

Collaborative Exploration of *Capsicum* Genetic Resources in Northern Cambodia, 2016

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Summary

The National Agriculture and Food Research Organization (NARO) and the Cambodian Agricultural Research and Development Institute (CARDI) have collaborated under the Plant Genetic Resources in Asia project to survey the vegetable genetic resources available in Cambodia, since 2014. As part of this project, two field surveys of solanaceous crops were conducted in November 2014 and 2015 in western and eastern Cambodia, respectively. In November 2016, we conducted a third field survey in northern Cambodia, in Kampong Thom, Siem Reap, Oddar Meanchey, and Preah Vihear provinces. We collected 46 chili pepper fruit samples from markets and farmer yards, including 13 *Capsicum annuum* and 33 *Capsicum frutescens* fruits. Harvested seeds were evenly transferred to the CARDI and the NARO gene banks.

KEY WORDS: *Capsicum annuum*, *Capsicum frutescens*, chili pepper, genetic resources, Cambodia

Introduction

There are abundant vegetable genetic resources available in Southeast Asia, many of them within Solanaceae (Yamamoto and Nawata 2005; Matsunaga *et al.* 2010). It is very important to use these resources for breeding purposes, as they represent useful wide genetic diversity (Saito *et al.* 2006; Matsunaga *et al.* 2015). However, few chili pepper genetic resources from Cambodia are known outside

Cambodia (Matsunaga *et al.* 2015). Therefore, it is necessary to promote the collection and exploration of genetic resources in this area. Recently, as improved road access and urbanization in rural areas steadily increases, chili pepper (*Capsicum* spp.) landraces traditionally cultivated in the region have been replaced by high-quality, high-yielding breeding lines with higher commodity value. Thus, the genetic diversity among the crops grown in this region has started to decrease. 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 for the Characterization and Evaluation of Plant Genetic Resources for Food and Agriculture to preserve and ensure the effective use of genetic resources. As part of this Joint Research Agreement, three chili pepper field surveys were completed in Cambodia. The first survey was conducted in November 2014 in western Cambodia, covering 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; this included the Mondulkiri and Ratanakiri highlands (Tanaka *et al.* 2016). Now, the third survey, in November 2016, focused on northern Cambodia, on route to the north of Tonlé Sap Lake. Here, we report the results of the third survey.

Methods

The third field survey was conducted from 17th to 24th November 2016 (Table 1). We collected our first sample (No. 1, unidentified *Capsicum* species) on 17th November from the garden of a CARDI staff member, because the fruits were round, which is rare in Cambodia. We left Phnom Penh for Kampong Thom province on 18th November, and collected chili pepper landraces from various locations in the provinces of Kampong Thom, Siem Reap, Oddar Meanchey, and Preah Vihear, in that order (Table 1, Fig. 1). We traveled by car to local markets (Photo 1) and farmer yards and fields (Photos 2 and 3). When we found chili pepper plants, we conducted interviews to obtain information regarding their origins, local names, and cultivation history (Photo 4). We collected mature fruits whenever - based on information gathered through interviews - we decided that the samples represented local landraces. We assigned a number to each sample and recorded the information obtained during interviews, as well as the location details (i.e., latitude, longitude, and altitude) determined by a Global Positioning System receiver. All samples were identified to species level using the taxonomic key (Eshbaugh 2012). Seeds were harvested from mature fruits within one day after collection and then dried for two days at our lodging.

Table 1. Itinerary followed during the 2016 survey in northern Cambodia

Date	Day	Itinerary	Stay
16-Nov	Wed	Chubu 11:00 (TG645) -- 15:40 Bangkok 18:20 (TG584) -- 19:35 Phnom Penh	Phnom Penh
17-Nov	Thu	Visit Cambodian Agricultural Research and Development Institute (CARDI)	Phnom Penh
18-Nov	Fri	Phnom Penh -- Kampong Thom -- Kampong Svay -- Siem Reap	Siem Reap
19-Nov	Sat	Siem Reap -- Preah Dak -- Tbeang -- Anlong Veng	Anlong Veng
20-Nov	Sun	Anlong Veng -- Trapeang Prasat -- Samrong	Samrong
21-Nov	Mon	Samrong -- Choam Khsant -- Tbaeng Meanchey -- Pou -- Tbaeng Meanchey	Tbaeng Meanchey
22-Nov	Tue	Tbaeng Meanchey -- Cheb -- Tbaeng Meanchey -- Kulen -- Tbaeng Meanchey	Tbaeng Meanchey
23-Nov	Wed	Tbaeng Meanchey -- Bos Poy -- Sambour -- Kampong Thom	Kampong Thom
24-Nov	Thu	Kampong Thom -- Phnom Penh	Phnom Penh
25-Nov	Fri	Visit CARDI, Phnom Penh 20:35 (TG585) -- 21:40 Bangkok	On flight
26-Nov	Sat	Bangkok 00:05 (TG644) -- 7:30 Chubu	

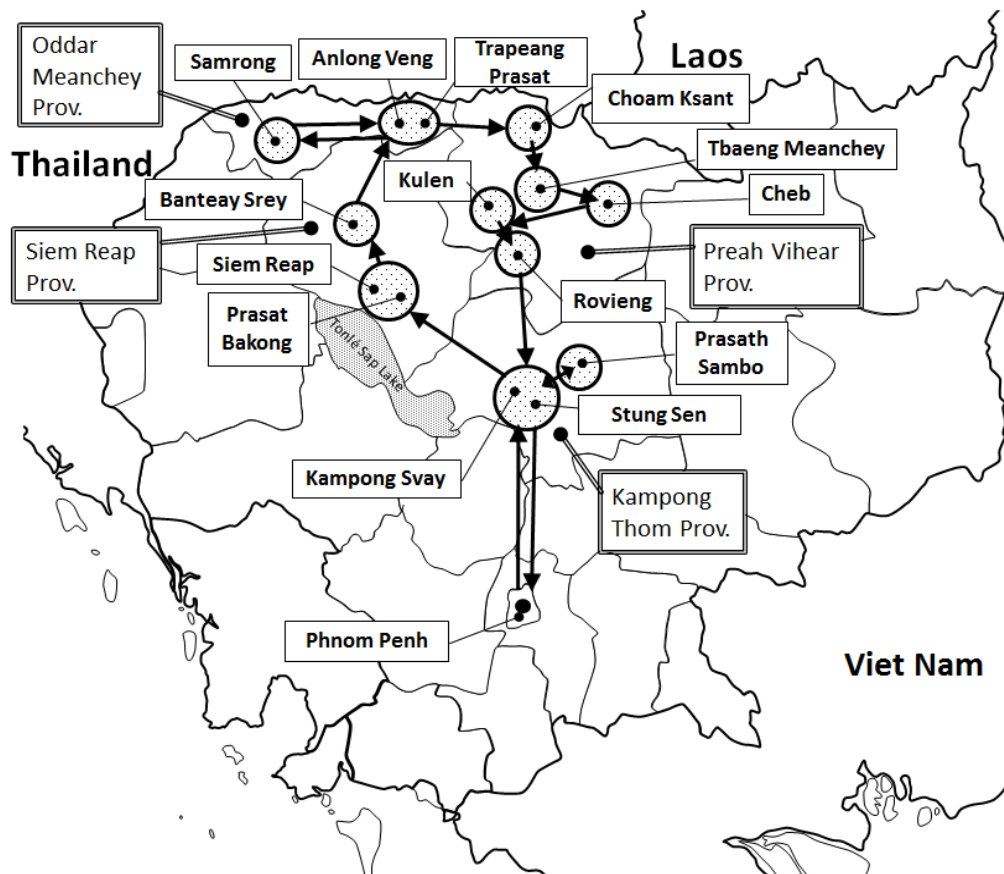


Fig. 1. Route of the third field survey in northern Cambodia, 2016

Results

Summary of samples collected

In addition to sample No. 1, we collected 46 chili pepper fruits (13 *Capsicum annuum* L. and 33 *Capsicum frutescens* L.) from various locations in northern Cambodia (Tables 2 and 3). The seeds were shared equally between NARO and CARDI, except for those of sample No. 1, which were immature.

Daily record of the field survey

18th November: We left Phnom Penh and traveled north on Route 6 toward Kampong, Thom province, in central Cambodia. We collected three chili-pepper fruit samples (Nos. 2-4) from the market in Kampong Thom, Stung Sen district. We then moved to Kampong Svay district, and collected three more fruit samples (Nos. 5-7) from farm yards. Next, we traveled on Route 6 toward Siem Reap province, in northwestern Cambodia. We collected one fruit sample (No. 8) from a plant growing beside an outdoor toilet in a farm yard in Prasat Bakong district, near Tonlé Sap Lake.

19th November: We first explored Siem Reap province. We collected a fruit sample (No. 9) from the yard of a house in a town in Siem Reap district. We then moved to Banteay Srey district, in central Siem Reap, and collected six fruit samples (Nos. 10-15) from farm yards and crop fields. After that we headed toward Oddar Meanchey province, north of Siem Reap province.

20th November: We initially explored the Rong Vong Moul market in Anlong Veng district, and collected three fruit samples (Nos. 16-18). Next, we headed east to Trapeang Prasat district, and collected four fruit samples (Nos. 19-22) from farm yards. We then traveled to Samrong district, west of Anlong Veng district, and collected four fruit samples (Nos. 23-26) from farm yards.

Table 2. Samples collected during the 2016 survey in northern Cambodia

Collection site (province)	<i>C. annuum</i>	<i>C. frutescens</i>	Total
Kampong Thom	2	6	8
Siem Reap	3	5	8
Oddar Meanchey	2	9	11
Preah Vihear	6	13	19
Total	13	33	46

21st November: We drove from Samrong district in Oddar Meanchey province to Preah Vihear province, in northern Cambodia. We collected two fruit samples (Nos. 27 and 28) at the Sra Em market, in Choam Ksant district. We then moved to Tbaeng Meanchey district, in central Preah Vihear, and collected two fruit samples (Nos. 29 and 30) from farm yards.

22nd November: We first explored the Kampong Pranak market in Tbaeng Meanchey, and collected four fruit samples (Nos. 31-34). We then traveled to Cheb district, in eastern Preah Vihear, and collected four fruit samples (Nos. 35-38) from farm yards. We next traveled to Kulen district, in western Preah Vihear, and collected three fruit samples (Nos. 39-41) from farm yards.

23rd November: We drove to Rovieng district, in southern Preah Vihear, and collected four fruit samples (Nos. 42-45) from farm yards. We then headed to Kampong Svay district, in Kampong Thom province, and collected one fruit sample (No. 46) from a farm yard. We next traveled to Prasath Sambo district, and collected another fruit sample (No. 47) from a farm yard.

24th November: We returned from Kampong Thom province to Phnom Penh.

25th November: Upon returning to Phnom Penh, we found that the seeds of sample No. 1 were immature, so we removed sample No. 1 from our collection. We reported the results of our field survey to CARDI, and we divided the collected dried seeds (except for the sample No. 1 seeds) equally between NARO and CARDI.

Discussion

Capsicum species, such as chili pepper, sweet pepper, and paprika, are consumed worldwide as fresh vegetables and spices, and are also used for food coloring. The genus *Capsicum* includes five domesticated species: *C. annuum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* L., and *C. pubescens* Ruiz & Pav. (Bosland and Votava 1999). Chili pepper plants originated in the Americas (Bosland 1994), and have been cultivated globally since the Columbian exchange, because of their high environmental adaptability and pleasant taste. In South, Southeast, and East Asia, various types of chili pepper are used as the base of many regional foods (e.g., curries) (Nunn and Qian 2010), including in Cambodia (Photo 5). In Cambodia, the two species detected (i.e., *C. annuum* and *C. frutescens*) are used mainly as spices (Yamamoto *et al.* 2011).

The 46 chili pepper samples that we collected were identified as *C. annuum* (13), and *C. frutescens* (33) (Tables 2 and 3). The absence of any other species collected is consistent with the results of the first two field surveys (Matsunaga *et al.*, 2015; Tanaka *et al.*, 2016).

The 33 *C. frutescens* accessions included 20 accessions of ‘Mates Ach Sath’, seven of ‘Mates Sor’, three of ‘Mates Kdor Chmar’, and one each of ‘Mates Khmer’, ‘Mates Sre’, and unspecified ‘Mates’. ‘Mates’

is the Khmer name for *Capsicum* peppers. The ‘Mates Ach Sath’ (“birds drop”) plants produced small fruits, 2 - 3 cm long (Photo 6). This landrace is the most widely cultivated *C. frutescens* chili pepper in northern Cambodia and was the most commonly collected chili pepper during our survey, as in the previous two surveys (Matsunaga *et al.*, 2015; Tanaka *et al.*, 2016). The ‘Mates Sor’ (“white”) plants produced small fruits 2 - 3 cm long (Photo 7), and the immature fruits were yellowish-white (Photo 8). The ‘Mates Kdor Chmar’ (“cat penis”) fruits were 1 - 4 cm long (Photos 9 and 10), and the immature fruits were pale green (Photo 11). The small ‘Mates Khmer’ (Photo 12) and unspecified ‘Mates’ (Photo 13) fruits were 3 cm long.

The 13 accessions identified as *C. annuum* included eight accessions of ‘Mates Dai Neang’ and one of each of the following: ‘Mates Chang Ol Mek’, ‘Mates Chrok’, ‘Mates Khiv’, ‘Mates Krochok Neang’, and unspecified ‘Mates’. ‘Mates Dai Neang’ (“ring finger”) is the most widely cultivated *C. annuum* chili pepper in northern Cambodia and was the most commonly collected *C. annuum* chili pepper in this survey. This result is similar to that of the previous two field surveys (Matsunaga *et al.* 2015; Tanaka *et al.* 2016). The ‘Mates Dai Neang’ fruits were usually 4 - 8 cm long (Photos 14 and 15), and were generally longer than the *C. frutescens* fruits collected, except that those of sample No. 39 were 3 - 5 cm long (Photo 16). Sample No. 39 was the only accession that produced purple immature fruits (Photo 17). The ‘Mates Chang Ol Mek’ fruits collected from the Kampong Pranak market were glossy and 5 - 7 cm long (Photo 18), while the ‘Mates Chrok’ fruits were 6 - 10 cm long (Photo 19). Farmers interviewed said that this chili pepper is not particularly spicy. The ‘Mates Khiv’ (“blue”) fruits were 3 - 4 cm long (Photo 20), and the ‘Mates Krochok Neang’ fruits were glossy and 5 cm long (Photo 21). At 7 - 10 cm, the unspecified ‘Mates’ fruits were relatively long (Photo 22).

As in the first survey, the morphological characteristics of the fruit differed to a lesser extent in the third survey than in the second survey, in eastern Cambodia (Matsunaga *et al.* 2015; Tanaka *et al.* 2016), where several *C. frutescens* genetic resources were collected, mainly from farm yards. The mountainous regions in eastern Cambodia may hold several *Capsicum* genetic resources. However, especially those of *C. annuum*, many high-quality accessions considered as breeding lines, had uniform size, the shape and the luster of ripen fruits, and were collected in local towns and cities. Additionally, attempts to improve chili pepper cultivars seem to be progressing in the Cambodian countryside, helping to prevent further decrease in the number of landraces being cultivated in these regions due to rapid improvement of road access in these areas. The preservation and use of the genetic resources collected during this project may be important for preventing additional losses of chili pepper genetic resources.

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2016年カンボジア北部におけるカプシカム属遺伝資源の 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）とカンボジア農業研究機構（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 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年と2015年の11月に、それぞれカンボジアの西部と東部地域において、2回のナス科作物の探索を実施した。2016年11月に我々は、カンボジア北部地域の Kampong Thom, Siem Reap, Oddar Meanchey, Preah Vihear 州において、3回目の探索を実施した。本探索において、13の *Capsicum annuum* と 33の *Capsicum frutescens* で構成された合計 46 サンプルのトウガラシを市場や農家の裏庭で収集した。収集した種子は、CARDI と NARO のジーンバンクに均等に分配した。

Table 3. List of *Capsicum* samples collected in Cambodia during the 2016 survey

Collection 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
2	30069405	258269	COL/CAMBODIA/2016/NIVTS/002	Nov 18	<i>Capsicum annuum</i>	Kampong Thom	Stung Sen	Kampong Rotes	Kampong Thom	12-42-42/ 104-53-13	3	Market (Kampong Thom)	landrace	Mates Dai Neang	from Siem Reap
3	30069406	258270	COL/CAMBODIA/2016/NIVTS/003	Nov 18	<i>Capsicum frutescens</i>	Kampong Thom	Stung Sen	Kampong Rotes	Kampong Thom	12-42-42/ 104-53-13	3	Market (Kampong Thom)	landrace	Mates Ach Sath	from Pray Sbov village, Stung Som Dist near the market
4	30069407	258271	COL/CAMBODIA/2016/NIVTS/004	Nov 18	<i>Capsicum frutescens</i>	Kampong Thom	Stung Sen	Kampong Rotes	Kampong Thom	12-42-42/ 104-53-13	3	Market (Kampong Thom)	landrace	Mates Ach Sath	from Samtoul Village, Kampong Svay Dis Kampong Thom Pro
5	30069408	258272	COL/CAMBODIA/2016/NIVTS/005	Nov 18	<i>Capsicum frutescens</i>	Kampong Thom	Kampong Svay	Tbeng	Prey Prosh	12-47-27/ 104-48-55	4	Farmer's House/ backyard	landrace	Mates Kdor Chmar	village traditional line
6	30069409	258273	COL/CAMBODIA/2016/NIVTS/006	Nov 18	<i>Capsicum frutescens</i>	Kampong Thom	Kampong Svay	Tbeng	Resey Chers	12-47-19/ 104-48-16	4	Farmer's House/ small field	landrace	Mates Sor	village traditional line
7	30069410	258274	COL/CAMBODIA/2016/NIVTS/007	Nov 18	<i>Capsicum annuum</i>	Kampong Thom	Kampong Svay	Tbeng	Resey Chers	12-47-19/ 104-48-16	4	Farmer's House/ small field	landrace	Mates	village traditional line
8	30069411	258275	COL/CAMBODIA/2016/NIVTS/008	Nov 18	<i>Capsicum frutescens</i>	Siem Reap	Pasath Bakong	Meanchey	Tapark	13-19-08/ 103-59-50	4	Farmer's House/ backyard	landrace	Mates Ach Sath	village traditional line, naturally germinated
9	30069412	258276	COL/CAMBODIA/2016/NIVTS/009	Nov 19	<i>Capsicum annuum</i>	Siem Reap	Siem Reap	Sala Kamprak	Wat Bo	13-21-07/ 103-51-38	3	Hotel/ backyard	landrace	Mates Dai Neang	Originated seed were from market in Siem Reap
10	30069413	258277	COL/CAMBODIA/2016/NIVTS/010	Nov 19	<i>Capsicum frutescens</i>	Siem Reap	Banteay Srey	Preah Dak	Preah Dak	13-26-32/ 103-55-28	3	Farmer's House/ backyard	landrace	Mates Sre	Originated seed were corrected in same field
11	30069414	258278	COL/CAMBODIA/2016/NIVTS/011	Nov 19	<i>Capsicum frutescens</i>	Siem Reap	Banteay Srey	Preah Dak	Ototeung	13-26-39/ 103-56-43	4	Farmer's House/ backyard	landrace	Mates Ach Sath	
12	30069415	258279	COL/CAMBODIA/2016/NIVTS/012	Nov 19	<i>Capsicum frutescens</i>	Siem Reap	Banteay Srey	Tbeang	Tbeang	13-31-42/ 104-01-06	3	Farmer's House/ Small field	landrace	Mates Ach Sath	village traditional line
13	30069416	258280	COL/CAMBODIA/2016/NIVTS/013	Nov 19	<i>Capsicum annuum</i>	Siem Reap	Banteay Srey	Tbeang	Tlok Vea	13-32-23/ 104-01-03	3	Farmer's Field	landrace	Mates Dai Neang	Originated seed were corrected in same field
14	30069417	258281	COL/CAMBODIA/2016/NIVTS/014	Nov 19	<i>Capsicum annuum</i>	Siem Reap	Banteay Srey	Tbeang	Tlok Vea	13-32-25/ 104-01-03	3	Farmer's Field	landrace	Mates Dai Neang	next field of No 13
15	30069418	258282	COL/CAMBODIA/2016/NIVTS/015	Nov 19	<i>Capsicum frutescens</i>	Siem Reap	Banteay Srey	Tbeang	Srash Krav	13-32-32/ 104-00-23	3	Farmer's Field	landrace	Mates Khmer	seeds from Siem Reap
16	30069419	258283	COL/CAMBODIA/2016/NIVTS/016	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Anlong Veng	Anlong Veng	Ochen Chean	14-14-01/ 104-04-53	27	Market (Rong Vong Moul)	landrace	Mates Ach Sath	cultivated far from market
17	30069420	258284	COL/CAMBODIA/2016/NIVTS/017	Nov 20	<i>Capsicum annuum</i>	Oddar Meanchey	Anlong Veng	Anlong Veng	Ochen Chean	14-14-01/ 104-04-53	27	Market (Rong Vong Moul)	landrace	Mates Krochok Neang	cultivated near by market
18	30069421	258285	COL/CAMBODIA/2016/NIVTS/018	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Anlong Veng	Anlong Veng	Ochen Chean	14-14-01/ 104-04-53	27	Market (Rong Vong Moul)	landrace	Mates Ach Sath	cultivated near by market
19	30069422	258286	COL/CAMBODIA/2016/NIVTS/019	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Trapeang Presat	Phav	Popel	14-13-29/ 104-11-24	73	Farmer's House/ backyard	landrace	Mates Ach Sath	naturally germinated
20	30069423	258287	COL/CAMBODIA/2016/NIVTS/020	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Trapeang Presat	Trapeang Presat	Trapeang Presat	14-11-34/ 104-21-45	88	Farmer's House/ backyard	landrace	Mates Ach Sath	from near area
21	30069424	258288	COL/CAMBODIA/2016/NIVTS/021	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Trapeang Presat	Trapeang Presat	Prey Saath	14-10-38/ 104-21-15	91	Farmer's House/ backyard	landrace	Mates Ach Sath	from near area
22	30069425	258289	COL/CAMBODIA/2016/NIVTS/022	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Trapeang Presat	Osvay	Chheu Teal Chrum	14-13-02/ 104-16-43	98	Farmer's House/ backyard	landrace	Mates Ach Sath	naturally germinated
23	30069426	258290	COL/CAMBODIA/2016/NIVTS/023	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Samrong	Konkrel	Chheu Krom	14-17-10/ 103-36-41	67	Farmer's House/ backyard	landrace	Mates Ach Sath	transplanted in 3 years ago
24	30069427	258291	COL/CAMBODIA/2016/NIVTS/024	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Samrong	Samrong	Kok Romdoul	14-12-59/ 103-32-26	48	Farmer's House/ backyard	landrace	Mates Ach Sath	from near area, cultivating in 1 year
25	30069428	258292	COL/CAMBODIA/2016/NIVTS/025	Nov 20	<i>Capsicum annuum</i>	Oddar Meanchey	Samrong	Samrong	Don Ken Sen Chey	14-10-25/ 103-30-55	50	Farmer's House/ backyard	landrace	Mates Khiv	'Khiv' means 'blue' Traditional line in this area

Table 3. (Continued).

Collection 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
26	30069429	258293	COL/CAMBODIA/2016/NIVTS/026	Nov 20	<i>Capsicum frutescens</i>	Oddar Meanchey	Samrong	Samrong	Okan Seng	14-09-54/ 103-31-03	45	Farmer's House/ backyard	landrace	Mates Sor	from Along Van
27	30069430	258294	COL/CAMBODIA/2016/NIVTS/027	Nov 21	<i>Capsicum frutescens</i>	Preah Vihear	Choam Khsant	Kantuot	Sre Em	14-14-21/ 104-43-55	80	Market (Sra Em)	landrace	Mates Ach Sath	cultivated near by market
28	30069431	258295	COL/CAMBODIA/2016/NIVTS/028	Nov 21	<i>Capsicum annuum</i>	Preah Vihear	Choam Khsant	Kantuot	Sre Em	14-14-21/ 104-43-55	80	Market (Sra Em)	landrace	Mates Dai Neang	cultivated soldier town Cambodia original fruit shape
29	30069432	258296	COL/CAMBODIA/2016/NIVTS/029	Nov 21	<i>Capsicum frutescens</i>	Preah Vihear	Tbaeng Meanchey	Pro Mai	Bos Thom	13-51-21/ 105-02-02	67	Farmer's House/ backyard	landrace	Mates Ach Sath	
30	30069433	258297	COL/CAMBODIA/2016/NIVTS/030	Nov 21	<i>Capsicum frutescens</i>	Preah Vihear	Tbaeng Meanchey	Bos Thom	Bos Thom	13-51-11/ 105-02-36	70	Farmer's House/ backyard	landrace	Mates Kdor Chmar	
31	30069434	258298	COL/CAMBODIA/2016/NIVTS/031	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Tbaeng Meanchey	Kampong Pranak	Kampong Pranak	13-48-33/ 104-58-39	55	Market (Kampong Pranak)	landrace	Mates Ach Sath	cultivated near by market
32	30069435	258299	COL/CAMBODIA/2016/NIVTS/032	Nov 22	<i>Capsicum annuum</i>	Preah Vihear	Tbaeng Meanchey	Kampong Pranak	Kampong Pranak	13-48-33/ 104-58-39	55	Market (Kampong Pranak)	landrace	Mates Dai Neang	cultivated near by market
33	30069436	258300	COL/CAMBODIA/2016/NIVTS/033	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Tbaeng Meanchey	Kampong Pranak	Kampong Pranak	13-48-33/ 104-58-39	55	Market (Kampong Pranak)	landrace	Mates Sor	cultivated near by market
34	30069437	258301	COL/CAMBODIA/2016/NIVTS/034	Nov 22	<i>Capsicum annuum</i>	Preah Vihear	Tbaeng Meanchey	Kampong Pranak	Kampong Pranak	13-48-33/ 104-58-39	55	Market (Kampong Pranak)	landrace	Mates Chang Oi Mek	fruits from Proyuth village
35	30069438	258302	COL/CAMBODIA/2016/NIVTS/035	Nov 22	<i>Capsicum annuum</i>	Preah Vihear	Cheb	Sangke	Saem	13-46-54/ 105-22-34	80	Farmer's House/ backyard	landrace	Mates Dai Neang	naturally germinated
36	30069439	258303	COL/CAMBODIA/2016/NIVTS/036	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Cheb	Sangke	Saem	13-46-49/ 105-22-39	79	Farmer's House/ small field	landrace	Mates	naturally germinated, cultivating in many years
37	30069440	258304	COL/CAMBODIA/2016/NIVTS/037	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Cheb	Sangke	Saem	13-46-48/ 105-22-48	79	Farmer's House/ backyard	landrace	Mates Sor	transplanted in June
38	30069441	258305	COL/CAMBODIA/2016/NIVTS/038	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Resay	Cheb	Cheb	13-46-16/ 105-23-38	83	Farmer's House/ small field	landrace	Mates Sor	seeds from the neighborhood, transplanted in June
39	30069442	258306	COL/CAMBODIA/2016/NIVTS/039	Nov 22	<i>Capsicum annuum</i>	Preah Vihear	Kulen	Kulen Tbong	Kulen Tbong	13-48-52/ 104-42-03	71	Farmer's House/ backyard	landrace	Mates Dai Neang	immature color is purple
40	30069443	258307	COL/CAMBODIA/2016/NIVTS/040	Nov 22	<i>Capsicum annuum</i>	Preah Vihear	Kulen	Kulen Tbong	Kulen Tbong	13-48-52/ 104-42-03	71	Farmer's House/ backyard	landrace	Mates Chrok	not so hot
41	30069444	258308	COL/CAMBODIA/2016/NIVTS/041	Nov 22	<i>Capsicum frutescens</i>	Preah Vihear	Kulen	Kulen Tbong	Odon Snoun	13-45-06/ 104-36-58	78	Farmer's House/ backyard	landrace	Mates Sor	cultivating in 3 years
42	30069445	258309	COL/CAMBODIA/2016/NIVTS/042	Nov 23	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Rom Dosh	Svey Path	13-29-35/ 105-01-15	80	Farmer's House/ backyard	landrace	Mates Sor	more than 2 years, farmer's landrace
43	30069446	258310	COL/CAMBODIA/2016/NIVTS/043	Nov 23	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Rom Dosh	Svey Path	13-29-33/ 105-00-31	80	Farmer's House/ backyard	landrace	Mates Ach Sath	transplanted in last June
44	30069447	258311	COL/CAMBODIA/2016/NIVTS/044	Nov 23	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Rong Roeung	Bos Pey	13-28-29/ 105-06-41	67	Farmer's House/ backyard	landrace	Mates Ach Sath	naturally germinated
45	30069448	258312	COL/CAMBODIA/2016/NIVTS/045	Nov 23	<i>Capsicum frutescens</i>	Preah Vihear	Rovieng	Rong Roeung	Bos Pey	13-20-32/ 105-06-40	67	Farmer's House/ small field	landrace	Mates Kdor Chmar	transplanted in last June, seed bought in market
46	30069449	258313	COL/CAMBODIA/2016/NIVTS/046	Nov 23	<i>Capsicum frutescens</i>	Kampong Thom	Kampong Svay	Chey	Tropeang Arek	12-50-23/ 104-57-43	45	Farmer's House/ backyard	landrace	Mates Ach Sath	cultivating in 1 year
47	30069450	258314	COL/CAMBODIA/2016/NIVTS/047	Nov 23	<i>Capsicum frutescens</i>	Kampong Thom	Prasath Sambo	Sambo	Ath Sou	12-50-45/ 105-00-44	26	Farmer's House/ backyard	landrace	Mates Ach Sath	3 years ago, farmer's landrace



Photo 1. Typical local market in Cambodia. This is a part of Phsar Kampong Thom market in Kampong Thom province.



Photo 2. Typical farm houses and yards in Cambodia. This is a farmer houses in Tbeng village, Siem Reap province.



Photo 3. The chili pepper growing at a back yard of farm house in Both Pey village, Preah Vihear province.



Photo 4. The interview to farmers with collected chili peppers.



Photo 5. Seasonings used with chili peppers at a restaurant in Cambodia.



Photo 6. The typical chili pepper (Collection No. 3) called 'Mates Ach Sath' in Khmer.



Photo 7. The typical chili pepper (Collection No. 26) called 'Mates Sor' in Khmer.



Photo 8. The tree of 'Mates Sor' (Collection No. 41) cultivating at farm backyard in Odon Snoun village, Preah Vihear province.

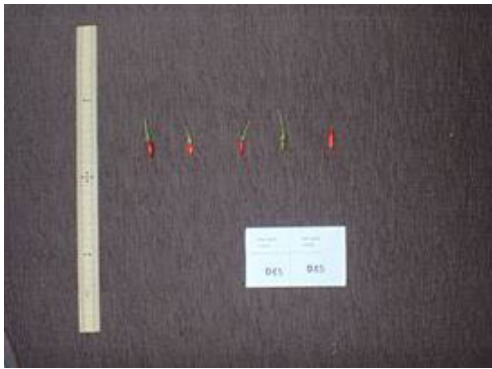


Photo 9. The chili pepper (Collection No. 45) called 'Mates Kdor Chmar' in Khmer.



Photo 10. The chili pepper (Collection No. 30) called 'Mates Kdor Chmar' in Khmer.



Photo 11. The tree of 'Mates Kdor Chmar' (Collection No. 30) cultivating at farm backyard in Bos Thom village, Preah Vihear province.



Photo 12. The chili pepper (Collection No. 15) called 'Mates Khmer' in Khmer.



Photo 13. The chili pepper (Collection No. 36) called 'Mates' (unspecified) in Khmer.



Photo 14. The chili pepper (Collection No. 2) called 'Mates Dai Neang' in Khmer.



Photo 15. The chili pepper (Collection No. 28) called 'Mates Dai Neang' in Khmer.



Photo 16. The chili pepper (Collection No. 39) called 'Mates Dai Neang' in Khmer.



Photo 17. The tree of 'Mates Dai Neang' (Collection No. 39) cultivating at farm backyard in Kulen Tbong village, Preah Vihear province.



Photo 18. The chili pepper (Collection No. 34) called 'Mates Chang Ol Mek' in Khmer.



Photo 19. The chili pepper (Collection No. 40) called 'Mates Chrok' in Khmer.



Photo 20. The chili pepper (Collection No. 25) called 'Mates Khiv' in Khmer.



Photo 21. The chili pepper (Collection No. 17) called 'Mates Krochok Neang' in Khmer.



Photo 22. The chili pepper (Collection No. 7) called 'Mates' (unspecified) in Khmer.