruessei village. We collected three chili pepper fruit samples (Nos. 43-45) and one eggplant fruit sample (No. 46) from four different farmers.

November 12: We surveyed along the Route 145 and collected two chili pepper fruit samples (Nos. 47 and 48) from a farmer and one chili pepper sample (No. 49) from another farmer. We went to Pursat on the Routes 145 and 5. After arriving at Pursat, we traveled to Pramaoy. On the way, we collected one chili pepper fruit sample (No. 50) from a farmer. After arriving at Pramaoy, we surveyed along the road toward Thailand. Along the road, we collected two eggplant fruit samples (Nos. 51 and 52) and two chili pepper fruit samples (Nos. 53 and 54) from a farmer.

November 13: We visit Pursat market. In this market, we found some kinds of *C. annuum* fruits and *C. frutescens* fruits and collected two chili pepper fruit samples (Nos. 55 and 56). We moved toward Tonlé Sap Lake. On the way, we collected four chili pepper fruit sample (Nos. 57-60) from different farmers.

We went eastward on the Route 5 and turned to Route 55. We collected two chili pepper samples (Nos. 61 and 62) from a farmer near a railway crossing. Sample No. 61 was an ornamental accession (Photo 10)

imported from Thailand. Subsequently, we surveyed along Route 146. On the way, we collected two chili pepper fruit samples (Nos. 63 and 64) from a farmer, one chili pepper fruit sample (No. 65) from another farmer, and three chili pepper samples (Nos. 66–68) from a third farmer.

November 14: We moved to Battambang on the Route 5. On the way, we turned to Route 150. Along the road, we collected one chili pepper fruit sample (No. 69) from a farmer, one fruit sample each of chili pepper and eggplant (Nos. 70 and 71) from a different farmer, and one chili pepper fruit sample (No. 72) from a third farmer who lived next door to the second farmer. Among them, No. 72 seemed to be a progeny of a hybrid cultivar.

After arriving at Battambang, we went to the road on Route 154. Along the way, we collected three chili pepper samples (Nos. 73–75) from a farmer. Sample Nos. 73 and 74 were cultivated in his field and No. 75 was grown in his backyard. Among them, No. 75 was an ornamental chili pepper accession (Photo 11) obtained from Thailand.

November 15: We traveled back to Phnom Penh.

November 16: We reported the results of our field survey to CARDI and equally divided the collected dried seeds. Half were conserved at CARDI, and the other half were transferred to the Genetic Resource Center, NARO, by using the standard material transfer agreement (SMTA).

Discussion

We conducted the fifth collaborative exploration for Solanaceae vegetables genetic resources in Cambodia. In the present survey, 64 chili pepper and 11 eggplant accessions were collected from central and mid-western Cambodia (Tables 2 and 3). The chili pepper accessions included two species: 15 *C. annuum* and 49 *C. frutescens*. In the previous four explorations, 225 *Capsicum* accessions were collected, including 86 *C. annuum* and 139 *C. frutescens* (Matsunaga *et al.* 2015, 2018; Tanaka *et al.* 2016; Sugita *et al.* 2017), but none of the other domesticated *Capsicum* species, for example, *Capsicum chinense*, *Capsicum baccatum*, and *Capsicum pubescens*, were collected. These results suggest that *C. annuum* and *C. frutescens* are the major cultivated species in Cambodia, and the other *Capsicum* species are not widely used. This has already reported by Matsunaga *et al.* (2018), and we also found chili pepper of *C. annuum* and *C. frutescens* in the fifth exploration.

The 15 accessions identified as *C. annuum* included 10 accessions of “Mates Dai Neang” (Photo 12); two of “Mates Laev Aav” (Photos 6 and 11); one each of “Mates Toeu” (Photo 8), “Mates Phlaok” (Photo 13), and “Mates Phka” (Photo 10). “Mates” means *Capsicum* pepper, “Dai Neang” means “ring finger,” “Laev Aav” means “button for shirt,” “Phlaok” means “scrotum,” “Toeu” means “dwarf,” and “Phka” means “flower” in Khmer. Among *C. annuum* accessions, “Mates Dai Neang” was the most observed in the present survey, same as that in the previous surveys.

“Mates Laev Aav,” “Mates Toeu,” and “Mates Phka” are ornamental species. In the surveys conducted in 2014, 2015, and 2016, we could not find any ornamental *Capsicum* pepper (Matsunaga *et al.* 2015; Tanaka *et al.* 2016; Sugita *et al.* 2017), however, in the last and the present surveys, we found some ornamental *Capsicum* accessions (Matsunaga *et al.* 2018), suggesting that the cultivation of ornamental chili pepper is increasing in Cambodia.

Forty-nine accessions identified as *C. frutescens* included 28 accessions of “Mates Ach Sath” (Photo 14), 18 of “Mates Sor” (Photo 15), two of “Mates Chongol Miek,” and one of “Mates Kuiteav.” “Ach Sath” means “bird dropping,” “Sor” means “white or light color,” “Chongol Miek” means “point the sky,” and “Kuiteav” means “noodle” in Khmer. “Mates Ach Sath” and “Mates Sor” were the most observed *C. frutescens* in the present survey, same as that in the previous surveys.

In the previous four surveys, we observed *C. frutescens* in most markets that we visited. However, in this survey, we could not find *C. frutescens* in several markets. This could be because, recently, the price of exported fruits of *C. frutescens* has become higher than that of the domestic ones, in Cambodia, and hence, farmers might prefer to export their fruits instead of selling them in domestic markets.

We could also collect 11 eggplant accessions including eight accessions of “Trop Sruoy” (Photo 16), two of “Trop Veng” (Photo 17), and one of “Trop Khar” (Photo 18). “Trop” means “eggplant,” “Sruoy” means “brittle,” “Veng” means “long,” and “Khar” means “revolting” in Khmer. “Trop Sruoy” was the most observed in the present survey, same as that in the previous surveys.

We could collect 75 accessions in the present survey. The traits of these accessions will be evaluated in Cambodia and Japan, and valuable breeding materials may be found in these genetic resources.

Acknowledgments

This work was supported by a grant (PGRAsia Project phase 2) from the Ministry of Agriculture, Forestry, and Fisheries of Japan.

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2018 年カンボジア中央部および中西部における ナス科野菜遺伝資源の共同探索

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和文摘要

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、カンボジア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 Resources 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、2015 年、2016 年および 2017 年の 11 月に、それぞれカンボジアの西部、東部、北部および南部地域において、4 回のナス科作物の探索を実施した。2018 年 11 月に我々は、カンボジア中央部および中西部地域の Kampong Cham, Kampong Thom, Preah Vihear, Kampong Chhnang, Kamdal, Pursat および Battambang 州において、5 回目の探索を実施した。本探索において、15 点の *Capsicum annuum*、49 点の *Capsicum frutescens* および 11 点の *Solanum melongena* からなる合計 75 点のトウガラシおよびナスを農家、市場およびミニマートで収集した。収集した種子は 2 等分し、半分は CARDI で保存し、残りの半分は SMTA（Standard Material Transfer Agreement）により NARO のジーンバンクに移送した。

Table 3. List of *Capsicum* and eggplant samples collected in Cambodia during the 2018 survey

Coll. No.	Passport No.	JP No.	JP Name	Date	Genus & Species	Province /State	District	Commune	Village	North latitude / East longitude	Altitude (m)	Source (Market name)	Status	Local name	Fruit characteristics, origin, etc.
1	30075909	268486	COL/CAMBODIA/2018/NIVTS/001	Nov. 7	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Cham city	Boeng Kok	Chong Thnal	12-00-25 / 105-28-02	18	Farmer's House / backyard	landrace	Mates Sor	natural germinated
2	30075910	268487	COL/CAMBODIA/2018/NIVTS/002	Nov. 7	<i>Solanum melongena</i>	Kampong Cham	Kampong Siem	Kaoh Mitt	Kaoh Paen Kho	11-57-09 / 105-27-16	15	Farmer's House / backyard	landrace	Trop Sruoy	more than 1 year
3	30075911	268488	COL/CAMBODIA/2018/NIVTS/003	Nov. 7	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Siem	Kaoh Mitt	Kaoh Paen Kho	11-56-42 / 105-26-58	16	Farmer's House / backyard	landrace	Mates Chongol miek	traditional
4	30075912	268489	COL/CAMBODIA/2018/NIVTS/004	Nov. 7	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Siem	Kaoh Mitt	Kaoh Paen Kho	11-56-42 / 105-26-58	16	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
5	30075913	268490	COL/CAMBODIA/2018/NIVTS/005	Nov. 7	<i>Capsicum annuum</i>	Kampong Cham	Kampong Siem	Kaoh Mitt	Kaoh Paen Kho	11-56-42 / 105-26-58	16	Farmer's House / backyard	landrace	Mates Dai Neang	traditional
6	30075914	268491	COL/CAMBODIA/2018/NIVTS/006	Nov. 8	<i>Capsicum annuum</i>	Kampong Cham	Kampong Cham city	Veal Vong	Phum Bei	11-59-09 / 105-27-45	19	mini mart	landrace	Mates Laev Aav	ornamental
7	30075915	268492	COL/CAMBODIA/2018/NIVTS/007	Nov. 8	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Siem	Ro'aing	Prek Svey	12-01-36 / 105-28-19	19	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
8	30075916	268493	COL/CAMBODIA/2018/NIVTS/008	Nov. 8	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Siem	Ro'aing	Ro'ang Kraom	12-02-14 / 105-28-42	25	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
9	30075917	268494	COL/CAMBODIA/2018/NIVTS/009	Nov. 8	<i>Capsicum frutescens</i>	Kampong Cham	Kampong Siem	Kien Chrey	Spean Thmei	12-04-25 / 105-29-53	22	Farmer's House / backyard	landrace	Mates Sor	traditional
10	30075918	268495	COL/CAMBODIA/2018/NIVTS/010	Nov. 8	<i>Capsicum annuum</i>	Kampong Cham	Kampong Siem	Kien Chrey	Spean Thmei	12-04-25 / 105-29-53	22	Farmer's House / backyard	landrace	Mates Dai Neang	traditional
11	30075919	268496	COL/CAMBODIA/2018/NIVTS/011	Nov. 8	<i>Solanum melongena</i>	Kampong Cham	Kampong Siem	Rumchek	Chheu Teal Srot Kraom	12-06-23 / 105-31-14	27	Farmer's House / backyard	landrace	Trop Sruoy	derived from a fruit sold in near market
12	30075920	268497	COL/CAMBODIA/2018/NIVTS/012	Nov. 8	<i>Capsicum frutescens</i>	Kampong Cham	Steung Trang	Preaek Bak	Preaek Preah Angk	12-10-40 / 105-31-24	21	Farmer's House / backyard	landrace	Mates Chongol miek	traditional
13	30075921	268498	COL/CAMBODIA/2018/NIVTS/013	Nov. 8	<i>Capsicum annuum</i>	Kampong Cham	Steung Trang	Preaek Bak	Preaek Preah Angk	12-10-40 / 105-31-24	21	Farmer's House / backyard	landrace	Mates Dai Neang	traditional
14	30075922	268499	COL/CAMBODIA/2018/NIVTS/014	Nov. 8	<i>Solanum melongena</i>	Kampong Cham	Steung Trang	Preaek Bak	Preaek Roluos	12-11-56 / 105-31-23	16	Farmer's House / backyard	landrace	Trop Veng	probably hybrid
15	30075923	268500	COL/CAMBODIA/2018/NIVTS/015	Nov. 8	<i>Capsicum frutescens</i>	Kampong Thom	Santuk	Kampong Thma	Khveag	12-31-58 / 105-08-48	16	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
16	30075924	268501	COL/CAMBODIA/2018/NIVTS/016	Nov. 8	<i>Capsicum frutescens</i>	Kampong Thom	Santuk	Kong Lvea	Thbeag	12-34-13 / 105-08-54	12	Farmer's House / backyard	landrace	Mates Sor	traditional
17	30075925	268502	COL/CAMBODIA/2018/NIVTS/017	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Sombour	Sombour	12-52-52 / 105-03-34	20	Farmer's House / backyard	landrace	Mates Sor	small fruits, traditional, cultivated more than 2 years
18	30075926	268503	COL/CAMBODIA/2018/NIVTS/018	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Sombour	Sombour	12-52-52 / 105-03-34	20	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
19	30075927	268504	COL/CAMBODIA/2018/NIVTS/019	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Sombour	Sombour	12-53-00 / 105-03-45	19	Farmer's Shop	landrace	Mates Sor	from near th shop
20	30075928	268505	COL/CAMBODIA/2018/NIVTS/020	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Sombour	Throu Pang Chrock	12-53-42 / 105-05-34	19	Farmer's House/ backyard	landrace	Mates Sor	traditional
21	30075929	268506	COL/CAMBODIA/2018/NIVTS/021	Nov. 9	<i>Solanum melongena</i>	Kampong Thom	Prasat Sombour	Sombour	Throu Pang Chrock	12-53-42 / 105-05-34	19	Farmer's House/ backyard	landrace	Trop Sruoy	traditional

Table 3. (Continued).

Coll. No.	Passport No.	JP No.	JP Name	Date	Genus & Species	Province /State	District	Commune	Village	North latitude / East longitude	Altitude (m)	Source (Market name)	Status	Local name	Fruit characteristics, origin, etc.
22	30075930	268507	COL/CAMBODIA/2018/NIVTS/022	Nov. 9	<i>Capsicum annuum</i>	Kampong Thom	Prasat Sombour	Chhuk	Throu Pong Sila	12-54-50 / 105-07-09	19	Farmer's House / backyard	landrace	Mates Dai Neang	from Thailand
23	30075931	268508	COL/CAMBODIA/2018/NIVTS/023	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Koul	Kampong Chvear	12-55-39 / 105-10-10	18	Farmer's House / backyard	landrace	Mates Ach Sath	big fruits, natural germinated
24	30075932	268509	COL/CAMBODIA/2018/NIVTS/024	Nov. 9	<i>Capsicum annuum</i>	Kampong Thom	Prasat Sombour	Koul	Kampong Chvear	12-55-39 / 105-10-10	18	Farmer's House / backyard	landrace	Mates Toeu	ornamental
25	30075933	268510	COL/CAMBODIA/2018/NIVTS/025	Nov. 9	<i>Capsicum frutescens</i>	Kampong Thom	Prasat Sombour	Koul	Kampong Chvear	12-55-39 / 105-10-10	18	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
26	30075934	268511	COL/CAMBODIA/2018/NIVTS/026	Nov. 9	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Roung Roung	Thnorl Kearn	13-20-24 / 105-05-53	64	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
27	30075935	268512	COL/CAMBODIA/2018/NIVTS/027	Nov. 9	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Roung Roung	Thnorl Kearn	13-20-24 / 105-05-53	64	Farmer's House / backyard	landrace	Mates Sor	natural germinated
28	30075936	268513	COL/CAMBODIA/2018/NIVTS/028	Nov. 9	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Roung Roung	Rouvieng Tboung	13-21-03 / 105-06-52	58	Farmer's House / backyard	landrace	Mates Sor	natural germinated
29	30075937	268514	COL/CAMBODIA/2018/NIVTS/029	Nov. 9	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Rak Smey	Trapeang Russei	13-23-05 / 105-07-38	51	Farmer's House / backyard	landrace	Mates Kuiteav	cultivated more than 2 years
30	30075938	268515	COL/CAMBODIA/2018/NIVTS/030	Nov. 10	<i>Capsicum frutescens</i>	Kandal	Ponhea Lueu	Phnom Bath	Throu Pang Roka	11-44-58 / 104-46-01	22	Farmer's House / backyard	landrace	Mates Sor	traditional, from near village
31	30075939	268516	COL/CAMBODIA/2018/NIVTS/031	Nov. 10	<i>Capsicum annuum</i>	Kandal	Ponhea Lueu	Phnom Bath	Thnod Chau	11-44-28 / 104-46-30	17	Farmer's House / backyard	landrace	Mates Dai Neang	parent fruit from a market
32	30075940	268517	COL/CAMBODIA/2018/NIVTS/032	Nov. 10	<i>Capsicum frutescens</i>	Kandal	Ponhea Lueu	Phnom Bath	Thnod Chau	11-44-28 / 104-46-30	17	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
33	30075941	268518	COL/CAMBODIA/2018/NIVTS/033	Nov. 10	<i>Capsicum frutescens</i>	Kandal	Angk Snuol	Thkaki	Throu Pang Raig	11-40-22 / 104-43-32	21	Farmer's House / backyard	landrace	Mates Ach Sath	traditional, more than 2 years
34	30075942	268519	COL/CAMBODIA/2018/NIVTS/034	Nov. 10	<i>Capsicum annuum</i>	Kandal	Ponhea Lueu	Thom Nob Thom	Srea Ta Mau	11-41-06 / 104-42-11	24	Farmer's House / backyard	landrace	Mates Phlaok	parent fruit from a market
35	30075943	268520	COL/CAMBODIA/2018/NIVTS/035	Nov. 10	<i>Solanum melongena</i>	Kandal	Ponhea Lueu	Thom Nob Thom	Srea Ta Mau	11-41-06 / 104-42-11	24	Farmer's House / backyard	landrace	Trop Sruoy	from near village, white flower
36	30075944	268521	COL/CAMBODIA/2018/NIVTS/036	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Rolea B'ier	Prey Mul	Trapeang Rie	12-08-23 / 104-35-04	23	Farmer's House / backyard	landrace	Mates Sor	traditional
37	30075945	268522	COL/CAMBODIA/2018/NIVTS/037	Nov. 11	<i>Capsicum annuum</i>	Kampong Chhnang	Rolea B'ier	Prey Mul	Trapeang Rie	12-08-23 / 104-35-04	23	Farmer's House / backyard	landrace	Mates Dai Neang	from market
38	30075946	268523	COL/CAMBODIA/2018/NIVTS/038	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Tuek Phos	Tang Krasang	Romeas	12-03-47 / 104-31-22	50	Farmer's House / backyard	landrace	Mates Ach Sath	from market
39	30075947	268524	COL/CAMBODIA/2018/NIVTS/039	Nov. 11	<i>Capsicum annuum</i>	Kampong Chhnang	Tuek Phos	Khlong Popok	Trapeang Chrey	12-02-36 / 104-29-29	55	Farmer's House / backyard	landrace	Mates Dai Neang	from market
40	30075948	268525	COL/CAMBODIA/2018/NIVTS/040	Nov. 11	<i>Solanum melongena</i>	Kampong Chhnang	Tuek Phos	Khlong Popok	Trapeang Chrey	12-02-36 / 104-29-29	55	Farmer's House / backyard	landrace	Trop Sruoy	from market, white fruit color
41	30075949	268526	COL/CAMBODIA/2018/NIVTS/041	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Tuek Phos	Khlong Popok	Trapeang Chrey	12-02-35 / 104-29-30	52	Farmer's House / backyard	landrace	Mates Ach Sath	traditional, more than 2 years
42	30075950	268527	COL/CAMBODIA/2018/NIVTS/042	Nov. 11	<i>Solanum melongena</i>	Kampong Chhnang	Tuek Phos	Khlong Popok	Trapeang Chrey	12-02-35 / 104-29-30	52	Farmer's House / backyard	landrace	Trop Sruoy	traditional

Table 3. (Continued).

Coll. No.	Passport No.	JP No.	JP Name	Date	Genus & Species	Province /State	District	Commune	Village	North latitude / East longitude	Altitude (m)	Source (Market name)	Status	Local name	Fruit characteristics, origin, etc.
43	30075951	268528	COL/CAMBODIA/2018/NIVTS/043	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Sameakki Mean Chey	Thlok Vien	Thlok Vien	11-57-12 / 104-38-16	26	Farmer's House / backyard	landrace	Mates Ach Sath	traditional
44	30075952	268529	COL/CAMBODIA/2018/NIVTS/044	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Sameakki Mean Chey	Thlok Vien	Thlok Vien	11-57-12 / 104-38-16	26	Farmer's House / backyard	landrace	Mates Sor	traditional
45	30075953	268530	COL/CAMBODIA/2018/NIVTS/045	Nov. 11	<i>Capsicum frutescens</i>	Kampong Chhnang	Sameakki Mean Chey	Thlok Vien	Toap Baoh	11-57-30 / 104-36-52	25	Farmer's House / backyard	landrace	Mates Sor	from near village
46	30075954	268531	COL/CAMBODIA/2018/NIVTS/046	Nov. 11	<i>Solanum melongena</i>	Kampong Chhnang	Sameakki Mean Chey	Krang Lvea	Thnal	11-58-05 / 104-34-41	36	Farmer's House / backyard	landrace	Trop Veng	from near village, white fruit color
47	30075955	268532	COL/CAMBODIA/2018/NIVTS/047	Nov. 12	<i>Capsicum frutescens</i>	Kampong Chhnang	Rolea B'ier	Krang Leav	Boeng Veang	12-13-17 / 104-33-05	27	Farmer's House / backyard	landrace	Mates Sor	from near here
48	30075956	268533	COL/CAMBODIA/2018/NIVTS/048	Nov. 12	<i>Capsicum frutescens</i>	Kampong Chhnang	Rolea B'ier	Krang Leav	Boeng Veang	12-13-17 / 104-33-05	27	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
49	30075957	268534	COL/CAMBODIA/2018/NIVTS/049	Nov. 12	<i>Capsicum frutescens</i>	Kampong Chhnang	Rolea B'ier	Krang Leav	Boeng Veang	12-13-03 / 104-32-34	21	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
50	30075958	268535	COL/CAMBODIA/2018/NIVTS/050	Nov. 12	<i>Capsicum frutescens</i>	Pursat	Phnum Kravanh	Som Rong	Phoum Bei	12-21-09 / 103-44-18	28	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
51	30075959	268536	COL/CAMBODIA/2018/NIVTS/051	Nov. 12	<i>Solanum melongena</i>	Pursat	Veal Veang	Pramaoy	Pramaoy	12-17-30 / 103-04-26	238	Farmer's House / backyard	landrace	Trop Khar	natural germinated
52	30075960	268537	COL/CAMBODIA/2018/NIVTS/052	Nov. 12	<i>Solanum melongena</i>	Pursat	Veal Veang	Pramaoy	Pramaoy	12-17-30 / 103-04-26	238	Farmer's House / backyard	landrace	Trop Sruoy	natural germinated
53	30075961	268538	COL/CAMBODIA/2018/NIVTS/053	Nov. 12	<i>Capsicum frutescens</i>	Pursat	Veal Veang	Pramaoy	Pramaoy	12-17-30 / 103-04-26	238	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
54	30075962	268539	COL/CAMBODIA/2018/NIVTS/054	Nov. 12	<i>Capsicum frutescens</i>	Pursat	Veal Veang	Pramaoy	Pramaoy	12-17-30 / 103-04-26	238	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
55	30075963	268540	COL/CAMBODIA/2018/NIVTS/055	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Pursat city	Rhtas Prey	Peal Jek 2	12-32-37 / 103-54-58	16	Market (Pursat)	landrace	Mates Ach Sath	traditional, from near here
56	30075964	268541	COL/CAMBODIA/2018/NIVTS/056	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Pursat city	Rhtas Prey	Peal Jek 2	12-32-37 / 103-54-58	16	Market (Pursat)	landrace	Mates Sor	traditional, from near here, gathered from some farmers
57	30075965	268542	COL/CAMBODIA/2018/NIVTS/057	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Kandieng	Kandieng	Stan Ny	12-35-10 / 103-57-25	14	Farmer's House / backyard	landrace	Mates Ach Sath	from Vear Vean
58	30075966	268543	COL/CAMBODIA/2018/NIVTS/058	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Kandieng	Kandieng	Drey Kdey	12-35-12 / 103-57-59	16	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
59	30075967	268544	COL/CAMBODIA/2018/NIVTS/059	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Kandieng	Kandieng	Kampong Krosang	12-35-44 / 103-58-28	14	Farmer's House / backyard	landrace	Mates Sor	from near market
60	30075968	268545	COL/CAMBODIA/2018/NIVTS/060	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Kandieng	Kandieng	Boeng Chhuk	12-36-13 / 103-59-14	15	Farmer's House / backyard	landrace	Mates Sor	traditional, from near here
61	30075969	268546	COL/CAMBODIA/2018/NIVTS/061	Nov. 13	<i>Capsicum annum</i>	Pursat	Krakor	Svay Sa	Kon Reng	12-20-47 / 104-07-03	54	Farmer's House / backyard	landrace	Mates Phka	from Thailand
62	30075970	268547	COL/CAMBODIA/2018/NIVTS/062	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Krakor	Svay Sa	Kon Reng	12-20-47 / 104-07-03	54	Farmer's House / backyard	landrace	Mates Ach Sath	natural germinated
63	30075971	268548	COL/CAMBODIA/2018/NIVTS/063	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Sampov Meas	Ro Leap	O Thkouv	12-28-16 / 103-54-30	31	Farmer's House / backyard	landrace	Mates Ach Sath	from near market

Table 3. (Continued).

Coll. No.	Passport No.	JP No.	JP Name	Date	Genus & Species	Province /State	District	Commune	Village	North latitude / East longitude	Altitude (m)	Source (Market name)	Status	Local name	Fruit characteristics, origin, etc.
64	30075972	268549	COL/CAMBODIA/2018/NIVTS/064	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Sampov Meas	Ro Leap	O Thkouv	12-28-16 / 103-54-30	31	Farmer's House / backyard	landrace	Mates Ach Sath	from near here
65	30075973	268550	COL/CAMBODIA/2018/NIVTS/065	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Sampov Meas	Choum Rien Pol	Thopul Kros	12-27-28 / 103-53-15	41	Farmer's House / backyard	landrace	Mates Sor	from near market
66	30075974	268551	COL/CAMBODIA/2018/NIVTS/066	Nov. 13	<i>Capsicum annuum</i>	Pursat	Sampov Meas	Choum Rien Pol	Thopul Kros	12-27-06 / 103-52-43	36	Farmer's Field	landrace	Mates Dai Neang	from near market
67	30075975	268552	COL/CAMBODIA/2018/NIVTS/067	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Sampov Meas	Choum Rien Pol	Thopul Kros	12-27-06 / 103-52-43	36	Farmer's Field	landrace	Mates Ach Sath	from near market, small fruits
68	30075976	268553	COL/CAMBODIA/2018/NIVTS/068	Nov. 13	<i>Capsicum frutescens</i>	Pursat	Sampov Meas	Choum Rien Pol	Thopul Kros	12-27-06 / 103-52-43	36	Farmer's Field	landrace	Mates Sor	from near market, in a mini farm
69	30075977	268554	COL/CAMBODIA/2018/NIVTS/069	Nov. 14	<i>Capsicum frutescens</i>	Battambang	Koas Krala	Thipakdei	Chay Balangk	12-51-16 / 103-16-03	17	Farmer's House / backyard	landrace	Mates Ach Sath	from near market
70	30075978	268555	COL/CAMBODIA/2018/NIVTS/070	Nov. 14	<i>Capsicum frutescens</i>	Battambang	Koas Krala	Thipakdei	Boeng Reang	12-49-06 / 103-15-50	17	Farmer's House / backyard	landrace	Mates Ach Sath	traditional, from near market
71	30075979	268556	COL/CAMBODIA/2018/NIVTS/071	Nov. 14	<i>Solanum melongena</i>	Battambang	Koas Krala	Thipakdei	Boeng Reang	12-49-06 / 103-15-50	17	Farmer's House / backyard	landrace	Trop Sruoy	traditional
72	30075980	268557	COL/CAMBODIA/2018/NIVTS/072	Nov. 14	<i>Capsicum annuum</i>	Battambang	Koas Krala	Thipakdei	Boeng Reang	12-49-06 / 103-15-50	17	Farmer's Field	landrace	Mates Dai Neang	traditional
73	30075981	268558	COL/CAMBODIA/2018/NIVTS/073	Nov. 14	<i>Capsicum frutescens</i>	Battambang	Banan	Chheu Teal	Chamkar Svay	12-58-40 / 103-08-38	17	Farmer's Field	landrace	Mates Ach Sath	from near market, small fruits
74	30075982	268559	COL/CAMBODIA/2018/NIVTS/074	Nov. 14	<i>Capsicum annuum</i>	Battambang	Banan	Chheu Teal	Chamkar Svay	12-58-40 / 103-08-38	17	Farmer's Field	landrace	Mates Dai Neang	from near market, probably progenies of hybrid
75	30075983	268560	COL/CAMBODIA/2018/NIVTS/075	Nov. 14	<i>Capsicum annuum</i>	Battambang	Banan	Chheu Teal	Chamkar Svay	12-58-40 / 103-08-38	17	Farmer's House / backyard	landrace	Mates Laev Aav	ornamental, from Thailand



Photo 1. Typical vegetable market. This is a part of Kampong Thom market.



Photo 2. Roadside vegetable market. This is a part of Pursat market.



Photo 3. Interviewing a farmer in Kampong Thom Province.



Photo 4. Interviewing a farmer in Pursat market.



Photo 5. Chili pepper (*Capsicum* sp.) field in the east side of the Mekong River in Kampong Cham Province.



Photo 6. Ornamental *Capsicum* plants, “Mates Laev Aav” (No. 6, *Capsicum annuum*), decorated in front of a mini mart in Kampong Cham Province.



Photo 7. A farmer's shop in Kampong Thom Province.



Photo 8. An ornamental *Capsicum* plant, "Mates Toe" (No. 24, *C. annuum*), in Kampong Thom Province.



Photo 9. A mango (*Mangifera indica*) field in Kampong Chhnang Province.



Photo 10. Ornamental *Capsicum* plants, "Mates Phka" (No. 61, *C. annuum*), in Pursat Province.



Photo 11. Ornamental *Capsicum* plants, "Mates Laev Aav" (No. 75, *C. annuum*), in Battambang Province.



Photo 12. Fruits of "Mates Dai Neang" (No. 22, *Capsicum frutescens*) in Kampong Thom Province.



Photo 13. A plant of “Mates Phlaok” (No. 34: left, *C. annuum*) in Kandal Province.



Photo 14. Fruits of “Mates Ach Sath” (No. 70, *C. frutescens*) in Battambang Province.



Photo 15. Fruits of “Mates Sor” (No. 65, *C. frutescens*) in Pursat Province.



Photo 16. “Trop Sruoy” (No. 52, *Solanum melongena*).



Photo 17. “Trop Veng” (No. 14, *S. melongena*).

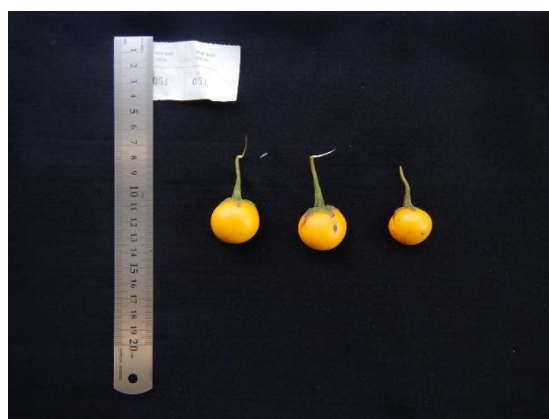


Photo 18. “Trop Khar” (No. 51, *S. melongena*).