

Collection of melon and other Cucurbitaceous crops in Cambodia in 2016

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Summary

A previous field survey in eastern Cambodia yielded ample information on cultivation and utilization of cucurbitaceous crops, and analyzed variations in fruit and seed traits in melon genetic resources. A field survey conducted mainly in northern Cambodia collected genetic resources of cucurbitaceous crops to better understand those variations from a higher breeding and botanic perspective and to uncover variations of fruit and seed traits in melon landraces. A total of 127 samples were collected at markets, farmer houses, and fields in nine provinces and in the capital, and were registered as a germplasm collection, both in Cambodia and Japan. Among the 70 accessions of melon, 52, 17, and 1 of them were collected as seeds, fruits, and a plant, respectively. These melon accessions comprised cultivated landraces, improved varieties, and wild melons. Cultivation, including open pollination of melon landraces and utilization were very similar to those recorded in eastern and western Cambodia, and are predicted to cause non-significant differences in fruit and seed traits between geographical areas in Cambodia. Fruit and seed lengths of collected melons in Cambodia, including those from previous field surveys, were greater than those in Yunnan Province, China, and Lao PDR, suggesting different combination of quantitative trait loci (QTL) related to fruit and seed length in melon landraces between Cambodia and other Southeast Asian countries. Other fruits characters, such as powdery texture of fruits, gelatinous sheath around seeds, oblong fruit shape, and low sugar concentration (brix) of flesh juice found in melon landraces from Cambodia were similar to those from South and East Asia, in which useful breeding materials for disease resistance were found among melon landraces. Thus, melon genetic resources in Cambodia should be analyzed for genetic

components of fruit and seed traits and evaluated for disease resistance for melon breeding purposes.

KEY WORDS: *Cucumis melo*, field survey, fruit, genetic resource, melon, seed

Introduction

Melon (*Cucumis melo* L.) is a diversified crop cultivated in tropical, subtropical, and temperate zones. Melon is classified as either cultivated or wild melon (Pitrat 2008). Many studies have classified melon by using infraspecific characters of plant, fruit, and seed, and have suggested that cultivated melon is classified into subspecies *melo* and *agrestis*, and subsequently into 15 botanical groups (Pitrat 2008). Among these, subsp. *agrestis*, comprises *C. melo* vars. *acidulus* Naudin, *conomon* (Thunberg) Makino, *momordica* (Roxburgh) Duthie & Fuller, *makuwa* Thunberg and *chinensis* Pangalo, which are found in eastern Asia from India to Japan. Their immature fruit is eaten as a vegetable, while the mature fruit of vars. *momordica* and *makuwa* are eaten as a dessert (Kitamura 1950; Kato *et al.* 2006, 2010; Nhi *et al.* 2010; Tanaka *et al.* 2014). The 15 botanical groups that easily hybridize with each other are found worldwide, but their hybrids have characters that make it difficult to classify them into proper botanical groups. Wild melon is free-living or weedy, having small fruits and seeds growing near farm fields.

Some South Asian melons show resistance to insects and diseases (Dhillon *et al.* 2012). East Asian melons, especially var. *conomon*, shows resistance to various diseases, including Fusarium wilt, gummy stem blight, and cucumber mosaic virus (Takada 1979, 1983). Molecular analysis has shown that South and East Asian melons are distantly related (Akashi *et al.* 2002; Yashiro *et al.* 2005; Tanaka *et al.* 2007). Both melons can be useful as breeding materials and will contribute to widen the genetic base in melons stored in gene banks for future use. However, access to melons from South Asia is difficult in Japan, unless a proper agreement for access and benefit-sharing is contracted between provider and user or those genetic resources are introduced from a third party, such as the U.S. National Plant Germplasm System (NPGS), where the largest number of accessions are preserved. Exotic melon genetic resources cannot ultimately be introduced in either case owing to a Japanese plant-protection policy aimed at preventing the introduction of cucumber green-mottle mosaic virus.

Southeast Asian melons are distantly related to East Asian melons, as shown by analysis of complementary genes that cause bitterness in the immature fruit of F1 hybrids (Fujishita *et al.* 1993). Melons from Southeast Asia are also thought to be useful genetic resources to widen the genetic base of cultivated melons, and should be used in looking for genetic variation in fruit and seed traits, both of which not only have valuable information to manage them as genetic resources efficiently, but may also contribute to downsizing the number of tested materials for screening of agricultural traits, such as disease resistance.

Filed surveys in Lao PDR, Vietnam, and Western Cambodia (Sakata *et al.* 2008; Saito *et al.* 2009; Kato *et al.* 2010; Matsunaga *et al.* 2016; Tanaka *et al.* 2017) found various kinds of cucurbitaceous crops that are conserved in the gene banks of the respective countries. Especially for melon landraces from eastern and western Cambodia, which were difficult to access previously, large variation in fruit and seed traits were recognized during field surveys and were expected to show genetic variation, including disease resistance (Matsunaga *et al.* 2016; Tanaka *et al.* 2017). Thus, field surveys should be conducted in northern and southern Cambodia to discover morphological and agricultural traits, and to increase genetic variation in overall Cambodian melon landraces.

Therefore, in this field survey, cucurbitaceous crops, including melon, were collected in all northern

Cambodia and in one part of eastern and southern Cambodia. Morphological traits, such as fruit traits and seed size, were measured to characterize cucurbitaceous crops, particularly melon landraces, and were compared with those of melon landraces in other Southeast Asian countries and South and East Asian countries.

Materials and Methods

A field survey was successfully conducted as part of the PGR Asia Project by the Ministry of Agriculture, Forestry and Fishers of the Government of Japan, according to a Letter of Agreement between the Cambodian Agricultural Research and Development Institute (CARDI; Cambodia), Genetic Resources Center in the National Agriculture and Food Research Organization (NARO; Japan). Starting on November 16, 2016, during the dry season (Table 1), the 18-day field survey included the capital (Phnom Penh) of Cambodia and nine provinces of mainly Northern Cambodia, including Kampong Cham, Kampong Thom, Siem Reap, Oddar Meanchey, Preah Vihear, Steung Treng, Kratie, Tbong Khmom and Kandal (Fig. 1).

Samples were collected from local markets, roadside vegetable stands, farmer houses, and cropping fields; the precise positions of the sites were recorded using a GPS. Other information, including local crop names and cultivation methods (e.g., cultivation place, sowing and harvest times, fertilizer application, and fruit usage), was also collected by interviews with residents. Seeds from each fruit or one seed-storage bag (in farmer houses) were registered as one sample. Mixed stored seeds were separated into seeds of each

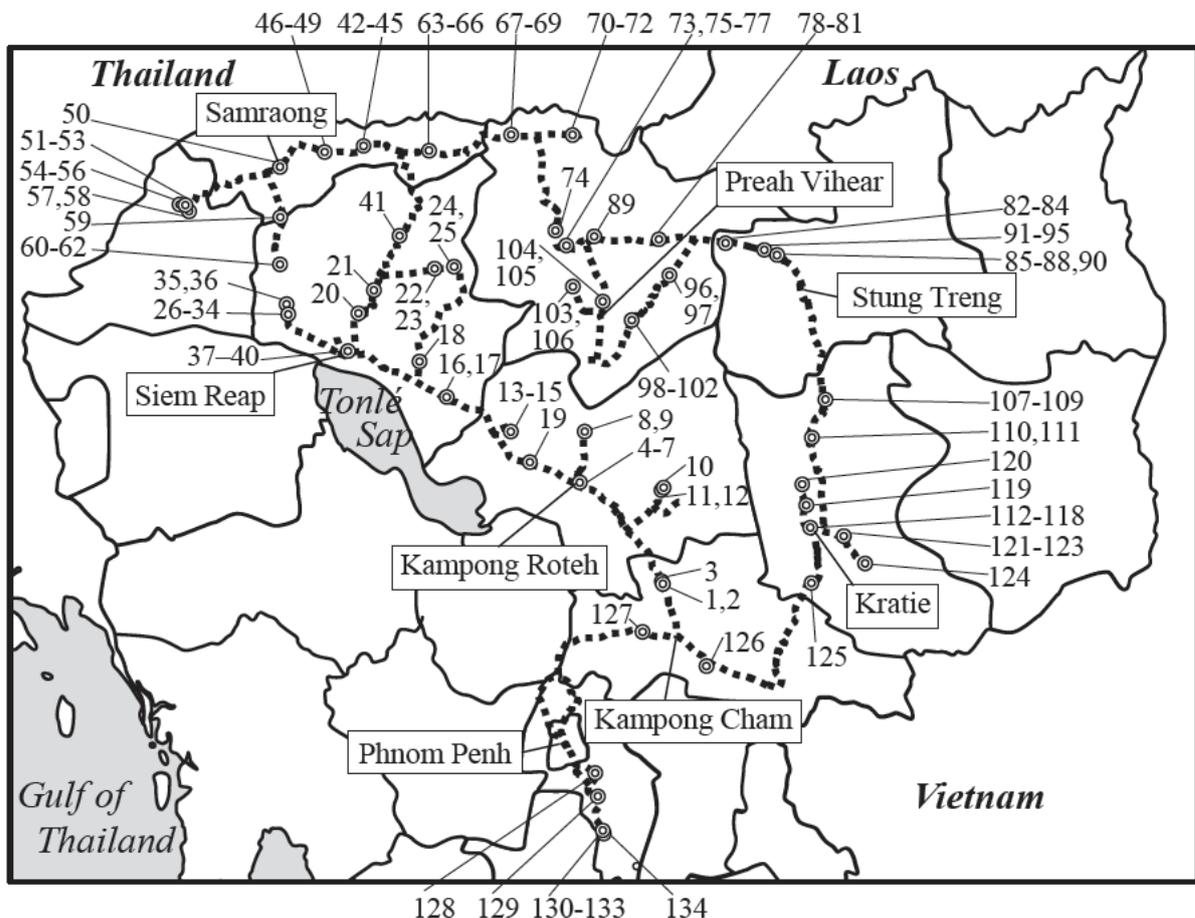


Fig. 1. Map of the explored route in Cambodia. The routes are shown by bold dotted lines. Each collection site is indicated by a double circle with a corresponding accession number(s). Accession numbers “16CJVC1”, “16CJVC2”, “16CJVC3”, and so on, are abbreviated as “1”, “2” and “3” and so on.

Table 1. Itinerary of the field survey in Cambodia, in 2016

Date	Itinerary ¹	Stay
16 Nov.	Haneda -- Bangkok -- Phnom Penh	Phnom Penh
17 Nov.	Phnom Penh -- CARDI	Phnom Penh
18 Nov.	Phnom Penh -- Kampong Cham (Kampong Cham) -- Kampong Roteh (Kampong Thom)	Kampong Roteh
19 Nov.	Kampong Roteh -- Visit to northeastern area	Kampong Roteh
20 Nov.	Kampong Roteh -- Kampong Svay -- Siem Reap (Siem Reap)	Siem Reap
21 Nov.	Siem Reap -- Visit to northern area	Siem Reap
22 Nov.	Siem Reap -- Visit to western area	Siem Reap
23 Nov.	Siem Reap -- Anglong veng (Oddar Meanchey) -- Samraong	Samraong
24 Nov.	Samraong -- Visit to western area across to Banteay Meanchey Province	Samraong
25 Nov.	Samrong -- Anlong Veng -- Tbeng Mean Chey (Preah Vihear)	Tbeng Mean Chey
26 Nov.	Tbeng Mean Chey -- Visit to eastern area across to Steung Treng Province	Tbeng Mean Chey
27 Nov.	Sample preparation	Tbeng Mean Chey
28 Nov.	Tbeng Mean Chey -- Visit to southern area	Tbeng Mean Chey
29 Nov.	Tbeng Mean Chey -- Steung Treng (Steung Treng) -- Kratie (Kratie)	Kratie
30 Nov.	Kratie -- Visit to northern area and southern area	Kratie
1 Dec.	Kratie -- Tbong Khmom (Tbong Khmom) -- Phnom Penh	Phnom Penh
2 Dec.	Phnom Penh -- Kandal (Kandal) -- CARDI -- Phnom Penh	Phnom Penh
3 Dec.	Sample preparation	Phnom Penh
4 Dec.	Phnom Penh -- CARDI -- Bangkok -- Haneda on 5 Nov.	On flight

¹Province is indicated in parenthesis.

crop and were registered independently as corresponding to individual seed samples.

We also investigated 13 fruit characteristics and recorded them for 18 melon fruits (Table 2). Seed length and width were measured on 10 seeds from each of 70 melon accessions, and the seed samples were classified as large- (≥ 9.0 mm length) or small-seed (< 9.0 mm length), according to Akashi *et al.* (2002). The seeds were selected randomly.

Data was analyzed using 18 melon fruits and 700 melon seeds (10 seeds of 70 accessions) mainly from northern Cambodia, along with previously reported data of the characteristics and sizes of 425 melon fruits and 3490 seeds from 422 melon accessions from East India, southern China (mainly Yunnan Province), northern and southern Lao PDR, western and eastern Cambodia. *C. melo* vars. *makuwa* and *conomon* were from China, Korea, and Japan (Saito *et al.* 2009; Kato *et al.* 2010; Nhi *et al.* 2010; Matsunaga *et al.* 2016; Tanaka *et al.* 2014, 2017). The number of fruits measured were 113 for 32 accessions of vars. *makuwa* and *conomon*, as follows: 1 fruit from 2 accessions (total: 2 fruits), 2 fruits from 9 accessions (total: 18 fruits), 3 fruits from 8 accessions (total: 24 fruits), 4 fruits from 4 accessions (total: 16 fruits), 5 fruits from 4 accessions (20 fruits), 3 fruits from 6 accessions (18 fruits, in all), 7 fruit from 1 accession (7 fruits, in all), and 8 fruits from 1 accession (8 fruits, in all). Seed size of each accession was measured for three seeds. For the 101 melon accessions from western and eastern Cambodia, a single fruit from each of 23 accessions was measured, and the seed size ($n = 10$) was measured for all accessions. For the 65 and 117 accessions melons from China and Lao PDR, respectively, a single fruit and 10 seeds from that single fruit were measured. For the 107 accessions from East India, a single fruit and three representative seeds was measured. Thus, the total number of melon fruits and melon seeds included in the analysis were 492 and 4,190, respectively. Using the Tukey-Kramer multiple comparison test, we compared the seed lengths of the accessions from four geographical regions in Cambodia and from other countries.

Table 2. Fruit characters of genetic resources of cucurbitaceous from Eastern Cambodia, 2016

Collection number	Fruit size			Fruit epicarp			Fruit flesh					Placenta color	Sheath ² around seed
	Weight (kg)	Length (cm)	Diameter (cm)	Color ¹	Stripe on rind	Sutures on rind	Outer ¹ color	Inner ¹ color	Thickness (cm)	Powder texture	Brix ()		
16CJV-C1	1.46	26.0	12.0	Y	+	-	LG	O	3.0	+	5.0	O	+
16CJV-C2	1.25	25.0	11.0	Y	+	-	LG	O	2.5	+	5.0	O	+
16CJV-C4	2.30	30.0	12.5	G	+	-	LG	LG	3.5	+	2.0	O	+
16CJV-C5	1.80	27.0	12.0	W	-	-	G	G	3.0	+	3.0	O	+
16CJV-C6	1.80	23.0	12.5	Y	-	-	LG	LG	3.5	+	3.0	O	+
16CJV-C16	1.00	30.5	10.0	G	+	-	W	W	2.7	+	4.0	W	+
16CJV-C37	0.74	26.0	8.0	G	+	-	G	G	2.0	+	2.6	W	+
16CJV-C38	1.34	29.0	10.0	Y	+	-	LG	LG	2.5	+	2.0	W	+
16CJV-C39	0.66	22.0	8.5	Y	-	-	G	G	1.5	+	2.0	W	+
16CJV-C40	1.31	25.5	11.5	W	-	-	G	G	2.5	+	2.0	W	+
16CJV-C112	3.90	35.0	16.0	Y	+	-	LG	LG	4.0	-	3.0	W	+
16CJV-C113	5.25	34.0	18.5	W	+	-	W	W	5.7	-	6.0	W	+
16CJV-C114	3.30	35.0	14.5	Y	+	+	LG	LG	4.0	-	3.0	W	+
16CJV-C115	5.40	36.5	20.0	G	+	-	LG	LG	5.0	-	3.6	W	+
16CJV-C116	3.85	36.0	17.0	G	+	-	G	W	5.0	+	3.0	W	+
16CJV-C117	1.25	13.0	14.0	Y	-	-	LG	LG	3.0	+	4.0	W	+
16CJV-C118	1.20	13.0	14.0	O	+	-	G	G	3.4	+	4.0	O	+
16CJV-C134	0.02	3.2	2.4	Y	-	-	W	W	0.30	-	6.0	W	+

¹G: Green, LG: Light green, DG: Dark green, O: Orange, W: White, Y: Yellow.

²Gelatinous sheath surrounding seed in melon.

Study area

During the field survey, mainly in northern Cambodia, we visited the capital, the provincial capitals of nine provinces, and various villages along the route (Fig.1). The field survey included lowland areas surrounding Tonle Sap and the Mekong River, at an altitude ranging from -2 to 133 meters above sea level (Photograph 1). During the survey, we observed the following two areas depending on water availability: a dry area distant from Tonle Sap and the Mekong River, especially in Oddar Meanchey and Preah Vihear, and a water-abundant-area covered with many ponds near Tonle Sap and the Mekong River (Photographs 2-5). Agricultural products were already harvested in the dry area, but were cultivated in the water-abundant-area even in dry season (Photographs 6 and 7). The dry area was also developed for the cultivation of cash crops, such as rubber, cassava, pepper, sugar cane and banana (Photographs 8 and 9). Local people used both wild and cultivated foodstuffs, including vegetables, fruits, animals, and fish, and they sell them and their processed foods at city and local markets (Photographs 10-14). Immature and mature fruits of cucurbitaceous crops, such as bottle gourd, cucumber, melon, pumpkin, sponge gourd, squash, watermelon, and wax gourd, were seen at the local markets and vegetable stands on the roadside, in which both, improved varieties and landraces were often found (Photographs 15-26). Those foodstuffs were carried from both, neighboring and distant areas by transportation over well-paved highways and dirt roads. Especially along the Mekong River, local people carry cucurbit fruits from islands where farmlands are located.

Results

This survey collected 127 samples from 49 sites and comprised nine kinds of cucurbit crops, as well as one type of maize, eggplant, and mung bean, respectively (Tables 3 and 4; Photographs 27-29). A total of 28 samples were collected, 27 as fruit and one as a plant (16CJV-C34), respectively; the remaining samples were collected as seeds from farmer houses (Photographs 29 and 30). Local farmers stored their seeds in

Table 3. Total number of collections obtained in Cambodia in 2016

Plant name	Total	Province									
		Kampong Cham	Kampong Thom	Siem Reap	Oddar Mean- cheay	Banteay Mean- cheay	Preah Vihear	Stung Treng	Kratie	Tbong Khmom	Kandal
Melon	70	3	8	14	5	3	12	4	14	2	5
Cucumber	3	0	1	0	0	0	0	2	0	0	0
Pumpkin	23	0	3	5	4	2	6	0	2	0	1
Watermelon	13	0	0	5	1	0	3	4	0	0	0
Wax gourd	10	0	1	1	2	2	2	1	1	0	0
Other crops ¹	8	0	0	3	1	0	2	1	0	0	1
Total	127	3	13	28	13	7	25	12	17	2	7

¹Angled luffa, bitter gourd, bottle gourd, snake gourd, maize, eggplant and mung bean included to "other crops".

storage cases, such as plastic bottles, bamboo tubes, bottle gourds, netted or plastic bags; further, some farmers stored all their cucurbit crop seeds together (Photographs 31 and 32). Especially for melon genetic resources, local farmers harvested seeds from more than two fruits, which were set by open pollination, and the stored seeds showed much variation (Photograph 33). Seeds of 25 melon samples (16CJVC-3, -9, -11, -18, -19, -41, -46, -52, -60, -72, -80, -86, -92, -96, -100, 104, -107, -108, -110, -120, -125, -126, -129, -130, -131) were separated by size into two types, which were treated as different samples when registered (Table 4). Thus, all 152 samples were registered as accessions in CARDI and NIAS with JP numbers.

Seventy accessions were collected for melon during the field survey (Table 3). Among them, 17 accessions were collected as fruits, and 52 accessions were collected as seeds stored by farmers (Table 2; Photographs 27, 30-32). The remaining accession, 16CJV-C134, was collected as a plant, and seeds were also collected from three fruits after cultivating by CARDI and checking fruit characteristics (Photographs 29 and 34). Based on interviews with local people, we learned that cultivation of melon landraces starts at the beginning of the rainy season (i.e., April to May), either by mixed cropping with maize, upland rice, wax gourd, and pumpkin or by single cropping in an open field on flat land or near a riverside. Especially near a river, where enough water is supplied for farming, melon is cultivated by double cropping in the latter half of the rainy season (i.e., September) or in the dry season (i.e., December). Before cultivation, the field is burnt with harvest remains, such as rice straw. Fertilizers and pesticides are not applied during cultivation, except for the improved melon variety (16CJV-C65, Photograph 24 shows similar fruits) cultivated using chemical fertilizer, pesticides, and mulch by using a plastic tunnel. Few farmers use irrigation, mulch and chemical fertilizers or cow manure to cultivate melon landraces (Photographs 35-37). During the cropping season, diseases were recognized in the melon fields for the following accessions: powdery mildew was present in 16CJV-C16, -C17, -C41, -C78 to -C80, -C96, -C103, -C104, -C125, -C128, and -C129, while downy mildew could be observed in fields where 16CJV-C83, -C128 were cultivated. Immature and mature melon fruits were harvested one and two months after sowing, respectively (Photographs 25 and 26). Immature fruits were prepared as a vegetable (e.g., being pickled or prepared in soups and salads), while mature fruits were eaten as desserts with sugar, condensed milk, coconut milk or crushed ice (Photograph 38). Seeds for cultivation the following year were collected from the first set fruit on the vine, good appearance of fruit or epicarp color of fruit, and number of fruits, normally two or three fruits, depending on the growing area. However, 16CJV-C134 was grown on the side of farmland and was not cultivated by local people who ate the fruit directly and occasionally sold them in the markets. Based on interviews with local people, two kinds of the fruits, sweet and sour, were observed.

The 18 melon accessions varied in measured fruit traits. For example, epicarp colors was green, orange, white or yellow (Table 2, Photograph 27). Fruit length varied widely and ranged from 3.2 to 36.5 cm, although the fruits were >20 cm in most cases. Exceptionally, short fruits were measured for “16CJV-C117”, “16CJV-C118” and “16CJV-C134” which were 13.0, 13.0 and 3.2 cm in length, respectively (Photographs 27I, 27II and 34, respectively; Fig. 2A). Fruit length correlated with fruit weight ($r = 0.718, p < 0.01$). Fruit weight strongly correlated with fruit diameter, which ranged from 2.4 to 20.0 cm ($r = 0.918, p < 0.01$; Fig. 2B). The averaged fruit shape index (length/diameter) was greater than 1.8, indicating that most fruits were elongated (e.g., Photographs 27III-27VI). The three accessions of shorter fruits mentioned above were exceptional, of which 16CJV-C117 and -C118 were globular (shape index = 0.9; Photograph 27I and 27II) and 16CJV-C134 was oblong (shape index = 1.3; Photograph 34). Flesh traits showed less variation. Both, the outer and inner flesh colors were green or white (Photographs 39 and 40), and the sugar concentration of the flesh was ≤ 6.0 °Bx and had low or no significant correlations with other fruit traits ($r = -0.034$ to $0.392, p > 0.01$; Fig. 2C). Gelatinous sheaths around the seeds were recognized in all fruits collected. Powdery texture was observed in 13 fruits that had sticky fruit flesh normally known from mature fruit of melon landraces from interviews at farmer house visited. Therefore, most melons collected on this field survey were elongated large fruits, while a few melons had small fruits of globular and oblong shapes.

Seed length varied widely, ranging from 3.84 to 11.73 mm among the 700 seeds (10 seeds from each of the 70 melon accessions) collected on this field survey (Fig. 2C). Among them, 637 seeds (91.0 %) were under 9.0 mm long and were classified as small seeds, while the remaining seeds were classified as large seeds. Especially with 16CJV-C134, all seeds were under 4.3 mm and obviously differed from other small seeds. Based on seed size, together with information from farmers and fruit traits, 16CJV-134 was classified as a wild melon (Photograph 34). Seeds from 16CJV-C65, except for one seed, were over

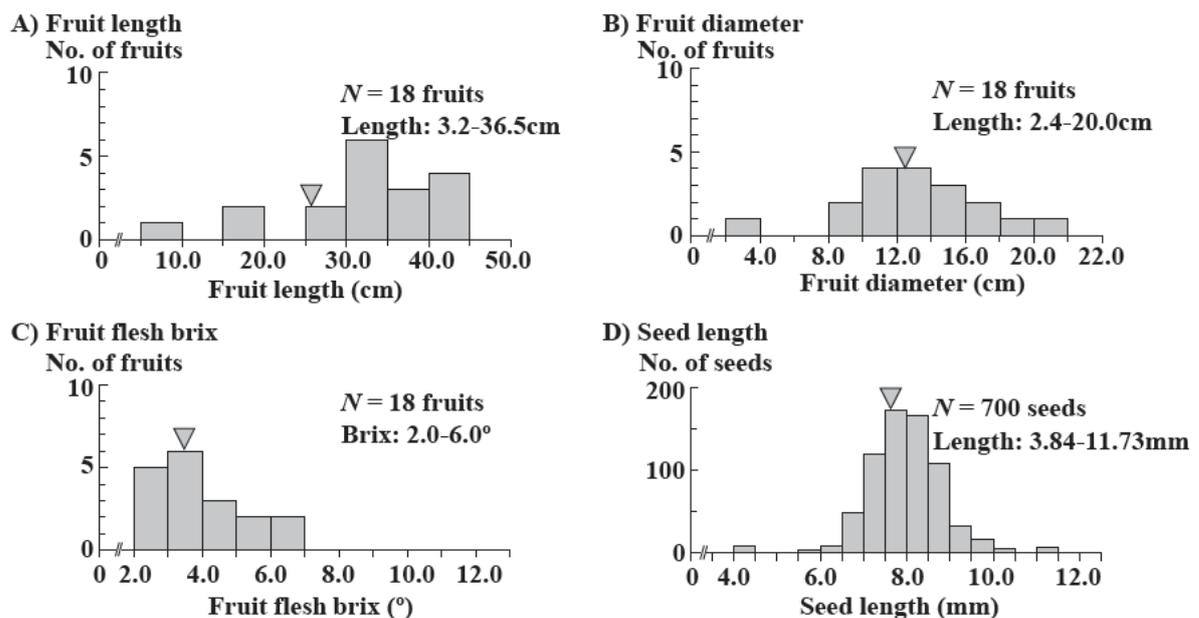


Fig. 2. Variations in fruit traits and seed length in 70 melon accessions from Cambodia. Arrowheads indicate the average value for each trait.

10.0 mm long. Based on seed length, together with information about cultivation method and seed origin, 16CJV-C65 was classified as *C. melo* var. *inodorus* Jacquin, whose seeds are normally over 10.0 mm long. The remaining 68 accessions were registered as landraces of cultivated melon (Photograph 27).

In all, 169 accessions collected from Cambodia, except for southwestern Cambodia (Fig. 3A), were registered as landraces of cultivated melon; among these, 40 accessions collected as fruits varied in fruit length and flesh sugar content by brix, which showed slight differences between four geographical areas in Cambodia (Figs. 3B and 3C). As with the length of the 1690 seeds (10 seeds from 169 accessions), no obvious differences were detected among those four geographical areas (Fig. 3D).

Fruit length and averaged seed length showed a weak correlation ($r = 0.502$, $p < 0.01$), when materials in this study were analyzed together with those from other countries. They increased toward low latitude in the following order: southern China (mainly from Yunnan Province), northern Lao PDR, southern Lao PDR, and Cambodia (Figs. 4A and 4D). Melon landraces of Cambodia had larger fruit and seed length than those of China and Lao PDR. These Cambodian melon landraces showed similar seed length to *Cucumis melo* var. *conomon* in Eastern China, Korea, and Japan. However, marked differences were not detected among materials from southern China, Lao PDR or Cambodia in fruit diameter and flesh sugar content by brix, which was similar in Cambodian melons and *Cucumis melo* var. *conomon* (Figs. 4B

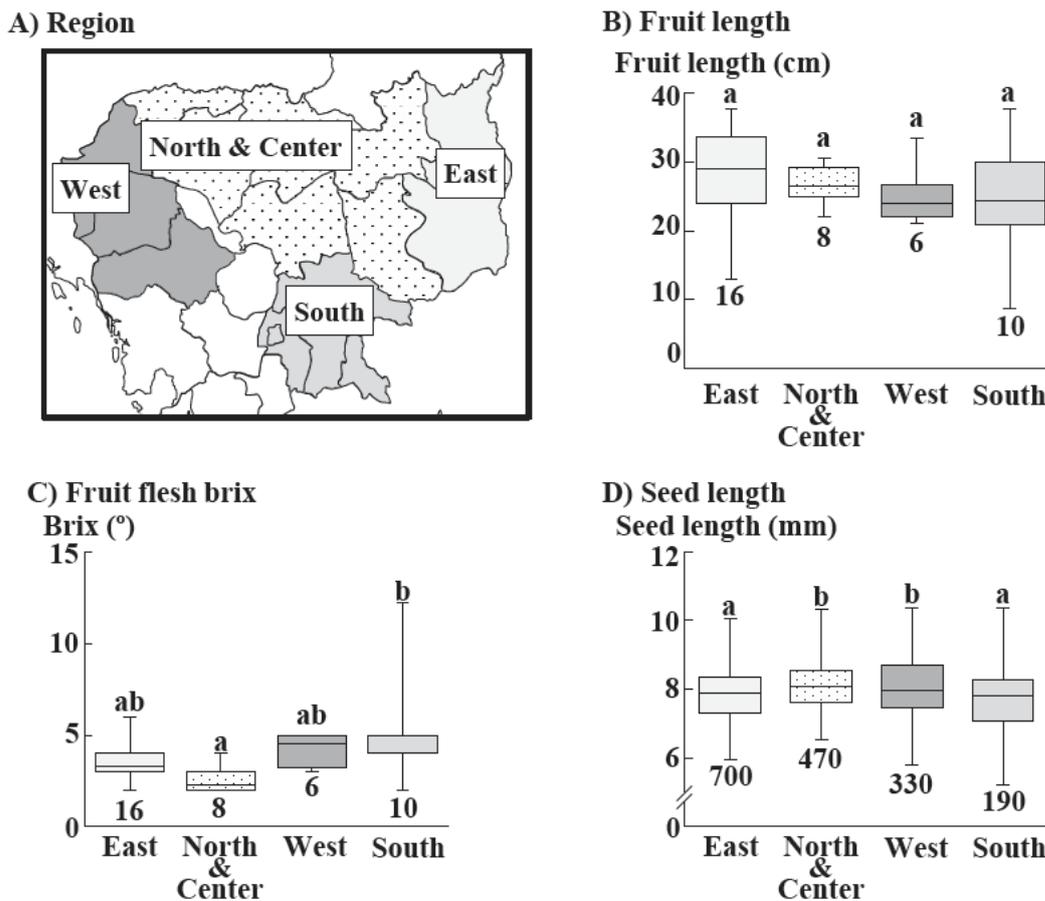


Fig. 3. Variation of fruit traits and seed length in cultivated melons from four geographical areas. A) Collected areas of melon landraces. B) Variation in fruit length, C) Variation in fruit flesh Brix, D) Variation in seed length. Letters a, ab, and b above the bars on boxplot indicate significant differences at $p < 0.01$ by the Tukey-Kramer multiple-comparison test in B), C), D). Numerical characters under boxplot indicate the number of fruits in B) and C) or seeds in D).

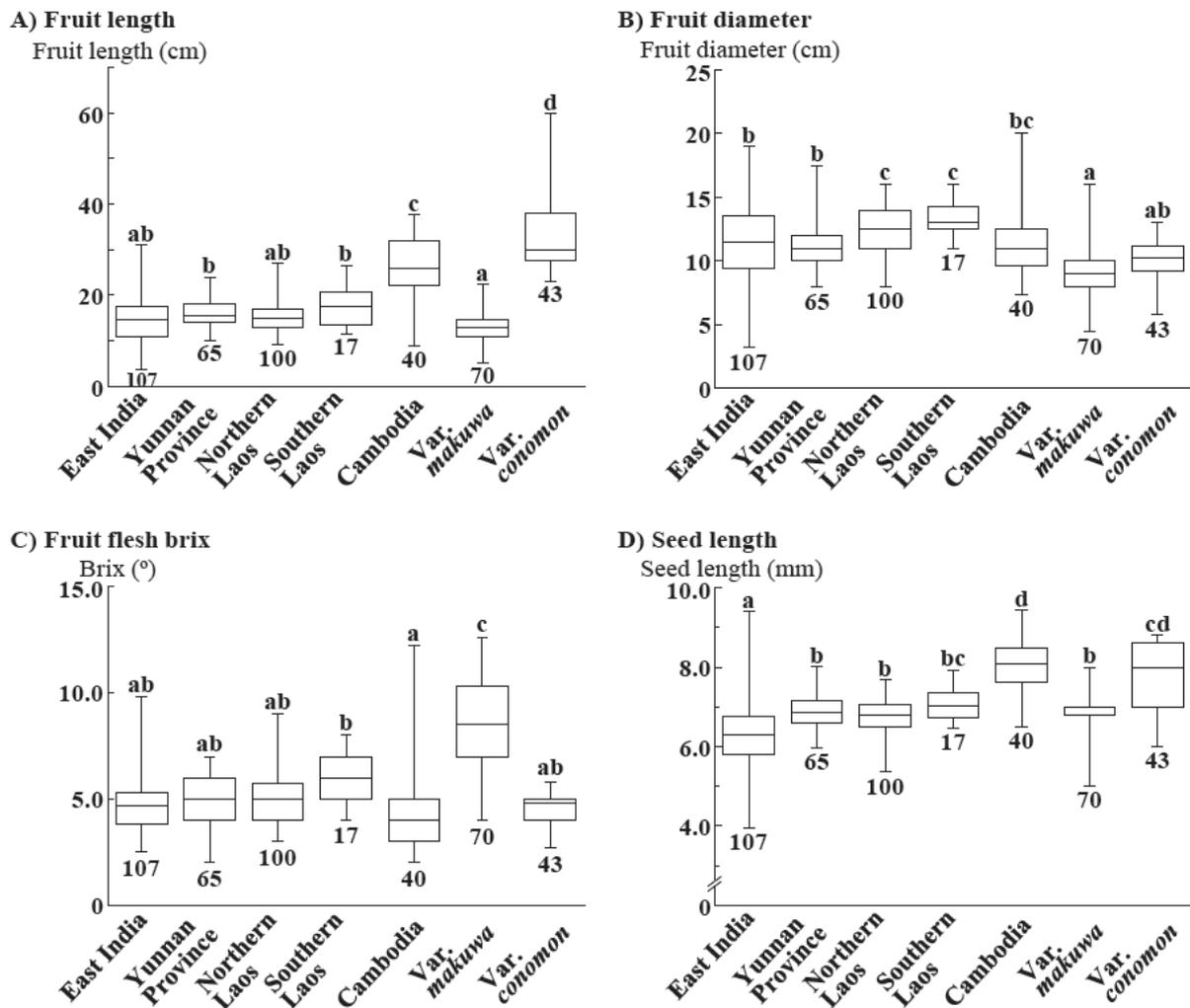


Fig. 4. Variation in fruit traits and seeds in cultivated melons of 442 accessions. Letters a–d above the bars indicate significant differences at $p < 0.01$ by the Tukey-Kramer multiple-comparison test. Numerical characters under boxplot indicate the number of fruits in A) – C) and the number of fruits that produced the measured-seeds in D).

and 4C). Therefore, the size of melon fruits and seeds clearly indicated a geographical pattern seemingly determined by latitude; further, larger sized seed was found in melon accessions from Cambodia, as well as those from East Asia.

Discussion

We collected 127 samples and information about the cultivation and utilization of cucurbitaceous crops in lowland areas of northern Cambodia, mainly. Immature and mature fruits of melon landraces were eaten as vegetable and dessert, respectively, the same in western and eastern Cambodia (Matsunaga *et al.* 2016; Tanaka *et al.* 2017). Melon landraces are cultivated without fertilizers or pesticides after slash-and-burn of plots in the sites we visited. Seeds were harvested from more than two fruits set by open pollination. These cultivation methods were also observed in western and eastern Cambodia (Matsunaga *et al.* 2016; Tanaka *et al.* 2017). Cultivation and utilization of melon landraces, in addition to sharing their gene pool through open pollination, seemed to be similar throughout Cambodia, leading to consistency in fruit and agricultural traits among those melon landraces. Thus, fruit length and diameter, fruit flesh brix and seed length of melon landraces showed slight differences between four geographical areas (Figs. 3B-

3D), even though wide variations were observed within the respective areas (Figs. 2A-2D; Matsunaga *et al.* 2016; Tanaka *et al.* 2017).

Fruit and seed length increased with latitude in melon landraces in the following order: Yunnan Province, northern Lao PDR, southern Lao PDR, and Cambodia (Figs. 4A and 4D), suggesting that increases in fruit and seed length can be detected among Southeast Asian melons, even though melon accessions from southern Cambodia were limited in this study. Most melon landraces from eastern, western, and northern Cambodia, had an elongated fruit shape, which is thought to be common in Cambodia melon landraces (Fig. 2; Matsunaga *et al.* 2016; Tanaka *et al.* 2017), while melon landraces from Yunnan Province and northern Lao PDR had an oblong fruit shape (Kato *et al.* 2006, 2010; Saito *et al.* 2009). According to Nhi *et al.* (2010), Vietnamese melons show geographical variation in fruit length: melon landraces from southern and northern Vietnam have an elongated and an oblong fruit shape, which are called “*Dua gang*” and “*Dua thom*”, respectively. Seed length also differed between these elongated and oblong fruit melons: 7.5 ± 0.6 mm and 7.0 ± 0.6 mm, respectively ($p < 0.01$). Moreover, both melon types showed genetic differentiation after RAPD analysis: elongated fruit melons were classified as Clusters IIa, b, c, d, and e, while oblong fruit melons were classified as Clusters Vb. These results support our suggestion that melon landraces of Cambodia have a different genetic component from those of Yunnan Province and northern and southern Lao PDR (Fig. 4). Fruit and seed length showed a wide variation not only in natural populations, as shown in this study, but also, in experimental lines; further, this variation is controlled by quantitative trait loci (QTLs) (Díaz *et al.* 2014; Wang *et al.* 2011). Cambodian melon landraces may have different QTLs sets from those present in other countries in Southeast Asia.

Cambodian melons collected in this field survey also had traits of fruit length and fruit texture brix similar to melons from other areas, especially to *C. melo* vars. *momordica* and *conomon*. Powdery texture and gelatinous sheaths around the seeds were also recognized in melons collected in northern, western, and eastern Cambodia (Table 2, Matsunaga *et al.* 2016; Tanaka *et al.* 2017), and were normally found in *C. melo* var. *momordica* in India (Kato *et al.* 2006; Dhillon *et al.* 2012). *C. melo* var. *conomon* in East Asia is large and an elongated fruit shape with low sugar concentration in the flesh than most other melons collected in this field survey. Cambodia is located between South Asia and East Asia; not surprisingly, the country has melons with shared fruit traits from varieties *momordica* and *conomon*. It is worthy of notice that both varieties are useful breeding materials for resistant to various kinds of insects, such as cucumber beetle and aphid, and diseases, such as powdery mildew, fusarium wilt, gummy stem blight and cucumber mosaic virus (Dhillon *et al.* 2012; Takada, 1979, 1983). Our observation of fruit traits might indicate that Cambodian melons have a potential resistance against insect and disease attack.

In conclusion, 127 samples were collected in this field survey, which were registered as genetic resources at national institutes in Cambodia and Japan. From characterization of melon fruits and seeds, Cambodian melons seem likely to have different genetic components from melons of neighboring countries, as well as resistance to insects and diseases. We were able to collect wild melon in southern Cambodia, which are not available anywhere in the world. From interviews, wild melon in Cambodia is classified into two types by taste, sweet and sour, although only the sour-taste type was collected in this field survey. Wild melon seems to be resistant to canker and virus (Fujishita 1977; Sowell 1981; Sakata *et al.* 2000); therefore, it may be very useful for melon breeding. Thus, further expeditions are needed in southern Cambodia to collect new genetic resources, such as wild melon, to increase available germplasm.

Genetic resources

All seeds of the 152 accessions collected have been stored as genetic resources in the CARDI gene bank, and a subset was placed in the NARO Genebank under the Standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). We plan to increase the genetic resources and to evaluate them in 2017.

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2016 年度カンボジアにおけるウリ科作物遺伝資源の探索

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和文摘要

ウリ科作物遺伝資源を収集するためカンボジア東部において調査を実施した。調査で収集した遺伝資源は 127 点で、市場、畑や農家にて収集した。これらのうち、メロン遺伝資源は 70 点であり、52 系統、17 系統および 1 系統をそれぞれ種子、果実および植物体として収集した。うち、後 1 者は採集後にカンボジア農業調査開発研究所の圃場にて生育を続け、果実形質を調査してから採種した。形質の分離が確認された 25 系統のメロンを含め、これら遺伝資源は、それぞれ、カンボジア農業調査開発研究所ならびに農業生物資源研究所において遺伝資源として登録した。農家からの聞き取りや形質調査に基づくと、収集したメロンは改良品種、雑草メロンおよび在来の栽培メロンで構成されていた。メロンの栽培方法や用途、特に、他家受精により遺伝子プールを共有できる状況はカンボジア東部や西部と類似しており、果実や種子の形質で地域間がほとんどない結果につながっているようであった。一方、カンボジアのメロン遺伝資源において果実や種子は隣国のラオス、雲南省を主とした中国の在来メロンよりも長く、これらの形質に関わる量的遺伝子座の組み合わせが隣国の在来メロンとは異なっていることを示唆していた。さらに、カンボジアのメロン遺伝資源は果肉の粉質や種子周辺のゼリー質では南アジアの在来メロンと類似性があるだけでなく、果実の形状や果肉の Brix では東アジアの在来メロンと類似性が認められた。南アジアや東アジアの在来メロンが病害抵抗性の育種素材として利用されていることから、これらの類似性はカンボジアのメロン遺伝資源が病害抵抗性を有している可能性を示唆していた。収集したカンボジアのメロン系統は、さまざまな形質変異を有しており、個別の育種において有望形質を選択できる素材であるので、今後の評価が待たれる。

Table 4. Details of materials collected in Cambodia in 2016

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/ landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258660	16CJVC-1	18 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kampong Cham	Chamkar Leu	Sray Teap	Tang Knang	N12-16-19 28 & E105-16-57 83	75	Road side shop	Orange color on epicarp, cultivated in Stung Treang Province
258661	16CJVC-2	18 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kampong Cham	Chamkar Leu	Sray Teap	Tang Knang	N12-16-19 28 & E105-16-57 83	75	Road side shop	Orange color on epicarp, cultivated in Stung Treang Province
258662	16CJVC-3	18 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Prei	Landrace	Seeds	Kampong Cham	Chamkar Leu	Sray Teap	Tang Knang	N12-16-25 38 & E105-17-8 05	74	Farmer	White color on epicarp, sweet flesh, var makuwa, large seeds
258663	16CJVC-3	18 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Prei	Landrace	Seeds	Kampong Cham	Chamkar Leu	Sray Teap	Tang Knang	N12-16-25 38 & E105-17-8 05	74	Farmer	White color on epicarp, sweet flesh, var makuwa, small seeds
258664	16CJVC-4	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kampong Thom	Steung Treang	Kdeydong	Kdeydong	N12-42-44 68 & E104-53-12 16	9	Farmer (Kampong Thom marlet)	Green color with stripes on epicarp
258665	16CJVC-5	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kampong Thom	Steung Treang	Kdeydong	Kdeydong	N12-42-44 68 & E104-53-12 16	9	Farmer (Kampong Thom marlet)	White color on epicarp
258666	16CJVC-6	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kampong Thom	Steung Treang	Kdeydong	Kdeydong	N12-42-44 68 & E104-53-12 16	9	Farmer (Kampong Thom marlet)	Yellow color on epicarp
258667	16CJVC-7	19 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	La Pao	Landrace	Fruit	Kampong Thom	Steung Treang	Kdeydong	Kdeydong	N12-42-44 68 & E104-53-12 16	9	Seller (Kampong Thom marlet)	Seller bought fruit at village distantly 1km from the market
258668	16CJVC-8	19 Nov , 2016	<i>Cucumis sativus</i>	Cucumber	Tror Sork Paok	Landrace	Seeds	Kampong Thom	Prasat Balang	Sala vichey	Tror peng Tmor	N12-57-18 24 & E104-57-10 91	18	Farmer	Long shaped fruit
258669	16CJVC-9	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	Prasat Balang	Sala vichey	Tror peng Tmor	N12-57-18 24 & E104-57-10 91	18	Farmer	Green color with stripes on epicarp, large seeds
258670	16CJVC-9	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	Prasat Balang	Sala vichey	Tror peng Tmor	N12-57-18 24 & E104-57-10 91	18	Farmer	Green color with stripes on epicarp, small seeds
258671	16CJVC-10	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	San tok	Dong Kda	Dong Kda	N12-37-23 75 & E105-17-34 61	40	Farmer	Green color with stripes on epicarp
258672	16CJVC-11	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	San Tok	Kro Yea	75 Chit Bram	N12-37-4 44 & E105-17-31 31	41	Farmer	Green or yellow color with stripes on epicarp and white color on epicarp, Storage mixed with no 11, large seeds
258673	16CJVC-11	19 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	San Tok	Kro Yea	75 Chit Bram	N12-37-4 44 & E105-17-31 31	41	Farmer	Green or yellow color with stripes on epicarp and white color on epicarp, Storage mixed with no 11, small seeds
258674	16CJVC-12	20 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	La Pao	Landrace	Seeds	Kampong Thom	San Tok	Kro Yea	75 Chit Bram	N12-37-4 44 & E105-17-31 31	41	Farmer	Storage mixed with no 10
258675	16CJVC-13	20 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	Stouug	Banteay Stoung	Banteay Stoung	N12-55-47 79 & E104-38-34 05	24	Farmer	Green color with stripes on epicarp and white color on epicarp
258676	16CJVC-14	20 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Kampong Thom	Stouug	Banteay Stoung	Banteay Stoung	N12-55-47 79 & E104-38-34 05	24	Farmer	
258677	16CJVC-15	20 Nov , 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Fruit	Kampong Thom	Stouug	Banteay Stoung	Banteay Stoung	N12-55-47 79 & E104-38-34 05	24	Farmer	Long shaped fruit
258678	16CJVC-16	20 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Siem Reap	Chi Kreng	Kok Tlork Krom	Tropeng Trav	N13-7-5 00 & E104-19-30 48	16	Farmer	Green color with stripes on epicarp
258679	16CJVC-17	20 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Chi Kreng	Kok Tlork Krom	Tropeng Trav	N13-7-5 00 & E104-19-30 48	16	Farmer	Green color with stripes on epicarp
258680	16CJVC-18	20 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Sout Nikoem	Samraong	Samraong	N13-18-24 24 & E104-8-7 46	33	Farmer	Green color with stripes on epicarp, Seeds were collected two years ago, large seeds
258681	16CJVC-18	20 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Sout Nikoem	Samraong	Samraong	N13-18-24 24 & E104-8-7 46	33	Farmer	Green color with stripes on epicarp, Seeds were collected two years ago, small seeds

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258682	16CJVC-19	20 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	Kampong Svay	San Kor	San Kor	N12-48-28 1 2 & E104-44-16 63	12	Farmer (San Kor market)	Green color with stripes on epicarp, large seeds
258683	16CJVC-19	20 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kampong Thom	Kampong Svay	San Kor	San Kor	N12-48-28 12 & E104-44-16 63	12	Farmer (San Kor market)	Green color with stripes on epicarp, small seeds
258684	16CJVC-20	21 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Fruit	Siem Reap	Khna Sunday	Khna Sunday	Bantey Srey	N13-35-5 53 & E103-57-49 56	57	Farmer	
258685	16CJVC-21	21 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Ban Teay Srey	Khun Ream	Khmar Roveas	N13-39-33 93 & E104-00-45 43	75	Farmer	White color on epicarp
258686	16CJVC-22	21 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Fruit	Siem Reap	Svay Leu	Taseam	Por Pel	N13-43-57 91 & E104-16-47 03	131	Farmer	
258687	16CJVC-23	21 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Svay Leu	Taseam	Por Pel	N13-43-57 91 & E104-16-47 03	131	Farmer	Green color with stripes on epicarp
258688	16CJVC-24	21 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Siem Reap	Svay Leu	Taseam	Tropong Thmor	N13-43-30 52 & E104-21-30 01	133	Farmer	
258689	16CJVC-25	21 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Svay Leu	Taseam	Tropong Thmor	N13-43-30 52 & E104-21-30 01	133	Farmer	Green color with stripes on epicarp
258690	16CJVC-26	22 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Yellow color with stripes on epicarp
258691	16CJVC-27	22 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Different skin texture from that in no 34
258692	16CJVC-28	22 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected at different time from those in no 33
258693	16CJVC-29	22 Nov, 2016	<i>Lagenaria siceraria</i> var. <i>gourda</i>	Bottle gourd	Tror Lack Srov	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected from one fruit
258694	16CJVC-30	22 Nov, 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected from one fruit
258695	16CJVC-31	22 Nov, 2016	<i>Luffa acutangula</i>	Angled luffa	Nor Noug Jrong	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected from one fruit
258696	16CJVC-32	22 Nov, 2016	<i>Trichosanthes anguina</i>	Snake gourd	Nor Noug Pors	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected from one fruit
258697	16CJVC-33	22 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Seeds were collected at different time from those in no 28
258698	16CJVC-34	22 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Siem Reap	Pouk	Yeang	Yeang	N13-33-28 11 & E103-36-45 23	16	Farmer	Different skin texture from that in no 27
258699	16CJVC-35	22 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Pouk	Khdey Ron	Tapang	N13-36-52 25 & E103-37-16 79	16	Farmer	White color on epicarp, Storage mixed with no 36
258700	16CJVC-36	22 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Cultivar	Seeds	Siem Reap	Pouk	Khdey Ron	Tapang	N13-36-52 25 & E103-37-16 79	16	Farmer	Seeds were sold at market near the village, Storage mixed with no 35
258701	16CJVC-37	23 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Siem Reap	Siem Reap	Slor Kram	Slor Kram	N13-21-35 32 & E103-52-25 11	-2	Seller (Psar Leur Thom New market)	Seller bought fruit from market at Banteay Srey District in Siem Reap Province, Green color with stripes on epicarp
258702	16CJVC-38	23 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Siem Reap	Siem Reap	Slor Kram	Slor Kram	N13-21-35 32 & E103-52-25 11	-2	Seller (Psar Leur Thom New market)	Seller bought fruit from market at Banteay Srey District in Siem Reap Province, Yellow color with stripes on epicarp

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258703	16CJVC-39	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Siem Reap	Siem Reap	Slor Kram	Slor Kram	N13-21-35 32 & E103-52-25 11	-2	Seller (Psar Leur Thom New market)	Seller bought fruit from market at Bontey Srey District in Siem Reap Province, Yellow color on epicarp
258704	16CJVC-40	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Siem Reap	Siem Reap	Slor Kram	Slor Kram	N13-21-35 32 & E103-52-25 11	-2	Seller (Psar Leur Thom New market)	Seller bought fruit from market at Bontey Srey District in Siem Reap Province, White color on epicarp
258705	16CJVC-41	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Varin	Srea Noy	Dai Av	N13-52-14 11 & E104-3-51 10	88	Farmer	Green or yellow color with stripes on epicarp, large seeds
258706	16CJVC-41	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Varin	Srea Noy	Dai Av	N13-52-14 11 & E104-3-51 10	88	Farmer	Green or yellow color with stripes on epicarp, small seeds
258707	16CJVC-42	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Oddar Meancheay	Onlong veng	Tror peng Tav	Tror peng Tav	N14-14-23 55 & E103-57-9 27	64	Farmer	Green color with stripes on epicarp, Storage mixed with no 43 to no 45
258708	16CJVC-43	23 Nov , 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Oddar Meancheay	Onlong veng	Tror peng Tav	Tror peng Tav	N14-14-23 55 & E103-57-9 27	64	Farmer	Seeds were collected from one fruit, Storage mixed with no 42, 44, 45
258709	16CJVC-44	23 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Oddar Meancheay	Onlong veng	Tror peng Tav	Tror peng Tav	N14-14-23 55 & E103-57-9 27	64	Farmer	Seeds were collected from one fruit, Storage mixed with no 42, 43, 45
258710	16CJVC-45	23 Nov , 2016	<i>Vigna radiata</i>	Mung bean			Seeds	Oddar Meancheay	Onlong veng	Tror peng Tav	Tror peng Tav	N14-14-23 55 & E103-57-9 27	64	Farmer	Storage mixed with no 42 to no 44
258711	16CJVC-46	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Oddar Meancheay	Samraong	Khun Khrill	Chuck Meas	N14-14-3 32 & E103-48-39 62	54	Farmer	Green color with stripes on epicarp, large seeds
258712	16CJVC-46	23 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Oddar Meancheay	Samraong	Khun Khrill	Chuck Meas	N14-14-3 32 & E103-48-39 62	54	Farmer	Green color with stripes on epicarp, small seeds
258713	16CJVC-47	23 Nov , 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Seeds	Oddar Meancheay	Samraong	Khun Khrill	Chuck Meas	N14-14-3 32 & E103-48-39 62	54	Farmer	Seeds were collected from one fruit
258714	16CJVC-48	23 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Fruit	Oddar Meancheay	Samraong	Khun Khrill	Chuck Meas	N14-14-3 32 & E103-48-39 62	54	Farmer	Bigger fruit size than no 49, Seeds collected from one fruit
258715	16CJVC-49	23 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Fruit	Oddar Meancheay	Samraong	Khun Khrill	Chuck Meas	N14-14-3 32 & E103-48-39 62	54	Farmer	Seeds collected from one fruit
258716	16CJVC-51	24 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Bontey Chhmar	N14-4-30 62 & E103-5-32 39	65	Farmer	Seeds were collected from one fruit
258717	16CJVC-52	24 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Bontey Chhmar	N14-4-30 62 & E103-5-32 39	65	Farmer	Green color with stripes on epicarp, large seeds
258718	16CJVC-52	24 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Bontey Chhmar	N14-4-30 62 & E103-5-32 39	65	Farmer	Green color with stripes on epicarp, small seeds
258719	16CJVC-53	24 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Bontey Chhmar Khang Lech	N14-4-30 62 & E103-5-32 39	65	Farmer	Seeds were collected from two fruits, Green color with stripes and white color on epicarp
258720	16CJVC-54	24 Nov , 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Kbal Ton Soung	N14-4-43 63 & E103-4-21 39	71	Farmer	Seeds were collected from one fruit
258721	16CJVC-55	24 Nov , 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Kbal Ton Soung	N14-4-43 63 & E103-4-21 39	71	Farmer	Seeds were collected from three fruits, Yellow color with and without stripes and white color on epicarp
258722	16CJVC-56	24 Nov , 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Seeds	Bontey Meancheay	Phmar Pouk	Bontey Chhmar	Kbal Ton Soung	N14-4-43 63 & E103-4-21 39	71	Farmer	Seeds were collected from one fruit

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
258723	16CJVC-58	24 Nov., 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Fruit	Bontey Meanchey	Phmar Pouk	Bontey Chhmar	Bontey Chhmar	N14-4-28 48 & E103-6-14 03	76	Farmer	
258724	16CJVC-59	24 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Oddar Meanchey	Chong Kal	Chong Kal	Prei Thom	N13-56-40 67 & E103-34-2 88	29	Farmer	Gellow and/or yellow color with stripes on epicarp
258725	16CJVC-60	24 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Srey Snom	Mouug	Mouug	N13-45-15 10 & E103-32-40 15	19	Farmer	Yellow and/or yellow color with stripes and white color on epicarp. Storage mixed with no 61, large seeds
258726	16CJVC-60	24 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Siem Reap	Srey Snom	Mouug	Mouug	N13-45-15 10 & E103-32-40 15	19	Farmer	Yellow and/or yellow color with stripes and white color on epicarp. Storage mixed with no 61, small seeds
258727	16CJVC-61	24 Nov., 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Cultivar	Seeds	Siem Reap	Srey Snom	Mouug	Mouug	N13-45-15 10 & E103-32-40 15	19	Farmer	Storage mixed with no 60
258728	16CJVC-62	24 Nov., 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Siem Reap	Srey Snom	Mouug	Mouug	N13-45-15 10 & E103-32-40 15	19	Farmer	Found powdery mildew during cultivation, Cultivated separately from no 61
258729	16CJVC-63	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Oddar Meanchey	Tro peng Brosat	Pha AV	Por Pel	N14-13-4 27 & E104-13-47 90	74	Farmer	Green color with stripes on epicarp
258730	16CJVC-64	25 Nov., 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Oddar Meanchey	Tro peng Brosat	Pha AV	Por Pel	N14-13-4 27 & E104-13-47 90	74	Farmer	Seeds were collected from one fruit
258731	16CJVC-65	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Prei	Cultivar	Seeds	Oddar Meanchey	Tro peng Brosat	Pha AV	Por Pel	N14-13-4 27 & E104-13-47 90	74	Farmer	<i>Cucumis melo</i> var <i>inodorus</i> , Yellow skin color on epicarp, Seeds is produced in Thailand company
258732	16CJVC-66	25 Nov., 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Fruit	Oddar Meanchey	Tro peng Brosat	Pha AV	Por Pel	N14-13-4 27 & E104-13-47 90	74	Farmer	
258733	16CJVC-67	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Cham Khsan	Khan Tout	Dei Thmey	N14-15-9 89 & E104-35-56 01	71	Farmer	Green color with stripes and white and/or yellow color on epicarp
258734	16CJVC-68	25 Nov., 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Preah Vihear	Cham Khsan	Khan Tout	Dei Thmey	N14-15-9 89 & E104-35-56 01	71	Farmer	
258735	16CJVC-69	25 Nov., 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Preah Vihear	Cham Khsan	Khan Tout	Dei Thmey	N14-15-9 89 & E104-35-56 01	71	Farmer	Green color with and/or without stripes on epicarp
258736	16CJVC-70	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Cham Khsan	Cham Khsan	Veal Thom	N14-12-45 49 & E104-53-33 06	74	Farmer	Green color with stripes on epicarp
258737	16CJVC-71	25 Nov., 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Preah Vihear	Cham Khsan	Cham Khsan	Veal Thom	N14-12-45 49 & E104-53-33 06	74	Farmer	Seeds were collected from two fruits
258738	16CJVC-72	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Cham Khsan	Cham Khsan	Veal Thom	N14-12-45 49 & E104-53-33 06	74	Farmer	Green color with stripes on epicarp, large seeds
258739	16CJVC-72	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Cham Khsan	Cham Khsan	Veal Thom	N14-12-45 49 & E104-53-33 06	74	Farmer	Green color with stripes on epicarp, small seeds
258740	16CJVC-73	25 Nov., 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Preah Vihear	Tbeng Mean Chey	Chhean Mok	Setha kech	N13-46-50 44 & E104-54-18 65	69	Farmer	Storage mixed with no 77
258741	16CJVC-74	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Khoulen	Thmey	Steung Sen	N13-51-36 75 & E104-49-15 38	51	Farmer	Green color with stripes and/or white color on epicarp
258742	16CJVC-75	25 Nov., 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Tbeng Mean Chey	Chhean Mok	Setha kech	N13-46-50 44 & E104-54-18 65	69	Farmer	Green color with stripes and/or yellow color on epicarp
258743	16CJVC-76	25 Nov., 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Preah Vihear	Tbeng Mean Chey	Chhean Mok	Setha kech	N13-46-50 44 & E104-54-18 65	69	Farmer	Seeds were collected from one fruit

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258744	16CJVC-77	25 Nov, 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Seeds	Preah Vihear	Tbeng Mean Chey	Chhean Mok	Setha kech	N13-46-50 44 & E104-54-18 65	69	Farmer	Storage mixed with no 73
258745	16CJVC-78	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chhaeb	Mlou Prey Mouy	Khdol	N13-48-52 92 & E105-16-8 44	63	Farmer	Green color with stripes or yellow color with stripe or white color on epicarp, Seeds were collected from one fruit
258746	16CJVC-79	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chhaeb	Mlou Prey Mouy	Khdol	N13-48-52 92 & E105-16-8 44	63	Farmer	Green color with stripes or yellow color with stripe or white color on epicarp, Seeds were collected from one fruit
258747	16CJVC-80	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chhaeb	Mlou Prey Mouy	Khdol	N13-48-52 92 & E105-16-8 44	63	Farmer	Seeds were collected from one fruit, Green color with stripes or yellow color with stripe or white color on epicarp, large seeds
258748	16CJVC-80	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chhaeb	Mlou Prey Mouy	Khdol	N13-48-52 92 & E105-16-8 44	63	Farmer	Seeds were collected from one fruit, Green color with stripes or yellow color with stripe or white color on epicarp, small seeds
258749	16CJVC-81	26 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Preah Vihear	Chhaeb	Mlou Prey Mouy	Khdol	N13-48-52 92 & E105-16-8 44	63	Farmer	Seeds were collected from one fruit
258750	16CJVC-82	26 Nov, 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach Roy	Landrace	Fruit	Steung Treng	Thala Borivat	Anlong Chrey	Srolov	N13-47-12 46 & E105-34-29 14	115	Farmer	
258751	16CJVC-83	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thala Borivat	Anlong Chrey	Srolov	N13-47-12 46 & E105-34-29 14	115	Farmer	Seeds were collected from three fruits, Yellow color with and without stripes and/or white color on epicarp
258752	16CJVC-84	26 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Steung Treng	Thala Borivat	Anlong Chrey	Srolov	N13-47-12 46 & E105-34-29 14	115	Farmer	Seeds were collected from one fruit
258753	16CJVC-85	26 Nov, 2016	<i>Cucumis sativus</i>	Cucumber	Tror Sork Pha'ak	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Seeds were collected from one fruit, Fruit length and diameter are 30 cm and 7 cm, respectively
258754	16CJVC-86	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Seeds were collected from four or five fruits, Green and/or yellow color with stripes and/or white color on epicarp, large seeds
258755	16CJVC-86	26 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Seeds were collected from four or five fruits, Green and/or yellow color with stripes and/or white color on epicarp, small seeds
258756	16CJVC-87	26 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Seeds were collected from two fruits
258757	16CJVC-88	26 Nov, 2016	<i>Cucumis sativus</i>	Cucumber	Tror Sork Pha'ak	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Seeds were collected from one fruit, Fruit length and diameter are 30 cm and 7 cm, respectively
258758	16CJVC-90	28 Nov, 2016	<i>Zea maize</i>	Corn	Pout Deomnerb	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Tnot Thmey	N13-43-25 90 & E105-49-24 25	92	Farmer	Plant height is 180cm, Panicle length is 30cm
258760	16CJVC-92	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Chhvang	N13-43-40 00 & E105-46-22 42	95	Farmer	Seeds were collected from one fruit, Green or yellow color with stripes and/or white color and yellow color on epicarp, large seeds
258761	16CJVC-92	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Chhvang	N13-43-40 00 & E105-46-22 42	95	Farmer	Seeds were collected from one fruit, Green or yellow color with stripes and/or white color and yellow color on epicarp, small seeds
258762	16CJVC-93	28 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Chhvang	N13-43-40 00 & E105-46-22 42	95	Farmer	Seeds were collected from one fruit

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258764	16CJVC-94	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Chhvang	N13-43-40 00 & E105-46-22 42	95	Farmer	Seeds were collected from one fruit, Green or yellow color with stripes and/or white color and yellow color on epicarp, small seeds
258765	16CJVC-95	28 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Steung Treng	Thla	Sa'ang	Chhvang	N13-43-40 00 & E105-46-22 42	95	Farmer	Seeds were collected from one fruit
258766	16CJVC-96	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chey Sen	Sa'ang	Teok Lech	N13-39-29 94 & E105-15-50 40	57	Farmer	Seeds were collected from two fruits, Green color with stripes and/or white color on epicarp, large seeds
258767	16CJVC-96	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Chey Sen	Sa'ang	Teok Lech	N13-39-29 94 & E105-15-50 40	57	Farmer	Seeds were collected from two fruits, Green color with stripes and/or white color on epicarp, small seeds
258768	16CJVC-97	28 Nov, 2016	<i>Benincasa hispida</i>	Wax gourd	Tror Lach M'rech	Landrace	Seeds	Preah Vihear	Chey Sen	Sa'ang	Teok Lech	N13-39-29 94 & E105-15-50 40	57	Farmer	Seeds were collected from one fruit
258769	16CJVC-98	28 Nov, 2016	<i>Solanum melongena</i>	Eggplant	Trap Sroy	Landrace	Seeds	Preah Vihear	Rov veng	Rek Reay	Khvang	N13-25-19 57 & E105-8-13 86	54	Farmer	Seeds were collected from one fruit, Fruit color and length are different from those of no 99
258770	16CJVC-99	28 Nov, 2016	<i>Solanum melongena</i>	Eggplant	Trap Sroy	Landrace	Seeds	Preah Vihear	Rov veng	Rek Reay	Khvang	N13-25-19 57 & E105-8-13 86	54	Farmer	Seeds were collected from one fruit, Fruit color and length are different from those of no 98
258771	16CJVC-100	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Rov veng	Rek Reay	Khvang	N13-25-19 57 & E105-8-13 86	54	Farmer	Green color or yellow color with stripes and/or white color on epicarp, large seeds
258772	16CJVC-100	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Rov veng	Rek Reay	Khvang	N13-25-19 57 & E105-8-13 86	54	Farmer	Green color or yellow color with stripes and/or white color on epicarp, small seeds
258773	16CJVC-101	28 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Preah Vihear	Rov veng	Rek Reay	Khvang	N13-25-19 57 & E105-8-13 86	54	Farmer	Seeds were collected from one fruit
258775	16CJVC-103	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Songkom	Cham Reoun	Da	N13-32-50 71 & E104-55-19 68	99	Farmer	Seeds were collected from two or three fruits, Green color or yellow color with stripes and/or white color and yellow color on epicarp
258776	16CJVC-104	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Ram Dos	Thnal Khong	Thnal Khong	N13-30-51 51 & E105-1-43 66	71	Farmer	Seeds were collected from two fruits, Green color or yellow color with stripes and/or white color on epicarp, large seeds
258777	16CJVC-104	28 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Preah Vihear	Ram Dos	Thnal Khong	Thnal Khong	N13-30-51 51 & E105-1-43 66	71	Farmer	Seeds were collected from two fruits, Green color or yellow color with stripes and/or white color on epicarp, small seeds
258778	16CJVC-105	28 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	La Pao	Landrace	Seeds	Preah Vihear	Ram Dos	Thnal Khong	Thnal Khong	N13-30-51 51 & E105-1-43 66	71	Farmer	
258779	16CJVC-106	28 Nov, 2016	<i>Citrullus lanatus</i>	Watermelon	Ov Lek	Landrace	Seeds	Preah Vihear	Songkom	Cham Reoun	Da	N13-32-50 71 & E104-55-19 68	99	Farmer	
258780	16CJVC-107	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sam Bo	O Khreang	O Khreang	N13-2-42 21 & E106-10-48 83	50	Farmer	Seeds were collected from two fruits, Green color with stripes on epicarp, large seeds
258781	16CJVC-107	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sam Bo	O Khreang	O Khreang	N13-2-42 21 & E106-10-48 83	50	Farmer	Seeds were collected from two fruits, Green color with stripes on epicarp, small seeds
258782	16CJVC-108	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sam Bo	O Khreang	O Khreang	N13-2-42 21 & E106-10-48 83	50	Farmer	Seeds were collected from two fruits, White color on epicarp, large seeds
258783	16CJVC-108	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sam Bo	O Khreang	O Khreang	N13-2-42 21 & E106-10-48 83	50	Farmer	Seeds were collected from two fruits, White color on epicarp, small seeds
258784	16CJVC-109	29 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao kingkok	Landrace	Seeds	Kratie	Sam Bo	O Khreang	O Khreang	N13-2-42 21 & E106-10-48 83	50	Farmer	Seeds were collected from one fruit

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site						Remarks	
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)		Source (Market name)
258785	16CJVC-110	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sambo	Kbal Damrei	Chong Horb	N12-49-51 39 & E106-11-3 82	58	Farmer	Green color or yellow color with stripes and/or white color on epicarp, Seeds were collected from each fruits in three kinds of epicarp color, large seeds
258786	16CJVC-110	29 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sambo	Kbal Damrei	Chong Horb	N12-49-51 39 & E106-11-3 82	58	Farmer	Green color or yellow color with stripes and/or white color on epicarp, Seeds were collected from each fruits in three kinds of epicarp color, small seeds
258787	16CJVC-111	29 Nov, 2016	<i>Cucurbita moschata</i>	Pumpkin	La Pao	Landrace	Seeds	Kratie	Sambo	Kbal Damrei	Chong Horb	N12-49-51 39 & E106-11-3 82	58	Farmer	Seeds were collected from many fruits
258788	16CJVC-112	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Light green color with stripes on epicarp
258789	16CJVC-113	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, White color with stripes on epicarp
258790	16CJVC-114	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Yellow color with stripes on epicarp
258791	16CJVC-115	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Green color with stripes on epicarp
258792	16CJVC-116	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Green color with yellow stripes on epicarp
258793	16CJVC-117	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Yellow color on epicarp
258794	16CJVC-118	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Fruit	Kratie	Kratie	Kratie		N12-29-4 15 & E106-1-4 32	23	Seller (Phsar Samaki Krong Kratie)	Melon is cultivated in Kaoh Chraeng island in the Mekhong River in Prey Brosorb district, Yellow color with stripes on epicarp
258795	16CJVC-120	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sambor	Sandan	Sandan Leu	N12-42-15 80 & E106-0-50 81	25	Farmer	Seeds were collected from seven fruits, Green color and/or yellow color with stripes or white color on epicarp, large seeds
258796	16CJVC-120	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Sambor	Sandan	Sandan Leu	N12-42-15 80 & E106-0-50 81	25	Farmer	Seeds were collected from seven fruits, Green color and/or yellow color with stripes or white color on epicarp, small seeds
258797	16CJVC-121	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Chit Borey	Khan Tout	Thmor Reap	N12-28-14 10 & E106-10-0 60	37	Farmer	Seeds were collected from two fruits of green color with stripes on epicarp
258798	16CJVC-122	30 Nov, 2016	<i>Benincasa hispida</i>	Wax gourd	Trolach	Landrace	Fruit	Kratie	Chit Borey	Khan Tout	Thmor Reap	N12-28-14 10 & E106-10-0 60	37	Farmer	
258799	16CJVC-123	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Chit Borey	Khan Tout	Thmor Reap	N12-28-14 10 & E106-10-0 60	37	Farmer	Seeds were collected from one fruit of white color on epicarp
258800	16CJVC-124	30 Nov, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kratie	Snoul	Svay Chras		N12-18-10 30 & E106-18-6 20	68	Farmer	Seeds were collected from one fruit, Green color with stripes
258801	16CJVC-125	1 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Tbong Khmom	Sambae	Seda	Prey Chhor	N12-15-9 05 & E105-58-35 68	24	Farmer	Seeds were collected from four fruits, Green or yellow color with stripes and/or white color on epicarp, large seeds

Table 4. (Continued).

JP No	Sample No	Collected date	Species	Plant name	Local name	Cultivar/landrace	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
258802	16CJVC-125	1 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Tbong Khmom	Sambae	Seda	Prey Chhor	N12-15-9 05 & E105-58-35 68	24	Farmer	Seeds were collected from four fruits, Green or yellow color with stripes and/or white color on epicarp, small seeds
258803	16CJVC-126	1 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Prei	Landrace	Seeds	Tbong Khmom	Tbong Khmom	Tonle Bet	Doun Mao Leu	N12-57-39 91 & E105-28-35 76	16	Farmer	Seeds were introduced from Thai pei, <i>Cucumis melo</i> var <i>makuwa</i> , large seeds
258804	16CJVC-126	1 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Prei	Landrace	Seeds	Tbong Khmom	Tbong Khmom	Tonle Bet	Doun Mao Leu	N12-57-39 91 & E105-28-35 76	16	Farmer	Seeds were introduced from Thai pei, <i>Cucumis melo</i> var <i>makuwa</i> , small seeds
258805	16CJVC-128	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Saang	Svay Broteal	Roussey Chroy	N11-24-31 35 & E105-2-3 93	13	Farmer	Green color with stripes on epicarp
258806	16CJVC-129	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Saang	Tkhol	Number8	N11-19-21 97 & E105-3-46 59	5	Farmer	Seeds were collected from many fruits, Green or yellow color with stripes and/or white color on epicarp, large seeds
258807	16CJVC-129	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Saang	Tkhol	Number8	N11-19-21 97 & E105-3-46 59	5	Farmer	Seeds were collected from many fruits, Green or yellow color with stripes and/or white color on epicarp, small seeds
258808	16CJVC-130	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	Seeds were collected from two fruits, Yellow color with stripes on epicarp, large seeds
258809	16CJVC-130	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	Seeds were collected from two fruits, Yellow color with stripes on epicarp, small seeds
258810	16CJVC-131	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	Seeds were collected from many fruits, Yellow color with stripes on epicarp, large seeds
258811	16CJVC-131	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	Seeds were collected from many fruits, Yellow color with stripes on epicarp, small seeds
258812	16CJVC-132	2 Dec, 2016	<i>Momordica charantia</i>	Bitter gourd	Tang On rass	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	Seeds were collected from many fruits
258813	16CJVC-133	2 Dec, 2016	<i>Cucurbita moschata</i>	Pumpkin	Lapao	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-33 07 & E105-4-45 04	8	Farmer	
258814	16CJVC-134	2 Dec, 2016	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Landrace	Seeds	Kandal	Koh Thom	Khampong Khong	Khbal Damrey Leu	N11-10-47 07 & E105-4-54 02	10	Field	Weedy melon



Photograph 1. Bumpy and muddy roads in lowland, Preah Vihear Province.



Photograph 2. Paddy field near Tonle Sap, Kampong Thom Province.



Photograph 3. Farmland near the Mekong River, Kratie Province.



Photograph 4. Lowland area, Kampong Cham Province.



Photograph 5. Stilted house, Kampong Thom Province. Stilted houses are common in Cambodia and prevents from flooding above floor level and infestation by mice.



Photograph 6. Dried paddy-field, after harvest, Preah Vihear Province.



Photograph 7. Vegetable fields at southern Cambodia, Kandal Province.



Photograph 8. Rubber plantation, Kampong Thom Province.



Photograph 9. Banana plantation, Preah Vihear Province.



Photograph 10. Market in Kampong Thom city, Kampong Thom Province.



Photograph 11. Fish shop in the market near Tonle Sap, Kampong Thom Province.



Photograph 12. Banana fruit shop in the market, Kampong Thom Province.



Photograph 13. Dried freshwater clam sold in the market. Dried freshwater clams are commonly eaten as light foods in Cambodia.



Photograph 14. Roasted and rolled banana sold in the market. Roasted and rolled bananas are eaten as sweets.



Photograph 15. Mature melon with yellow fruit skin sold in the roadside market, Kampong Thom Province.



Photograph 16. Immature cucumber sold in the vegetable market, Siem Reap Province.



Photograph 17. Immature luffa sold in the vegetable shop, Kampong Thom Province.



Photograph 18. Mature luffa sold in the vegetable shop, Oddar Meanchey Province.



Photograph 19. Mature watermelon sold in the market, Kratie Province.



Photograph 20. Immature watermelon sold in the vegetable market, Oddar Meancheat Province.



Photograph 21. Oblong bottle gourd sold in the vegetable market, Siem Reap Province.



Photograph 22. Immature snake gourd sold in the vegetable at market, Oddar Meanchey Province.



Photograph 23. Bitter melon sold in the vegetable market, Siem Reap Province.



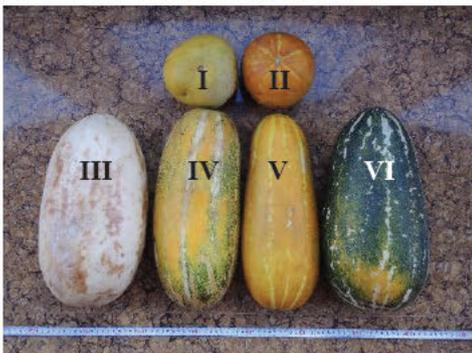
Photograph 24. Improved variety of melon sold in the market, Siem Reap Province.



Photograph 25. Immature melon fruit, Oddar Meanchey Province.



Photograph 26. Melon fruits sold in the Phsar Samaki Krong Kratie market, Kratie Province.



Photograph 27. Variation of melon fruits found in a market of Photograph 26. I: 16CJV-C117, II: 16CJV-C118, III: 16CJV-C113, IV: 16CJV-C112, V: 16CJV-C114, VI: 16CJV-C115.



Photograph 28. Landrace of maize at Tnot Thmey village, Steung Treng Province.



Photograph 29. Wild melon growing in the field, Kandal Province.



Photograph 30. Farmer' house at Bateay Stoung village, Kampong Thom Province. Interview were conducted for stored-seeds of melon "16CJVC-13" showing sample photograph.



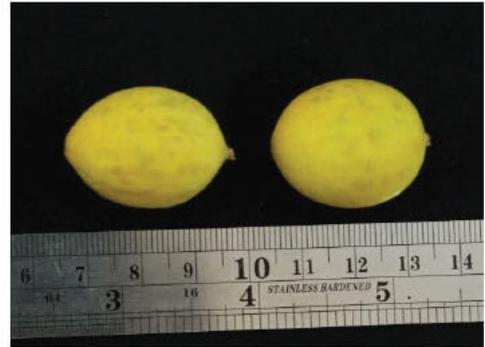
Photograph 31. Stored-seed of "16CJV-C83" and "16CJV-C84" in netted bag, Steung Treng Province.



Photograph 32. Stored-seed of "16CJV-C26" to "16CJV-C34" at a farmers' house, stored separately for each crop, Siem Reap Province.



Photograph 33. Ten-melon-seeds of “16CJV-C9” measured.



Photograph 34. Wild melon of “16CJV-C-134”.



Photograph 35. Melon cultivation at Samraong village, Siem Reap Province.



Photograph 36. Thinned-out-seedlings of melon after transplanting at field in Photograph 35.



Photograph 37. Young seedling of melon at Khbal Damrey Leu village, Kandal Province.



Photograph 38. Three kinds of pickled melon sold in the market, Kampong Thom Province.



Photograph 39. Melon fruit of “16CJV-C113” collected in Kratie Province.



Photograph 40. Melon fruit of “16CJV-C5” collected in Kampong Thom Province.